
GOVERNMENT

CONGRESS

The Congressional Research Service of the Library of Congress has updated its issue brief on "Radiation Health and Safety Issues of Congressional Interests." The brief written by Christopher Dodge of the Science Policy Research Division covers both ionizing and non-ionizing radiation and includes a listing of legislative authorities, federal regulatory authorities, pending legislation, hearings, and a chronology of events. (Brief Number IB77062, October 23, 1980.)

AGENCIES

Air Force

The Air Force wants to develop new and improve existing hardening techniques for its systems exposed to a nuclear electromagnetic pulse (EMP). See *Commerce Business Daily*, November 7, 1980.

Bureau of Radiological Health (FDA)

BRH promulgated a final rule amending the performance standard for microwave ovens in the *Federal Register* on November 28, 1980 (45 FR 79028). The rule, which becomes effective on November 30, 1981, deletes the error limit and effective aperture requirements for instruments used to detect leaks from microwave ovens.

The rule was on the agenda of the Technical Electronic Product Radiation Safety Standard Committee (TEPRSSC) meeting held on December 3-4 in Washington.

BRH proposed a performance standard for microwave diathermy products in the July 29, 1980, *Federal Register* (45 FR 50359). A summary of the comments on the standard submitted to BRH will appear in our February issue.

Department of Commerce

The Commerce Department ruled in early December that the Toshiba Corporation of Japan sold countertop microwave ovens at prices so low that they were unfair and violated the Tariff Act. The case has been forwarded to the US International Trade Commission, which will determine whether Toshiba ovens injured domestic production. If the ITC makes such a finding, penalty duties will be assessed.

According to the December 3 *Federal Register* (45 FR 80157) notice, ovens made by the Matsushita Electric Industrial Company, the Sanyo Electric Company, and the Sharp Corporation were not dumped in the American market. The four companies accounted for 98% of the 740,000 ovens imported into the United States from Japan in 1979 at a value of \$149 million.

Environmental Protection Agency

EPA sponsored a workshop on RF measurements in Las Vegas last November 3-5. Thirty government officials and a limited number of outsiders held intensive discussions on the current status of measuring electromagnetic fields. According to Richard Tell of EPA, the workshop organizer, "This was the first time all the instrumentation experts from the government were in the same room at the same time."

The participants agreed to two sets of recommendations:

1. That a group, such as the American National Standards Institute (ANSI), should set the following standards for broad band RF survey instruments: a) minimum, uniform reporting requirements of performance characteristics for existing instruments; b) minimum testing procedures for evaluating instrument performance; and c) performance characteristics for future instruments.

2. That standardized measurement techniques be developed based on: a) existing instrumentation, b) applicable safety standards, and c) specific exposure situations.

The second set of recommendations arose from the lack of uniformity in the way measurements are taken.

The recommendations will be published at a later time, though the form of publication has yet to be decided, perhaps an EPA technical report or a journal article.

The Nonionizing Radiation Surveillance Branch of EPA is providing all the Agency's regional offices with a new Holaday electric field probe to permit local surveys of radiofrequency levels. According to Branch Chief, Dave Janes, "We are providing only the training and equipment, the time and resources devoted to this are up to each individual regional office."

EPA is also buying higher frequency probes: one of five or six Narda probes will be lent to a regional office when requested as soon as they are delivered by the manufacturer. A single field intensity meter and associated antennas which can identify the frequency of a particular source will also be available for loan. A four day training course for regional personnel was held by EPA in mid-December in Las Vegas.

Department of Energy

The DOE's Office of Electric Energy Systems held its annual contractors review meeting on the biological effects of electric fields from overhead transmission lines in Washington DC last November 18-19. Researchers from about a dozen on-going projects in the multi-million dollar program reviewed their progress.

The DOE program is now focused on AC work, but in the years ahead the emphasis will change to DC lines.

For a copy of the abstracts presented at the November meeting contact: Mr. Alec O. Bulawka, US DOE/EES, Mail Stop 3344, 12th and Pennsylvania Avenue, NW, Washington DC 20461, (202) 633-8638.

Federal Communications Commission

At the end of January, the FCC will issue a statement in response to the comments received on its 1979 Notice of Inquiry (NOI) [44 FR 37008, June 25, 1979] concerning the biological effects of radiofrequency radiation.

The FCC has decided not to issue any interim radiation standards, according to Robert Cleveland of the Commission's Technical Planning Staff. But the FCC will participate in the rule-making proceedings of other agencies on RF issues. The statement will include a summary of the some 25 comments submitted to the FCC in response to the NOI.

Cleveland said that the FCC issued the NOI to meet its duties to promote safety under the Communications Act, and to satisfy its responsibilities under the National Environmental Policy Act.

National Cancer Institute

NCI has issued a request for proposals for the synthesis and evaluation of radiosensitizers, chemicals which selectively sensitize hypoxic (oxygen deficient) tumor cells to radio-therapy. A three year project is planned. RFP NCI-CM-17485 is available from Maria Decker, NCI, Treatment Contracts Section, Blair Building, Room 228, NIH, Bethesda, MD 20205.

National Institute for Occupational Safety and Health

The schedule for the NIOSH criteria document on radiofrequency and microwave (RF/MW) radiation is still slipping. Drafts of the document were released in 1979, but were withdrawn due to unfavorable reviews. NIOSH is now aiming for a substantially shorter document, one that is less encyclopedic with more critical analysis. NIOSH's consultants are in the process of evaluating the RF/MW biological data. This phase of the operation is going slowly, and the agency cannot proceed until it is completed. A review draft may be finished by the spring.

The NIOSH procurement office in Cincinnati has issued a request for quotation [RFQ 81-12; November 14, 1980] for the writing of two television scripts on the health risks associated with Video Display Terminals (VDT's).

NIOSH, BRH, OSHA

A team from NIOSH, BRH and OSHA is developing a bulletin on control technologies for dielectric heaters, including RF sealers.

Preliminary tests indicate that shielding can have a significant effect on both the magnitude and direction of the impinging field. The team is not yet ready to make firm recommendations on control technologies.

The joint bulletin is due to be out in late Spring.

National Telecommunications and Information Agency

The Electromagnetic Radiation Management Advisory Council (ERMAC), the advisory committee to NTIA, is anticipating holding a meeting at the end of January or early February in Washington.

The BENER Task Force report, "Nonionizing Electromagnetic Radiation Safety: A Program of Coordinated Federal Activities Related to Biological Effects of Nonionizing Electromagnetic Radiation (0-300 GHz)," was published last summer, but has yet to receive any official attention.

Dr. Howard Clark of the National Bureau of Standards who served as the Task Force chairman hoped that the report would provide "a frame of reference for examination of the various agency programs and budgets that relate to the coordinated federal BENER program," and would be "useful to federal agencies in planning or describing their individual activities as related to a common goal."

The Task Force was set up by Henry Geller, the Administrator of NTIA at the request of Dr. Frank Press, the President's science advisor. Nevertheless, the report has not been officially forwarded to Press, nor does it seem to be a planning tool of the individual agencies involved in bioeffects research.

Occupational Safety and Health Administration

Bob Curtis of OSHA's Salt Lake City office organized a training session for two members of each of OSHA's ten regional offices to teach them how to measure radiofrequency and microwave radiation levels in the workplace. As a result of the December 3-4 sessions, held in Salt Lake City, workers will have a greater opportunity to check their on-the-job exposures to non-ionizing radiation.

Helping Curtis were Michael Larsen and Alfred Owyand of OSHA and Edward Aslan of Narda.

Radiation Policy Council

The US Radiation Policy Council, the interagency group created by the President in February 1980, has issued its "Progress Report and Preliminary 1981-1983 Agenda" (No. RPC-80-001, September 30, 1980).

The Report concentrates on ionizing radiation to the virtual exclusion of non-ionizing radiation. Beyond intending to grapple with general radiation policy which may (or may not) spill over

(continued p. 4)

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BIOLOGICAL RESEARCH

Frey Reworks BBB Data

Allan Frey of Randomline Inc. believes he has resolved some of the contradictions in the experimental results of the blood brain barrier (BBB) research. Writing in the November 1980 issue of the *Bioelectromagnetics Society Newsletter*, Frey argues that the use of inappropriate statistical analysis explains why many researchers erroneously concluded that microwaves do not change the permeability of the BBB.

At least three teams of researchers, including one led by Frey himself, have shown that microwaves can cause certain dyes to pass through the BBB into the brain. In one of the most significant studies, Oscar and Hawkins discovered that pulsed 1.3 GHz radiation could change the permeability of the BBB at average power densities of only 0.03 mW/cm² (*Brain Research*, 126, 281, 1977).

However, three groups of scientists cast doubt on these results by reporting no microwave effects on the BBB for various exposure conditions. Frey has taken the published data of two of the groups, and, by applying what he thinks are more appropriate statistical tests, found that the opposite conclusions hold: they demonstrate increased permeability. One set of results by Merritt *et al.* now supports Frey's original paper, and another by Preston *et al.* confirms Oscar and Hawkins' work. Frey also speculates that the third group, Spackman *et al.*, may have also used inappropriate statistical analyses and a faulty experimental design.

As Frey concludes: "The supposed conflicting and controversial data actually are quite consistent and indicate that something is happening in the brain under low intensity microwave energy exposure."

New Review Article

Richard Lerner has published a comprehensive review of current research on health effects of non-ionizing radiation, with special emphasis on low-level effects, in the December 1980 issue of *IEEE Spectrum*: "RF Radiation: Biological Effects." The article also details some of the controversy surrounding the new ANSI standard.

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to the non-ionizing portion of the spectrum, the RPC agenda promises little attention to microwave, radiofrequency, or ELF radiation.

Included in the report are summaries of the RPC public meetings held across the country during 1980, and the public comments submitted to the Council.

Three of the public comments address non-ionizing radiation:

- AFL-CIO, Food and Beverage Trades Department: strengthen occupational exposure standards for microwave and radio-frequency radiation from microwave ovens and sealing equipment, and radiation emanating from video display terminals. (p. E-12)
- Natural Resources Defense Council: Examine both ionizing

EPA Funds Teratological Study

The Environmental Protection Agency's Health Research Laboratory has awarded Dr. Mary Ellen O'Connor and Dr. Robert Strattan of the University of Tulsa a contract to study the teratological effects of microwave radiation.

The two-year, \$230,377 study will consist of exposing mice *in utero* throughout the gestation period with 2450 MHz continuous wave radiation. The irradiation will stop after they are born. The experiment will begin with exposures to power levels of 30 mW/cm²; the levels will decrease to 10, 1, and 0.1 mW/cm² until no effects are observed. The mice will be monitored for fetal weight and developmental abnormalities.

Dr. O'Connor is with the Department of Psychology and Dr. Strattan is with the Electrical Engineering Department.

New Idea about Cataract Formation

A new explanation for cataract formation has been developed by a group of physiologists at Rush University in Chicago (*Science*, 209, 1007, August 29, 1980). The group has rejected the view that the lens of the eye is a homogeneous mass. Instead, based on a combination of biophysical techniques and mathematical models, the scientists have proposed that the interior cells of the lens have impermeable membranes that block the entry of small ions. These fibrous cells can stop the flow of sodium and water into the lens' interior, thereby preserving its volume and transparency.

Microwave Hearing

How do people hear pulsed microwaves? The mechanism for the perceived buzzing or clicking sound is still a mystery; various hypotheses continue to be proposed, rejected, and defended. In a tart exchange of views in *Science* (209, 1143, 5 September 1980), two opposing camps reaffirmed their positions. One group led by C.K. Chou of the University of Washington Medical School maintains that hearing results from a tiny pressure wave in the head when the radiation pulse is converted to thermal energy. Allan Frey and Elaine Coren of Randomline, Inc. continue to offer the hypothesis that microwave hearing is the result of the thermoacoustic expansion within the cochlea, the small snail-shaped region of the inner ear.

and non-ionizing radiation since many of the problems that have hindered past work on ionizing radiation are also obstacles in the study of non-ionizing radiation. (p. E-4)

- Raytheon Corporation: Encourage EPA to develop a mandatory Federal standard on exposure of the general public to non-ionizing radiation or recommend a definition of current consensus standards (ANSI C95) by Congress as a mandatory national standard until formal Federal standards are developed. Ensure active participation by federal agencies in legitimate efforts of public education in the area of non-ionizing radiation. (p. E-8)

If you want to be on the RPC mailing list, write to: US Radiation Policy Council, Room 3026, New Executive Office Building, 726 Jackson Place, NW, Washington, DC 20503.

RF Radiation, A New Tool in Cancer Treatment

Radiofrequency radiation is a promising weapon against cancer, according to a December 1980 *IEEE Spectrum* article. "RF Therapy for Malignancy" explains how this treatment works and describes equipment design and function, tissue models used in research, and various hyperthermia methods.

Radiofrequency induced heating of tissue (42 to 43.5°C) is used alone or in conjunction with radiation (ionizing) therapy or chemotherapy to treat malignancies. A range of frequencies is used; higher ones—up to 2450 MHz—are easier to focus than the lower frequencies which can penetrate more deeply into the body. Because solid tumors generally have poor blood circulation, a tumor can be selectively heated without significantly increasing the temperature of surrounding, healthy tissue. The authors state that for localized treatment, there are no serious side effects from radiofrequency hyperthermia.

VDT's

The *Columbia Journalism Review* will feature a story on VDT's in the newsroom in its January-February issue. The article looks at both the health hazards associated with the machines and the reporting of this story by the press.

Electrotherapy Controversy

New York Magazine, in a two-part article that ran November 23 and December 1, detailed the controversy over the use of low-level electricity for bone healing.

The story began as a profile of Arthur Pilla, a chemical engineer at Columbia University. Pilla, who claimed to have played a major role in developing the electrical technology to treat fractures that previously would not heal, piqued the reporter's interest by claiming that the device was now being tested for its efficacy in treating cancer and that human applications could start within the year.

Dr. Andrew Bassett, a doctor at Columbia's medical school, cautioned that Pilla was overstating the prospects and further, downgraded Pilla's contributions in their research.

Bassett had worked with Dr. Robert Becker, then at the VA Hospital in Syracuse, New York, to show that stress applied to any bone is translated into electricity. Bassett's later cooperation with Pilla resulted in a practical, non-invasive electrical coil device, which Pilla and another colleague patented. They all formed a private corporation, Electro-Biology, Inc. of Fairfield, New Jersey with the financial backing of Wall Street entrepreneurs.

Zimmer-USA, Inc. and Teletronics Proprietary Ltd. offer other bone-growth stimulators, although Electro-Biology's is the only one which does not require implanting an electrode under the skin.

Dr. Bassett received more than \$1 million in government grants in the course of his research. The writer, Lally Weymouth, raised questions about transferring medical research paid for by public funds to profit-making private companies. She noted that the government gets a share of Zimmer-USA royalties because its product was underwritten by the Navy.

New Reports

Two major studies of the Department of Energy's SPS system are nearing completion. Each will contain an analysis of the impact of microwave radiation on human health and the environment.

One study by the National Research Council (NRC) is due to be completed by the end of June 1981, with a draft report by early January 1981. The other by the Congressional Office of Technology Assessment (OTA) was due to be published by the end of January 1981, but is running late.

NRC

The Environmental Studies Board (ESB) of the NRC appointed a Committee on Satellite Power Systems to provide an independent review of DOE's assessment of the SPS concept. Towards this end, the ESB organized a "Workshop on Mechanisms Underlying Effects of Long-term, Low-level, 2450 MHz Radiation on People." A workshop summary, prepared by Christopher Dodge of the Science Policy Research Division of the Library of Congress, was released last fall. (See box for conclusions of workshop participants.)

OTA

The two-year OTA project was requested by the House Committee on Science and Technology. The completed study will compare the impacts of beaming energy from collecting satellites by lasers, microwaves, and reflected light. With respect to microwaves, the study will look at both the DOE reference system and a solid state system which would use lower power densities and smaller rectenna sites.

SRI

Last summer, SRI International completed a study for the Environmental Protection Agency, "An Assessment of the Potential Impact of Microwave Radiation from a Solar Power Satellite." This then became the basis for a chapter in the DOE report, "Environmental Assessment of the Satellite Power System (SPS) Concept Development and Evaluation Program (CDEP)," prepared by Anthony Valentino of Argonne National Laboratory (No. DOE/ER-0069, August 1980).

CONCLUSIONS OF SPS-NRC WORKSHOP

A. There are relatively little microwave health and bioeffects data available of direct relevance to the radiation parameters of the proposed SPS. What data are available are difficult to evaluate in terms of a potential health impact of the SPS.

B. There is no presumptive evidence in the data available that exposure of the general public to 0.1 mW/cm² or lower at the frequency of 2450 MHz generated by the SPS will result in any health decrements. However, because a number of functional phenomena of known significance have been reported in response to exposure to low-intensity microwaves, further research and evaluation...is necessary in order to decrease present uncertainties about potential low-level microwave health effects.

Georgia Power Challenged on Microwaves

A group of 27 residents of rural Clayton, Georgia, have filed suit in county court to prevent Georgia Power Company from erecting a 180-foot microwave tower on top of nearby Screamer Mountain. Citizens Against Microwaves, led by homeowner David Kraft, brought the case in September, shortly after the Rabun County Commission approved the tower in a 2-1 vote before a packed hearing room.

The suit, which names the power company and the two county commissioners who approved the tower, charges that allowing Georgia Power to build on land seized by the county for nonpayment of taxes is a violation of covenant, will create a health hazard and constitutes an improper disposal of county property. *Atlanta Weekly*, the Sunday magazine of the *Atlanta Constitution*, ran a long article on the controversy in its November 23, 1980 issue.

HBO Cancels Out

In late November, Home Box Office (HBO), Time-Life's subscription TV network, withdrew its application to build a satellite communications complex in Rockaway Township, New Jersey.

The HBO proposal was under intense scrutiny by the Rockaway Board of Adjustment which had to grant a variance before construction could begin. The Concerned Citizens' Committee of Rockaway Township was formed to oppose the HBO proposal. The Committee was worried about the siting of a major source of microwave radiation in a residential area, only 1000 feet from a neighborhood school. The Board had held 16 hearings since last spring, and another 30 were scheduled.

Edward Horowitz, HBO vice-president of studio and network operations, explained that while "the local Board was responsive and HBO was overcoming the local opposition, we could not afford the delay."

The cancellation will not hurt HBO's immediate programming. The Rockaway site would have provided the pay TV system with added flexibility. As for a new site, Horowitz said that HBO will look for suitable areas across the country: "The primary interest is in the New York-New Jersey Metropolitan area, but once away from here, it doesn't really matter where you go."

California OSHA

California's Occupational Safety and Health Standards Board has proposed a substitution in the State's General Industry Safety Orders on non-ionizing radiation. The standard remains at 10 mW/cm²; the purpose of the change is to make it more enforceable. Cal OSHA held a public hearing on the proposal on November 19, 1980.

Dr. Daniel Cahill of the Environmental Protection Agency's Health Effects Research Laboratory in Research Triangle Park, North Carolina, has been awarded the Public Health Service Commendation Medal. Dr. Cahill, the Director of the Lab's Division of Experimental Biology was cited for: "Outstanding research and research management in the areas of ionizing and non-ionizing radiation health effects in the environment."

Mays Swicord, Chief of the Electromagnetics Branch at the Bureau of Radiological Health, was awarded his doctorate last month from the Electrical Engineering Department at the University of Maryland. He completed the thesis: "Studies of Microwave Absorption in Liquids by Optical Heterodyne Detection of Thermally Induced Refractive Index Fluctuations" in November. The objective of the research was to develop a spectroscopic method, flow spectroscopy, to look at microwave absorption of specific molecules. Swicord investigated DNA and found enhanced absorption as predicted by E.W. Prohofsky of Purdue University.

COMAR wants to make a movie about microwaves. John Osepchuk of the Raytheon Corporation and Don Justesen of the VA Medical Center in Kansas City, two active members of the Institute of Electrical and Electronics Engineers' (IEEE) Committee on Man and Radiation (COMAR), are exploring the idea of producing a 30-minute film on non-ionizing radiation for public television. The project is in its early stages of development and must still be approved by the IEEE. Once the go ahead is given, Dr. Osepchuk estimates that it will take a year and a half to complete.

Over a hundred colleagues and friends of Professor Herman Schwan gathered at the University of Pennsylvania in Philadelphia last November 24-25, to wish him a happy 65th birthday.

Those who attended the two-day *Festschrift*, "The Interaction of Acoustical and Electromagnetic Fields with Biological Systems," funded by the Office of Naval Research, heard twenty presentations. The proceedings will be published in a special issue of *Bioelectromagnetics*, the Journal of the Bioelectromagnetics Society.

Professor Schwan is currently on sabbatical at the Max Planck Institute of Biophysics in Frankfurt, Germany.

A profile of Dr. Andrew Marino of the Veterans Administration hospital in Syracuse, New York, "Law with a Spark," appeared in the September 29, 1980 issue of the *National Law Journal*. Marino, who is both a biophysicist and an attorney, does research on the bioeffects of ELF and at the same time is participating in various cases involving high voltage transmission lines. The article was written by Jill Jonnes.

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MOSCOW (continued from p. 1)

Follow-Up Studies

If the State Department decides to discontinue formal follow-up studies of Moscow employees, the decision would be at odds with the earlier advice of Professor Abraham Lilienfeld of Johns Hopkins University who completed an epidemiology of the Moscow employees in 1978, and of the Senate Commerce Committee. Both urged the State Department to pursue the health studies.

Dr. Herbert Pollack, a medical consultant to the State Department, did say, however, that he and Dr. Charles Brodine were continuing to monitor those employees present during the

*"a follow-up would buy a
sense of security."*

— Lilienfeld

period of maximum exposure (May 1975-February 1976). "We have a complete roster of all those exposed, and every time they get a medical check up, one of us reviews their complete medical history," Pollack emphasized.

In a recent interview, Professor Lilienfeld agreed that from a scientific point of view he would not expect to see any deleterious effects at such low doses. But from a political and personal point of view, he felt that continued examinations would be a "prudent thing to do." "It's a matter of judgment," he said, "a follow-up would buy a sense of security." Professor Lilienfeld pointed out that the major costs had already been spent and future surveys would be comparatively cheap.

The ERMAC advice could have some effect on pending claims by former embassy workers. John Parker Hills, an attorney who is handling four claims, said that up to now the State Department has been basically "ignoring" him. Hills has two claims before the Workmen's Compensation Board and two before the State Department, one of which is a class action on behalf of all women irradiated in Moscow. According to Justice Department and Veterans Administration spokesmen, neither agency has any Moscow-related claims pending.

ERMAC took up the question of a follow-up to the 1978 epidemiology at the request of the State Department, which paid the expenses for the ERMAC meeting. In a January 16, 1980 letter to Henry Geller, the State Department asked whether there was any basis for continued study. Mr. Geller referred the matter to ERMAC. According to Pollack, the State Department is waiting for the ERMAC recommendation before responding to any Moscow claims.

Before debating the merits of a follow-up investigation, ERMAC heard R.C. Mallalieu of Johns Hopkins University's Applied Physics Laboratory describe the results of his attempt to reconstruct the radiation levels on the upper floors of the embassy. According to Mallalieu's report ("A Model of the Microwave Intensity Distribution Within the US Embassy in Moscow,

1966 to 1977," No. FS-80-166, JHU-APL, August 1980), the most intense microwave exposures occurred between May 1975 and February 1976, with average levels of continuous wave radiation of 3.5 to 5.0 $\mu\text{W}/\text{cm}^2$ and average peak intensities due to multiple reflections of 7 to 10 $\mu\text{W}/\text{cm}^2$. The largest recorded power density was 24 $\mu\text{W}/\text{cm}^2$. From 1966 to 1975, the average signal strengths for those rooms with the greatest exposure was about 1.5 $\mu\text{W}/\text{cm}^2$ with maximum levels of 4 $\mu\text{W}/\text{cm}^2$, though there were transient peaks of as high as 20 $\mu\text{W}/\text{cm}^2$. Areas more distant from the radiation sources had microwave levels of less than 0.1 $\mu\text{W}/\text{cm}^2$. In February 1976, protective shielding was installed which reduced all exposures to 0.1 $\mu\text{W}/\text{cm}^2$ or less. Based on these data, the State Department has estimated that over a 22 year period, about 240 employees were exposed to average power levels of about 1.5 $\mu\text{W}/\text{cm}^2$ for about 2 hours during the workday. ("Exposure of Model Personnel," State Department, August 26, 1980.)

Lilienfeld Study

The Lilienfeld epidemiology failed to identify any major differences in either mortality or morbidity between Moscow embassy personnel and a comparative population working in other embassies in Eastern Europe. Lilienfeld had only minimal information on the signal strength inside the embassy building, though he did know that the maximum exposure took place during the nine months ending in February 1976. The radiation surveys were classified until after his study was released. Since only a short time has elapsed between the period of maximum exposure and his study, Lilienfeld recommended that "it would seem desirable that this particular study population should be contacted at periodic intervals, of 2 to 3 years, within the next several years, in order to ascertain if any health effects would appear." He went on: "it would be important to develop a surveillance system for

*"every time they get a medical check up,
one of us reviews their
complete medical history," — Pollack*

deaths in the entire study population to be certain that no mortality differences occur in the future and to monitor the proportion of deaths due to malignancies, especially among the women."

In an April 1979 report, the Senate Committee on Commerce, Science and Transportation "urged" that the State Department pursue this Lilienfeld recommendation, especially for those people exposed between June 1975 and February 1976. ("Microwave Irradiation of the U.S. Embassy in Moscow") The Committee noted that its recommendation reflected a "precautionary attitude."

A subcommittee made of Dr. Marylou Ingram (chairwoman), Professor Cleary, Professor Mary Ellen O'Connor and George Wilkening wrote up the ERMAC recommendations, which are now circulating among the full ERMAC membership. A statement is expected to be released in January.

CONFERENCES

NEWS

BEMS

More than 300 people attended the second annual meeting of the Bioelectromagnetics Society in San Antonio, Texas, last September. Some 160 papers were presented providing a rich blend of new research findings and open discussion.

In the months ahead, *Microwave News* will feature a series of articles on some of the important topics covered in San Antonio. The first in this series, "Microwave-Drug Synergy," will appear next month. Later, we will run a piece on Professor A.W. Guy's long-term experiment which began last fall at the University of Washington in Seattle.

VDT's

A one day conference on "Health Hazards of VDU's" was held at the Human Sciences and Advanced Technology Research Group, Department of Human Sciences, Loughborough University in Leicestershire, England on December 11, 1980. (VDU is the European equivalent of our VDT.) Among the papers presented were two reports of skin rashes among VDT operators in England and Norway.

IMPI

The International Microwave Power Institute (IMPI) held a symposium on "The Washington Impact: How It Affects Microwave Users" on November 13-14, 1980. A host of government officials briefed the more than two dozen attendees on what the government agencies are doing.

The proceedings of the symposium will be available from IMPI for \$40.00 for members and \$50.00 for non-members. Order from: IMPI, 211 East 43rd Street, New York, NY 10017.

PROCEEDINGS

Now Available:

Proceedings of a Workshop on Thermal Physiology, held in Rockville, Maryland, March 29, 1979. Edited by Dr. T. Whit Athey, Bureau of Radiological Health, sponsored by the Radio-frequency and Microwave Committee of the Interagency Regulatory Liason Group. Dated March 1980. Available from BRH, Rockville, MD 20857.

Non-Ionizing Radiation, Proceedings of a Topical Symposium held in Washington D.C., November 26-28, 1979, sponsored by the American Conference of Governmental Industrial Hygienists. Order from: ACGIH, P.O. Box 1937, Cincinnati, OH 45201.

Proceedings of the International Symposium, *Electromagnetic Waves and Biology*, held in Jouy en Josas (outside Paris) France, June 30-July 4, 1980. Send \$40.00 to Dr. A.J. Bertaud, CNRS, 2 rue H. Dunant, 94329 Thiais, France.

CALENDAR

• January 12-16: *National Radio Science Meeting*, University of Colorado, Boulder, CO. Sponsored by the US National Committee of IEEE Societies. Contact: Center for Conferences and Management/Technical Programs, 970 Aurora Avenue, University of Colorado, Boulder, CO 80302.

• February 16-17: *Treatment of Cancer by Radiofrequency and Microwave Thermotherapy*, Princess Kaiulani Hotel, Honolulu, HI. A short course arranged by the Bioelectromagnetics Corporation of Rockville, MD. Fee: \$495. Contact: Dr. S.S. Stuchly, Department of Electrical Engineering, University of Ottawa, Ottawa, Canada K1N6N5.

• April 13-15: *Annual Conference and Trade Show of the International Association of Satellite Users*, Washington Hilton Hotel, Washington DC (\$95 IASU Members; \$195 Others). Contact: A. Fred Dassler, IASU, 6845 Elm Street, Suite 710, McLean, VA 22101.

• June 9-12: *16th Annual Symposium of the International Microwave Power Institute*, Royal York Hotel, Toronto, Canada. Contact: IMPI, 211 East 43rd Street, New York, NY 10017.

• June 15-19: *IEEE and URSI Symposium*, Bonaventure Hotel, Los Angeles, CA. Sponsored by the Antenna and Propagation Society and the Microwave Theory and Techniques Society of the IEEE and four Commissions of URSI. Contact: IEEE, 245 East 47th Street, New York, NY 10017.

• June 30-July 4: *International Symposium on Biomedical Thermology*, Palais de la Musique et des Congres, Strasbourg, France. Includes sessions on hyperthermia in cancer treatment (July 3) and bioelectromagnetics (July 1). Simultaneous translation in English, French, and German. Contact: Dr. M. Gautherie, Laboratoire de Thermologie Biomedicale, Faculte de Medicine, Universite Louis Pasteur, 11 rue Humann, 67085 Strasbourg, France.

• August 10-12: *3rd Annual Bioelectromagnetics Society Meeting*, Washington DC. Contact: BEMS, P.O. Box 3651, Arlington, VA 22203.

• August 10-19: *20th General Assembly of the International Union of Radio Science (URSI)*, Hyatt Regency Hotel, Washington DC Includes a series on "Interaction of Electromagnetic Waves with Biological Systems," on August 13-14, chaired by Professor Saul Rosenthal of Polytechnic Institute of New York, and an "Open Symposium on Millimeter and Submillimeter Waves." Contact: Mr. Richard Y. Dow, Organizing Committee of URSI General Assembly, National Academy of Sciences, 2101 Constitution Avenue, NW, Washington DC 20418.

• August 19-21: *3rd Annual Satellite Communications Users Conference*, Regency Inn, Denver, CO (\$145 pre-paid; \$195 at the door). Contact: SCUC '81, Satellite Communications Magazine, 3900 S. Wadsworth Blvd, Denver, CO 80235.

MICRO WAVE NEWS

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A Monthly Report on Non-Ionizing Radiation

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Microwave News is changing its publication schedule and will now appear ten times a year, monthly except for January and July. This year, Volume I will consist of eleven issues; next year, Volume II will have ten.

All current six-month and annual subscribers will have their subscriptions extended by one and two months respectively to reflect our initial commitment to a twelve issue year.

New orders received by June 15, 1981 will still be based on the twelve issue year; subsequent orders will follow the new schedule. The domestic and foreign subscription prices remain unchanged.

As a special offer to our current subscribers, we will accept renewals according to the old schedule (12 issues—14 months and 6 issues—7 months) through the end of July. Beginning in August, the new rates will apply to all subscribers.

Our next issue will appear in mid-August.

We have recently computerized our mailing list. We ask our subscribers to check their mailing labels and inform us of any errors.

CHINA ADOPTS 50 μ W STANDARD BASED, IN PART, ON U.S. STUDIES

Chinese microwave experts will soon recommend the promulgation of the provisional 50 μ W/cm² occupational standard as the formal non-ionizing radiation standard for the People's Republic of China, according to Allan Frey of Randomline, Inc. in Huntingdon Valley, PA. The 50 μ W/cm² standard is based, in part, on the published US literature, Frey told *Microwave News* in a telephone interview soon after his return from China.

Some 80 Chinese research scientists and representatives of civilian and military users met to discuss the standard at a national conference held in Hangchow the week of April 20.

The Chinese standard, which is not frequency dependent, stands in sharp contrast to the current NIOSH, ANSI and ACGIH proposals. These proposals are a factor of 20 less restrictive at the most stringently regulated frequencies—in the 30–300 MHz range—and 100 times weaker at the higher GHz frequencies. The Chinese standard is similar to the 50 μ W/cm² population stan-

(continued p. 7)

SUBCOMMITTEE FINDS RF SEALERS HAZARDOUS, CASE AGAINST VDTs STILL UNCERTAIN

Some 30 experts from government, labor and business tried to sort out the potential hazards associated with VDTs and RF sealers at congressional hearings held May 12–13. At their conclusion, there was a general consensus that RF heaters and sealers present a serious health risk to their operators. Radiation from VDTs was deemed less hazardous, though a number of important questions remain unanswered.

After the hearing, Albert Gore, Jr. (D-TN), the chairman of the Subcommittee on Investigations and Oversight of the House Committee on Science and Technology, said: "We believe that there are serious problems associated with RF sealers and heaters, and plan to vigorously pursue research and standards with the appropriate agencies." With respect to VDTs, he said, "The preponderance of evidence suggests that VDTs are safe, but we will encourage the Bureau of Radiological Health to set appropriate standards for VDTs and do more research on low frequency effects."

VDTs: More Research Needed?

An overflow crowd jammed the room to hear about the radiation emissions from VDTs, their health effects, and their possible regulation. Armed with his Bureau's recent report, *An Evaluation of Radiation Emissions from Video*

(continued p. 2)

GORE SUBCOMMITTEE HEARINGS

(continued from p. 1)

Display Terminals (see *MWN*, May 1981), John Villforth, the BRH director, told the subcommittee that VDTs "do not pose a significant radiation hazard to persons who operate them," and that BRH is not "currently planning a regulatory standard for [VDT] radiation."

Ophthalmologist Dr. Milton Zaret, of Scarsdale, NY, offered a different view. In a slide presentation, he showed the subcommittee examples of what he believed to be radiant energy cataracts caused by VDTs. In his prepared statement, Zaret called BRH's conclusion that there were no significant health effects from 15 to 125 kHz radiation "unwarranted."

There was considerable debate over the merits of an epidemiology of VDT operators. Representatives of the Newspaper Guild urged a "fullfledged government-funded study, unhampered by financial limitations...to determine whether VDT operators are developing cataracts or other health damage attributable to radiation."

Dr. Vilma Hunt of EPA's Office of Health Research expressed skepticism that a suitable study population could be identified. And John Rankine of IBM said that, through a "combination of conservative safety criteria, careful design—which incorporates numerous fail-safe features—rigid design testing, manufacturing checks, and company-sponsored research," he was sure VDTs do not present a radiation hazard.

Sealers: A "Shocking" Situation

The sharpest exchanges came the second day when there were smaller crowds and no TV cameras. After hearing how little enforcement is going on at RF sealer work sites, freshman Congressman Bob Shamansky (D-OH) said that he was "almost flabbergasted" by the situation and that it was "frankly shocking."

Earlier, when Gore found out that NIOSH intended to cut off funding for a long-planned epidemiology of RF sealer workers, he responded, "It's an outrage." Now, however, due to the congressional interest, NIOSH officials are planning to reinstate the funds for the study, according to knowledgeable sources.

In one of the most forceful presentations, Dr. Joseph Lary, a research biologist at NIOSH, told the subcommittee, "It is apparent that many sealer/heater operators are being exposed to hazardous levels of RF energy," and said that the OSHA standard "must be reexamined to assure that sufficient protection is afforded the worker." At one point Lary told Gore he would not want his wife exposed to RF sealer radiation.

But on the basis of the NIOSH and OSHA testimony, it became clear that it will be a long time before a new standard is proposed and promulgated. The NIOSH criteria document will only be ready for external review in December, three months later than the last estimated date. And OSHA officials said that the agency would need a considerable amount of time to do economic, feasibility and cost-benefit analyses. Then public hearings will have to be held. Dr. Bailus Walker, director of health programs for OSHA, would not specify how long this work will take.

Nor is a performance standard for new RF machines in the offing. Villforth told Gore that BRH did not "believe that a regulatory performance standard by FDA, applicable to new sealers, would be the most effective approach." Instead, he

endorsed the enforcement of exposure standards.

Despite the projected delays, Sheldon Samuels, director of health at the Industrial Union Department, AFL-CIO, said he was "delighted" with the hearings: "It was one of the most useful hearings that I have attended. The subcommittee saw itself in a role of forcing action in the public interest." He said that he did regret not having more hard data on those exposed to RF sealer radiation. Indeed, over and over again, the subcommittee was frustrated by the absence of data on the number of machines in the workplace, the number of people exposed, and the incidence of harm.

Howard Samuel, president of the IUD, recommended that an RF/microwave standards advisory committee be set up at OSHA to expedite the completion of the NIOSH criteria document and the setting of a new occupational standard.

The one spokesman for the RF sealer manufacturers, Angelo Vassallo of the Solidyne Corp. in NY, said that it may be possible to shield machines that now exceed OSHA emission standards. RF sealers that do not meet FCC specifications, however, are too old and should be replaced, he advised.

DOD Controversy

Perhaps the greatest controversy was generated by the Department of Defense's role in health research. Captain Paul Tyler, director of DOD's Radiobiology Research Institute, was scheduled to testify on the first day. Instead, Colonel Phillip Winter, who is responsible for the Tri-Service Electromagnetic Radiation Bioeffects Program, accepted the subcommittee's invitation.

Paul Brodeur, of the *New Yorker*, was scornful of the subcommittee's acceptance of the substitution. He told *Microwave News* that Dr. Ian Marceau, of the subcommittee staff, had indicated to him, after lengthy background discussions, that Tyler would be called to answer questions about his long-time role in setting bioeffects research policy for the military. "It was a sell out," Brodeur said. "The subcommittee had a tiger by the tail and could have exposed a large part of the cover-up in bioeffects research for the last 20 years. The Gore subcommittee furnishes a prime example of how the Congress is weakened by timidity in the performance of its oversight duties on DOD." Brodeur cited a memorandum written by Tyler on the 1975 Tri-Service Research Plan and excerpted in his book, *The Zapping of America* (p. 239). In it, Tyler recommends studies be done to "disprove" the claim that microwaves can cause delayed cataracts. "The fact that a high-ranking military doctor could call for such studies is a travesty of the intellectually honest scientific approach," Brodeur said.

When asked why he did not testify, Tyler said that he was not directly involved with DOD microwave/RF work and that DOD wanted to pick its own spokesman. When they learned the subcommittee "had invited me, there was panic at DOD," Tyler said. DOD selected Winter, he went on, because he represents the whole research program for all the services.

According to Marceau, the Congressional Liaison Office of DOD had recommended Winter over Tyler because the Radiobiology Institute deals only with ionizing radiation and because Tyler had been out of non-ionizing radiation research for three years. Tyler, however, said that he still considered himself an expert on RF and microwaves. He did agree that the

Institute no longer had any active research on non-ionizing radiation.

Winter also provided some excitement when he announced, on questioning, that he had "access to brand new data" suggesting that there may be other than thermal effects on the lens of the eye. Winter promised to supply the new information to the subcommittee on June 1. Reached in his office at the end of May, Winter said that he had been "mistaken," and that the evidence in question had already been published in the IEEE Microwave Theory and Techniques Society's 1980 *International Symposium Digest*: "Microwave and Temperature Effects on the Murine Ocular Lens *In Vitro*," (pp. 341-344) by six authors, including P. Jill Stewart-DeHaan of the University of Western Ontario and L.E. Larsen of the Walter Reed Institute of Research in Washington, DC.*

Other Highlights

Agency witnesses also made the following points about RF sealers:

- NIOSH surveys of more than 200 RF heaters and sealers revealed that emission from about 60 percent of the units created fields which exceeded the current OSHA standard, with maximum levels as high as 2,500 V/m for E-fields and 13 A/m for H-fields. Also, the fields can vary by a factor of ten over the human body.
- Three cases of birth defects and one of fetal development problems have been reported to NIOSH. Gore requested additional data on other types of reported injuries, including one death, two miscarriages and a case of blindness.
- NIOSH and the FCC agree that the approximately 21,000 registered heaters and sealers represent only a fraction of the machines in use. "At least 100,000 workers, and probably many more, have been exposed," OSHA's Mark Cowan reported.
- OSHA now has 20 trained investigators and ten new probes for monitoring workplace exposure levels of non-ionizing radiation. OSHA had to wait a year and a half to receive the meters.
- OSHA made 57 on-site inspections in the past two years. Six citations were issued during 33 inspections carried out under the federal compliance program. OSHA found equipment problems in 30 percent of the 57 sites.
- RF shielding costing \$300 to \$1,000 for a \$12,000 sealer can reduce RF exposures by one to three orders of magnitude.
- OSHA's Cowan said that there is no question that exposure to RF radiation is a serious health hazard, but the government must determine the extent of the problem before establishing priorities.

Another Hearing Planned

The subcommittee had originally planned a third session on a new Department of Agriculture report, which warned consumers that microwave ovens may fail to kill pathogenic organisms in pork. See story p. 7.

The published record of the hearings will not be available for some months. For a copy, write to Congressman Albert Gore, Jr., Subcommittee on Investigations and Oversight, Committee on Science and Technology, US House of Representatives, Washington, DC 20515.

*In that paper, the authors state: "Preliminary observations on lenses exposed to either [pulsed or continuous wave] microwave radiation indicate that both types can apparently cause an additional effect—holes in the cell membranes—when compared to unirradiated controls at the same temperature."

WITNESSES BEFORE THE SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT

(In Order of Appearance)

May 12, 1981

Charles Perlik, Jr., President, The Newspaper Guild
David Eisen, Research and Information Director, The Newspaper Guild
John Villforth, Director, Bureau of Radiological Health (BRH)
Dr. Alan Anderson, Associate Director, Division of Biological Effects, BRH
Bill Herman, Associate Director, Division of Electronic Products, BRH
Dr. Milton Zaret, Director of Research, The Zaret Foundation
Colonel Phillip Winter, Military Assistant for Medical and Life Sciences, Office of the Under Secretary of Defense for Research and Engineering
Dr. Elliot Postow, EMR Program Manager, Research and Development Command, National Naval Medical Center
Dr. Joe Elder, Chief, Cellular Biophysics Branch, Environmental Protection Agency (EPA)
John Rankine, Director of Standards and Data Security, IBM Corp.
Dr. Bruce Dickerson, Corporate Director for Health and Safety, IBM Corp.
George Mine, Advisory Engineer, IBM Corp.
Vico Henriques, President, Computer and Business Equipment Manufacturers Association (CBEMA)
Dr. Myron Wolbarsht, Professor of Ophthalmology, Duke University Medical College
William Hanrahan, Senior Director, CBEMA

May 13, 1981

George Cashau, Coordinator of Operations, American Newspaper Publishers Association Research Institute
Howard Samuel, President, Industrial Union Department, AFL-CIO
Sheldon Samuels, Director of Health, Industrial Union Department, AFL-CIO
Dr. Joseph Lary, Research Biologist, Division of Biomedical and Behavioral Science, National Institute for Occupational Safety and Health (NIOSH)
Dr. Barry Johnson, Director, Division of Biomedical and Behavioral Sciences, NIOSH
Dr. Richard Lemen, Acting Director, Division of Criteria Documentation and Statement Development, NIOSH
Dr. Ezra Berman, Research Biologist, Experimental Biology Division, EPA
Dr. Ralph Smialowicz, Chief of Immunology Section, Experimental Biology Division, EPA
Dr. Vilma Hunt, Deputy Assistant Administrator, Office of Health Research, EPA
Dr. David Conover, Research Physicist, Division of Biomedical and Behavioral Science, NIOSH
Mark Cowan, Special Assistant for Regulatory Affairs and Director of Policy, Occupational Safety and Health Administration (OSHA)
Robert Curtis, Senior Industrial Hygienist, OSHA
Dr. Bailus Walker, Director of Health Programs, OSHA
Stephen Finan, Acting Director of Legislation, OSHA
Angelo Vassallo, Technical Consultant, Solidyne Corp.

CONGRESSIONAL HEARINGS: EXCERPTS

VDTs

Perlik: "If we are going to be the guinea pigs in front of the VDT screens, then we want some early answers.... [The situation requires] a fullfledged government-funded study...of a large population of VDT users."

Villforth: [Based on the BRH survey which found that VDTs] do not pose a significant radiation hazard...we are not currently planning a regulatory standard for radiation.

Albert Gore (D-TN) questioned Villforth about VDT emissions in the 15 to 125 kHz range:

Gore: Well, if there is no standard for the emissions in that range, why is it reassuring to you that the non-existent standard is not violated?

Villforth: The voluntary scientific community has not felt a need for standards in this area based on non-observance of biological effects.

Gore: But you say yourself...[that] research on bioeffects for the 15 to 125 kHz range is lacking.... It may be that your reassurance is valid, but it doesn't appear to be based on any scientific evidence at all.

Gore posed the same question to Zaret:

Zaret: It's idiotic, sir...you have no standard, you don't need a standard, we don't need it because there is no research to show that you need it. But we haven't done the research. It makes no sense.

Gore sought a response on this point from Anderson:

Anderson: In the region of say 10 to 100 kHz...we have both a theoretical analysis of the way in which both the electric field and the magnetic field will interact with biological material and we also have just recently done a modeling calculation which indicates the level of absorption of radiation that you would expect in something the size of a human being.

Gore: In other words, you don't have any actual tissue tests.

Anderson: From the standpoint of work we've conducted in house, no, we do not.

Gore: All you have is some theoretical work that has led you to believe that it is probably not a problem.

Anderson: The theory is corroborated by the admittedly small but nonetheless real bit of information that comes from those researchers who have attempted to expose laboratory animals to radiation....

Gore: Why have you not promulgated standards for performance and testing?

Villforth: Because we don't think there is a problem.

Bob Shamansky (D-OH) and Gore questioned Winter: Should the public be assured there are no low frequency radiation problems despite little data?

Winter: Yes...The best available evidence, in my opinion, warrants a statement that, so far as we know, there is no appreciable risk at those frequencies....

Shamansky: How good is the best evidence available? You didn't give me a value judgment on that.

Winter: I would agree that the data in the frequency range in question is very sparse, and one, I think, is forced, given the need to come to a judgment at the moment, to extrapolate from what data as exist in nearby frequency ranges—this is the basis on which the ANSI standards are established, in any case.

Shamansky: But isn't there another alternative: to refuse to give such a judgment? So you don't have enough to give a valid judgment?

Winter: Certainly that's an option.

Shamansky: Isn't it a medically more sound option?

Winter: I'm not sure that I'd agree with that.... We are often called upon to make judgments in the absence of adequate information.... At the moment we have no firm reason to believe that there is a hazard. However, the possibility exists and further study in the area is warranted.

Shamansky: It seems to me that the brunt of Dr. Zaret's testimony is exactly that.

Winter: It is sir, if you accept the data at face value.

Shamansky: Hearing the testimony, do you think that at this point there is enough circumstantial evidence, enough clinical evidence, to warrant a study?

Winter: Yes sir.

Gore asked Hunt if EPA supports the need for an epidemiological study of VDT users:

Hunt: The basic question is the extent to which it is a feasible and practical approach...To identify an appropriate population large enough for good statistical analysis of the data comes to be probably not a good use of resources when compared with all the research that can be done under more controlled circumstances. That is not to say that if a population is available we should not make every endeavor to insure that the exposure assessment goes forward with the best methods available, with the best quality control available....

Robert Walker (R-PA) asked Cashau if the newspaper publishers regard VDT safety as a high priority issue to resolve with their employees:

Cashau: Yes. We certainly regard any health and safety issue as a matter of high priority...and yet we use approximately one percent of the total VDTs in the US.

Henriques: In view of the work that has been going on in our industry for many years, it comes as no surprise to us that this recent FDA testing program and a similar NIOSH testing program conclude what we have known for some time, that radiation from VDTs is well within safe levels.

RF HEATERS AND SEALERS

Exposed Population

The subcommittee had been informed that as many as one million workers are exposed to radiation from RF heaters and sealers. Gore asked Samuels for his figures:

Samuels: In one industry—and we are just now beginning to add up the numbers—namely the lumber and plywood industry...we are making a very rough estimate that the 40,000 RF sealers expose about 80,000 workers.

Gore: Well now, that is one industry among a hundred or so where these instruments are used. Is that correct?

Samuels: That's correct. In the plastics industry, where you have a larger percentage of female employees, you would find a substantial number of women exposed.... I think a million is reasonable.

Biological Effects

Smialowicz: Whereas chronic stress can lead to physiological disorders including immune dysfunction, whether significant dysfunctions in the immune system occur under chronic exposure conditions remains to be determined....

Berman: It is my opinion that only RF levels which cause very high body temperatures are associated with birth defects. It is also my opinion that it is only the high temperature which causes RF-induced birth defects.

Lary: Most RF induced birth defects occur only after significant elevation of maternal body temperature. However, there have been reports of minor developmental deviations, increased embryonic death, delayed development, and decreased fetal weight in animals exposed during pregnancy to levels at or below 10 mW/cm².

Numerous disturbances attributed to RF/microwave exposure have been reported in endocrine, nervous, auditory, ocular, cardiovascular, hematologic, and immunological systems in animals. Many of the changes noted were reported at levels at or below the current 10 mW/cm² standard....

Since NIOSH and OSHA measurements indicate that unshielded RF heaters and sealers commonly emit radiation in the vicinity of the operator which far exceeds the current OSHA standard, it is apparent that many sealer/heater operators are being exposed to hazardous levels of RF energy....

We are currently conducting research to determine if protracted exposure of pregnant rats to lower intensity RF radiation at a level which causes no measurable rise in body temperature is teratogenic or embryotoxic. In addition, cooperative research with teratologists at the University of Cincinnati Medical School is being conducted to determine the mechanisms of RF-induced fetal malformations and death.

Villforth: We have also undertaken research to determine the feasibility and cost of a full-scale study of the risk of psychological disorders resulting from exposure to RF sealer radiation. This study is complementary to an effort being planned by NIOSH to review reproductive histories in such exposed persons.

Gore: If you had a pregnant woman operating one of these machines, would you feel comfortable?

Lary: Frankly, I wouldn't feel comfortable at all.... I can say on the basis of my research and on the basis of an analysis of the literature that if significant heating of the maternal body during pregnancy occurs, you run the risk of having a birth defect. But I cannot state with any degree of certainty that women being exposed to RF heaters and sealers indeed run a significant risk of having birth defects under the conditions in which they are exposed. In a broader sense, not considering just the possibility of birth defects, but considering the possibility of any health effect, I would not want my wife exposed to the radiation.

Toward a Regulatory Decision

Villforth: Considering the large number of sealers already in use, their long working lifetimes, and the relatively low rate at which new sealers are being manufactured, we do not believe that a regulatory performance standard by FDA, applicable only to new sealers, would be the most effective approach to solving this problem. Another important drawback in promulgating a standard aimed at the manufacturer of sealers is that the units are often modified by the user. Thus, the most effective enforcement of standards would be in the workplace rather than at the place of manufacture. This is the approach taken in the IRLG plan.

Gore: I hope that OSHA doesn't take a go slow attitude to it, because we are talking about serious effects.

Cowan: The last impression we would like to leave you with today is that we do not consider this a serious problem. If we felt it was not a problem we would not be enforcing it.... When we receive the NIOSH criteria document... then we will proceed to reexamine our current standard.... I understand it will be presented to us some time near the end of the year in December, NIOSH suggests.

Lary: Until the NIOSH review process is completed, we cannot predict what maximum permissible exposure levels NIOSH will recommend.

Gore: If [NIOSH] gets it to you by the end of September, how long will it take you to deal with it? To act as a result?

Walker: I don't want to talk in terms of months, but it will take us a considerable amount of time because we have to do an economic analysis. We have to examine the whole question of feasibility as required by the Act and under the President's executive order. We now have to look at the whole cost/benefit question. So there is a lot of activity that will have to take place even before we can go to a public hearing and get public input on such a document.

Gore asks Cowan how long it will take OSHA to decide on the most efficient regulatory option after the NIOSH criteria document is in hand:

Cowan: I would like to ask our economists... Until our economists can look at the data provided... to determine what they would have to do further, I certainly am not in a position to say how long it will take our economists to do a cost/benefit analysis of this issue or that issue.

Gore: What is your reaction to all this today?

Cowan: My personal reaction is that it is somewhat confusing in several regards. One is that there seems to be a delay... in the final compilation of data.... Another concern I have, being in the position I am, is when you start dealing with figures and someone says there are 20,000 workers and, of course when we start talking about significant risk, this is obviously a factor we have to consider when we have 20 or 30 items on the plate and we have to pick one or two or three at a time. One figure is that there are 20,000 workers; our colleagues at NIOSH suggest that there are 100,000 workers... another one million.... We have to determine how broad this problem is. There is no question that there is a problem, and that there is a serious health hazard involved in exposure to radiation.

Gore: In light of the testimony that you've heard, Mr. Curtis, on bio-effects and based on your own test results, do you agree with the conclusion of NIOSH that there is a serious risk to operators of some RF heaters and sealers?

Curtis: In fact, yes, I do. And it is on that basis that we enforce the standard under the general duty clause, and we have to declare that we feel that it is a serious risk. And that is our policy and that is my position.

Current Action

Shamansky tried to determine who has the authority to require manufacturers to supply shielding and who is currently attempting to enforce OSHA standards. Cowan said that of the 1,200 OSHA enforcement officers in the field and the five and a half million workplaces to monitor, there are 20 trained equipment inspectors with the authority to cite and attach penalties to manufacturers and to require them to retrofit equipment. Shamansky was frustrated by the OSHA representatives' explanations of why shielding is not now required and why so little enforcement has been done.

Shamansky: I'm almost flabbergasted. It's frankly shocking.

Later:

Shamansky: Having probed behind the surface of your [Cowan's] statement, I am not at all pleased. I'm disturbed by that. In fact, there is more form than substance to what you are actually doing in the market place where the things are going on. So it's a very nice statement, it's very reassuring, if you only read what you are saying. In fact, the performance is not very reassuring.

Vassallo: It is our belief that enforcement of the present standards and the continued self-monitoring of the industry is sufficient to protect users of RF equipment from harmful effects unless there is evidence to the contrary.

BIOLOGICAL EFFECTS

Microwaves and the Lens: A New Report

Working Group 35 of the National Research Council's Committee on Vision has issued a six-page report, *Effects of Microwave Radiation on the Lens of the Eye*. Among the findings and conclusions are:

- "Existing evidence does not suggest that microwave fields of less than 10 mW/cm² can induce cataracts."
- "Existing evidence does not suggest that routine screening for cataracts of all Air Force personnel working in the vicinity of microwave devices is justified at this time."
- "More research is needed to characterize the effects of low-level microwave radiation, particularly for chronic exposure."
- "Laboratory research is required to elucidate the mechanisms of ocular damage from microwave exposure."
- "A well-designed prospective study, with careful matching of test and control groups, could provide valuable information about possible effects on humans of low-level microwave exposure. However, such a study, if adequately designed, would be expensive."
- "A study of the use of microwave diathermy devices might be useful."

The Membership of Working Group 35 is: Stanley Ballard (Chairman), University of Florida; Russell Carpenter, BRH; Stephen Cleary, Medical College of Virginia; Arthur Guy, University of Washington; William Ham, Medical College of Virginia; Heinrich Rose, retired, Stanford University Medical School; and Myron Wolbarsht, Duke University Medical Center.

Key Dismukes was the study director. The work was done under a contract from the Office of Naval Research. Copies are available from the Committee on Vision, 2101 Constitution Avenue, NW, Washington, DC 20418, but supplies are limited.

Membrane Break in Cataract Formation

Professor Abraham Spector and his research group at Columbia University's College of Physicians and Surgeons in New York City have refined their model, first proposed approximately two years ago, detailing the mechanism of cataract formation in the human lens (*Proceedings of the NAS*, 78, 1892, March 1981). On the basis of new experimental studies, Spector now postulates that the lens fiber plasma membrane may be ruptured in the cataract lens, in conjunction with the accelerated oxidation of membrane proteins.

Spector told *Microwave News* that "any energy source of sufficient power, including appropriately focused microwaves, could potentially perturb the membrane, and set off the sequence described in the model." He warned, however, that "I don't know of any evidence that microwaves do break the membrane."

Research in Utah

The University of Utah has won a number of research grants and contracts in recent months. They include:

- Approximately \$150,000 from EPA/ORD to Professors Om Gandhi and John D'Andrea of the Electrical Engineering Department for a four month chronic exposure study of male rats to 0.5 mW/cm², 2450 MHz radiation. The rats, exposed seven hours a day, seven days a week, will undergo blood and urine analyses, as well as tests for susceptibility to electric shock. The study, begun last October, will include some dosimetry and computer modeling at 2450 MHz.
- A \$153,000 grant from the Air Force to Gandhi on the bioeffects of millimeter waves, specifically 26.5-90 GHz. He will investigate the mutagenic effects of mm waves on *E. coli* and other biological organisms, Raman and Brillouin spectra of biological molecules in order to understand the mechanism of interaction and the dielectric properties of biological tissues at mm wavelengths.
- A three-year, three-phase, \$160,000 (approx.) NIEHS grant to D'Andrea, begun last February, to (i) develop a computer model to predict whole body absorption and local "hot spots" in rats at frequencies in the range of 300-5,500 MHz; (ii) study acute behavioral effects at those frequencies that create hot spots and those that do not; and (iii) compare the effects of chronic exposure, three to six

months, seven days a week, seven hours a day, at two different frequencies, with and without hot spots, but with equivalent SARs.

- A \$130,329 contract from the AF to Professor Carl Durney, also of the EE Department, for theoretical and experimental comparisons of RF absorption. Predictions from computer models will be compared to results from experiments using prolate spheroid and human-shaped phantoms. The contract, awarded in April, is a continuation of previous work, which will allow Durney to extend his calculations to the near field.

- A \$107,547, one-year contract from the Office of Naval Research to Professor Lester Partlow and Larry Stensaas of the School of Medicine and Gandhi for (i) new work on calcium efflux in monolayers cultures of embryonic chick brains. The team will use a quantitative autoradiographic technique (described in a forthcoming paper in *Bioelectromagnetics*), which can measure quick changes in calcium concentrations; (ii) continuation of a study involving the irradiation of whole rats and the investigation of the deposition of microwaves in the central nervous system. Here the group will look at the heating patterns in different portions of the brain at different frequencies and different orientations, calorimetric measurements of dead animals to learn heat gain data, and studies of the uptake of 2-deoxy-D-glucose to determine the pattern of electrical activity in the brain.

Cleary Begins New Project

The Office of Naval Research has awarded Professor Stephen Cleary, of Virginia Commonwealth University Medical College in Richmond, \$110,000 for a 20-month study of cellular effects of X-band radiation. Working with 8-10 GHz pulsed and continuous wave microwaves, Cleary will investigate changes in cell-to-cell communication in culture under far field conditions. He is finishing up his work with blood cells to pursue this new line of research.

Bioeffects Research at BRH

BRH has released its *Annual Report of the Division of Biological Effects, Bureau of Radiological Health, Fiscal Year 1979, October 1, 1978-September 30, 1979* (HHS Publication FDA 81-8152, dated June 1980, but released April 1981). The report includes brief abstracts of active research as of September 30, 1979 on ionizing, light, RF and microwave radiation and ultrasound, and of epidemiological and experimental studies. In many cases unpublished results are presented.

Among the abstracts are updates on: "The Effect of Prenatal Microwave Exposure on the Development of Behavioral Responses in the Mouse," "Mutagenic, Chromosomal, and Reproductive Effects of Microwaves—Chromosomal Effects of Low-level Microwaves," "The Effect of Millimeter Wave Radiation on Induction Phenomena in *E. coli*," "Evaluation of the Effects of Long-Term, Low-Level Microwave Exposure on the Absorption of Calcium Ions Across Cell Membranes," and "Effect of 10 GHz Pulsed Electromagnetic Radiation in *E. coli*."

In "Measured Modulation Waveform of Leakage Radiation from Microwave Ovens," Henry Ho and W.P. Edwards note that "leakage radiation from microwave ovens is known to be low-frequency amplitude-modulated because of the effect of the modestirrer built into the ovens."

There is also a report of a study by Dr. Asim Jamakosmanovic from the University of Sarajevo, Yugoslavia, on the "Effect of Microwave Radiation on the Nervous System."

The report for FY80 is scheduled for November 1981.

Medical and Legal Seminar

Bell Labs, RCA and Raytheon jointly sponsored a seminar on medical and legal aspects of microwaves at the Homestead in Hot Springs, VA, this May 7-8. Ron Peterson of Bell Labs, the seminar's co-organizer with Howard Johnson of RCA and John Osepchuk of Raytheon, reports that about 100 lawyers, engineers and doctors attended tutorials on the biological effects of RF and microwave radiation. The seminar was patterned after the New York Institute of Medicine's April 1979 "Symposium on Health Aspects of Non-Ionizing Radiation," according to Peterson. The registration fee was \$200.

GOVERNMENT

USDA Issues Alert on Cooking Pork in MW Ovens

Uneven microwave heating could fail to kill harmful microorganisms in pork, according to the Department of Agriculture. Preliminary, unpublished studies by Professor William Zimmerman of the Veterinary Medical Research Institute in Ames, IA, prompted the May 8 notice cautioning consumers that pork must reach 170°F throughout to ensure killing trichinae parasitic worms and other pathogenic bacteria present in a very small number of US hogs. Donald Houston, administrator of the USDA's Food Safety and Quality Service, said the Department is in the process of verifying the results.

No cases of illness have been linked to microwave-cooked pork. "Consumers who follow prudent cooking procedures face no health hazard," assured Houston. Specifically, USDA recommends that dishes be rotated during cooking and that meat be allowed to stand for several minutes after cooking. In this way, cold spots created by variations in water distribution, uneven deposition of microwaves and potential blockage by bones in the meat can be eliminated.

The report was to be the subject of congressional hearings by the Gore subcommittee in mid-May (see p. 1), but they were delayed until later this summer because of the preliminary nature of the findings.

EMP News

Electromagnetic pulse radiation was the subject of a flurry of popular articles last month. *Science News* ran a two-part series on EMP: "A Sleeping Electronic Dragon," May 9, and "Defensive Strategies," May 16, by Janet Raloff. Eric Lerner's "Electromagnetic Pulses: Potential Crippler" was featured in the May issue of *IEEE Spectrum*. *Science* began a three-part series by William Broad with "Nuclear Pulse (I): Awakening to the Chaos Factor" in the May 29 issue. And Richard Schaffer highlighted EMP vulnerability in the *Wall Street Journal's* May 29 technology column. They all focus on EMP's potential disruption of electronic devices, everything from communications networks to power grids and protective "hardening" strategies.

In her first article, Raloff states: "EMP is presumed to be no more harmful to humans than a flash of distant lightning." *Microwave News* is interested in learning about studies on the biological effects of EMP. We invite readers to send us relevant scientific information.

In EMP contract news, the AF Systems Command, Norton AFB, CA, is negotiating a contract with EG&G, Albuquerque, NM, on the construction of a horizontal shelter site for EMP hardness tests, and the Defense Nuclear Agency is issuing a RFP on the development of technical reports supporting DNA's EMP simulation test effects (*Commerce Business Daily*, May 18).

Oven Variance

BRH has granted a two-year variance to microwave ovens used in combination microwave and electric or gas self-cleaning ranges, manufactured by the Caloric Corp. of Topton, PA (46 *Federal Register* 23810, April 28).

The ovens sold under the names Caloric, Montgomery Ward, Sharp Electronics and Amana Refrigeration will have three safety interlocks, instead of the usual two, and may still be operated if the first two fail, as long as the third and its monitor are functioning.

BRIEFS

The latest, semi-annual summary of EPA's agenda of forthcoming regulations indicates that a notice of proposed rulemaking on public exposure to RF radiation will be issued in December 1981, with a final rule in December 1982 (46 *Federal Register* 23696, April 27). . . . The FDA is seeking nominations for membership on the Technical Electronic Product Radiation Safety Standards Committee (TEPRSSC).

The Committee gives advice on radiation performance standards for electronic products. Nominations are due July 21. For more information contact: Zory Glaser, Executive Secretary, TEPRSSC at BRH, (301) 443-3429. . . . The Air Force Office of Scientific Research has awarded Professor Arthur Oliner, of the Polytechnic Institute of New York, \$290,000 to continue research on "microwaves, electromagnetic theory and information processes". . . . The International Communications Agency has signed an estimated \$75,000 contract with the Institute of Telecommunication Sciences in Boulder, CO, for "Radio Propagation Predictions". . . . The Rome Air Development Center in NY is seeking R&D proposals on the development of a terrestrial microwave line-of-sight radio system (*Commerce Business Daily*, May 7). . . . The Bureau of Mines wants to fund a study on the use of a narrow band pulsed audio tone transmitter to detect and locate trapped miners (*CBD*, May 1). . . . The Naval Research Lab, Washington, DC, is negotiating a contract with Norden Systems, Melville, NY, for measurements related to spurious emissions from AN/SPS-40B, C&D radars.

CHINA ADOPTS 50 uW STANDARD

(continued from p. 1)

dard proposed by Dr. Leonard Solon of the New York City Bureau for Radiation Control in 1978.

Two Chinese scientists, Drs. Huai Chiang and K.C. Yee of Chechiang Medical College, toured some of the leading US labs last year. At a seminar on research and standard setting in China reported to the Bureau of Radiological Health in Rockville, MD, last June, Dr. Chiang discussed the then-provisional standard, which Frey understands the Chinese will soon formally adopt with essentially no change. The standard specifies an average power density of 50 uW/cm² during a six-hour working day. For an eight-hour shift, the exposure has to be less than 40 uW/cm², with an integrated dose for a whole day of 300 uW.hr/cm². The maximum exposure can never exceed 5 mW/cm². The standard makes no distinction between pulsed and continuous wave exposures.

Frey found the Chinese experts well versed in the US literature but their labs light on equipment. He also notes that researchers are doing interesting epidemiological studies of factory workers. Frey says the Chinese have devised innovative medical applications for microwave energy—for instance, they are treating uterine cancer with an antenna inserted within the uterus during treatment.

Frey was invited to China to lecture in various cities on the biological effects of microwave radiation. Frey, a prominent member of the bioeffects research community, is well known for his work on the blood brain barrier and microwave hearing.

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VDTs....The Norwegian Labor Directorate has introduced draft rules that would prevent workers from working in front of VDTs for more than two hours without a break, according to the *New Scientist*, May 7. The regulations would also require that operators spend no more than half their time doing straight input typing, that their eyes be checked every two years up to the age of 45, and annually thereafter, and that high frequency sound be eliminated....The National Research Council's Committee on Vision is sponsoring a public symposium to be held in Washington, DC, August 20-21, as part of its study of the impact of VDTs on the vision of workers. For more information, contact the Committee at (202) 389-6068. Experts from abroad will be invited....The HUSAT research group at Loughborough University in England has published the papers presented at its second conference, *Health Hazards of VDTs? 2, Some Solutions to the Common Problems*, held March 19, and has scheduled a third meeting for July 2, *A Positive Approach to the Future*....The Health Advocacy Unit of Toronto's Department of Public Health has published *Health Effects of Video Display Terminals: The Non-Radiation Problems*, by Linda Rosenbaum, May 1981....A revised version, Legislative Document No. 1612, of the Maine VDT bill was released May 15....A report of the April 24 hearing on VDT safety held by the Joint Standing Committee on Labor of the Maine Legislature appeared in the May 8 issue of the *Guild Reporter*....The same issue notes that a tentative pact between the Guild and the *New York Times* and the *Daily News* has a provision that requires monitoring of VDTs and the reporting of the data to the Guild....Meanwhile, according to an article in the *New York Times*, May 29, Harvey Siegel, the *Times*'s safety director, described the paper's policy on VDTs: they should not emit any detectable levels of RF radiation. The article also outlined a paper, delivered at the AIHA meeting in Portland, OR, May 28, by Siegel and Otto White, of Occupational Environmental Health Analysts in Upton, NY: a survey of 437 VDTs (15 models) at the *Times*, with "sensitive detectors," found power densities indistinguishable from background levels for 420 of them. (No mention was made of the now infamous 1 mW/cm² background level found by NIOSH in its 1977 survey of the *Times*.) The 17 machines that emitted "low levels" of RF were modified to eliminate the emissions.

Technology....Xerox Corp. has dropped its Xten project, the planned data communications network for major cities. Despite FCC's allocation of 130 MHz for the service at about 10.6 GHz (*MWN*, February 1981), the company scrapped Xten last month, citing economic reasons....A blue-green laser has successfully sent messages from an aircraft to a submerged submarine, according to *Aviation Week & Space Technology* (May 25). The laser system has now passed three tests. The Senate added \$20 million to its FY82 budget, for a total of \$42 million, but this authorization must still win approval in a House-Senate conference. The system is described in the fifth part of Roland Starkey's series on submarine communications: "Blue-Green Laser/Satellite Technology: The Search for the Rainbow," in the March issue of *Military Electronics/Communications*. Whether DOD will substitute the new laser for the ELF antenna is still an open question....Dr. F. Kristian Storm's Magnetron hyperthermia unit, still seeking FDA market approval (*MWN*, May 1981), is described by Denise Grady in the June *Discover*....Rakesh Jain of Carnegie-Mellon University told *Science News* (May 2) some good and some bad news about his research team's work on hyperthermia. Tests show that glucose therapy can lower the blood flow rate and increase pH differences between normal and cancerous cells, and help shrink tumors in rats when used with hyperthermia treatment. Unfortunately, metastases—cancer cells that create new tumors elsewhere in the body—grow much more easily with the glucose treat-

To the Editor: Let me bring to your attention a point of information. In *MWN*, January 1981, you mention the exchange between Chou, *et al.* and me about microwave hearing (*Science*, 209, 1143, 5 September 1980). You noted that we disagreed about the mechanism for microwave hearing. You indicated that we differed in that they contended the hearing was due to thermoacoustic expansion occurring in the head with consequent bone conducted acoustic waves stimulating the cochlea and that I contended it was due to thermoacoustic expansion occurring in the cochlea. That's not quite correct.

The problem was that Chou, *et al.* concluded that they had explained the microwave hearing phenomena and that it was all wrapped up. In a paper published in *Science* (206, 232, 12 October 1979), I pointed out that there were five lines of evidence indicating that an explanation based on thermoacoustic expansion in the head was not particularly satisfactory and showed that the results of their experiments could be attributed to uncontrolled variables such as microwave induced vibration in the foam on which the animal lay. However, my key point was that microwave hearing had not been explained and wrapped up.

A few weeks after the exchange between us appeared in *Science*, the Bioelectromagnetics Society Annual Meeting was held in San Antonio. At that meeting, Wilson, *et al.* and Lebovitz presented evidence from independent experiments that showed, with some microwave energy parameters, that the microwave hearing phenomena can be attributed to specific effects within the cochlea. Thus, it would appear that the question of the mechanism for microwave hearing is not all wrapped up.

Allan H. Frey
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To the Editor: We have a position available for a research associate with an MD or PhD degree and at least two years of clinical, neuro-anatomical and neuropathologic training. Knowledge of microwave and biological tissue interactions is desirable.

Dr. Ernest Albert
Professor of Anatomy
The George Washington University
Medical Center
2300 I Street, NW
Washington, DC 20037

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

ment. The result is a shorter lifespan for the rat....The National Weather Service has plans to convert its conventional radar system to Doppler radar by 1990 with a \$340 million program (*Wall Street Journal*, May 29). The new radar would enable forecasters to predict approaching tornadoes 20 minutes before they hit, compared with the present system which cannot provide an early warning.

Litigation....Attorneys working on microwave injury cases are planning a meeting at the American Trial Lawyers Association, to be held in San Francisco the last week of July. For more information, contact Matthew Shafner of Groton, CT (203) 445-2463 or Seymour Ellison of San Francisco, CA, (415) 392-1884....Shafner also reports that the Engel case (see *MWN*, April 1981) is moving slowly: no trial date has yet been set.

MICRO WAVE NEWS

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Yannon Decision Upheld; NY Telephone To Appeal Again

A New York court has upheld a workers' compensation award to Samuel Yannon's widow. In a May 6 decision, the State Supreme Court Appellate Division found sufficient evidence to link the New York Telephone Company technician's death to microwave radiation exposure. The action affirms previous rulings from an administrative law judge and a 1981 appeal before a state Workers' Compensation Board. New York Telephone is now requesting another appeal.

The case, brought by Mrs. Nettie Yannon in 1975, is the first establishing chronic exposure to microwave radiation as a cause of death. Yannon spent 15 years adjusting microwave relay equipment for the phone company on the 87th floor of the Empire State Building before being terminated for medical reasons in 1970. Yannon died four years later from what his doctor diagnosed as "chronic brain syndrome with psychotic overtones due to biological brain changes resulting from prolonged exposure to short wave radiation." (See *MWN*, April 1981.)

In its unanimous decision, the appellate division court concludes that there was "substantial evidence to establish the necessary causal relationship" between Yannon's exposure and the development of an occupational disease ending in his death. Addressing New York Telephone's contention that there is no evidence of unsafe radiation levels, the opinion states that data on Yannon's exposure are not available and that "the present state of scientific knowledge has not advanced to the point where exactitude exists in fixing the limits of microwave radiation on the human body." (See page 2 for full text.)

Charles Herndon from the New York Telephone's legal department announced that the company will seek an appeal but would not comment on the

(continued p. 2)

Radiation Control Officials Meet

A new task force has been set up within the Conference of Radiation Control Program Directors to investigate model state regulations for non-ionizing radiation. Word of the new effort came at the conference's 14th annual meeting in Portland, ME, during the week of May 24.

Among the other items disclosed at the meeting were:

- The Bureau of Radiological Health (BRH) intends to investigate the possible effects of ultrasound on the fetus, according to BRH Director John Villforth. He said that about 60 percent of all deliveries now use ultrasound to diagnose abnormalities. Potential risks include increased fetal activity, delayed neural motor response and reduced birth weight.

- Villforth noted that BRH is having problems publishing technical reports due to budgetary pressures.

- BRH's William Herman reviewed the control of radiation from RF sealers. He said that the machines, though operating in the 27 MHz band, give off "parasitic" radiation at higher frequencies. Interestingly, in some cases these harmonic signals have been found to be stronger than the fundamental

(continued p. 3)

Yannon Appeal Decision (continued from p. 1)

case while it is before the court. The phone company has maintained that Yannon suffered from pre-senile dementia, probably Alzheimer's disease.

Because the decision is unanimous, the phone company must seek permission from the appellate division to take the case to the Court of Appeals, the state's highest court. Angelo Gucciardo, the New York City lawyer handling Mrs. Yannon's case, does not think there are grounds for another review.

After the February 26, 1981, compensation board appeal ruling, Mrs. Yannon received \$29,000 in retroactive benefits from the phone company and an award of \$45 per week for life or until she remarries.

Pleased with the recent decision, Mrs. Yannon said, "This has been a long ordeal, but at last my husband's disease will be on the books as an occupational problem."

A second suit brought by Mrs. Yannon against RCA, the manufacturer of the relay equipment her husband used, is still in its early stages. Filed in 1976 in the New York State Supreme Court, Richmond County, the \$3.5 million action charges RCA with breach of warranty and negligence.

Text of Appeal Decision

Claimant is the widow of Samuel Yannon, a former employee of the New York Telephone Company, who died on June 10, 1974. From 1955 until the early part of 1968, decedent was a radio technician assigned to a special service unit which monitored and repaired microwave transmission units at the employer's Television Transmission Facility located on the 87th floor of the Empire State Building. Except for rare occasions when decedent worked on units in the field, he worked exclusively at this facility on a daily basis, with considerable overtime. The tenure of his co-workers generally did not exceed three years.

There were 25 microwave units at the facility, spaced about five feet apart, each with its parabolic reflecting dish facing the outer glass wall of the building. Protruding from the center of each reflecting dish was a "feedhorn" antenna from which microwave transmissions could be beamed out to or received from other locations. Behind the center of each dish, enclosed in a housing, was a klystron tube, which was the power source of the unit that emitted the microwave transmissions. Among decedent's duties was the tuning, repairing and aligning of these microwave units. Access to the "feedhorn" antennas was by means of a "walkable area" between the glass wall of the building and the parabolic reflecting dishes, while the klystron tubes could be reached from the interior console area. The tuning process was performed two or three times each day and required approximately 20 minutes on each occasion. The tube emitted microwaves as it was tuned, while the antenna was supposed to be turned off during such adjustments. One of the crucial questions presented, and one which resulted in conflicting views, was the amount of microwave radiation to which decedent was exposed; whether it exceeded permissible standards and whether those standards themselves are within acceptable levels.

Prior to 1968 decedent's health was good. However, early that year, at the age of 57, he began to suffer a drastic deterioration of his hearing, sight and coordination to such an extent that he was unable to perform his duties, requiring his placement on disability leave. He was retired on July 7, 1971, and died three years later after a prolonged period of progressive physical and mental deterioration. The hospital records where decedent was confined indicate that he suffered from an "organic brain syndrome" or a "degenerative central nervous system disease" or a "chronic brain syndrome" of unknown etiology. There were, however, references in the record, by attending physicians, that decedent's symptomatology could be related to microwave exposure. On January 11, 1975, the claimant widow filed her claim for death benefits, contending that decedent's death resulted from his exposure to microwave radiation.

The testimony at the numerous workers' compensation hearings, both lay and expert, was lengthy and conflicting. The Administrative Law Judge awarded claimant benefits and the board affirmed, finding that decedent's death resulted from an occupational radiation disease, one within the meaning of section 3 (subd. 2, par. 30) of the Workers' Compensation Law, and that said disease and his ultimate death were directly related to his exposure to microwave radiation while employed by the New York Telephone Company.

On this appeal, we must first consider whether the record demonstrates the existence of a recognizable occupational disease identified as "microwave radiation sickness" and, if so, whether decedent was so afflicted. In order to be so identified, such a disease must actually be caused by the employment and from the particular work the employee is performing. It must result from the nature of the employment and as a natural incident thereof (*Matter of Goldberg v. 954 Marcy Corp.*, 276 N.Y. 313). It cannot be founded upon the aggravation of a pre-existing condition which is not occupational in nature. In other words, "there must be a recognizable link between the disease and some distinctive feature of the claimant's job" (*Matter of Detenbeck v. General Motors Corp.*, 309 N.Y. 558).

Claimant's leading expert, Dr. Milton Zaret, provided the board with ample evidence of the existence of a disease identified as "microwave or radiowave sickness." Dr. Zaret's own studies, including those performed for the United States Government, and excerpts of reports from the Warsaw Conference of 1973 which documented the diagnosis of such a disease in other countries, substantiate this conclusion. The board was entitled to credit his testimony and that of other experts supporting this view.

Whether claimant was so afflicted with this disease presents a more difficult question. The employer's experts, also eminently qualified, steadfastly maintained that decedent suffered from Alzheimer's disease which caused pre-senile dementia, retinitis pigmentosa and generalized arteriosclerosis. This conclusion also finds ample support in the record. However, our review is limited to whether there is substantial evidence in the record to support the board's decision, not whether upon this record the court would have come to a different conclusion (*Matter of Palermo v. Gallucci & Sons*, 5 N.Y.2d 529).

The requisite proof that decedent's death was causally related to exposure to microwave radiation during the course of employment presents another troublesome issue. The employer contends that there is no evidence of exposure to unsafe levels of radiation. However, the accuracy of the measurements of radiation taken by the employer is in issue, as well as the number of microwave units in operation when measurements were taken. Moreover, there was expert testimony that even at permissible levels, exposure over a prolonged period of time could produce long-term harmful effects. Here, the exact proof of the amount of radiation to which decedent was exposed is not available (see *Matter of Murphy v. Beaunit Fibers*, 42 A.D.2d 1009). However, the present state of scientific knowledge has not advanced to the point where exactitude exists in fixing the limits of microwave radiation on the human body. This does not mean that the testimony of recognized experts should be rejected where their views are supported by a record that presents arguable issues as to the degree of radiation, as long as there is substantial evidence to support these views after a study of all the salient material available (*Matter of Besner v. Kiddie Nuclear Lab.*, 24 A.D.2d 1045; *Matter of Matthews v. General Elec. Co.*, 2 A.D.2d 623; *Matter of Zaepfel v. du Pont de Nemours & Co., Inc.*, 284 App. Div. 693, affd. 309 N.Y. 962).

Finally, upon the entire record and with the assistance provided by the applicable presumption, we conclude that there is substantial evidence to establish the necessary causal relationship between decedent's exposure to microwave radiation, the development of the within [sic] occupational disease and his ultimate death (Workers' Compensation Law, § 47; *Matter of Lapinsky v. Ardom Bake Shop*, 18 A.D.2d 850, affd. 13 N.Y.2d 1163). While the hospital records indicate preliminary conclusions that decedent's condition was idiopathic, the record, as developed, supports the board's decisions.

The decisions should be affirmed, with costs to the Workers' Compensation Board.

Opinion per Kane, J.
Mahoney, P.J., Sweeney, Casey and Mikoll, JJ., concur.

State of New York Supreme Court
Appellate Division, Third Judicial Department

May 6, 1982

BOOK REVIEWS

Robert O. Becker and Andrew A. Marino, *Electromagnetism and Life*. Albany, NY: State University of New York Press, 1982, 211 pp., \$33.50 (hardcover), \$10.95 (paper).

Becker and Marino present a comprehensive review of the influence of electromagnetic fields (EMFs) on living systems. Beginning with an overview of the scientific and political history of bioelectrical phenomena, they go on to discuss what is known about intrinsic and natural EMFs, and the effects of man-made EMFs on the nervous, endocrine, cardiovascular, hematological, immune and reproductive systems.

The authors, well known for their work on regeneration, develop the hypotheses that intrinsic EMFs control biological functions, while natural EMFs convey information to living organisms. Artificial fields, meanwhile, act as stressors—stimuli that elicit a common physiological, adaptive response. In this well-referenced book, Becker and Marino argue that “the present abnormal electromagnetic environment can constitute a health risk.”

Arthur D. Bloom, ed., *Guidelines for Studies of Human Populations Exposed to Mutagenic and Reproductive Hazards*. White Plains, NY: March of Dimes Birth Defects Foundation, 1981, 163 pp., \$10.00.

In 1980, people living near Love Canal were driven into a frenzy as scientists argued about the validity of a study that showed that they had an increased incidence of damaged chromosomes. The study turned out to be a dud. In an effort to avoid future confusion, a conference was organized to set up some guidelines on how to do such investigations. This volume is the product of that meeting.

Today, at a time when a number of clusters of birth defects and miscarriages have been reported among VDT operators, there is growing anxiety about what in fact constitutes a significant grouping of adverse effects. This book could serve as a tutorial for those uninitiated in epidemiological research. One chapter, “Guidelines for Reproductive Studies in Exposed Human Populations,” is especially useful: it explains, in simple English, the different types of studies, the “normal” incidence rates for major malformations, the statistics of sample size and many other key issues.

Lowell L. Klessig and Victor L. Strite, *The ELF Odyssey: National Security Versus Environmental Protection*. Boulder, CO: Westview Press, 1980, 310 pp., \$27.75.

Klessig and Strite use the history of the Navy’s proposed ELF communications system for sending messages to submerged submarines as a case study of citizen action. The book provides an interesting and

clearly written account of the massive antenna system’s evolution and the stormy politics surrounding it. Successively known as Sanguine, Seafarer and finally ELF, the project has met strong opposition on ecological grounds in proposed host states since 1968.

The authors maintain that “the ELF experience is an example of the bewildering technology and mammoth bureaucracy that threaten to obliterate democratic decision-making.” Advocating citizen involvement, they use ELF to show how government functions and how the public can influence its decisions.

John N. Ott, *Light, Radiation & You*. Old Greenwich, CT: Devin-Adair, 1982, 174 pp., \$14.50.

Those who have read Ott’s previous book, *Health and Light*, will find themselves on familiar ground. Ott announces his objective at the outset: he wants to take decisions about lighting away from the janitor and place them firmly “under scientific control.” He cites examples of what he calls malillumination (exposure to light which has biologically important wavelengths missing), the potentiating effects of visible radiation on drugs, hyperactivity caused by fluorescent lights and the healing power of full spectrum light. One intriguing hypothesis is that fetal monitoring equipment can weaken muscles, thus forcing a Caesarian birth.

Some readers may be put off by Ott’s chatty and anecdotal style, and there is much here that probably will not stand up to the rigors of the scientific method. But Ott is no doubt correct in his view that specific wavelengths have specific biological functions and that these will soon be the subject of greater experimental scrutiny.

Ronald T. Pretty, ed., *Jane’s Weapon Systems, 1981–82*. 12th edition, 1006 pp., \$140.00.

R.J. Raggett, ed., *Jane’s Military Communications, 1981*. 2nd edition, 629 pp., \$125.00.

Both volumes are published in the US by Jane’s Publishing, Inc., New York, NY, and distributed by Franklin Watts, Inc., New York, NY.

These are extraordinary reference books. They are indispensable to anyone trying to sort out the different kinds of military radar and communications systems now in use all over the world. Each system is described in detail, including operating characteristics (such as frequency, power and waveform), use, manufacturer and history. The indexes make it easy to find any listing, and both volumes are profusely illustrated.

Radiation Directors (continued from p. 1)

at 27 MHz. A possible explanation is that the fundamental may be better controlled inside the machine. It adds up to a “very tricky” measurement problem, Herman said. He also reported that the National Institute for Occupational Safety and Health (NIOSH) had found average exposures of 591 V/m at the operators’ necks and 1.04 A/m at their chests. The highest readings were 2500 V/m and 13 A/m.

- The Environmental Protection Agency has sponsored a study, *Identification of Potential Human Study Populations for Non-Ionizing Radiation Health Effects*, to help in future epidemiological research. The contractor, JRB Associates of McLean, VA, pinpointed eight such groups and outlined the pros and cons of each. The study is now being peer reviewed.

- NIOSH’s William Murray said that the agency had not yet been able to set up an epidemiology of RF sealer workers.

- Robert Watkins of Massachusetts’ radiation control program explained the state’s reasoning for deriving public exposure standards from occupational standards. He said that they had considered a factor of ten but had found that it

would have too great an impact, and had therefore settled on a factor of five. The state will soon propose a frequency-dependent population standard of 200 uW/cm², at its most stringent level. (See *MWN*, March 1982.)

The new task force on model state standards, chaired by Robert Hallisey of the radiation control program at the Massachusetts Department of Public Health, is the radiation control directors’ third group dealing with non-ionizing radiation. This new effort complements the radiation directors’ on-going work on model standards for laser safety. Charles Tedford of the Arizona Radiation Regulatory Agency heads one on measurement and instrumentation, and Lawrence McDonnell of the Wisconsin Department of Health and Social Services is in charge of a group that is studying setting priorities for radiation-emitting consumer products.

Some 325 radiation officials from 49 states attended the meeting. Only the radiation director from Idaho was unable to come to Maine because of restrictions on out of state travel. The briefing on RF sealers was requested by a number of states including Vermont, which asked for assistance in evaluating RF hazards.

ASME Decision: Impact on Voluntary Standard Setting Committees

In a decision that could have wide ranging impact on all voluntary standard setting organizations, the United States Supreme Court has ruled that the American Society of Mechanical Engineers (ASME) is liable for the actions of its committee members. The Supreme Court supported a lower court's finding that the ASME had violated the antitrust laws when a member of one of its technical committees had "successfully used his position within the ASME in an effort to thwart" a competitive challenge.

The case was brought by Hydrolevel Corp., which began competing with McDonnell & Miller, Inc., (M&M) for a share of the market for water boiler safety devices in the 1960's. Members of a subcommittee of the ASME's Boiler and Pressure Vessel Committee worked with M&M executives to discourage customers from buying Hydrolevel's product. Hydrolevel eventually went out of business and all the parties to its suit alleging violation of the antitrust laws settled except for the ASME.

Under the court's ruling, the society is now liable for treble damages under the Sherman Act. The district court entered a judgment against ASME of more than \$7 million; whether this amount will in fact be awarded will be decided later. The ASME has some 90,000 members and an annual budget of approximately \$12 million a year.

The ruling has caused a chill within voluntary standard setting organizations. Most of the standards dealing with non-ionizing radiation are set by such bodies. Whether the decision would affect committee work on health and safety is not clear at this time. A number of experts contacted by *Micro-wave News* thought that the impact would be determined by future litigation.

Eric Herz, the executive director and general manager of the Institute of Electrical and Electronic Engineers (IEEE), expressed "serious hope that we can do things in such a way that we do not discourage volunteer participation." He said that the IEEE would review its procedures in order to see if improvements were needed.

William Rockwell, legal counsel for the American National Standards Institute (ANSI), issued a statement which read in part: "It is clearly evident that the Hydrolevel case is not an indictment of voluntary standards development or accreditation. It is confined to the question of the authority of volunteer committee participants to interpret a standard and the liability of the developing group for such actions." He went on to note that ANSI has already revised its procedures to prevent such cases.

Justice Harry Blackmun wrote the majority decision for a divided court. He concluded:

When ASME's agents act in its name, they are able to affect the lives of large numbers of people and the competitive fortunes of businesses throughout the country. By holding ASME liable under the antitrust laws for the antitrust violations of its agents committed with apparent authority, we recognize the important role of ASME and its agents in the economy, and we help to ensure that standard-setting organizations will act with care when they permit their agents to speak for them.

The six-to-three decision in *American Society of Mechanical Engineers, Inc., v. Hydrolevel Corp.* was issued on May 17.

Multnomah County Delays Standard

Multnomah County, OR, has delayed adopting a radiofrequency/microwave exposure standard. The County Board of Commissioners decided not to approve a draft ordinance setting criteria for siting broadcast antennas in unincorporated Multnomah, next to Portland, because of concern over potential health hazards. To avoid placing new transmission towers in urban areas, allowed under the proposed rules, the board has suggested creating an antenna farm in the undeveloped Dixie Mountain area.

The draft ordinance submitted to the board last month by the county planning commission would have set exposure limits at 200 $\mu\text{W}/\text{cm}^2$ for 30-300 MHz, rising to 1 mW/cm^2 for frequencies above 1500 MHz and to 20 mW/cm^2 for those below 3 MHz. New broadcasters would have been required to share towers because of a lack of suitable locations and an anticipated increase in demand for transmitters.

According to Larry Epstein of the commission staff, by clustering sources only two new towers would be needed in the next five to ten years. Epstein said putting towers on Dixie Mountain could cause transmission losses that would be expensive to overcome. The Federal Aviation Administration has declared that the site would pose hazardous radiofrequency interference problems for aircraft.

The planning commission must now expand its six-month effort to develop a standard that can win board approval. In the interim, the county is continuing its moratorium on applications for new facilities. The freeze was imposed last December when the county decided to commission studies on the environmental impact of transmission towers. (See *MWN*, January/February 1982.) The board has scheduled hearings for June 8 and 15.

Swedish Physiotherapists: Pregnancy Study

An epidemiology of female physiotherapists suggests that exposure to non-ionizing radiation during pregnancy can increase the incidence of malformations and fetal death. The statistical finding is only "borderline," according to the researchers; they warn that it may only be a random phenomenon.

Dr. Bengt Kallen and Gert Malmquist of the Department of Embryology and Dr. Ulrich Moritz of the Department of Physical Therapy at the University of Lund in Sweden reviewed the histories of 2,043 infants born to 2,018 women between 1973 and 1978. Then they studied the 37 women who had seriously malformed or perinatally dead infants, investigating their use of X-ray, shortwave, microwave, ultrasound and electrostimulator equipment during pregnancy.

While as a group the women had fewer problem pregnancies than statistically expected, the researchers did find that "there are indications of a higher degree of shortwave use (and perhaps of ultrasonic waves also) among those females who gave birth to a malformed or perinatally dead infant." No data on radiation exposure were available, nor was it possible to separate exposure to ultrasound from shortwave radiation. Microwaves were used so rarely that no inferences on their potential hazard could be drawn.

Writing in the March/April *Archives of Environmental Health*, the Swedish team notes the possibility that "repeated exposure to non-ionizing radiation in the form of shortwaves (and perhaps also microwaves) could slightly increase the risk

for fetal damage," but that "it is difficult to reject, without further discussion, the finding as a random phenomenon."

Congress: Glenn Bill, RFI and Radio Marti

The subcommittee on energy, nuclear proliferation and government processes of the Senate Committee on Governmental Affairs held hearings on Senator John Glenn's (D-OH) Federal Radiation Protection Act of 1982 (S. 2284) on April 29. The bill would set up a Federal Council on Radiation Protection and a Federal Conference on Research Into the Biological Effects of Radiation to coordinate regulation and research respectively. (See *MWN*, May 1982.)

Witnesses were split on the merits of the proposal. For instance, the General Accounting Office's J. Dexter Peach supported the measure while Assistant Secretary for Health Dr. Edward Brandt spoke against it. Some, like Robert Minogue of the Nuclear Regulatory Commission, thought that the present Interagency Radiation Research Committee could effectively deal with the proposed conference's mandate. In his comments supporting the bill, Warren Sinclair of the National Council on Radiation Protection and Measurements asked that the scope of the proposed council and conference include non-ionizing radiation.

Both the chairman of the subcommittee and the committee have been asked to schedule a mark up for the bill. No response has yet been received.

The Communications Technical Amendments Act of 1982 (H.R. 5008) was reported out of the House subcommittee on telecommunications, consumer protection and finance on May 5. An amendment was approved that authorizes the Federal Communications Commission to set "minimum performance standards for audio and visual electronic equipment to reduce their susceptibility to interference from radio-frequency energy." Parallel language is contained in Senator Barry Goldwater's (R-AZ) bill (S. 929). The measure was scheduled to go before the Committee on Energy and Commerce on May 27, but was delayed until early June.

The telecommunications subcommittee held hearings on Radio Marti on May 10. On May 20, the subcommittee voted to prohibit the Reagan Administration from using AM frequencies for broadcasting information to Cuba. If this is approved by the full committee, Radio Marti would have to use shortwave frequencies.

Satcom Stations Booming in New York

Work will soon begin on three major satellite communication stations in the New York City metropolitan area. Home Box Office (HBO) has won approval for its station in Smithtown on Long Island. The City Planning Commission is expected to act favorably on an application by Hughes Aircraft to build the first station of its new Galaxy communication system in the Spring Creek section of Brooklyn. And a joint venture between the Port Authority of New York and New Jersey (PA) and Merrill Lynch to develop a huge "Teleport" complex in Staten Island is in the process of assembling the necessary approvals.

The PA-Merrill Lynch plan is by far the most ambitious, calling for at least ten receive and transmit antennas on a 350-acre site on Staten Island, with connections via a fiber optic cable to Jersey City, NJ, and the World Trade Center in downtown Manhattan. The complex will have the capability to communicate with all satellites in the Northern Hemisphere's orbital arc. The legal details of the "partnership" between Merrill Lynch and the PA are in the process of being negotiated.

Merrill Lynch's Stanley Welland predicted that the satellite antenna farm would serve a wide range of clients including broadcast networks, cable TV, banks, and financial institutions. Joseph Milano of the PA said that construction on Staten Island could begin as early as late this summer, with services beginning next year. Expansion would continue over the next decade.

Representatives of Hughes Aircraft presented their case for the first station in their new domestic communication network at a hearing before the New York City Planning Commission on May 19. According to the environmental impact statement, the maximum public exposure would be 1-2 $\mu\text{W}/\text{cm}^2$ at the property line. (See *MWN*, April 1982.) Peter Berle, an attorney and the former head of the state's Department of Environmental Conservation, called his client's review "the most comprehensive analysis that has ever been done." He said that the radiation levels would be "far below any known standard."

Speaking for the city's Public Development Corp., Jed Marcus said that "any neighborhood would be proud of the Hughes project." Commission approval is expected in June. Hughes only needs permission from the city's Board of Estimate before construction can begin.

The Smithtown Board of Zoning Appeals approved the building of up to seven 45-foot antennas for HBO in Suffolk County, Long Island, on February 11. The site will be connected to the Gulf + Western building in midtown Manhattan by a combination of microwave line-of-sight and cable relays. John Rosenblum of Telspec in Hauppauge, NY, said that his radiation analysis indicated that the maximum radiation exposure, estimated on a worst case basis, would be 10.9 $\mu\text{W}/\text{cm}^2$ at the HBO property line. The board hired John Baum of Brookhaven National Laboratory to review the HBO application.

The cable entertainment company had originally planned to build the station in Rockaway, NJ, but gave up in the face of strong community opposition. (See *MWN*, January 1981.) Scientific Atlanta is expected to build the station for HBO.

IRPA Occupational Exposure Guideline

The International Non-Ionizing Radiation Committee of the International Radiation Protection Association (IRPA) is circulating a review draft of its occupational exposure standard for 100 kHz to 300 GHz radiation. The frequency-dependent guideline proposes a 1 mW/cm^2 limit for exposure to 10 MHz-1 GHz radiation and recommends up to a tenfold additional safety factor for general population exposures. The committee also recommends that "under all circumstances exposures should be kept as low as readily achievable."

In the other frequency ranges, the proposed levels are: 25 mW/cm^2 for 100 kHz-1 MHz; 10 mW/cm^2 for 1 MHz-10 MHz; and 5 mW/cm^2 for 1 GHz-300 GHz. For all frequencies, a six-minute averaging time for measuring exposures is suggested.

The IRPA guideline closely parallels the new ANSI standard, except that the exposure limit for different frequency bands changes as a step function rather than as a continuous function of frequency. The draft claims the step approach is "more desirable from a compliance viewpoint."

No recommendation is made for a peak power limit for radiation with a pulse width on the order of milliseconds or less. The committee does advise, however, that "pulsed repetition rates at extremely low frequencies (8-16 Hz) and intermittent exposures repeated with the same frequencies should be avoided."

UPDATES

Biological Effects.... Dr. Joe Elder of EPA's Environmental Biology Division reports that he has received four reviews of Dr. William Morton's study, which found a correlation between three types of cancer and RF/MW radiation among residents of Portland, OR. (See *MWN*, January/February and May 1982.) On the basis of these reviews, Elder has asked Morton to "extensively revise" and resubmit his study. No new timetable has yet been worked out. Elder refused to comment on the study itself.... A new draft of EPA's health effects document, *Biological Effects of Radiofrequency Radiation*, will be ready for review by the agency's Scientific Advisory Board (SAB) this summer. As soon as it goes to the SAB, it will be available to the public. The document will be the basis for EPA's "guidance," or recommended safety level, for public exposures to RF/MW radiation. The formal notice of an intent to issue a guidance is still waiting for Administrator Anne Gorsuch's approval.... The papers presented at the *Festschrift* for Professor Herman Schwan, held in November 1980, have been published in Volume 3, Number 1 of *Bioelectromagnetics*. The collection, *The Interaction of Acoustical and Electromagnetic Fields with Biological Systems*, edited by Shiro Takashima and Elliot Postow, is also available as Volume 86 of *Progress in Clinical and Biological Research* for \$28 from Alan R. Liss, Inc., 150 Fifth Avenue, New York, NY 10011.... EPA is negotiating a contract with researchers at the University of Illinois, Urbana, on the effects of whole body and local exposure to microwaves on local tissue blood flow. Dr. Kenneth Holmes of the Department of Veterinary Biosciences and Dr. Richard Magin of the Department of Electrical Engineering are the joint principal investigators. They will use 2450 MHz radiation at both thermal and subthermal levels, though the exact power densities have still to be worked out.... Drs. Norman Rosenthal and Thomas Wehr at the National Institute of Mental Health have found that exposure to visible light—special bright lights—can relieve depression, according to an item in the May 21 *Washington Post*. The lights fooled the participants into thinking it was still summer in the middle of winter, helping them fight off what the researchers have called "gray sky syndrome."

Communications.... The FCC has allocated 3 MHz of spectrum space for one-way paging systems. The recent action makes room for 80 paging channels in the 929-932 MHz band.... Commission rules for low-power television are in the May 18 *Federal Register* (47 FR 21468).... In response to petitions from the Local Digital Distribution Company and Satellite Business Systems, the commission has reconsidered its spectrum allocation decision for digital termination systems (DTS) (see *MWN*, February 1981). DTS power limits are now calculated by power spectral density rather than absolute power. So far 29 applicants are seeking DTS licenses.... The interconnection, which phone companies will provide for cellular systems operated by non-wireline companies, will be discussed at an FCC public meeting June 16. Contact the commission's Tom Gutierrez at (202) 632-6450 for details.... The Justice Department has filed for a partial stay of the FCC's authorization for cellular radio service. The department asked that the commission accept applications on June 7 as planned but be restrained from processing those from local phone companies until completion of a legal review.... AT&T, GTE, MCI Communications, LIN Broadcasting, Associated Communications Corp. and Western Union are among the companies seeking licenses.... Metro-media Inc. is acquiring Radiofone Corp. and plans to finance the radio paging operator's cellular action.... The May 10 *Electronic News* reports on joint ventures among radio common carriers for entry into cellular markets. Up to \$20 million in start-up costs may be required for a single market.... Away from the cellular front, GE wants 9 MHz of the 900 MHz band for personal radio communications services (PRCS). A "base" station tied in to customers' home phones and a "mobile" unit installed in their cars would allow drivers to make calls 5 to 15 miles from home. GE is seeking a mass, general consumer market with a system priced at around \$400.... Stock market quotes sent via FM radio will soon flash across handheld receiver display screens. Dataspeed Inc. of San Francisco plans to introduce a small gadget in December that can receive all prices from major stock exchanges in 70 seconds.

Compatibility & Interference.... The Bureau of Mines is worried about the possibility that communication and control devices, installed to improve safety and productivity, may interfere with each other. The bureau has issued a RFP (J0123038) to identify those devices, including mining machines, shuttle cars, conveyor systems and radio communication systems, which may interact. The contractor will develop solutions to minimize any harmful RFI.... The FCC has acted favorably on a petition by the Computer and Business Equipment Manufacturers Association (CBEMA), which sought certain exemptions from RFI verification procedures. The FCC decided to allow the operation of Class A and B computing devices at trade shows and at the manufacturer's site prior to verification of compliance with the commission's RFI regulations. Class A devices, generally large mainframe computers, can also be tested at the users' sites; Class B computers, such as personal computers, were not exempted however. The CBEMA petition was filed on December 8, 1980; the commission issued its decision on March 22.... Inverters that convert DC from solar cells to AC emit radiation over a broad frequency range which can interfere with AM radio reception. An item in the May 15 *Science News* cites tests performed by NBS's John Adams that indicate photovoltaic cells will probably need shielding.... The FCC is seeking further public comment on rules to alleviate interference caused by noncommercial, educational FM stations in the 88-92 MHz band to the operation of Channel 6 (82-88 MHz) in the same area. For more information contact FCC's Gordon Godfrey, (202) 632-9660.... The commission is also soliciting comments on how to implement the agreement reached on AM broadcasting at the 1981 Rio de Janeiro conference. See 47 FR 18009, April 27, or contact Louis Stephens, (202) 632-7792, on legal issues or Larry Olson, (202) 254-3394, on engineering matters.... Comsearch, Inc., of Reston, VA, is now offering free literature on "Interference Protection for Cable TV Systems from Low Power TV Stations." For more information contact: Jerry Schulman, (703) 620-6300.

EMP.... *Science* magazine's William Broad took his arguments against increased funding of space weapons in the face of EMP threats to the op-ed page of the *New York Times* (May 13).... The piece prompted a reply (May 23) from Frederick Jacobs, who, basing his views on articles in the January 18 and March 15 *Aviation Week and Space Technology*, believes that DARPA is now aware of the EMP problem and addressing it. Jacobs is a freshman at the University of Chicago.... The papers to be presented at the July 23 *Conference on Hardened Electronics and Radiation Technology* at Nellis AFB, Las Vegas, NV, will be published in a special issue of the *Journal of Defense Research*.... The Army Construction Engineering Research Lab in Champaign, IL, is looking for a contractor to revise technical manuals on the effects of EMP with emphasis on protection and shielding.

Government.... EPA has announced the appointment of a new director of its Office of Radiation Programs. Glen Sjoblom, the assistant director for environmental controls in the navy's reactor program, will soon replace Dr. Gordon Burley, who has been serving as the office's acting director since the departure of Dr. David Rosenbaum.... At OSHA, Dr. R. Leonard Vance has been named the head of the Directorate of Health Standards Programs. Vance, a chemist and lawyer, was an assistant attorney general in Virginia. He replaces Dr. Bailus Walker, who resigned last year.... An NTIA spokeswoman said that there have been no new developments on finding a new home for ERMAC. NTIA wants to transfer the responsibility for coordinating federal activities on the bioeffects of RF/MW radiation, but it is not clear who, if anyone, will pick up the advisory committee's work. (See *MWN*, May 1982.) Meanwhile, the House Energy and Commerce Committee approved an FY83 budget of \$13.4 million for NTIA while the Senate Commerce Committee supported the Reagan Administration's request of \$12.4 million. A conference committee will settle the difference; a compromise of \$12.9 million is expected. The extra \$500,000 would be allocated to continued funding of NTIA's public telecommunications program, contrary to the administration's plan to phase it out.... On another front, NTIA is

soliciting proposals for a study to see which parts of its Spectrum Management and Federal Systems program can be contracted out to the private sector. The Electromagnetic Compatibility Analysis Center which is operated by the IIT Research Institute for DoD is one example of such outside assistance. Solicitation No. SA-82-RSB-0029 was issued May 6... BRH's Technical Electronic Product Radiation Safety Standards Committee (TEPRSSC) is once again looking for new members to fill four vacancies coming up on December 31. Those persons nominated last year but not elected will be reconsidered. New nominations are due by July 12. For more information contact: Dr. Zory Glaser, (301) 443-3429.

Litigation... A local citizens group in Coventry, CT, has filed suit in the state's Superior Court to block a relay transmission tower proposed by US Telecommunication Systems, an ITT subsidiary. Citizens Against the Tower is appealing the town Zoning Board of Appeals' April 20 approval for the 20-watt facility because of concern over potential radiation health hazards. Lawrence Bates, the group's attorney in Coventry, has also requested a temporary restraining order to prevent construction until the case is settled. A hearing on the request is scheduled for June 16. According to ITT's attorney, William Hall, the company has offered to delay construction plans in exchange for dropping the restraining order request and quickly taking the case to court this summer. The Coventry site is one of four towers being planned to link New Jersey and Boston. Hall explained that "the company is anxious for speedy disposition of the case so that the whole system can be built." ITT has already completed a system with over 100 towers between Houston and New Jersey. At zoning board hearings last month, Dr. Herbert Pollack testified as a medical consultant for ITT and Dr. Sol Michaelson appeared for the board.

Medical Applications... Francis Smith of the Department of Nuclear Medicine at the Aberdeen Royal Infirmary in Aberdeen, Scotland, reports in the April 24 *Lancet* that no short or medium term ill-effects have been found after the examination of 548 patients and healthy volunteers, ranging in age from two weeks to 84 years, with an NMR imager. The imager used was designed and developed in Aberdeen. He believes that NMR imaging is a "safe technique at the magnetic fields used for imaging and that it does not cause any ill-effect."... Dr. Ian Pykett, a member of the research team on NMR imaging at Massachusetts General Hospital in Boston, has written a review article, "NMR Imaging in Medicine," for the May issue of *Scientific American*... An "electric Band-Aid" could speed up the healing of wounds, according to a presentation by Oscar Alvarez of the University of Pittsburgh School of Medicine at the Society for Investigative Dermatology meeting in Washington, DC, and reported in the May 22 *Science News*. An electrode made of silver impregnated cloth, which was placed over surface scrapes, reduced the healing time from 4.6 to 2.9 days, compared with no treatment. More work is needed before any firm conclusions can be reached.

Ovens... Congressman Richard Ottinger's (D-NY) subcommittee on energy conservation and power of the House Committee on Energy and Commerce held hearings on DOE's decision not to set efficiency standards for appliances, including microwave ovens, on May 21. (See *MWN*, May 1982.) Ottinger, with the support of 50 co-sponsors, has introduced H.R. 6202, which would amend the Energy Policy and Conservation Act to eliminate the preemption of state standards. Ottinger attacked DOE's analysis supporting the "no standard" approach as "manipulated" and an example of "voodoo economics." His position was supported by a recently released GAO report, *Appliance Efficiency Standards: Issues Needing Resolution by DOE* (GAO/EMD-82-78, May 14, 1982), which concludes that the basis for DOE's proposal is "highly questionable." Representatives of DOE testified that the agency's position was that "mandatory federal standards would place unnecessary restraints on manufacturers." The Association of Home Appliance Manufacturers (AHAM) endorsed the DOE decision, arguing that the marketplace would accomplish the goal of energy efficiency... Meanwhile, DOE cancelled its May 11-12 public hearing in Chicago on the standards due to lack of interest. Only two requests to speak were submitted

and both parties agreed to participate at the hearings in Washington, DC, scheduled for May 18-21... The Society of Plastic Industries is sponsoring a seminar on microwave oven cookware on July 26 as part of the annual meeting of the International Microwave Power Institute to be held in San Diego, CA. (See conference calendar.)... AHAM reports that shipments of microwave ovens were down 13.4 percent in April compared to April 1981. Factory shipments for the year now stand at 1,213,100, more than 10 percent fewer than last year.

Radar... Dr. Jack Verona of the Defense Intelligence Agency testified on technology transfer from the US to the USSR before the permanent subcommittee on investigations of the Senate Committee on Governmental Affairs on May 5. He argued that Soviet radar development was hastened by US lend-lease equipment sent after World War II, the unclassification of MIT Radiation Laboratory's volume on radar theory and the acquisition of American microcircuitry... Stephen Johnson published a reply to Thomas Amlie's article on the dangers of over-reliance on radar (see *MWN*, April 1982) in the May *IEEE Spectrum*... *Science News* features a report on the accuracy of police traffic radar in its May 22 issue... The Rome Air Development Center at Griffis AFB, NY, is negotiating a contract with Raytheon Co. for a feasibility demonstration of HF radar.

Satellite Communications... The FCC voted to cut off processing new applications for orbital slots at a meeting last month. To avoid delay in assigning slots, it will now consider only the ten applications already in for approval. New applications will be processed as a separate group... Most people would not buy a new television to get a better quality picture, according to a study by Frank N. Magid Associates. On May 17, *Broadcasting* magazine reported that this survey supports a push by United States Satellite Broadcasting, a direct broadcasting services applicant, for allocating spectrum to DBS rather than high resolution TV... COMSAT's Satellite Television Corporation (STC) is making plans for a DBS satcom station in Las Vegas... Meanwhile, FCC approval for the company's DBS satellites is pending... Tandem Computers Inc. and American Satellite Co. have joined forces to market Infosat, a system for sending computerized information via satellite. An article in the May 13 *Wall Street Journal* reports that the system will be available next year... On the same day, the *Journal* examines the policy issues surrounding satellite links between the US and Canada. Growing commercial demands for communications services have prompted US satcom operators to request the links, which are now not permitted... The May 3 *Aviation Week and Space Technology* details features of the new Intelsat VI satellites... Hughes Communications International will build Australia's first satcom system. The company recently signed a \$175 million agreement with Aussat Proprietary Ltd., the national satellite company... The FCC has approved COMSAT's plans for six satcom stations in Micronesia and the Marshall Islands.

Standards... Approval of the new health and safety RF/MW standard is still under consideration at ANSI... On another front, ANSI is seeking comment on a new standard, *Recommended Practice for the Measurement of Spurious Emissions from Land-Mobile Communication Transmitters* (No. BSR/IEEE 377-1980). It covers definition of terms, controlled test conditions, test apparatus and test methods in the range 25 MHz to 1000 MHz. For a copy send \$6 to: Board of Standards Review, ANSI, 1430 Broadway, New York, NY 10018. Comments are due July 13... ANSI has also published a 16-page booklet, *Directory of International and Regional Standards Organizations*. Send \$3 to the ANSI Sales Dept... The International Electrotechnical Commission has issued a technical report on *Methods of Measurement of Wideband Noise Radiated from Motor Vehicles — Appendix A: Measurement and Performance Specifications for a Standard NAD Measuring Equipment — Appendix C: Overlay Method for Assessing Receiver Degradation in the Presence of Impulsive Noise*, Publication No. 489-9, Section 2. A copy is available for \$7 from the ANSI Sales Dept. The IEC has also proposed a number of amendments to the International Special Committee on Radio Interference's Publication No. 14. For more information, contact ANSI.

Technology... A team from the Johns Hopkins University School of Medicine describes the use of 1 kV/cm electric pulses for 50 microseconds to fuse 3T3 cells in monolayer culture, in the April 30 *Science*. The researchers proposed that "transient pore formation and energization of cell membranes brought about by the electric field are responsible for the fusion of cells in close contact." ... A satellite system using pulse-doppler radar could control global air traffic in the next century, according to designers at the Aerospace Corp. in El Segundo, CA. The system is described in the May 17 *Electronic News*. ... The US Army Armament R&D Command in Dover, NJ, has announced three new contracts for the development of railgun technology. Negotiations are being conducted with Sandia National Labs in Albuquerque, NM, GT Devices of Alexandria, VA, and Vought Corp., of Dallas, TX.

VDTs... A summary of VDT radiation test results from Dayton T. Brown is due in June. The firm has been testing units used by Darleen Weiss, a VDT operator who sought workers' compensation for cataracts allegedly induced by radiation from the terminals. (See *MWN*, October 1981.) ... Canada's Radiation Protection Bureau retests of Bell Canada VDTs reported to emit X-rays have found nothing. Bureau director Dr. Ernest Latourneau said that the high readings taken by the company last year were the result of procedural errors. ... A VDT safety bill introduced in the Massachusetts legislature is not likely to be considered this year. (See *MWN*, April 1982.) A spokeswoman for the House Committee on Commerce and Labor that had begun review of House Bill 2910 said the measure would probably be reintroduced next year. ... The city of Toronto has agreed to grant women working on VDTs alternate work during pregnancy. The option is part of a contract between the city and the Local 79 of the Canadian Union of Public Employees.

Etc... Bernard Schwartz, the chairman of Loral Corp., has given the City College of the City University of New York \$165,000 to set up a microwave laboratory at its School of Engineering. The money, which will be used to buy equipment, is a step toward establishing a major center for microwave research at CCNY. ... Physicists at Stanford University, CA, believe they have finally detected a magnetic monopole, a single north or south magnetic pole. The discovery is causing much excitement and promises to intensify the search by other scientists. ... Dr. Merle Tuve, one of the leading developers of radar, died in Bethesda, MD, on May 20.

LETTERS

To the Editor: Upon reading your report of our work ("Low-Intensity Pulsed Magnetic Fields Stimulate Release of Noradrenaline," *MWN*, May 1982), there is one inaccuracy I would like to correct. You state that "they suggest that weak magnetic fields could damage the surface of cell membranes" whilst we stated that "irreversible membrane damage has not occurred."

We were able to draw this conclusion because we designed part of the protocol to specifically check this possibility. The observations that elevated Mg^{++} levels inhibit the stimulated release and that prior exposure to our magnetic field does not alter high K^{+} stimulated release both strongly suggest that the stimulation we observed is of the normal vesicle mediated stimulus coupling pathway found in these cells. Indeed, we believe that reversible co-operative interactions between surface bound glycoproteins may well mediate this response, which is a model that has been developed by Ross Adey in his recent publications.

Richard Dixey
Department of Medical Electronics, St. Bartholomew's
Hospital, West Smithfield, London EC1A 7BE, England

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

• 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 14-16: 4th *International Workshop on Biomagnetism*, Rome, Italy. Contact: Dr. G. Spissu, Istituto di Elettronica dello Stato Solido del C.N.R., Via Cineto Romano, 42-00156, Rome, Italy.

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

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

• September 22-24: 35th Annual *Conference on Engineering in Medicine and Biology*, Marriott Hotel, Philadelphia, PA. Contact: ACEMB, 4405 East-West Highway, Suite 210, Bethesda, MD 20814.

• October 26-28: 1st *International Symposium on Medical Imaging and Image Interpretation*, Berlin, West Germany. Contact: Dr. Judith Prewitt, c/o IEEE Computer Society, PO Box 639, Silver Spring, MD 20901.

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A Monthly Report on Non-Ionizing Radiation

June 1984

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Pulsed Magnetic Fields: Conflicting Results

Low frequency magnetic fields are becoming a focal point for bioeffects research. One of the major objectives is to replicate the experiments of Dr. Jose Delgado, who has shown that very low intensity, pulsed magnetic fields can have a dramatic effect on a developing chick embryo. Scientists are anxious to repeat and explain Delgado's experiments because, if confirmed, his results could shed new light on how radiation interacts with living systems and could force a major reassessment of radiation hazards.

At least three research groups are trying to replicate Delgado's experiments, with varying success. One team has failed, another has partially succeeded and a third will start work later this summer. In addition, workshops to exchange research ideas are being planned and funds are being set aside to allow scientists on both sides of the Atlantic to visit each other's labs.

Delgado's Experiment

In 1982, Delgado and his associates at the Centro Ramon y Cajal Hospital in Madrid, Spain, showed that pulsed magnetic fields at frequencies of 10, 100 and 1000 Hz can have a "consistent and powerful" effect on the growth and development of chick embryos at intensities ranging from 1.2-120 milligauss (see *MWN*, March 1983). In a follow-up study, Delgado's group concluded that pulse shape could be the decisive parameter for determining whether magnetic fields modified embryonic development, though the precise mechanism remained unknown (see *MWN*, November 1983).

(continued on p.2)

EPA Delays Decision on Releasing RF/MW Guidance

The Environmental Protection Agency (EPA) has delayed the release of its proposed radiofrequency/microwave (RF/MW) radiation exposure guidance, which was scheduled for this month. In the first official statement to indicate rule making may be abandoned, EPA Assistant Administrator Joe Cannon announced in early June that the agency is considering a number of options for the guidance, including putting it on ice.

As we go to press, agency officials would only say that an active "internal debate" is in progress and that a decision should be reached later this summer.

Meanwhile, the Office of Research and Development's report on RF/MW bioeffects has received final approval from EPA's Scientific Advisory Board. The document was prepared as the basis for standard setting (see Standards Update, p.12).

Miller Fails

Dr. Morton Miller, of the University of Rochester in New York, has completed his attempts to duplicate the effects reported by Delgado. "We found absolutely nothing," he said in a telephone interview. Miller studied only the two highest frequencies (100 and 1000 Hz) and the two highest intensity levels (12 and 120 milligauss) used in Delgado's original experiment. Professor Edwin Carstensen of the university's department of electrical engineering and Sandra Maffeo, a lab technician, collaborated with Miller on the study. Miller is with the department of radiation biology and biophysics at the School of Medicine and Dentistry.

Miller used 0.5 millisecond pulses with rise times of approximately 10 microseconds.

He noted that the study had been run "blind," but that there was one difference between his set up and that of Delgado's. The eggs in the two experiments had different orientations with respect to the coils. Thus, according to Miller, the induced electric fields in Delgado's eggs were "slightly higher."

Miller expressed disappointment about coming up empty-handed. "I haven't a clue why we did not get any results in comparison with Delgado's massive effects," he said.

A paper describing Miller's results has been accepted by the *Journal of Anatomy*, the same journal that published Delgado's two papers. In it, the Rochester team concludes: "Our failure to replicate the results of [Delgado's] earlier report cannot be said to invalidate that work. It does imply that if there are effects of magnetic fields on embryogenesis, they must be very subtly related to the conditions of exposure. In view of the obvious importance of the observations, we strongly encourage other independent investigators to try to replicate the observations." The paper should appear later this year.

Mild's Partial Success

Dr. Kjell Hansson Mild, of Sweden's National Board of Occupational Safety and Health in Umea, has had some success where Miller failed. In a telephone interview from Sweden, Mild said that he had detected the Delgado effect: "We seem to have confirmed the same general trend, but with a lower rate of malformation." Mild noted that the effect he observed was statistically significant.

In his original paper, Delgado reported that nearly 80 percent of the eggs developed abnormally when exposed to pulsed magnetic fields. Mild said that he was finding an abnormality rate of about 30 percent. He added that more of

the control eggs in his experiment were developing normally than in Delgado's.

There was at least one minor difference between Mild's and Delgado's experiments. Mild pointed out that, "We have slightly different techniques for preparing the embryos."

Mild used a 10 milligauss peak field, with pulses that were 0.5 milliseconds wide with 40 microsecond rise and fall times. The pulse repetition rate was 100 pulses per second (100 Hz).

Mild said that he is preparing a short communication describing his results for submission to *Bioelectromagnetics*.

EPA-NIEHS' Attempt

The third attempt to repeat Delgado's experiment will be made by a team from the Environmental Protection Agency (EPA) and the National Institute for Environmental Health Sciences (NIEHS) in Research Triangle Park, NC (see *MWN*, January/February 1984). According to the current schedule, the study will begin later this summer.

Before the power is turned on by the EPA-NIEHS team, EPA's Richard Tell and Dr. Ezra Berman will visit Delgado's lab in Madrid. "I want to understand all of Delgado's field parameters before we start," Tell said. The EPA trip will be sponsored by the Office of Naval Research (ONR).

According to ONR's Dr. Michael Marron, Dr. Tom Rozzell has visited Delgado's lab and was impressed with what he saw there. (Rozzell is on a two-year assignment at ONR's London office.) Using funds from ONR's visiting scientist program, the Navy is planning to fly two of Delgado's associates to the US later this year.

CW Fields

Dr. H.B. Graves would also like to try to repeat Delgado's experiment. He recently completed a study in which he exposed some 20,000 chicken eggs to continuous wave (CW) 60 Hz fields ranging from 100 V/m to 100 kV/m, and found no effects on a large number of end points, including growth, body weight and behavior. The study was sponsored by the Electric Power Research Institute (EPRI).

Graves, who is a professor of biology and poultry science at Pennsylvania State University, said that he had asked both EPRI and the US Department of Energy (DOE) for funds to attempt a Delgado replication with no success. "I feel like the Delgado study has implications that are too important to ignore," Graves said in a telephone interview. "We must seize upon this to try and understand how such a signal can couple with a living system."

Dr. Rob Kavet at EPRI told *Microwave News* that the institute has no immediate plans to fund a Delgado-type study because that kind of pulsed signal does not show up in transmission line environments.

Graves opposed this view. He maintained that, "It's an error for EPRI not to fund a replication. If Delgado's effect is robust, it has implications for utilities and many other industries." (Miller said that his study had been supported by DOE and the Empire State Electrical Energy Research

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Corp., a consortium of New York state private utilities modeled after EPRI.)

Why is Replication Difficult?

A number of scientists were asked why they thought it was so difficult to repeat Delgado's experiment. A common reply was that Delgado had not provided detailed descriptions of his study design in his published papers. For instance, in his first paper, Delgado does not specify the rise time of the pulses he used, a variable he claims in his second paper may be the "decisive parameter." In that latter paper, he reported finding a maximum effect with a rise time of 42 microseconds and an intensity of 10 milligauss.

Although Miller and co-workers claim to have attempted a replication of Delgado's experiment, they used a different pulse shape with a 10 rather than 42 microsecond rise time.

If Delgado's hypothesis that there are windows in the teratogenic effects of electromagnetic fields proves to be correct, the differences in pulse shape and field intensity could be decisive.

Others suggested that a number of variables could be critical: the orientation of the exposed eggs to the Earth's magnetic field, the temperature at which the eggs are incubated and the way the eggs are handled during the course of the experiment. Mild speculated that, "There may be some

other parameter that we are not controlling for."

According to Marron, Rozzell noted in a report on his visit to Delgado's lab that he had been told that the orientation of the exposed eggs to the Earth's magnetic field is a crucial variable. Neither Miller nor Mild took this factor into account in their experiments — because it is not cited in Delgado's papers.

Delgado was in Sweden in May, and Mild met with him. Mild reports that Delgado is now exposing live, pregnant rodents to pulsed magnetic fields and investigating changes in the brain chemistry of the embryos.

Workshops

ONR's Marron told *Microwave News* that he is considering organizing a workshop on low frequency fields for this fall.

In addition, there will be a symposium on "Magnetic Fields and Biological Systems" on the evening of July 15 at the Bioelectromagnetics Society (BEMS) meeting in Atlanta, GA. Among the papers to be presented is a review of preliminary attempts by Tell and co-workers to duplicate Delgado's results.

Delgado, Mild and Miller will not be at the BEMS conference; Mild and Miller are planning to attend the Hanford ELF symposium in Richland, WA, in early October. ●

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Health Hazards of Electromagnetic Fields

This new report reviews basic aspects and all latest research from ELF to microwaves, including 60 Hz power installations. Practical advice on health/environmental impacts. \$60 plus \$2 postage (US). Robert O. Becker, MD, Star Route, Lowville, NY 13367.

A Guide to FCC Equipment Authorizations

The updated second edition of the original book by William K. Roberts, former Assistant Chief Engineer of the FCC. Tells what type of authorization is required for your product and the procedure to use in obtaining FCC authorization. To be released in the second quarter of 1984. Send check or p.o. for \$79.50 to the EMXX Corp., 6706A Deland Drive, Springfield, VA 22152, (703) 451-4619.

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VDT News is the resource for reliable, up-to-date information on VDT health and safety. Coverage includes research, legislation and resources. Order today (\$18/year for individuals [personal check required], \$35/year for institutions.) Orders must be prepaid. Send to: *VDT News*, PO Box 1799, Grand Central Station, New York, NY 10163, (212) 725-5254.

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Computers on Aircraft: RFI More Likely

New test results from the Federal Aviation Administration (FAA) and the Boeing Airplane Co. indicate that electronic devices can interfere with an airplane's navigation and communications systems. According to Frank White, the chairman of a study panel investigating the potential dangers of radiofrequency interference (RFI) aboard aircraft, "There is now a definite possibility for RFI."

Although two incidents of RFI aboard aircraft have been reported, concerns over interference have been discounted by experts. Nevertheless the Radio Technical Commission for Aeronautics' (RTCA) Special Committee 156 (SC156) on Potential Interference to Aircraft Electronics Equipment from Devices Carried Aboard, under White's leadership, has been pressing computer manufacturers, aircraft companies, airlines and government agencies to generate data on the nature and scope of the problem (see *MWN*, October 1983 and April 1984).

In a memorandum prepared for the next meeting of RTCA SC156, Boeing reported that measurements made aboard one of its 757s indicated "that devices radiating at the specification limits produce interfering signal levels far above the receiver sensitivity threshold and therefore are a potential interference threat." Boeing concluded that, "In view of the results...we cannot rely on the inherent shielding of the aircraft fuselage to provide sufficient shielding effectiveness to protect airborne receivers from levels permitted for a class B device."

Previous FAA tests had shown that there was little likelihood of interference when the radiating source was placed in the aisle of the plane. More recent FAA measurements confirmed the Boeing findings: the mean minimum path loss for a radiating antenna against the window and in the aisle is 51.41 and 59.12 dB respectively. These new findings could affect the use of computers and other electronic devices on airplanes; as Boeing wrote to RTCA, "it is not practical to restrict the use of personal computers to those sitting in aisle seats."

In another memorandum to RTCA, David Hanttula of Apple Computer argues that the immunity of aircraft electronic equipment to RFI has not yet been fully characterized. "We must know what the immunity thresholds of the equipment are," he told *Microwave News*. Hanttula also wants RTCA to characterize the "interior electromagnetic ambients" aboard aircraft "to determine what RF levels are present without the presence of carried aboard electronic devices." (Hanttula is leaving Apple as of June 1, but he said that he plans to attend at least one more SC156 meeting.)

When asked in a telephone interview how serious the RFI problem might be, RTCA's White answered that, "We must see if the signals are strong enough and stable enough to cause RFI." To that end, White wants committee members to carefully characterize potentially interfering emissions. He added that the FAA and Boeing tests reflected worst case

rather than actual operating conditions.

More data will be generated before the next SC156 meeting on June 12-13. As White put it, "We have a lot of learning to do and I'm not drawing any conclusions yet."

Yannon v. RCA Suit Continues

The widow of a former New York Telephone radio technician has successfully appealed the dismissal of her \$3.5 million product liability suit against RCA. Mrs. Antoinette Yannon alleges long-term occupational exposure to microwave radiation caused her husband's illness and eventual death, a claim for which she won workers compensation benefits (see *MWN*, April 1981 and June 1982). RCA's motion for dismissal will now be reheard.

Samuel Yannon worked on microwave relay equipment at the Empire State Building for 15 years before being transferred to another site in 1968. The phone company forced him to retire in 1971 for medical reasons. Yannon died in 1974.

Mrs. Yannon's New York State workers compensation case was the first to present "substantial evidence to establish the necessary causal relationship" between exposure to microwave radiation and occupational disease ending in death. The current product liability case, however, will be much more difficult to win. Should RCA's motion for dismissal be denied, Mrs. Yannon must then prove that her husband's condition was causally linked to radiation exposure and that RCA, as the manufacturer of the equipment he worked on, was at fault.

In an April 30 decision, the Appellate Division of the New York State Supreme Court, Second Department, in Brooklyn reversed a July 1982 ruling by Supreme Court Judge Richard Goldberg which granted RCA's motion for dismissal based on the statute of limitations (see *MWN*, July/August 1982). A new hearing on the motion will be scheduled before the Supreme Court, Richmond County, for some time this year.

The key issue in this pre-trial action is whether Samuel Yannon was mentally capable of filing suit in 1968, the last year of his exposure to radiation. RCA maintains he was legally sane, and that therefore the statute of limitations had expired before Mrs. Yannon filed suit in 1976. Mrs. Yannon claims that by 1968 her husband was suffering from "chronic brain syndrome" caused by radiation exposure which left him incapable of managing his own affairs or defending his legal rights (see *MWN*, April 1982).

Brian Shoot, one of the attorneys representing Mrs. Yannon, told *Microwave News* that she has a good chance of defeating RCA's motion at the next hearing. The appellate court ruling will allow Mrs. Yannon to submit important evidence which was disallowed by Judge Goldberg. Shoot is a member of the New York City law firm of Schneider, Kleinick and Weitz, which was hired by Mrs. Yannon's personal attorney, David Paully, to handle the appeal and to act as trial counsel.

RCA refused to comment on the case.

Non-Union Fractures: PEMFs Ineffective?

Preliminary results from the first double-blind study of the efficacy of pulsed electromagnetic fields (PEMFs) for the treatment of non-union bone fractures indicates that immobilization without weightbearing may be more effective than PEMF therapy.

In the May 5 issue of *Lancet*, a team led by Dr. A.T. Barker of Sheffield University in England reports interim results on their study of tibial fractures that suggest that "conservative management of non-union is effective and this may explain much of the success attributed to pulsed magnetic field therapy." Conservative management involves stopping all movement and not placing any weight on the fracture.

The number of patients treated was small: nine received PEMF treatment, with seven controls. The fractures of five of the nine who had active coils had united at the end of 24 weeks, while five of the seven controls had also healed. All those participating in the study had fractures that were at least a year old.

One patient in the control group had been injured 11 years before the trial; his fracture was united after 24 weeks.

Those who wore active coils received 5 millisecond

pulses with a peak field of 1.5 millitesla, repeated at 15 Hz for approximately 12-16 hours a day for 24 weeks. Although the authors do not specify that they used Electro-Biology, Inc.'s coils, they credit the signal to Dr. C.A.L. Bassett, one of the company's founders.

The English researchers cite a number of possible explanations for their results, which they call unexpected: "high efficacy of long-term immobilization of the limb and avoidance of weightbearing, the placebo effect of the patients 'treating' themselves for extended periods each day, the limits on patient activity during waking hours caused by being connected to the machine with a cable approximately two meters long, the additional attention they received on their frequent visits to the clinic or any combination of the above."

Barker and his co-authors, Drs. R.A. Dixon, W.J.W. Sharrard and M.L. Sutcliffe, reported these "early" or interim results because only a small number of patients had come to their clinic. They recommend a multi-center study be undertaken with about 150 patients.

The researchers conclude, "Although long-term immobilization and conservative management is not common practice at present...it appears...that conservative management of non-union should be reappraised as a treatment of choice..."

(continued on p.6)

SHORT COURSES

July 9-12: Antenna Systems for Radar, Communications and Avionics, Los Angeles, CA. Fee: \$895. Contact: Continuing Education Institute, 10889 Wilshire Blvd., Los Angeles, CA 90024, (213) 824-9545. Repeated **July 30-August 2**: Boxborough, MA.

July 16-20: Microwave Antenna Measurements, Atlanta, GA. Fee: \$800. Contact: Dept. of Continuing Education, Georgia Institute of Technology, Atlanta, GA 30332, (404) 894-2400.

July 17-18: Radar Principles for the Non-Specialist, Washington, DC. Fee: \$625. Contact: George Harrison, Continuing Engineering Education, George Washington University (GWU), Washington, DC 20052, (800) 424-9773, or (202) 676-6106 in DC.

July 17-19: Advances in Magnetic Resonance Imaging, Andover, MA. Fee: \$655. Contact: Dick Murray, Institute for Graphic Communication, 375 Commonwealth Ave., Boston, MA 02115, (617) 267-9425.

July 17-22: Grounding & Shielding, Boulder, CO. 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 **August 14-17**: Ottawa, Canada; **September 18-21**: San Diego, CA; **October 23-26**: Atlanta, GA.

July 31-August 3: Antenna Theory and Design, Myrtle Beach, SC. Fee: \$645. Contact: Ann Beckman, Southeastern Center for Electrical Engineering Education (SCEEE), Central Florida Facility, 11th & Massachusetts Ave., St. Cloud, FL 32769, (305) 892-6146.

August 6-10: Non-Ionizing Radiations: Biophysical and Biological Basis, Applications and Hazards in Medicine and Industry, Cambridge, MA. Fee: \$950. Contact: Office of Summer Session, Room E19-356, MIT, Cambridge, MA 02139.

August 7-9: Grounding & Interference Control in Buildings and Electrical/Electronic Facilities, Philadelphia, PA. Fee: \$785. Contact: DWCI, see July 17 above.

August 13-17: Antennas and Arrays, Ottawa, Canada. Fee: \$875. Contact: GWU, see July 17 above. Repeated **October 22-26**: Washington, DC.

August 14-15: EMI Diagnostics & Fixes, Virginia Beach, VA. Fee: \$635. Contact: DWCI, see July 17 above.

August 21-24: EMC Engineering, San Mateo, CA. Fee: \$770 (3 days); \$955 (4 days). Contact: Edith Webb, Center for Professional Advancement, PO Box 964, East Brunswick, NJ 08816, (201) 249-1400. Repeated **September 24-27**: East Brunswick, NJ.

August 27-28: Grounding, Bonding & Shielding, Washington, DC. Fee: \$625. Contact: GWU, see July 17 above.

August 27-29: Electromagnetic Pulse and Its Effects on Systems, San Diego, CA. Fee: \$695. Contact: GWU, see July 17 above. Repeated **November 19-21**: Washington, DC.

September 10-11: EMI Testing Workshop: Commercial, Philadelphia, PA. Fee: \$595. Contact: Michele Elkes, R&B Enterprises, 20 Clipper Rd., West Conshohocken, PA 19428, (215) 825-1965. Repeated **October 29-30**.

September 10-14: EMC Design & Measurement for Control of EMI, Philadelphia, PA. Fee: \$995. Contact: DWCI, see July 17 above.

September 17-21: Modern Radar Technology and Applications, Los Angeles, CA. Fee: \$895. Contact: UCLA Extension, 6266 Boelter Hall, UCLA, Los Angeles, CA 90024, (213) 825-1295.

September 17-21: Microwave Systems Planning, Washington, DC. Fee: \$875. Contact: GWU, see July 17 above.

September 20-21: EMI Testing Workshop: Military, Philadelphia, PA. Fee: \$595. Contact: R&B, see September 10 above.

September 24-25: Grounding, Bonding & Shielding, Chicago, IL. Fee: \$495. Contact: R&B, see September 10 above. Repeated **October 9-10**: Boston, MA; **November 13-14**: Washington, DC.

Immunity and ANS C63 Committees: Progress Reports

The work of the American National Standards Institute's (ANSI) Ad Hoc Committee on Public Law 97-259 has entered a new phase. The committee, which is developing voluntary standards to enhance the immunity of home electronic equipment, is now attempting to define the relationship between given levels of immunity and the resulting volume of consumer complaints.

According to committee chairman Don Heirman of AT&T Information Systems Labs, one of the next objectives of the committee is to come up with "protection distances" for TVs and VCRs from sources of interference. In this way, it is possible to suggest configurations that will reduce unacceptable RFI. This task, Heirman says, is very complex and will be difficult.

In an April 27 status report, Heirman notes that a draft standard on conducted (via the antenna) immunity of TV receivers in the 535 kHz-30 MHz frequency range has been circulated among members of the Electronic Industries Association's (EIA) Consumer Electronics Group. EIA Bulletin No.10 received general approval except from the American Radio Relay League (ARRL). ARRL wants to build in more protection from amateur radios.

Manufacturers are continuing their testing to determine the radiated immunity of TVs and VCRs. Preliminary data indicate that a target of 3 V/m is still out of reach, and some manufacturers are asking if the 3 V/m level is too strict.

An immunity level of 1 V/m may be sufficient to deal with CB radio radiofrequency interference (RFI). This problem area is diminishing because of the decreased use of CBs, improved TV receiver design and increased use of cable TV. The 1 V/m level may not take care of RFI from amateur radios, however. The question of immunity from signals above 30 MHz must still be addressed.

As the work on TVs and VCRs continues, a new working group on cordless telephones has been set up within the ad hoc committee under the chairmanship of Peter Bennett of EIA. The group's first order of business is to determine whether an electromagnetic compatibility (EMC) problem exists and, if so, how it should be approached. Interference to home security devices will be taken up later.

One of the objectives of the ANSI committee is to devise voluntary standards to reduce the number of interference complaints from consumers so that the Federal Communications Commission (FCC) can comply with the Communications Amendments Act of 1982 (PL 97-259) without setting mandatory standards (see *MWN*, October 1982 and May 1983). To make sure that the needs of the FCC are being met by the ANSI committee, an executive steering committee has been established. Its members are Don Heirman, Harold Gauper of General Electric, Dr. Ralph Showers of the University of Pennsylvania and E.N. Skomal of the Aerospace Corp.

The next meeting of the ad hoc committee is scheduled for June 12 in Washington, DC.

ANS C63

The American National Standards Committee (ANS) C63 Committee met in San Antonio, TX, on April 27 and officially changed its name to the C63 Committee on Electromagnetic Compatibility (instead of Committee on Radio-Electrical Coordination). The committee also redefined its scope:

Development of definitions and methods of measurement of electromagnetic noise and signal strengths (radiated and conducted), determination of levels of signal strength and levels of unwanted sources, limiting ratio of noise and/or unwanted sources to signal and development of methods of control of, and guidelines for, influence, coupling and immunity. *Note:* Where subjects dealt with overlap those of other national committees, appropriate liaison will be established.

Work is continuing on the revision of C63 standards. A vote on amending C63.4-1981 on measurement methods to include open area test sites was generally positive, but a number of semantic and technical problems remain unresolved. A task group under the chairmanship of Edwin Bronaugh of Electro-Metrics will tackle these details.

Within subcommittee 1 of C63, Al Smith, Jr., of IBM has completed the first draft of a two-part report on medical device EMC. Part I on emissions covers medical diathermy and ultrasound therapy equipment; Part II on immunity covers cardiac pacemakers, electroencephalographs (EEG) and electromyographs (EMG).

Meanwhile, Howard Bassen, of the Food and Drug Administration's (FDA) Center for Devices and Radiological Health, will no longer lead efforts to develop susceptibility limits for medical devices within C63. In a telephone interview, Bassen explained that there had been little support for past FDA work on medical device EMC and there was insufficient evidence that this area was a priority compared to other medical device problems.

The next meeting of the C63 Committee is tentatively scheduled for September in Washington, DC.

Bigger FY85 Research Budgets at EPA and DOE

Both the Environmental Protection Agency (EPA) and the Department of Energy (DOE) are requesting bigger budgets for their non-ionizing radiation research programs for fiscal year 1985 (FY85). Given the significant cuts in recent DOE budgets and the protracted battle to save EPA's entire radiofrequency and microwave (RF/MW) bioeffects program last year (see *MWN*, June 1983), the modest increases in the current proposals are encouraging for researchers in this field.

EPA

At EPA's Experimental Biology Division in Research Triangle Park, NC, Acting Director Dr. Joe Elder reports, "We're back and we expect to have our program continuing over the next few years." If approved, the new budget will

maintain the extra-mural research program at \$1 million but increase the in-house appropriation to \$897,700, a \$335,500 increase over FY84. The million dollars available for extra-mural contracts is triple the FY83 level.

Some of the additional funds will support new research on extremely low frequency (ELF) radiation, as work in other parts of the spectrum is extended. In its request to Congress, EPA noted that, "Presently, only continuous wave radiation (as averaged over the whole body) can be addressed in the [RF/MW exposure] guidance," and cited the need for more work in the following areas: (1) peak power, intermittent, partial body, lifetime exposures, wave modulation and non-uniform energy absorption; (2) central nervous system effects at extremely low exposure levels; and (3) frequencies outside the range of the RF/MW guidelines — especially ELF radiation.

Summing up, EPA reported that in 1985 it plans to evaluate the need for regulating exposures to radiation outside the RF/MW band and increase RF/MW research on "neurological effects, long-term low-level exposure and dose/extrapolation modeling."

DOE

DOE has requested \$3.7 million for its electric field effects program within the Electric Energy Systems Division for FY85, an increase of \$700,000 over this year's budget. The bulk of the DOE-funded research examines the health

and environmental effects of power line (ELF) radiation. Division Director Dr. Ray Dunlap reports that part of the increase will be used to evaluate whether a new program on magnetic fields is needed.

More funds will also be available for a "low-level" program on the effects of ions from DC power lines. A DOE staffer estimates that the current budget for this program is about \$300,000.

Although the proposed boost in funds for the Electric Energy Systems Division suggests a stronger commitment to ELF health effects research, the overall DOE budget shows that much of the proposed increase is the result of consolidation rather than real growth. Specifically, the ELF research program at the Office of Health and Environmental Research, which received \$1 million in FY82 and \$400,000 in FY83, was zeroed out in FY84 and will not be refunded.

The office's Martin Minthorn told *Microwave News* that "our budget has been under strong pressure for several years and some things just had to be cut." He said some of the work initially funded by Health and Environmental Research would be picked up by the Electric Energy Systems Division, which operates out of a different part of DOE.

A status report on DOE-funded research might be prepared later this year. In a telephone interview, Dunlap noted that he would like to write a brief overview of power line radiation research in addition to the abstracts from the department's annual contractors review meeting.

CONFERENCES

July 2-6: 1984 Nuclear EMP Meeting, Baltimore Hilton Hotel, Baltimore, MD. Contact: Dr. Arthur Sindoris, Harry Diamond Labs, 2800 Powder Mill Rd., Adelphi, MD 20783.

July 2-6: 4th International Symposium on Hyperthermic Oncology, Aarhus, Denmark. Contact: Dr. Jens Overgaard, Institute of Cancer Research, Radiumstationen, DK-8000 Aarhus C, Denmark.

July 9-12: 9th Annual Conference of the Australian Radiation Protection Society, Darwin, Australia. Contact: Ian Prince, C/GPO Box 1701, Darwin, NT 5794, Australia.

July 15-19: 6th Annual Bioelectromagnetics Society Meeting, Omni International Hotel, Atlanta, GA. Contact: BEMS, 1 Bank St., Gaithersburg, MD 20878, (301) 948-5530.

July 15-20: IEEE Power Engineering Society: 1984 Summer Meeting, Washington Plaza, Seattle, WA. Contact: Jack Richardson, Puget Sound Power & Light Co., 10608 NE Fourth St., Bellevue, WA. 98008, (206) 453-6800.

July 22-25: 21st Annual Conference on Nuclear and Space Radiation Effects, Broadmoor Hotel, Colorado Springs, CO; followed by **July 26-27: 1984 Hardened Electronics and Radiation Technology (HEART) Conference**, Fort Carson Army Base, Colorado Springs, CO. Contact for both meetings: B.D. Shafer, Division 2115, Sandia National Labs, Albuquerque, NM 87185, (505) 846-0629.

July 29-August 4: 8th International Biophysics Congress, Bristol, England. Contact: Meon Conferences Services, Petersfield, Hampshire GU32 3JN, England, (0730) 66561.

July 30-August 3: Gordon Conference on Bioelectrochemistry, Tilton School, Tilton, NH. Contact: Dr. Alexander Cruickshank, Gordon Research Center, University of Rhode Island, Kingston, RI 02881, (401) 783-4011.

August 13-14: Industrial Applications of Computed Tomography and NMR Imaging, Hecla Island, Manitoba, Canada. Contact: Optical Society of America, 1816 Jefferson Place, NW, Washington, DC 20036, (202) 223-8130.

August 19-23: Electromagnetic Waves and Neurobehavioral Function: A Workshop, Corsendonk, Belgium. Contact: Dr. Richard Lovely, Battelle Pacific NW Labs, PO Box 999, Richland, WA 99352, (509) 375-2269.

August 20-24: Conference on Precision Electromagnetic Measurements, Delft, Netherlands. Contact: Mrs. I.J. Smits, Department of Electrical Engineering, Delft University of Technology, PO Box 5031, 2600 GA Delft, Netherlands, 31-15-781736.

August 27-30: Open Symposium on Interaction of Electromagnetic Fields with Biological Systems, Florence, Italy. (The symposium will be held as part of the URSI Assembly, see August 28 below.) Contact: Dr. Elliot Postow, Naval Medical R&D Command, Bldg. 142, National Navy Medical Center, Bethesda, MD 20814, (202) 295-1140.

August 28-September 5: 21st General Assembly of the International Union of Radio Science (URSI), Florence, Italy. Contact: Professor A.M. Scheggi, Istituto Ricerca Onde Elettromagnetiche (IROE), Consiglio Nazionale delle Ricerche, Via Panciatichi 64, 50127 Florence, Italy, (55) 4378512.

September 10-13: 14th European Microwave Conference, Liege, Belgium. Contact: Microwave Exhibitions & Publishers, Convex House, 43 Dudley Rd., Tunbridge Wells, Kent TN11 1LE, England.

September 17-19: 19th Annual Microwave Power Symposium, Minneapolis Plaza Hotel, Minneapolis, MN. Contact: IMPI, Suite 520, 301 Maple Ave. West, Vienna, VA 22180, (703) 281-1515.

September 17-19: 37th Annual Conference on Engineering in Medicine and Biology, Los Angeles Hilton, Los Angeles, CA. Contact: Patricia Horner, Alliance for Engineering in Medicine and Biology, Suite 402, 4405 East-West Hwy., Bethesda, MD 20814, (301) 657-4142.

FDA Guide for Measurement Devices

The Food and Drug Administration (FDA) has published a useful guide to the array of non-ionizing radiation measurement devices now on the market. The report, developed by the Conference of Radiation Control Program Directors' Subcommittee G-3 on Non-Ionizing Radiation, lists the specifications for almost all commercially available instruments for measuring extremely low frequency, radiofrequency and microwave radiation, and ultrasound.

The guide was assembled specifically for state and local radiation control officers by staffers at the FDA's Center for Devices and Radiological Health and the Electrosystems Division of the National Bureau of Standards (NBS).

According to the center's Dr. Whit Athey, who headed this joint effort, the report was kept as simple and straightforward as possible in order to be of the most use to local authorities. References are provided for those needing more detailed information.

In addition to listing instrument specifications, the authors characterize each type of radiation and provide a brief

description of appropriate measurement techniques and applicable standards or safety guidelines.

The equipment specifications were provided by the manufacturers and were *not* verified by FDA or NBS. Athey said product testing will continue to be done on a case by case basis only.

The publication's tables for devices measuring extremely low frequency radiation and RF/MW radiation, and its list matching specific products with the meters that are most suitable for measuring their emissions are reprinted below. A separate list is provided for microwave oven survey instruments. The authors have excluded several inexpensive (less than \$50) devices for checking microwave oven emissions because "there are serious questions" about whether they work.

Copies of *Instrumentation for Non-Ionizing Radiation Measurement*, FDA 84-8222, January 1984, are available for \$2.00 from the Government Printing Office, Washington, DC 20402; Order No. 017-015-00220-9.

Instruments Currently Used in Microwave Oven Manufacturers' Compliance Testing Programs

Narda Microwave Corporation	Holaday Industries
Narda Model 8100*	Holaday Model 1700
Narda Model 8110B*	Holaday Model 1501
Narda Model 8201	(5/N-20915 and above)
Narda Model 8250	Holaday 1510
Simpson Electric Company	
Simpson Model 380 M	

* Suitable for testing 915 MHz ovens

50/60 Hertz Instruments

Manufacturer/Instrument	E-Field Full Scale	H-Field Full Scale	Price
Monroe Model 238A-1	5/10/25 kV/m	N/A	\$595
Electric Field Meas. Co. Model 111	1/3/10/30/100/300/1000/3000/10000/30000/100000 V/m	.01/.03/.1/.3/1/3/10/30/100/300/1000 A/m	\$1200

DC Electric Field Meters

Manufacturer	Model	Full Scale	Price
Electric Field Measurement Co. *Requires Model 111 AC field meter.	112*	10/30/100/300/1000/3000/10000/30000/100000 V/m (±)	\$800
Monroe Electronics, Inc.	245	.1/.2/.5/1/2/5/10 kV/cm (±)	\$1850
	245K	(Model 245 x 2)	\$1850
Trek, Inc.	354	Digital, to ±100 kV/m	\$695

Instruments Capable of Measuring Emissions from Specific Products

Product	Instruments (numbers refer to Table 1 entries)	
	E Field	H Field
Microwave Diathermy - - - - -	10, 15, 16, 17, 18, 19, 20, 21, 23, 24, 30, 31, 35	Not Required
Microwave (cw) Industrial Equipment - - -	10, 15, 16, 17, 18, 19, 20	Not Required
Radar (Microwave-Short Pulse) -	15, 17, 30, 35	Not Required
Shortwave Diathermy - - - - -	1, 2, 3, 16, 18, 19, 20, 21, 23, 24, 25, 26, 35, 37	4, 5, 22, 23, 32, 33, 34
RF Sealers - - - - -	1, 2, 3, 16, 18, 19, 20, 21, 23, 25, 26, 35, 37	4, 5, 22, 23, 32, 33, 34
Video Display Terminals - - - -	Active Antenna & Spectrum Analyzer or EMC receiver, 6, 7, 20	11, 12 (one-axis probe), shielded loop and spectrum analyzer, EMC receiver.
Police Radar - - - - -	10, 15, 17, 18, 19, 20, 30, 31	Not Required
Microwave Intrusion Alarms/Door Openers - -	10, 15, 17, 18, 19, 20, 30, 31	Not Required
Mobile and Hand Held Transceivers - - - - -	1*, 2*, 3*, 10*, 15*, 16*, 17*, 18*, 19*, 20, 21*, 23, 24, 25*, 26*, 30*, 31*, 37*	4*, 5*, 22, 23, 32, 33, 34
Microwave Ovens - - - - -	(See section on oven instruments)	Not Required

*Partial frequency coverage.

All tables reprinted from: *Instruments for Non-Ionizing Radiation Measurement*, FDA 84-8222, January 1984. Data provided by the manufacturers.

(Based on Manufacturers' Data)

Broadband Radiofrequency/Microwave Survey Instruments

(Table I) (Based on Manufacturers' Data)

Manufacturer/Instrument Model Number	Price	Frequency Range	Sensor Type (E=electric, H=magnetic)	Quantity Reported (E=V/m, H=A/m, S=mW/cm ²)	Dynamic Range (Full Scale Reading)	Field Strength	Equivalent Power Density (mW/cm ²)
• Aeritalia (Amplifier Research) TE 307							
(w/Fiber Optic Link)	3760						
Probes				E or H			
(1) 13RV1001-1	840	4-500 MHz	E			10 V/m	0.027
(2) 14RV1001-1	840	1.5-500 MHz	E			100 V/m	2.7
(3) 15RV1001-1	840	1-500 MHz	E			1000 V/m	270
(4) 16RV1001-1	1040	2-100 MHz	H			10 A/m	3770
(5) 17RV1001-1	1040	2-100 MHz	H			1 A/m	37.7
(6) 19RV1001-1	1250	0.005-2.5 MHz	E			10/100/1000 V/m	N/A
(7) 19RV1001-2	1250	0.005-2.5 MHz	E	(switch selectable)		1/10/100 V/m	N/A
(8) 19RV1001-3	1250	0.02-10 kHz	E			10/100/1000 V/m	N/A
(9) 19RV1001-4	1250	0.02-10 kHz	E			10 ² /10 ³ /10 ⁴ V/m	N/A
• EIT							
Meter w/Precision Fiber Optic Link 679/1079	9300			E ² or S			
(10) Probe 979	1500	0.1-12 GHz (useable to 40 GHz)	E (single axis)			140 V/m	5
• Electromechanics Co.							
Meter 6640	9900		E or H				
Probes							
(11) 3201	1400	0.1 Hz-50 KHz	H (single axis)			80 μA/m-0.8 A/m	N/A
(12) 3202	1400	0.1 Hz-50 KHz	H			0.8-80 A/m	N/A
(13) 3204	1400	0.1 Hz-50 KHz	H			2 - 2500 A/m	N/A
(14) 3302	1600	0.1 Hz-50 KHz	E			20 μV/m-0.2 V/m	N/A
• General Microwave							
(15) Raham 1	950	0.3-18 GHz	E (single axis)	S		87/275/870 V/m	2/20/200
(16) Raham 2	795	0.01-3 GHz	E	S		87/275/870 V/m	2/20/200
(17) Raham 3	1500	0.3-18 GHz	E	S		8.7/27/87/275 V/m	.02/.2/2/20
(18) Raham 4*	1520	0.01-26 GHz	E	S		8.7/27/87/275 V/m	.02/.2/2/20
(19) Raham 4A	1520	0.2 MHz-26 GHz	E	S		87/275/870 V/m	2/20/200
(20) Raham 12 (Raham 1 & 2)	1295	0.01-18 GHz	E (single axis)	S		87/275/870 V/m	2/20/200
• Holaday Industries							
(21) HI 3001 with E Probe	2495	0.5-1000 MHz	E	E ²		10 ² /10 ³ /10 ⁴ /10 ⁵ / /10 ⁶ /10 ⁷ V ² /m ²	0.03-2650
(22) STH-01 Optional H Probe	600	3-300 MHz	H	H ²		0.1-1 A/m	0.38-37.7
(23) HI-3002 (includes E and H Probes)	2795	0.5-6000 MHz	E	E ²		10 ³ /10 ⁴ /10 ⁵ /10 ⁶ /10 ⁷ V ² /m ²	0.26-2650
(24) HI-3003 (3 axis switches)	3750	0.5-6000 MHz	H	H ²		.1/1/10/100 A ² /m ²	0.38-3770
HI-3004 (same as 3002 w/o H-field probe)	2395		E	S		87/192/275/615 V/m	2/10/20/100
• Instruments for Industry							
(25) RM-1	1195	0.01-220 MHz	E	E		3/10/30/100/ /300 V/m	.0024/.026/ .24/2.6/24
(26) RM-2	1375	0.01-220 MHz	E	E			
(27) EFS-9	595	0.01-220 MHz	E (single axis)	E			
(28) EFS-2 (pulse capability)	945	0.01-220 MHz	E	E			
(29) EFS-3 (monopulse capability)	1145	0.01-220 MHz	E	E			
• Narda Microwave							
8616 Meter, one used with	1220			S			
8611 Meter, following:	350			S			
(30) 8621B probe	1450	0.3-26 GHz **	E			8.6-275 V/m	0.2/2/20
(31) 8623B probe	450	" " "	E			20-614 V/m	1/10/100
(32) 8631 probe	975	10-300 MHz	H			0.02-0.73 A/m	0.2/2/20
(33) 8633 probe	975	" " "	H			0.05-1.6 A/m	1/30/100
(34) 8635 probe	2950	10-300 MHz	H			0.5-16 A/m	10 ³ /10 ⁴ /10 ⁵
(35) 8644 probe	2650	10-3000 MHz	E			86-2750 V/m	20/200/2000
(36) 8652 probe	300	0.3-10 MHz	H				
(37) 8662 probe	1200	0.3-300 MHz	E				
8619 meter (used with 8633/35/44 probes)	1500			E ² or H ²			

* Older units must be modified to meet low frequency (10-30 MHz) published specifications.

** These probes will operate to 40 GHz. Calibration for 26-40 GHz available.

BIOLOGICAL EFFECTS

Adey to Head ELF Panel...The National Council on Radiation Protection and Measurements (NCRP) has chosen Dr. Ross Adey, the associate chief of staff for R&D at the VA Hospital in Loma Linda, CA, to head its new study panel on the bioeffects of ELF radiation. Scientific Committee No. 79 is being set up under a \$150,000, three-year contract from EPA (see *MWN*, December 1983). Adey has presented NCRP's Board of Directors with a list of 10-12 proposed panel members. According to NCRP Executive Director Roger Ney, the board will make its selections at or before its next meeting on July 21.

Threshold for Fetotoxicity...Dr. Ezra Berman and Hershell Carter of EPA's Experimental Biology Division in Research Triangle Park, NC, have identified a possible threshold for the effects of 2450 MHz CW microwaves on pregnant rats. In a paper published in the March *Health Physics*, they report that female rats exposed to power levels of 40 mW/cm² for 100 minutes daily on the sixth through 15th day of gestation (SAR=6.0 W/Kg), had no significant differences in the number of live or abnormal births as compared to controls, but that the mean fetal body weight was significantly lower. When they grouped these new data with those from past teratological studies, Berman and Carter discerned a possible threshold: "The break from a no-effect level of SAR to one which causes a significant decrease in fetal weight is at approximately 6.0 W/Kg." They conclude that microwaves can induce a decrease in fetal body weight (fetotoxicity) without also causing defects or death (embryotoxicity) and that "body weight may be a better variable with which to delineate a threshold of detrimental fetal response to [radiofrequency radiation]."

Resources...The second part of Eric Lerner's special report on electromagnetic fields appears in the May *IEEE Spectrum*. The 13-page article, which reviews low-level bioeffects, is based on a round table discussion held at last year's Bioelectromagnetics Society meeting....In our July/August 1982 issue we reported the upcoming publication of a cumulative index for the bioeffects bibliographies compiled by FDA's Dr. Zory Glaser and published by the Navy, NIOSH and the Bioelectromagnetics Society since 1971. Now, after a host of unforeseen delays, the index is finally available. In addition to author and subject indexes, the 285-page book includes a frequency and wavelength index. It is available for \$25 from Julie Moore & Associates, 6130 Camino Real, PO Box 5156, Riverside, CA 92517.

COMMUNICATIONS

EPA Completes Honolulu Radiation Survey...EPA has completed its survey of RF/MW radiation levels in Honolulu, HI, where for several years it has suspected that some exposures exceed 1 mW/cm² (see *MWN*, April 1984). EPA's Richard Tell told *Microwave News* that no results will be made public until a report is submitted to the FCC. Tell would only say that "we found levels in the range we

had anticipated" in some locations. Agency officials do not yet know how long it will take to complete the report. The survey team—including Tell, two other staffers from EPA in Las Vegas, NV, and Robert Cleveland of the FCC—spent more than a week in Hawaii last month. Earlier this year, the commission asked EPA to take measurements and evaluate whether or not Honolulu broadcasters are creating potential radiation health hazards.

COMPATIBILITY & INTERFERENCE

Pacemakers at Substations...An interdisciplinary group from England headed by Dr. G.S. Butrous of St. Bartholomew's Hospital in London has been investigating the effect of high intensity fields on implanted cardiac pacemakers. They review their findings in two recent papers. In the November-December 1983 issue of *PACE* (Vol.6, pp.1282-1292), they report that the field strengths necessary to affect pacemakers vary from unit to unit and from model to model. Units made by Teletronics were found to be the most sensitive; all others needed more than 5 kV/m to alter their behavior. The fields did not change the units' programming. The authors stress that the general public is not at risk from transmission line fields. In the second paper, appearing in the November 1983 issue of the *British Journal of Industrial Medicine* (Vol.40, pp.462-465), they document two cases of interference among workers at electric substations. They found that, "High intensity electric fields induced reversion to the interference mode [a fixed pulsing schedule], producing in one case competitive rhythm and in the other inappropriate slow pacing which resulted in asymptomatic pauses of up to 2.5 [seconds]." The workers could be protected with a somewhat bulky "Faraday suit." The researchers also tested a new Medtronic pacemaker with a special circuit that allows it to ignore interfering signals in fields of up to 20 kV/m (which induce body currents of greater than 300 uA).

LPTV RFI...On May 15, the Association of Maximum Service Telecasters (AMST) petitioned the FCC to protect existing, full power television stations from possible interference from low power television and translators (LPTV). The association, which is made up of some 250 TV broadcasters, asked the commission to set a specific standard for determining when a LPTV station causes objectionable RFI to a full-service station and to extend the deadline for filing objections to successful LPTV applicants from 15 to 45 days. AMST is located at 1735 DeSales St, NW, Washington, DC 20036, (202) 347-5412.

GOVERNMENT

Nominations for FDA Committees...FDA is seeking nominations for a number of advisory committees to its Center for Devices and Radiological Health. The Radiologic Devices Panel, which reviews and evaluates data on the safety and efficacy of radiation emitting medical devices, is seeking two new members with expertise in diagnostic radiology, radiation therapy, hyperthermia or

NMR imaging. The Technical Electronic Product Radiation Safety Standards Committee (TEPRSSC), which advises FDA on the adequacy of emission standards from electronic products, has nine open slots: two from government agencies, four from industry and three from the general public. (TEPRSSC has been dormant for quite a while, and FDA notes that while it wants nominations, no appointments will be made until a meeting is scheduled.) You can nominate one or more persons for a four-year term. You can even nominate yourself. There is no deadline for nominations. For details, see the May 24 *Federal Register* (49 FR 21991) or contact the center's Kay Levin at (301) 443-3516.

INTERNATIONAL

WHO Completes ELF Report...A joint World Health Organization/International Radiation Protection Association (WHO/IRPA) working group has finished its report on the biological effects of ELF radiation (WHO Technical Report No.35). The group, chaired by Dr. M.H. Repacholi of the Royal Adelaide Hospital in Adelaide, Australia, met for the last time in Geneva in March. The report has gone to the printers and will be published this fall.

IRPA Guidelines...IRPA's International Non-Ionizing Radiation Committee has published "Interim Guidelines on Limits of Exposure to [RF] Electromagnetic Fields in the Frequency Range from 100 kHz to 300 GHz" (see *MWN* March 1984) and "Interim Guidelines on Limits of Human Exposure to Airborne Ultrasound" in the April issue of *Health Physics*.

LITIGATION

Air Traffic Controllers Win Settlement...Four product liability suits against the manufacturers of equipment at an air traffic control center in Hilliard, FL, reached a surprising conclusion early this year: a publicly disclosed \$160,000 settlement from Raytheon. In claims filed in 1979 in the US District Court for the Middle District of Florida, Jacksonville Division, four controllers maintained that they developed cataracts as a result of workplace radiation exposure. Although makers of RF/MW equipment such as radar have settled similar suits out of court, the defendants in several prior cases have imposed gag orders on the terms of settlement (see *MWN*, December 1982 and January/February 1983). Raytheon would not comment on the Hilliard case, and the plaintiffs' attorneys at the Jacksonville, FL, firm of Bedell, Dittmar, DeVault, Pillans and Gentry, do not seem to know why the settlement was allowed to be made public. According to John Tucker, who worked on the case with William Gentry, this could have been an oversight, "but who knows?" In addition to the \$160,000 settlement reached in January, the four men and a fifth worker at Hilliard shared an earlier settlement of \$60,000 from Rockwell International, Admiral and Collins Radio. Ophthalmologist Dr. Milton Zaret was brought in by the plaintiffs and found that four of the men had cataracts and that a fifth had lenticular and retinal damage. Zaret told *Microwave News*

there was "overwhelming evidence" that radiation was part of the etiology. The plaintiffs have also filed workers' compensation claims with the Department of Labor which are still pending. The defendants in this case manufactured the radar scopes, radars, radio transmitters and other electronic equipment used in air traffic control and monitoring.

MEDICAL APPLICATIONS

Magnetic Fields from Diathermy Equipment...Drs. Raymond Lau, of the Charing Cross Hospital in London, England, and P.B. Dunscombe, of the Manitoba Cancer Treatment and Research Foundation in Winnipeg, Canada, have studied the stray magnetic fields from a Siemens Ultratherm 608 diathermy unit, which operates at 27.12 MHz. In a short note published in the April issue of *Health Physics*, they report that the stray fields depended on the unit's power setting, increased with the size of the capacitor plate and were significantly affected by the cables.

NMR Assessment...The Office of Health Technology Assessment (OHTA) has initiated a study of the safety, efficacy and usefulness of NMR imaging. Among the data sought by OHTA are how NMR compares with other diagnostic techniques as well as any unique applications of NMR. OHTA will issue a report and a recommendation to assist the Health Care Financing Administration in setting Medicare coverage policy. All submissions are due by July 30. For more information call (301) 443-4990 or see the May 1 *Federal Register* (49 FR 18624).

MEETINGS

URSI Bioeffects Symposium...Fourteen countries will be represented on the program of URSI's *Open Symposium on Interaction of Electromagnetic Fields with Biological Structures*, to be held in Florence, Italy. Researchers from most European countries will attend, as will scientists from Japan and Argentina. No one from the Soviet Union will be coming, however. During the first three days, August 27-29, 76 papers will be presented; on the 30th, there will be eight invited review papers on the bioeffects of ELF, RF, MW radiation and MM waves. See Conference Calendar for details.

UK EMC...The program for the *4th International Conference on Electromagnetic Compatibility*, scheduled for September 18-21 at the University of Surrey, UK, has been issued. Among the agenda items are papers by: R.J. Harry of the Home Office on "The Measurement of the Immunity of Handheld Radar Speedmeters;" B.T. Maloney of British Aerospace on "Spacecraft EMC Specifications — An Overview;" P.J. Kerry of the Department of Trade and Industry on "Potential EMC Problems Arising from the Reception of DBS;" J.L. ter Haseborg and H. Trinks of the Technical University in Hamburg on "Problems Concerning EMP and Lightning Protection of High Frequency Transmission Lines;" Frank Harlen of the UK's NRPB on "A Rationale of Microwave RF Exposure Standards;" R.A. Hobbs of the Royal Aircraft Establishment on "The Mea-

surement of Field Strengths in the Vicinity of HF Transmitters;" R.J. Clowes of Plessey Electronic Systems Ltd., on "Computation of the Near Field of Aperture Antennae for Assessment of Hazards;" and J. Gannaway, also of Plessey, on "A Simple Method of Estimating Signal Levels from Distant Transmitters at VHF and Microwave Frequencies." For more information, contact: The Institution of Electronic and Radio Engineers, 99 Gower St., London WC1E 6AZ, (01) 388-3071.

MILITARY SYSTEMS

AWACS and Radar Radiation...What are the radiation risks to pilots who fly near an AWACS aircraft? This question was raised in a letter to *Aviation Week*, May 14. The editors replied that the AWACS radar would be turned off if other aircraft were flying nearby—even though the antenna might continue to rotate. Before responding, the editors of *Aviation Week* had consulted John Mitchell of the AF School of Aerospace Medicine. In a telephone interview with *Microwave News*, Mitchell said that the technicians inside the AWACS are shielded by the plane's fuselage. Mitchell said that a number of radiation surveys have been carried out to confirm this....In the wake of the radar accident at Clear AF Station in Alaska, Mitchell is preparing a report on some 60 Air Force cases of over-exposure to non-ionizing radiation in his files. The report is not yet complete, but Mitchell will present a preview on July 17 at the Bioelectromagnetics Society meeting.

POWER LINES

Michigan Power Lines Report...The Legislative Science Office of the Michigan State Legislature has published *The Effects of Electromagnetic Fields Produced by High Voltage Transmission Lines*. The report was sponsored by Rep. Ken DeBeaussiaert. For information, contact Bill Robinson, Office of Rep. DeBeaussiaert, c/o State Capitol, Lansing, MI 48909.

Virginia Legislature Plans Hearings...The Virginia State Legislature has voted to hold hearings on power line health and safety issues. Senate Joint Resolution 26, sponsored by state senators Madison Marye and Virgil Goode, Jr., was approved this spring. The measure calls for "establishing a joint subcommittee to study the adequacy of present protections afforded the citizens of Virginia when high voltage electrical transmission lines are constructed and maintained." Marye expects to hold at least one public hearing in mid-summer. The seven-member subcommittee will report back to the legislature before the 1985 session.

Kavet Leaves EPRI...Dr. Rob Kavet is leaving the Electric Power Research Institute (EPRI) in Palo Alto, CA, where he has been the program manager for health studies on AC and DC transmission lines, to join the Health Effects Institute in Cambridge, MA. The institute, funded by EPA and the motor vehicles industry, investigates the potential health effects of tail pipe emissions. EPRI is in the process of recruiting a replacement for Kavet.

STANDARDS

Connecticut Adopts ANSI Limits...Connecticut has become the third state to adopt RF/MW radiation exposure guidelines for the general public. Legislators approved House Bill 5675 in early May, establishing the 1982 ANSI guidelines as the state standard (see *MWN*, April 1984). The measure does not apply to hand-held or mobile sources, consumer products, or scientific and medical equipment. According to the fiscal impact statement accompanying the bill, the only appreciable cost of standard setting will be the purchase of about \$100,000 worth of monitoring equipment. Enforcement will occur on a complaint basis and "few violations are anticipated." At its strictest level, ANSI sets a 1 mW/cm² exposure limit for the 30-300 MHz band. New Jersey has already adopted the ANSI standard for the general public, while Massachusetts has chosen limits five times more stringent.

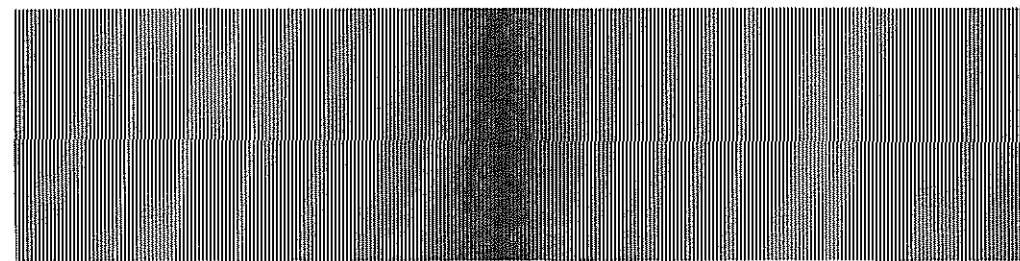
EPA Bioeffects Report Approved...EPA's Scientific Advisory Board has given final approval to the Office of Research and Development's (ORD) report, *Biological Effects of Radiofrequency Radiation*. The lengthy document, prepared under the direction of ORD's Dr. Joe Elder, will serve as the basis for the guidance (see *MWN*, October 1983 and January/February 1984). The document could be printed as early as mid-July, though publication details were not available at press time. A publication announcement will appear in an upcoming *Federal Register*.

VDTs

Rhode Island Study Commission...Lawmakers in Rhode Island have set up a special panel to review VDT health risks and to report its findings to the legislature. The 13-member commission will include state representatives and senators, business and labor officials, and specialists from the state's Departments of Health and Labor. No limitations were placed on the scope of the panel's study. The study bill, H 7012 (Substitute A), was approved on May 8, as a compromise in place of a more extensive measure (see *MWN*, January/February 1984). The Rhode Island and Providence Chambers of Commerce supported the substitute after opposing the original legislation, but several computer manufacturers, particularly IBM, strongly objected to the compromise. Appointments are expected soon to the study panel, which has until February 15, 1985 to complete its work.

Legislation...The Illinois House of Representatives has convened a special subcommittee to consider House Bill 2397, the state's only pending VDT measure. After holding a hearing on April 25 in Springfield, the subcommittee planned three more hearings: in Chicago, in Springfield and in a yet to be named location....On March 16, Maryland's House Committee on Economic Matters unfavorably reported House Joint Resolution 47, a bill directing the state's Division of Labor and Industry to study the health effects of VDTs, draft occupational standards and report to the General Assembly on its findings.

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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.

New Soviet Population Standard: 10 $\mu\text{W}/\text{cm}^2$ at MW Frequencies

The Soviet Union has relaxed its standard for the exposure of the general population to radiofrequency and microwave (RF/MW) radiation. At microwave frequencies (300 MHz-30 GHz), the standard has doubled from 5 $\mu\text{W}/\text{cm}^2$ to 10 $\mu\text{W}/\text{cm}^2$. This new level is still as much as 500 times more stringent than the guidelines set by the American National Standards Institute (ANSI).

At lower frequencies, the exposure standard is only a little weaker than the one adopted in 1978. For instance, for 30-300 MHz, the maximum permissible limit was increased from 2 V/m to 3 V/m (see Table). For frequencies below 30 MHz, the exposure limits are given in terms of the electric field, without specifying a limit for the magnetic field.

The revised standard was set by a committee chaired by Professor M.G. Shandala, the director of the A.N. Marzev Research Institute for General and Communal Hygiene in Kiev. A translation of the standard appears on pp.2-5.

In Section 1.4, it is stated that the standard covers frequencies up to 300 GHz, but no limit is actually specified for 30-300 GHz. The 1978 standard cites the same value for this band as for the 300 MHz-30 GHz band.

Unlike U.S. and Western standards, the Soviet standard includes limits for certain types of pulsed radiation sources.

The Soviet occupational standard is 100 $\mu\text{W}/\text{cm}^2$ for two-hour exposures to radiation in the 300 MHz-300 GHz frequency band (see *MWN*, September 1983). ●

Maximum Permissible Levels (MPLs)

Frequency	1978	1984
30-300 kHz	20 V/m	25 V/m
300 kHz-3 MHz	10 V/m	15 V/m
3-30 MHz	4 V/m	10 V/m
30-300 MHz	2 V/m	3 V/m
300 MHz-3 GHz	5 $\mu\text{W}/\text{cm}^2$	10 $\mu\text{W}/\text{cm}^2$
3-30 GHz	5 $\mu\text{W}/\text{cm}^2$	10 $\mu\text{W}/\text{cm}^2$
30-300 GHz	5 $\mu\text{W}/\text{cm}^2$	Not Specified

Soviet General Population RF/MW Radiation Exposure Standard

Reprinted below are excerpts from the 1984 Soviet standard for general population exposures to radiofrequency and microwave (RF/MW) radiation. This standard, which replaces the 1978 version, was sent to Microwave News by Professor M.G. Shandala, director of the A.N. Marzev Research Institute for General and Communal Hygiene in Kiev. The regulations are interim and must be reviewed in five years in light of new bioeffects data.

The standard was translated from the original Russian by Microwave News. Every effort has been made to convey the meaning of the original text in the translation, but

some parts of the standard were not clear and their interpretation remains open to question. Table 3.2 has been omitted here; it presents operational details (including allowances for duty factors) for specific types of Soviet radars.

Any subscriber who would like a copy of the standard in the original Russian should send Microwave News a check for \$7.50, together with a mailing label. The cost for non-subscribers is \$25.00 (prepaid). Please note that the original copy is mimeographed and certain parts are hard to decipher.

U.S.S.R. Ministry of Health, Central Health and Epidemiological Administration

Interim Health Standards and Regulations on Protecting the General Population from the Effects of Electromagnetic Fields Generated by Radiotransmitting Equipment, Moscow-1984

**(Approved by the Chief State Physician of the
U.S.S.R., P.N. Burgasov, January 19, 1984; No. 2963-84)**

1. General

1.1 These health standards and regulations ("Regulations") for protecting populations from the effects of electromagnetic fields (EMF) generated by installations with radiotransmitting equipment (RTE) determine the health protection requirements for radio, television and radar stations, and other types of equipment that belong to ministries, administrations, institutions and organizations and that radiate electromagnetic (EM) energy into the environment. These Regulations cover existing residential areas and housing projects, public and industrial buildings, and public recreation areas located in the vicinity of existing sources of radiofrequency EM energy or those under design or construction.¹

1.2 The ministries, administrations, institutions and organizations that use, construct or design RTE installations that radiate EM energy are responsible for implementing these Regulations. The planning and construction of projects in areas where RTE is located will be the responsibility of local administrative bodies. Responsibility for design and construction of residential and civil buildings in restricted areas will be carried out by the organizations performing the design and construction.

1.3 The Health and Epidemiological Administration (HEA) of the USSR Ministry of Health, the Ministries of Health of the Union Republics, and the medical services of other ministries and departments are responsible for supervising and controlling application of these Regulations.

1.4 The maximum permissible EMF levels established by these Regulations cover the frequency range 30 kHz-300 GHz.

1.5 Failure to follow these Regulations may result in a condition exposing populations to the harmful effects of

EMF. To prevent this, a set of maximum permissible EMF levels and health regulations must be applied to RTE sites. The main principles of these requirements are contained in these Regulations.

2. Units of Measurement

2.1 EM energy emitted by a RTE antenna spreads into space, forming an EMF characterized by the component electric (E) and magnetic (H) fields.

2.2 The EMF within bands 5-8 [30 kHz-300 MHz] is to be designated by the electric field strength, the measuring unit being volts/meter (V/m).²

2.3 Within the bands 9-11 [300 MHz-300 GHz], current measurement methods use power density (PD), with the unit watts per square meter (W/m²) [1 W/m² = 0.1 mW/cm² = 100 uW/cm²].

3. Maximum Permissible Levels (MPLs) of EMF in Populated Areas

3.1 In the frequency range 30 kHz-30 GHz, the MPLs for the effective electric field strength or the average PD are tabulated by band in Table 3.1.

3.2 The MPLs in bands 9-11 for pulsed emissions into populated areas adjacent to active radar stations, projects under construction at any design stage and areas of future construction near active radar stations should not exceed the permissible levels shown in Table 3.2. [Omitted]

3.3 For RTE types not listed under Table 3.2, the EMF in settled areas should not exceed 10 uW/cm². The same is true for pulsed radars operating in the 150-300 MHz range.

3.4 In existing populated areas adjacent to RTE sites installed before approval of these Regulations, the MPLs can be exceeded until the necessary protective steps are

1. These regulations do not cover mobile radio stations, household electrical appliances and medical devices that radiate EM energy.

2. For populated areas, the magnetic field limits have not been specified in these regulations.

implemented if agreed to by the USSR Ministry of Health, the Ministries of Health of the Union Republics and the owners of the RTE.

3.5 Organizations and institutions using RTE not meeting these Regulations should, together with the local Soviet authorities, devise and implement a plan with the HEA of the USSR Ministry of Health and the Ministries of Health of the Union Republics for normalizing the electromagnetic environment in the adjacent areas.

4. Requirements for Siting RTE and for Establishing Health Protection Zones (HPZ) and Restricted Construction Zones (RCZ)

4.1 Areas for siting RTE should be selected taking account of transmitter power, directional characteristics, height and design characteristics of the source, the nature of the area and the use of the adjacent areas — in order not to exceed the MPLs noted in Section 3 for populated areas.

4.2 RTE areas are to be established according to the applicable Regulations; residential complexes and public buildings are not to be allowed in these areas.

4.3 To protect populations from the effects of EMF generated by RTE, the HPZ and the RCZ are to be established, if necessary.

4.4 An HPZ is an area adjacent to the territory occupied by RTE. The outer HPZ boundary is determined at a height 2 meters above ground, in accordance with the MPLs noted in Section 3.

4.5 An HPZ is established by considering the EM emission source; that is, the transmitting equipment and the prospects for growth. Use of the HPZ is regulated by "Health Regulations in Design of Industrial Plants," SP245-71.

4.6 Public services and amenities in an HPZ are to be organized according to the "Environmental Protection Measures" of RTE design.

4.7 An RCZ is an area with EMF levels, measured at a height of 2 meters or more above ground, that exceed the levels in Section 3. The outer RCZ boundary is defined by

the highest floor in a proposed building where the EMF would not exceed the MPLs noted in Section 3.

4.8 HPZs and RCZs are to be established in accordance with the methods given in the appendix [omitted in version received]. The HPZ and the RCZ boundaries are to be defined more exactly by actual measurements at the time of the project's approval.

4.9 The HPZ and the RCZ are to be established for transmitting stations with antennas that are non-directional in the horizontal plane, for television stations and for scanning radars.

4.10 For stations equipped with directional antennas and radars scanning in defined sectors or fixed in one direction, the HPZ and the RCZ are established in the principal direction of emission, but sidelobe and backlobe levels should also be taken into account in calculations.

4.11 For radio, television and radar stations transmitting energy in defined directions, the EMF levels depend on the height above ground level, and the RCZ should be set incrementally for every height in the building's vertical dimension.

4.12 To reduce radiation levels in an area and to decrease the HPZ size, stations should be built on natural protuberances, high ground, hills, etc., to minimize the use of transmitting directions making negative angles with the horizon.

4.13 Planning and development at active sites and those in the design stage involving RTE must be laid out with defined HPZs and RCZs as established in approved RTE projects.

5. Building in a RCZ

5.1 Within a RCZ, various uses are allowed if EMF levels do not exceed those given in Section 3. To comply with these regulations, protective measures should be used to reduce EMF levels below the MPLs.

5.2 In a RCZ, medical buildings, kindergartens, schools and homes for the elderly and handicapped should

Table 3.1
Maximum Permissible Levels (MPLs) for
Exposure to Electromagnetic Fields

Band	Frequency Range	MPLs
5	30-300 kHz	25 V/m
6	300 kHz-3 MHz	15 V/m
7	3-30 MHz	10 V/m
8	30-300 MHz	3 V/m
9	300 MHz-3 GHz	10 μ W/cm ²
10	3-30 GHz	10 μ W/cm ²
11	30-300 GHz	Not Specified

EXCERPTS

be located in low radiation areas.

5.3 Designers should specify ways of reducing levels below the MPLs given in Section 3.

5.4 When siting new buildings in a RCZ, consideration should be given to the possibility of reducing EMF levels in playgrounds by using buildings and other types of construction for shielding, and in building interiors, by building the facade with the minimum area of glass windows facing the radiation source. If necessary, balcony-type buildings should be planned with living quarters on the side opposite to the radiation source.

5.5 In the design of a building located in a RCZ, the density of construction should be at the lower end of that permitted in the appropriate regulations.

5.6 In a RCZ, the roofs of industrial and residential buildings should be covered with protective structures of good shielding materials (like reinforced concrete) or with grounded metallic nets. Use of protective walls, canopies, and deep depressions should also be considered.

5.7 RCZ areas should be planted with the maximum amount of greenery, and paved roads and pedestrian paths should be minimized. Preference should be given to sand, clay and gravel surfaces.

6. EM Control Methods in the Environment

6.1 Controlling the permissible EMF level is done by the HEA of the USSR Ministry of Health, the Ministries of Health of the Union Republics and by medical specialists in other ministries during the design stages of buildings, during the construction of RTE and in the areas adjacent to the active and proposed installations.

6.2 Project documentation in a section called "Environmental Protection Measures" should contain the results obtained in calculating HPZ and RCZ boundaries and also the data being used for these calculations.

6.3 The EMF calculations should take into account the height of the RTE transmitter and its distance to existing and planned construction. The local topography should also be taken into account.

6.4 If RTE installations are equipped with transmitters and receivers working within bands 5-8 [30 kHz-300 MHz], the total field strength in each of these bands is determined by the following formula:

$$E_s = \sqrt{\sum (E_i)^2}$$

where E_s = root-mean-square sum field strength; and
 E_i = field strength generated by i th transmitter at the defined point in the specific band.

*Similarly, the total PD in the adjacent area for bands 9-11 [300 MHz-300 GHz] is determined by the following formula:

$$PD_s = \sum PD_j$$

where PD_s = total power density; and
 PD_j = PD generated by j th transmitter at the defined point.

6.5 When several radiation sources are operating in different bands, the total field created by all sources at the HPZ boundary must be calculated by the following formula:

$$\sum (E_i/E_{mi})^2 + \sum (P_j/PD_{mj}) = 1$$

where E_i = the fields from the individual sources;
 PD_j = the individual PDs;
 E_{mi} = the MPL associated with the i th source; and
 PD_{mj} = the PD MPL associated with the j th source.

6.6 When a residential complex or an individual building is designed to be in an area with RTE, calculating and actually measuring EMF levels should be carried out according to the methods set forth in these Regulations.

6.7 Measurements of EMF levels are required for areas of proposed installations and construction.

6.8 Measurements of EMF levels should be made: • by the owners of RTE together with the representatives of HEA, when the RTE is being approved; • by HEA together with the owners of the RTE, when civil constructions are located in the area adjacent to the RTE being approved; • by HEA together with the owners of the RTE at the time of regular health inspections.

6.9 Every RTE emitting EM energy must have a health certificate containing the following information:

- equipment name; • address; • time of its first activation; • project design and construction data; • a diagram of the installation with location of HPZ and RCZ boundaries; • number, type and power of transmitters; • location of antennas and direction of the beam; • antenna pattern; • height of the antenna measured from ground level; • maximum lobe angle of the antenna; • operating frequencies; • modulation type; • antenna directional diagrams in the horizontal and vertical planes; • time and operating modes; • calculations of distribution of EMF levels in areas adjacent to the RTE; • EMF measurement data indicating measurement equipment used (type and serial number, inspection date); • HEA's conclusions about the installation; • recommendations for normalizing EMF levels (if necessary); • results of carrying out the recommendations of HEA; and • inspection date.

The health certificate should be prepared by the radio-technical administration, signed by its director, by a representative of the HEA of the USSR Ministry of Health, by the Ministries of Health of the Union Republics and by a representative of medical services of other ministries and registries. The certificate is to be kept at the installation and is to be available to be shown to HEA specialists.

7. "Health Standards and Regulations for the Location of Radio, Television and Radar Stations," No.1823-78, approved February 8, 1978, is void.

8. Methods for Calculating and Measuring EMF and Ways of Determining HPZ and RCZ Boundaries for RTE will be published as a necessary supplement to these Regulations.

9. EMF levels generated by radar stations should be determined according to methods approved by the USSR Ministry of Health and described in the following documents: "Methods for Calculation of the Density of EMF, Dimensions of the HPZ and Placement of Meteorological

Radars," No.309?-77 [number unclear in original]; "Methods for Calculation of EMF Levels and Health Requirements in Placing VHF, UHF and SHF RTE for Civil Aviation," No.2284-81.

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HIGHLIGHTS

Selikoff To Study VDT Reproductive Risks

Dr. Irving Selikoff, a professor at the Mount Sinai School of Medicine in New York City, will direct the first prospective epidemiological study of the reproductive risks associated with working at video display terminals (VDTs). Selikoff is assembling an inter-disciplinary team of researchers to devise a study protocol designed to determine whether VDT radiation causes pregnancy problems. The study is being partially funded by a grant from the March of Dimes.

The Service Employees International Union (SEIU) and 9 to 5, the National Association of Working Women, will collaborate with Selikoff on the VDT project, which will involve 10,000-12,000 women. SEIU volunteers will be asked to complete questionnaires on work patterns, medical histories and lifestyles.

Selikoff's team will field test questionnaires in a six-month feasibility phase beginning in June. Subsequent data collection will take three years, followed by a year of analysis. The study will follow the model developed by the American Cancer Society in its studies on cancer prevention, which included millions of volunteer participants.

At a June 6 press conference announcing the study, Selikoff said that, "Clusters of problem pregnancies have been identified in VDT-intensive offices and questions have been raised as to whether exposure to the non-ionizing radiation emitted by VDTs is involved." The Mount Sinai study will seek to address continuing concern that the clusters are related to VDTs.

Selikoff and his associates at the Environmental Sciences Lab at Mount Sinai have an international reputation in the study of toxic materials, including asbestos, polychlorinated biphenyls (PCBs) and vinyl chloride.

Three other epidemiological studies are also about to begin; they are all retrospective studies, however. In the United States, one team under Dr. Teresa Schnorr of the National Institute for Occupational Safety and Health (NIOSH) and a second team directed by Drs. Bill Butler and Kelly Brix of the University of Michigan each plan to begin distributing questionnaires this summer or fall. In Denmark, researchers at the Marselisborg Hospital in Aarhus and at the Institute of Social Medicine at the University of Aarhus are in the process of identifying 2,000 women who were pregnant in 1983 and 1984 to answer questionnaires.

NBS To Proceed with EMC Lab Accreditation Program

The National Bureau of Standards (NBS) has approved a request to establish a national voluntary laboratory accreditation program (NVLAP) for electromagnetic compatibility (EMC) and telecommunications equipment. The NBS decision follows a January 23 request from Walter Poggi of Retliff Testing Laboratories in Ronkonkoma, NY (see *MWN*, March 1985).

The NBS must now establish viable test methods by which labs can be judged, and the bureau will host a workshop in Gaithersburg, MD, on June 17 to discuss possible methods and criteria for accrediting labs.

Peter Unger, associate manager of NBS's accreditation program, told *Microwave News* that he hopes to have the criteria finalized and the LAP application package available by October.

Poggi has formed a task group to develop draft test methods (for, among others, conducted and radiated emissions) and technical requirements (including quality control, laboratory practices and record keeping) to present at the workshop.

According to the NBS's Jeffrey Horlick, project leader for the EMC LAP, the bureau received 14 sets of comments on Poggi's proposal: 8 were positive, 4 were conditional and 2 were negative.

The majority of those in favor of the LAP represent independent testing labs and believe that a LAP would help win the acceptance of products by foreign countries.

The Computer and Business Equipment Manufacturers Association (CBEMA) and R&B Enterprises opposed the LAP. CBEMA argued that the present procedures are working and that a new LAP would only add administrative expenses. R&B noted that a LAP made little sense due to the lack of agreement among the Army, Air Force and Navy on measurement and instrumentation techniques.

The Electronics Industries Association (two sets), the Naval Electronic Systems Command (NAVALEX) and the Federal Communications Commission all expressed mixed opinions on the need for the LAP. For instance, the NAVALEX told the NBS that the LAP would win its approval as long as it did not apply to the Navy.

The question of fees for participation in the LAP will be decided later. Horlick explained that the costs of laboratory accreditation cannot be computed until the methods and requirements are settled.

HIGHLIGHTS

For more information, contact NBS's Unger at (301) 921-3431 or Retlif's Poggi at (516) 737-1500.

Voluntary FDA Standard for RF Sealer Workers

The Food and Drug Administration (FDA) has issued voluntary exposure standards for operators of radiofrequency (RF) sealers and dielectric heaters. FDA's recommendation is based on the 1982 American National Standards Institute (ANSI) standard.

The FDA has no authority to enforce its new guidelines. The agency advises that it "believes that the responsibility for implementing these recommendations lies with the owners of new and existing equipment and the manufacturers of new equipment." Only the Occupational Safety and Health Administration (OSHA) can set mandatory federal exposure standards, but it has not done so. Although OSHA has a voluntary 10 mW/cm² standard in its rulebook, that standard cannot be enforced (see *MWN*, November 1983 and March 1984).

When asked why the FDA was setting occupational exposure guidelines, William Herman, director of the Division of Physical Sciences, replied, "FDA also has the responsibility for issuing recommendations for radiation emitted by RF devices under the Radiation Control for Health and Safety Act of 1968."

Another reason for the FDA action appears to be prompted by the high radiation levels to which RF sealer operators are exposed. In its cover letter accompanying the standards, the FDA states that RF sealers "often expose operators to time-averaged electric and magnetic field strengths that are 10 to 100 times higher than prevailing voluntary exposure standards promulgated by ANSI" [emphasis FDA's]. (See *MWN*, January/February 1982.)

The agency could have set a performance standard for RF equipment, but it would only apply to new equipment. At hearings held in May 1981, John Villforth, the director of the FDA's Center for Devices and Radiological Health, told Congress that such an approach would not be the most effective one (see *MWN*, June 1981).

When the exposure guidelines were proposed last year (see *MWN*, September and November 1984), Edward Baier, head of OSHA's Directorate of Technical Support, wrote to the FDA that his agency has no plans to regulate RF radiation but that "we are supportive of voluntary efforts to provide greater worker protection from hazards."

Under the ANSI standard, exposure limits below 3 MHz and above 30 MHz are 100 mW/cm² and 1 mW/cm² respectively. For any frequency (f) between 3 and 300 MHz, the limit is 900/f² mW/cm². The FDA recommends that RF survey meters should be located 10 cm from the operator's surface closest to the RF device. Measurements should be made at the face, chest, gonads, thighs, knees, shins and feet, with the operator in the normal operating position.

For a copy of the FDA guidelines, contact Dr. Zory Glaser or Howard Bassen at the Center for Devices and Radiological Health, FDA, Rockville, MD 20857, (301) 443-7155 or 443-6536.

ANS C63 and NEMA on EMC

American National Standards Committee C63 on Electromagnetic Compatibility (EMC) met in Washington, DC, on May 24. Among the developments at the meeting:

- The committee approved a move by subcommittee 1 to begin work on a recommended practice on configurations for electromagnetic interference (EMI) testing procedures, with special emphasis on the placement of cables. Glen Dash, of Dash, Straus & Goodhue in Boxboro, MA, is the chairman of the task group set up for this new effort. C63 Chairman Ralph Showers asked Dash to report back on a proposed work plan at the next committee meeting. It was pointed out that cable placement is also under study by CISPR.

- The Naval Electronic Systems Command (NAVALEX) has circulated a proposed *EMC Standardization Program Plan*, covering some 25 Department of Defense documents; 6 are presently being revised and 7 are in preparation. The program plan lists their current status. For more information, contact David Perkins, Standardization Branch, NAVALEX, Washington, DC 20363.

- A question arose as to what policies C63 should recommend for the measurement of transients. A task group was set up within subcommittee 1 to consider this question. Ed Bronaugh of Electro-Metrics, Glen Dash, Don Heirman of AT&T Information Systems Labs and Ralph Showers of the University of Pennsylvania will serve on the ad hoc group. (See also Standards Update on p.10.)

- A letter from Joseph Charyk, chairman of the National Security Telecommunications Advisory Committee, requesting assistance in the development of standards to protect the "U.S. Telecommunications Infrastructure" from disruption by an electromagnetic pulse (EMP) was circulated at the meeting. Showers will write back expressing interest in helping develop instrumentation to measure EMPs, but leaving open the question of developing protection techniques.

- Harold Gauper, vice-chairman of the C63 committee, announced that he will be retiring from GE Corporate R&D as of July 31. He said his decision was based in part on GE Corporate R&D's new policy of discontinuing work on EMC. Responsibility for compatibility will now rest solely with those divisions that market specific products. Gauper said that he will do consulting and will continue to work with C63, though not as vice-chairman.

The next meeting of C63 will be held in Washington, DC, on November 15; subcommittee 1 will meet during the August 20-22 meeting of the IEEE EMC Society in Wakefield, MA, and again before the full committee meeting in November.

NEMA

Less than a year ago, the National Electrical Manufacturers Association (NEMA) established a "Coordinating Committee on EMC" to address an emerging concern about EMI. The committee is seeking to identify the possible impact of EMI on the large number of NEMA's prod-

uct areas, to establish liaisons with other EMC standard-setting and coordinating groups and to investigate the problem of power line noise. One of the committee's functions is to channel information among those NEMA divisions responsible for ensuring that specific products do not cause EMI, as well as to keep up with international EMC activities, according to Frank Kitzantides, manager of NEMA's Engineering Department. GE's Harold Gauper is the chairman of the coordinating committee.

Within NEMA's Lighting Division, a "Joint Section Committee on EMI from RF Lighting Devices" has been set up under the chairmanship of Sina Javidi of GE. The committee is sponsoring laboratory research on radiated and conducted electromagnetic interference (EMI) from

radiofrequency (RF) lighting devices. In addition, NEMA has installed such devices in its own offices to run experiments on the potential for EMI.

The Lighting Division has two task forces at work: one on measurements, chaired by Ed Marrie of Universal Manufacturing, and one on emission limits, chaired by Ed Morton of North American Phillips Lighting Corp. According to Richard Geissler, NEMA's Manager of Marketing Development and executive of the lighting division, the two task groups hope to complete draft reports by early next year. These documents will be forwarded to the Federal Communications Commission, which has rulemaking pending on RF lighting devices (see *MWN*, September 1983).

BOOK REVIEWS

W. Ross Adey and Albert F. Lawrence, editors, **Nonlinear Electrodynamics in Biological Systems**, New York, NY: Plenum Press, 1984, 603 pp., \$89.50.

In June 1983, an international group of experts assembled in Loma Linda, CA, to discuss possible modes of interaction between electromagnetic radiation and living systems (see *MWN*, July/August 1983). The proceedings have been edited by the conference organizers, Dr. Adey of the VA Hospital in Loma Linda and Dr. Lawrence of Hughes Aircraft Co. in Carlsbad, CA. Among the authors of the 38 papers collected in this volume are the leading researchers interested in non-thermal effects. Adey, Davis, Frohlich, Keilman, Kremer, Pohl, Rein, Scott, Swicord and Webb are all represented. Solitons and chaos theory are much discussed — often in quite technical terms.

Robert O. Becker and Robert Selden, **The Body Electric: Electromagnetism and the Foundation of Life**, New York, NY: William Morrow and Co., 1985, 364 pp., \$17.95.

Dr. Becker, an orthopedic surgeon best known for his pioneering work on limb regeneration in salamanders, is a leading proponent of the basic role electromagnetism plays in biological systems. Formerly with the VA Hospital and the Upstate Medical Center in Syracuse, NY, Becker has geared his new book toward a lay audience. It is a clearly written, well-illustrated primer that explores Becker's hypothesis that the emerging scientific understanding of the electromagnetic nature of living systems will lead to a revolution in biology and medicine. Becker and his coauthor also discuss the public issues raised by the proliferation of electromagnetic technology. Becker includes a postscript on the opposition to his research in the late 1970's, which eventually led him to retire.

P.N. Cheremisinoff, O.G. Farah and R.P. Ouellette, editors, **Radio Frequency/Radiation and Plasma Processing**, Lancaster, PA: Technomic Publishing Company, Inc., 1985, 213 pp., \$45.00.

Focusing on manufacturing applications, the editors pre-

sent 17 articles on topics ranging from RF drying systems to infrared (IR) uses in France to plasma arc heaters. Based on papers first presented at the International Conference on Electrotechnologies in Industry held in Montreal, Canada, in 1982, this collection emphasizes the cost savings, the improved product quality, the benefits to worker safety and the decreased environmental impacts of these technologies compared to standard ones. Several reports assess research and development efforts and predict future applications.

Vilas D. Nene, **Advanced Propulsion Systems for Urban Rail Vehicles**, Englewood Cliffs, NJ: Prentice-Hall, Inc., 1985, 228 pp., \$39.95.

The bulk of this book addresses the electromagnetic compatibility and interference (EMC-EMI) problems generated by chopper-controlled DC and inverter-controlled AC drives used in mass transit vehicles. Of special concern are possible EMI to wayside signaling and communications systems, as well as to automatic train control equipment, and to a lesser extent, EMI to adjacent telephone, radio and TV circuits. The book closes with a number of case studies of EMC in transit systems in the U.S. and Japan.

Nicholas H. Steneck, **The Microwave Debate**, Cambridge, MA: MIT Press, 1984, 279 pp., \$25.00.

Steneck, a historian at the University of Michigan in Ann Arbor, recounts the evolution of scientific understanding of the biological effects of radiofrequency and microwave radiation and the development of safety standards — both the 1966 ANSI 10 mW/cm² guidelines and their revision in 1982. Along the way he covers a number of controversial episodes, including the thermal versus non-thermal debate, RCA's and HBO's attempts at siting satellite stations, the Moscow embassy affair and the Yannon case. Steneck delves into the specifics of some of the best known bioeffects imbroglios: Zaret's cataract hypothesis, Frey's finding of leakage through the blood brain barrier and the Guy-Air Force long-term, low-level study. Steneck argues that "politics and science have become intertwined in the microwave debate."

BIOLOGICAL EFFECTS

Electric Field Exposure...A research team from the Central Electricity Generating Board, the Central Electricity Research Labs and the University of Oxford in the U.K. has found "no significant correlations of health [among workers] with either measured or estimated exposure to electric fields." The results are based on questionnaires and exposure assessments of 390 electrical power transmission and distribution workers exposed to 50 Hz electric fields. Among the findings was the "striking" low level of exposures: only 28 were exposed to more than 6.6 kV/m.hr over the two-week measurement period — the largest was 242.6 kV/m.hr. (Note that measured and estimated exposures did not correlate well with each other.) The authors caution that the electric fields may have an effect on health other than on those indices studied, that larger electric fields might have an effect or that certain vulnerable individuals may be at greater risk. "Health of Workers Exposed to Electric Fields" by D.E. Broadbent et al. appears in the *British Journal of Industrial Medicine*, 42, 75-84, 1985.

Guy Cancer Data Released...The tumor data from the long-term study at the University of Washington, Seattle, on the effects of low levels of pulsed microwaves have been released by the U.S. Air Force (see *MWN*, July/August 1984 and March 1985). Dr. Bill Guy and coworkers report that:

The incidence of neoplastic lesions corresponds to that reported for this strain of rat [Sprague-Dawley]...The endocrine system had the highest incidence of neoplasia in the aging rats, as is to be expected in this experimental animal. The low incidence of neoplasia with no increase in any specific organ or tissue required the data to be collapsed and statistically evaluated with respect only to occurrence of the neoplasm, with no attention given to the area of occurrence. This analysis indicated that neither group had an excess of benign lesions. There is statistical evidence that the mean number of primary malignancies was higher in the exposed animals than in the sham exposed, but the biological significance of this difference is reduced by several factors. First, detection of this difference required the collapsing of sparse data without regard for the specific type of malignancy or tissue of origin. Also, when the incidence of the specific primary malignancies in the exposed animals is compared with specific tumor incidence reported in the literature, our exposed animals had an incidence similar to that of untreated control rats of the same strain, maintained under similar [specific-pathogen-free] conditions. It is important to note that no single type of primary malignancy was enhanced in the exposed animals. From the standpoint of carcinogenesis, benign neoplasms have considerable significance under the assumption that the initiation process is similar for both benign and malignant tumors. The fact that treatment groups

showed no difference in benign tumor incidence is an important element in defining the promotion and induction potential of microwave radiation for carcinogenesis. The collapsing of sparse data without regard for tissue origin is useful in detecting possible statistical trends, and the finding here of excess primary malignancies in the exposed animals is provocative; however, when this single finding is considered in the light of other parameters evaluated, it is questionable if the statistical difference reflects a true biological activity. No meaningful statistical analysis could be made of metastatic neoplasms because of their low incidence.

The total number of tumors identified by Guy was: 18 primary malignancies, 36 metastatic malignancies and 62 benign for the exposed rats. For the control animals, the tumor totals were: 5 primary malignancies, 18 metastatic malignancies and 53 benign. The Guy team also note that "there is some indication that the survival times are longer in the exposed animals." *Volume 8: Evaluation of Longevity, Cause of Death and Histopathological Findings* is available from Dr. Jerome Krupp, USAF School of Aerospace Medicine, Brooks AFB, TX 78235. The final, summary volume (No.9) is still in preparation.

COMMUNICATIONS

More Teleports...The number of teleports in the U.S. will rise to 200 by 1995, although only 18 are currently operating, according to a new report from Frost & Sullivan, an international market research firm. "The Market for Teleports in the United States: 1985-1994" (Report No.1388, February 1985) projects total expenditures over the next decade of \$1.5 billion (in constant 1985 dollars), including \$400 million spent on microwave links for the communications centers during that period. Another \$100 million will be invested in fiber optics. To meet the steadily growing need for affordable satellite communications, the average 1995 teleport will use 25 earth station antennas, 50 microwave links and 10 miles of fiber optic cables. The report is available for \$1,700 from Frost & Sullivan, Inc., 106 Fulton St., New York, NY 10038, (212) 233-1080.

COMPATIBILITY & INTERFERENCE

ELF EMI to Pacemakers...Some unipolar pacemakers are sensitive to high intensity 60 Hz electric fields, according to a study for EPRI by Drs. A.J. Moss and E. Carstensen of the University of Rochester. The researchers exposed 11 patients with seven different implanted pacemakers from 4 manufacturers to 2-9 kV/m electric fields, with total body currents of 47-175 uA. Only unipolar units made by Cordis (models 190A and 190F) and Cardiac Pacemakers (model 505) were susceptible to EMI; the types of transient alterations detected were: inappropriate triggered activity, inhibition of impulse generation, reduction in rate and reversion from demand to asynchronous mode. The authors note that the interference-causing fields can be encountered under 500 and 765 kV power lines, but add that new circuit designs can eliminate the potential for EMI. *Evaluation of the Effects of Electric Fields on Implanted*

Cardiac Pacemakers (EPRI EA-3917, February 1985) is available for \$11.50 from Research Reports Center, PO Box 50490, Palo Alto, CA 94303, (415) 965-4081. (See also *MWN*, June 1984.)

UHF RFI...The National Association of Broadcasters (NAB) and the Association of Maximum Service Telecasters (AMST) have asked the FCC to set up a government-industry committee to "study the issue of interference to UHF television signals by land mobile licensees operating in the UHF spectrum." In an April 26 letter to FCC Chairman Mark Fowler, NAB President Edward Fritts and AMST President Tom Paro recommended that laboratory and, if necessary, field testing should be done under the auspices of the FCC. They also urged that this committee should complete its work within eight months of its formation.

Other Developments...At the last meeting of the RTCA Special Committee 156 on potential EMI to aircraft electronics from computers and the like, held April 23-24, a question was raised as to whether shielding of aircraft windows might increase path loss and thus reduce the risk of interference. This and other issues will be discussed at the committee's next session, July 23-24. (See also *MWN*, September 1984.)...Non-striking pilots for United Airlines reported numerous cases of radio communications "jamming" by pilots from other airlines during the United strike. A spokesman for the FAA explained that unionized pilots were "keying" their microphones when United pilots attempted to talk to air traffic control. The FAA's Administrator for Air Traffic, Donald Engen, warned both United and the Air Line Pilots Association in telegrams, sent on May 20th, that the agency would prosecute violators, but an FAA staffer admitted that with several pilots using a frequency at any given time it is "very hard" to catch violators....Static electricity caused the fatal fire on January 11 at a Pershing II nuclear missile site in West Germany, U.S. Army experts have concluded. A two-month investigation found that a static charge sparked the missile's solid fuel propellant, killing 3 servicemen and injuring 16 others. The accident will prompt better grounding of Pershing engines, according to Army officials....Stray electrical currents below New York City's Central Park may be corroding metal pipes in the refrigeration system of the park's ice skating rink, which is under renovation. The currents, which some experts believe come from underground cables or the subways, are common in the city, according to a consultant hired to remedy the problem. The *New York Times* reported on May 22nd that it could cost the city \$2 million to repair the damage.

MEDICAL APPLICATIONS

Resources...The safety of NMR imaging is the subject of an editorial in the April 20 *Lancet* — which prompted two interesting replies in the British journal's May 11 issue. A detailed review of NMR safety will appear in a forthcoming issue of *Microwave News*....Also in the May 11 *Lancet*, Dr. A.T. Barker and coworkers at Sheffield University in the U.K. report on a non-invasive method of stimulating

the human motor cortex with a pulsed magnetic field....The FDA's Center for Devices and Radiological Health has published *Therapeutic Microwave and Shortwave Diathermy: A Review of Thermal Effectiveness, Safe Use and State of the Art: 1984* (No. FDA 85-8237). It is available for \$2.25 from the Government Printing Office, Washington, DC 20420. Order No. 017-015-00226-8....The June issue of *IEEE Spectrum* features an article on "The Friendly Uses of RF." Robert Shupe and Ned Hornback of the Indiana University School of Medicine review the use of PEMFs to heal fractures and of RF energy for hyperthermia....New from Professor C.A.L. Bassett: with M.H.M. Harrison, "Use of Pulsed Electromagnetic Fields in Perthes Disease: Report of a Pilot Study," in *Journal of Pediatric Orthopedics*, 4, 579-584, 1984; and with James S. Kort, "Role of Electricity in the Treatment of Congenital Pseudoarthrosis of the Tibia," in *Reconstruction Surgery and Traumatology*, 19, 140-146, 1985.

MEETINGS

Power Line Review...The annual review of research on the bioeffects of electric and magnetic fields associated with high voltage power lines has been tentatively scheduled for the week of November 4 in Washington, DC. Like last year, contractors for EPRI and the New York State Power Line Project are expected to join DOE researchers. The schedule will be finalized over the summer. For more information, contact Dr. William Wisecup, Aerospace Corp., Suite 4000, 955 L'Enfant Plaza, SW, Washington, DC 20024, (202) 488-6000.

DNA Workshop...ONR sponsored a *Workshop to Review Research on Biological Effects of High Frequency Electromagnetic Fields* in Asilomar, CA, April 28-30. 25 scientists were invited to discuss theoretical (vibrational, electronic and cooperative responses) and experimental (effects on DNA) topics. One of the primary objectives of the meeting was to help the ONR and the FDA set future funding priorities. No proceedings are being prepared.

PEOPLE

New Head of EEPA...The Electromagnetic Energy Policy Alliance (EEPA), the trade association of manufacturers and users of non-ionizing radiation systems, elected Barry Umansky as its new president on May 17 at EEPA's annual meeting in San Diego, CA. Umansky, who is the deputy general counsel for the National Association of Broadcasters (NAB), replaces Daniel Walters, a vice president of

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UPDATES

MCI Telecommunications Corp. Corporate members of EEPA include: AT&T Bell Labs, CBS, GTE, IBM, MCI, Motorola, NAB, NBC, Raytheon, RCA and Rockwell International.

RADAR

Phased Arrays...The new generation of electronically steered radars called "phased arrays" is much in the news. The most famous — or perhaps infamous — unit is the one under construction near Krasnoyarsk and Abalakova in central Siberia. U.S. officials believe that the Soviet radar violates the SALT I accords, though there is still an ongoing debate on the significance of the violation. Under SALT I, phased array radars must be built along Soviet Union or U.S. borders. In the U.S. the Air Force has two PAVE PAWS radars in operation: one on the east coast at Otis Air Guard Base on Cape Cod in Massachusetts and one on the west coast at Beale Air Force Base in California. Are the Soviets up to something sinister or is there another explanation for building the radar 600 miles from the nearest frontier? R. Jeffrey Smith outlines both sides of the argument in the March 22 *Science* magazine. The Soviets contend that the radar doubles as a way of tracking objects in space, which is allowed under SALT I — indeed, the U.S. PAVE PAWS radars also perform this function. Some analysts contend that the Soviets picked the internal site as an economy move (saving them from having to build two radars) or for topographic and climatic considerations (for instance, the harsh frigid winters that would make maintenance a nightmare). On March 9, syndicated columnist Jack Anderson offered another possibility: the late Konstantin Chernenko grew up in Siberia and may have used his political influence to put the radar there in the age-old tradition of pork barrel politics. On April 16, *The Washington Post* reported that the Americans and Soviets are beginning to soften their positions and the Soviets are violating SALT I. The *Post* cites a new U.S. intelligence consensus that the Krasnoyarsk radar is an early warning radar — built primarily to spot submarine-launched missiles from the northern Pacific. One possible solution to the disagreement is that the Soviets could limit the radar's angle of coverage. For a discussion of the impact of phased array radars on the ABM treaty, see "U.S., Soviet Programs Threaten ABM Treaty" in the April issue of the *Bulletin of the Atomic Scientists*. ...Meanwhile, the U.S. is continuing to add new phased array radars to its early warning system. The third PAVE PAWS radar is nearing completion at Robins Air Force Base in Georgia, and late last year ground was broken on the fourth PAVE PAWS installation in Eldorado, TX, near Goodfellow Air Force Base. The Air Force also expects a new phased array radar to be operational in Thule, Greenland, in the fall of 1986....The U.S. also uses a phased array radar, called Cobra Judy, at sea. According to the January 1985 *Defense Electronics*, the Air Force is in the process of adding an X-band radar, which will stand five stories tall, to the USNS Observation Island. It will complement the ship's existing S-band phased array unit....To learn how a phased array radar works, see Eli Brookner's extremely readable

article in *Scientific American* (the February issue's cover story). Brookner, who is with Raytheon, which is building the PAVE PAWS units for the Air Force, explains how the electronically steered radar can yield information on the location, bearing, velocity and even the length of a target. He describes how the new generation of gallium arsenide technology will encourage the development of smaller phased array radars: a few monolithic microwave ICs will replace hundreds of parts. He predicts that NASA will soon send a phased array radar into space for surveillance and mapping duties....Such radars are already being used for research on ionospheric phenomena. A group from Johns Hopkins University's Applied Physics Lab describes the phased array backscatter radar in operation at Goose Bay, Labrador, Canada, in the January-February 1985 issue of *Radio Science*. ...On October 15-18, many of the technical issues related to these radars will be addressed at *Phased Arrays '85* in Bedford, MA. For more information, contact Dr. Hans Steyskal, RADC/EEA, Hanscom AFB, MA 01731, (617) 861-2052....Phased arrays are also being used in the treatment of cancer. The *IEEE Transactions on Microwave Theory and Techniques* is planning to publish a special issue in May 1986 on the use of phased arrays for hyperthermia. For more information, contact Professor James Lin, Department of Bioengineering, University of Illinois at Chicago, Box 4348, Chicago, IL 60680, (312) 996-2331.

STANDARDS

Blasting Caps and Medical Surveillance...ANSI C95's Subcommittee V has drafted a new standard, *Safe Distances from Radiofrequency Transmitting Antennas for Electric Blasting Operations*. Members of C95 have until June 28 to cast their ballots on the draft standard, which was developed under the aegis of Subcommittee V Chairman Ramie Thompson. Based on the possibility that the wires of an electric blasting cap can act as a receiving antenna for RF energy, the proposal discusses procedures to minimize the risk of accidental detonation....An ad hoc committee of C95 has been studying the merits of developing a surveillance program for workers exposed to RF/MW radiation. Dr. Charlotte Silverman of the FDA, the chairwoman of the ad hoc group, reports that such a program "is needed and is feasible." The group has prepared a report that will be discussed, among other matters, at the committee's next meeting on June 20, immediately following the BEMS conference in San Francisco.

IEC on Measuring Transients...The IEC's Technical Committee No.77 on EMC between electrical equipment has released a *Guide on Methods of Measurement of Short Duration Transients on Low Voltage Power and Signal Lines*. Publication 816 describes the effects of such transients, caused primarily by lightning or electrical switches, and explains how to determine which parameters should be measured to characterize them. The well-illustrated report, printed in English and French, is available for \$62.00 plus postage from ANSI's International Sales Dept., 1430 Broadway, New York, NY 10018.

TECHNOLOGY

Pulsed Power...William Weldon of the University of Texas at Austin reviews the technology required to generate pulsed power for electromagnetic launchers, EMP simulators, fusion research and lasers in the March issue of *IEEE Spectrum*....The NBS is planning a *Workshop on Measurement of Electrical Quantities in Pulse Power Systems*, to be held in Gaithersburg, MD, March 5-7, 1986. Among the topics to be covered are the measurement of voltage, current and power, as well as calibration methods. The attendance fee has yet to be set but is expected to be less than \$100. Contact: Ron McKnight, B344 Metrology Bldg., NBS, Gaithersburg, MD 20899, (301) 921-3121....The Army Electronics R&D Command is setting up a Pulse Power Center at Fort Monmouth, NJ. Contact: Joseph O'Connell at Fort Monmouth's Low-Energy Pulsers Team Electronics Technology and Devices Lab, (201) 544-5404....The *5th IEEE Pulsed Power Conference* will be held in Arlington, VA, this June 10-12. Contact: Dr. Frank Rose, Naval Surface Weapons Center, F-04, Dahlgren, VA 22448, (703) 663-8026.

FROM THE FIELD

IBM on Guy's VDT Report

To The Editor:

Your recent *Microwave News* story misinterprets a report prepared for IBM by Dr. A.W. Guy (*MWN*, April 1985). Your story is inaccurate and grossly misleading.

This is especially distressing since IBM provided you in advance with additional clarifying information. You also had Dr. Guy's report summary which states there is "no valid evidence that would indicate any health hazards associated with...persons operating VDTs."

Dr. Guy since has added a preface to his full report which states "VDTs are safe to use." He adds that the emissions from "both older and newer model VDTs are well below the levels shown to cause harmful biological effects."

Here, again, are the facts:

- No place in the report or summary does Dr. Guy recommend refitting older VDTs with shielding because of possible health problems. Dr. Guy reconfirms this in his preface by saying: "I do not feel...that unshielded VDT emission levels represent a potential health hazard."
- Dr. Guy does observe that there is a *perceived* problem based on *unverified* reports. In his preface, Dr. Guy explains that current shielding is desirable because it reassures individuals concerned by those reports, not because he has any health or safety concerns [emphasis in original].
- IBM has not kept Dr. Guy's findings confidential. In accordance with standard scientific practices, Dr. Guy has been reporting his findings at appropriate scientific forums and he will continue to do so. Also, Dr. Guy's summary has been available since September and the full report is available now.
- Dr. Guy's basic conclusion is that VDTs are *safe* and present *no* health hazards to users.

Robert J. Siegel, Director of Information,
IBM, Armonk, New York 10504

VDTs

Swedish Research Review...A researcher with Sweden's National Board of Occupational Safety and Health (NBOSH) has published an 87-page review, *Video Display Terminals and Health: A Technical and Medical Appraisal of the State of the Art*. It assesses the risks faced by workers for a wide range of reported ailments, including stress, reproductive abnormalities, visual and ocular damage and musculoskeletal problems. In the report's summary, author Ulf Bergqvist and his NBOSH colleague Bengt Knave conclude that "VDT/CRT units do not cause birth defects or spontaneous abortions." In addition, they dismiss reported similarities between VLF radiation emissions from VDTs and the fields used by the Delgado team on chick embryos (see *MWN*, September 1984). Single copies of the report, which appeared originally in the *Scandinavian Journal of Work, Environment & Health*, 10, Supplement 2, 1984, are available for 130 Swedish Kronor each (about \$14.50), prepaid, from Bergqvist, NBOSH, S-171 84 Solna, Sweden (make checks payable to "WWDU").

We strongly dispute IBM's contention that our story is inaccurate and misleading. We offered no judgment on the question of VDT safety. We simply reported what we consider to be a clear recommendation by Guy for shielding VDTs which do not meet the 1983 electromagnetic interference (EMI) rules set by the Federal Communications Commission.

Referring to older model VDTs in a section titled "Recommendations" on page 56 of his report to IBM, Guy states: "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" [emphasis added]. We regret that IBM does not address this recommendation in its letter.

Indeed, to avoid any possibility of misrepresenting Guy's advice to IBM, Microwave News reprinted the full text of his recommendations. We refer interested readers to page 11 of our April issue.

On receiving IBM's letter, we contacted Guy at the University of Washington in Seattle, but he refused to comment on either our story or Siegel's letter.

Guy's new preface, cited by IBM, is dated April 18; the original report is dated December 2. (By April 18, our April issue was already on its way to our subscribers.) While the preface may help everyone better understand Dr. Guy's position, in no way does it alter the contents of the report itself.

Last fall, when Microwave News first learned that Dr. Guy was preparing a report for IBM, we repeatedly asked for a copy. We were told that it was for internal use only. Later, IBM released a six-page report summary that did not include Guy's recommendations. Only after we published our story did IBM finally release the full report.

We stand by our story. — The Editors

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CONFERENCES

July 14-19: **1985 Summer Meeting of the IEEE Power Engineering Society**, Hotel Vancouver, Vancouver, BC, Canada. Contact: PES Special Activities, IEEE, 345 East 47th St., New York, NY 10017, (212) 705-7895.

July 22-24: **22nd Annual Conference on Nuclear and Space Radiation Effects**, followed by July 25-26: **1985 Hardened Electronics and Radiation Technology (HEART) Conference**, Monterey, CA. Contact: K.F. Galloway, Div. 726, NBS, Gaithersburg, MD 20899, (301) 921-3541.

July 22-25: **1985 International Symposium on Microwave Technology in Industrial Development —Brazil**, Campinas, Brazil. Contact: Attilio Jose Giarola, SBMO Symposium Committee, UNICAMP-CCPG (Reitoria), CP 1170, 13100 Campinas, SP, Brazil.

August 11-16: **14th International Conference on Medical and Biological Engineering and 7th International Conference on Medical Physics**, Espoo, Finland. Contact: Congress Office, PO Box 105, SF-00251 Helsinki, Finland.

August 19-21: **10th Annual Conference of the Australian Radiation Protection Society**, Melbourne, Australia. Contact: Dr. T.H. Gan, Australian Radiation Lab, Lower Plenty Rd., Yallambie, Victoria 3085, Australia.

August 19-23: **5th Annual Meeting of the Society of Magnetic Resonance in Medicine**, London, UK. Contact: Institution of Electrical Engineers (IEE), Savoy Place, London WC2R 0BL, UK, (01) 240-1871.

August 20-22: **1985 IEEE International Symposium on Electromagnetic Compatibility**, Hilton at Colonial, Wakefield, MA. Contact: Dr. Chester Smith, PO Box 536, Bedford, MA 01730, (617) 271-7086.

August 20-22: **International Symposium on Antennas and Propagation**, International Conference Hall, Kyoto, Japan. Contact: Professor Kazuaki Takao, Dept. of Electrical Engineering, Kyoto University, Kyoto 606, Japan.

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August 26-28: **20th Annual Microwave Power Symposium**, Hotel Continental, Chicago, IL. Contact: International Microwave Power Institute, Tower Suite 520, 301 Maple Ave. West, Vienna, VA 22180, (703) 281-1515.

August 26-28: **1985 International Symposium on Antennas and EM Theory**, Beijing, China. Contact: Professor Mao Yukuan, Northwest Telecommunications Engineering Institute, Xi'an, Shaanxi Province, China.

August 26-30: **International Conference on Magnetism 1985**, San Francisco, CA. Contact: Diane Suiters, Suite 300, 655 15th St., NW, Washington, DC 20005.

September 9-12: **15th European Microwave Conference**, Paris, France. Contact: Microwave Exhibitions & Publishers Ltd., Convex House, 43 Dudley Rd., Tunbridge Wells, Kent TN1 1LE, UK.

September 10-12: **7th Annual Electrical Overstress/Electrostatic Discharge Symposium**, Radisson South Hotel, Minneapolis, MN. Contact: Michael Martin, 3M/Static Control Div., 2111 W. Braker Lane, Bldg. 501, PO Box 2963, Austin, TX 78769, (512) 834-3117.

September 12-14: **1st Annual Clinical Hyperthermia Symposium and Workshop**, St. Louis, MO. Contact: Dr. B. Emami, Division of Radiation Oncology, Mallinckrodt Institute of Radiology, 4511 Forest Park Blvd., St. Louis, MO 63108, (314) 362-3470.

September 23-26: **4th International Conference on AC & DC Power Transmission**, London, UK. Contact: IEE, see August 19 above.

September 27-30: **7th Annual Conference of the IEEE Engineering in Medicine and Biology Society**, Americana Congress Hotel, Chicago, IL. Contact: Dr. Barry Feinberg, Kendall Co., 411 Lake Zurich Rd., Barrington, IL 60010, (312) 381-0370. Followed by September 30-October 2: **38th Annual Conference on Engineering in Medicine and Biology**, Chicago, IL. Contact: Susan Leone, ACEMB, 4405 East-West Hwy., Suite 402, Bethesda, MD 20814, (301) 657-4142.

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Buddy, Can You Spare a Dime?

Growing Evidence That Cell Phone Radiation Can Affect the Brain

Latest Data from Finnish and German Labs

While public fears about brain cancer remain unresolved, there is now a growing body of evidence that wireless phone radiation can affect the nervous system. Studies from Finland and Germany are the latest to find changes in brain activity.

Some of the new results show subtle behavioral effects, while others involve changes in brain-wave patterns. They do not point to any health risks — in fact, some studies suggest that a cellular phone signal can actually speed up certain mental functions. But while these findings are still tentative, they do call into question the assumption that low-power radiofrequency and microwave (RF/MW) exposures do not cause neurological effects.

In the Finnish study, volunteers exposed to mobile phone signals responded significantly faster on two different tests of reaction times. The amount of time needed for a simple task of mental arithmetic was also decreased. “Our results suggest that GSM cellular telephones may have an effect on cognitive processing,” write Dr. Mika Koivisto and colleagues at the Center for Cognitive Neuroscience at Finland’s University of Turku in the February issue of *NeuroReport*

(continued on p.10)

EMF Polarization: Ignored Too Long? Study Prompts New Outlook

In the laundry list of variables used to characterize electromagnetic fields (EMFs), polarization is usually an afterthought — if it is mentioned at all. This is mostly because it is neither easy to understand nor simple to describe.

But now, there is new interest in polarization as a possible missing variable that could explain the conflicting results that are the hallmark of EMF biological studies.

The catalyst for the new attention to polarization is a study of melatonin among electric utility workers by Dr. Jim Burch of Colorado State University in Fort Collins. Burch has shown that melatonin levels are more affected by certain EMF environments than others and that the key difference may be the polarization of the magnetic field.

Burch’s study is preliminary and would be much less noteworthy if it did not agree with a series of animal studies by Dr. Masamichi Kato in Japan, which, though well known, have until now been generally ignored in the U.S. and Europe.

If Burch and Kato prove to be right, then their work will focus new atten-

(continued on p.3)

Suicide Linked to EMF Exposure Among Electrical Workers

EMF exposures increased the risk of death by suicide in a study of male electrical workers by researchers at the University of North Carolina (UNC), Chapel Hill. They note that several studies have linked EMFs to lower melatonin levels, and that low levels of this hormone have in turn been linked to depression.

"We found a dose-response relationship for recent exposure," Edwin van Wijngaarden told *Microwave News*. "There also seemed to be a higher risk at relatively younger ages." The study was based on data on 139,000 utility workers, originally collected by Drs. David Savitz and Dana Loomis (see *MWN*, J/F95). The 536 deaths from suicide in that cohort were matched with 5,348 controls.

Workers with the highest EMF exposures in the last year, estimated to average 13 mG or more, were 70% more likely to die by suicide than those who were unexposed at work. There was a clear dose-response gradient: Risk grew as exposure increased, though only the increase for the most-exposed workers was statistically significant.

"Stronger associations, with odds ratios in the range of 2.12-3.62, were found for men less than 50 years of age," van Wijngaarden, Loomis, Savitz and colleagues write in the April issue of *Occupational and Environmental Medicine* (57, pp.258-263, 2000). They suggest that this may reflect "a difference in the nature of depression and suicide between age groups." The UNC researchers explain that there are two types of depression, major and minor, and that major depression more often occurs at younger ages. Minor depression, in contrast, is frequently linked to physical illness and "is common and important in later life."

Van Wijngaarden also looked at suicide in three job titles that have generally high EMF exposures: electricians, linemen and power plant operators. Those who had worked as electricians in the last year were more than twice as likely as other workers to commit suicide, a significant increase. Some significant increases were also seen for linemen, while work as a power plant operator showed a weak negative association with suicide.

The discrepancy in results among these job titles might reflect different patterns of EMF exposure, the UNC team writes. Their paper cites one study that found electricians to have the highest average EMF exposures of these three jobs, and another which reported linemen and electricians to have higher exposures to high-frequency transients than power plant operators.

"Exposure to EMFs may alter melatonin secretion," according to several studies cited in the paper. Van Wijngaarden and colleagues note that low melatonin levels have been linked to depression, and suggest this as a mechanism through which EMF exposure might lead to suicide.

Past studies of EMFs and depression have had mixed results (see *MWN*, M/J88, J/A92 and M/A96). A small study by Savitz in 1994 found no greater incidence of depression in the broad class of electrical workers, but some evidence for a greater risk among electricians (see *MWN*, M/A94).

A large 1996 study of electric utility workers in Québec showed no clear relationship between suicide and EMF exposure (see *MWN*, M/A96). Van Wijngaarden pointed out, however,

Italy Moves Towards a 2 mG Limit For Schools near Power Lines

The Italian Ministry of the Environment has proposed setting a goal of a maximum magnetic field of 2 mG (0.2 μ T) in new schools, kindergartens and playgrounds built next to power lines. A draft ordinance, released at the end of 1999, favors a 5 mG standard as a "precautionary measure," but otherwise accepts ICNIRP's 1 G exposure limit, according to the March issue of *ElektrosmogReport*, published in Berlin.

While this is still only a recommendation, it is "an important step" towards a formal rule, Dr. Paolo Vecchia, the head of the non-ionizing radiation section of the National Institute of Health in Rome, told *Microwave News*.

The 5 mG standard — an annual average — would apply to buildings where people may be expected to stay for four or more hours a day. Exposures could never exceed 20 mG over a tenth of a second.

Meanwhile, a prosecutor has opened a criminal investigation of three employees of Enel, the state electric utility, in connection to health problems associated with a 132 kV power line near a school in a small town near Venice. Agence France-Presse, the news service, reported on February 13 that charges of manslaughter are being considered because some children died of leukemia and other cancers.

that the Québec analysis was based on 49 cases of suicide as compared to over 500 in the UNC study. "Our study has much more power to detect an effect on the order of a 1.7-fold increase," he said.

The possible connection between EMFs and suicide was first pointed out over twenty years ago by Dr. Stephen Perry, a British physician.

NSA Workers' Suit Blames Degausser for Brain Tumors

Two employees of the U.S. National Security Agency (NSA) believe they developed brain tumors as a result of using a magnetic tape-erasing machine and are suing its manufacturer. Two other NSA workers who used the degausser also developed brain cancer; all four had benign meningiomas that required surgery. A fifth worker developed another type of cancer.

All five are represented by the firm of Peter Angelos, a powerful Baltimore trial lawyer who has made a fortune on asbestos and tobacco litigation. No decision has been made on how to proceed with the claims of the three who have not yet filed suit.

For each of the four workers with brain cancer, the tumor occurred on the side of the head that was closest to the machine, according to attorney John Pica of Angelos's law firm.

In an interview with *Microwave News*, Pica said that there might be others who used the degausser and have had health problems. "We're still in the investigative phase of this lawsuit." Angelos might try to turn the case into a class action suit.

Degaussers erase magnetic storage media such as audio,

video and computer tapes by applying a powerful magnetic field. (They are also widely used in radio and television studios.) The five NSA staffers sat close to the machine and placed a stream of computer tapes onto a conveyor belt that passed the tapes through a magnetic field of up to 2,500 G.

The original degausser was supplied to the highly secretive intelligence agency in 1967 by Electro-Matic Products Co. of Chicago, and was installed at NSA headquarters in Fort Meade, MD. While that unit was no longer in use, agency technicians surveyed the magnetic fields from a similar degausser in 1997 with an EMDEX High Field meter, which measures frequencies from 40 to 800 Hz.

At the loading position, the magnetic fields were above 900 mG within three feet of the machine. Within a few inches of its sides, the fields were as high as 44 G.

Beginning in the early 1980s, the two plaintiffs, Thomas Van Meter and Tommy Grimes, used the machine for up to three hours a week. Van Meter was diagnosed with a brain tumor in 1986, and Grimes in 1989. Their complaint, filed in a Maryland court in March 1998, states that both have lasting disabilities.

Initially, Grimes and Van Meter were represented by the firm

of Brassel & Baldwin in Annapolis, MD. Last year, however, Jon Brassel determined that his firm had a conflict of interest and the case was taken over by the Angelos firm.

Harold Walter of Tydings & Rosenberg in Baltimore is defending Electro-Matic. The company's degausser "was believed to be safe when it was designed, more than 30 years ago," Walter told *Microwave News*. "Nothing that has been learned since then suggests otherwise." He added that he expects the case to be dismissed. A jury trial is currently scheduled for December.

Starting in the 1960s, Angelos got rich representing thousands of workers in personal injury lawsuits against asbestos manufacturers. In 1993, Angelos led an investment group that bought the Baltimore Orioles baseball team for over \$170 million. As counsel for the state of Maryland in its recently settled lawsuit against tobacco companies, his firm stands to receive up to \$1 billion — though the state may reduce the fee to \$500 million or less.

The NSA has what is widely believed to be the largest computer operation in the world. According to James Bamford, the author of *The Puzzle Palace: A Report on America's Most Secret Agency*, the agency had 11 acres of mainframe computers in the early 1980s.

New Interest in EMF Polarization (continued from p.1)

tion on the relationship between EMF exposure and melatonin, a once-hot topic that has cooled off recently due to inconsistent results.

Polarization refers to the change in direction of the electric or magnetic field. There are two extremes: linear and circular polarization. A linearly polarized magnetic field simply reverses its direction over time. In a circularly polarized field, the direction of the field moves in a circle like the hands of a clock.

Dr. Bill Guy, now retired from the University of Washington, Seattle, explained how this can affect an animal study. "In any position, other than looking right at the source, the rat gets more field exposure from a circularly polarized field," he said. "In a circularly polarized field, there are less peaks and valleys in the induced current as the rat moves around the cage."

To put it even more simply, if you believe that the key EMF effect is to induce a current in the body — the predominant expert view — then a circularly polarized field guarantees the most consistent exposure in an animal experiment. That is why the exposure system Guy designed for long-term RF/MW-animal studies used circularly polarized radiation (see *MWN*, J/A84).

In real-world environments, EMFs are somewhere between linearly and circularly polarized, or more precisely, they are elliptically polarized (see box, p.4).

In a study of 149 utility workers, Burch found that those exposed to fields that were more circularly than linearly polarized had lower levels of melatonin metabolites in their urine. Burch's exposure assessment was crude — he did not make any polarization measurements — but differences in melatonin profiles are apparent.

Subjects who worked for more than two hours a week in environments associated with circularly polarized fields, such as in substations or near 3-phase power lines, excreted significantly less melatonin than those exposed to linearly polarized

Measuring Polarization: Neither Easy, Nor Cheap

Only one meter can measure the polarization of a magnetic field: the Multiwave developed by Electric Research. The System III dosimeter costs \$9,800.

Dr. Joseph Bowman at the National Institute for Occupational Safety and Health (NIOSH) in Cincinnati has four of them. "It's the best way to pursue those characteristics of the field that may be important," he told *Microwave News*. Practically all previous surveys have left out harmonic content, the static field, polarization and spatial orientation, Bowman said. "The Multiwave can capture all these aspects of the field." (See also box, p.4.)

Bill Feero, who designed the Multiwave with Fred Dietrich, explained that, "We have always maintained that polarization could be as important as any other metric." Feero is based in State College, PA, and Dietrich is in Pittsburgh.

fields associated with single-phase power lines and low-voltage electrical wiring.

Writing in the February issue of the *Journal of Occupational and Environmental Medicine* (42, pp.136-142, 2000), Burch calls it a "clear trend," and concludes that his findings "are consistent with the hypothesis that magnetic fields with circular or elliptical polarization are more effective at suppressing melatonin production than linearly polarized fields."

"We are the first to introduce polarization in the context of an epidemiological study," Burch told *Microwave News*.

Kato's experiments with animals show a similar pattern, except that he had the advantage of exposing his rats to pure linearly or circularly polarized fields. Kato found that rats exposed

Polarization at Home, at Work and in the Environment

There have been so few measurements of polarization that it is not obvious where one finds linearly and circularly polarized fields. In fact, outside the lab, most fields are elliptically polarized — that is, somewhere between the two extremes.*

Everyone agrees that very close to 3-phase transmission lines, magnetic fields are nearly circularly polarized and that as you move away, the fields become progressively more linear. There is less agreement about how far from the power line those elliptically polarized fields extend.

In the most detailed set of polarization measurements available, Electric Research found that the “degree of circular polarization in fields within [a 345 kV] substation is comparable to or less than that in residential settings.”† (See also p.3.)

“We were surprised to see as much elliptical polarization as we did in homes,” Fred Dietrich of Electric Research told *Microwave News*. Bill Kaune of EM Factors has pointed out that,

*The skinnier, or taller, an ellipse becomes, the closer it is to being linear. When the ellipse’s two axes are equal, it is a circle.

†Electric Research and Management, *Measurement of Power System Magnetic Fields by Waveform Capture*, Palo Alto, CA: EPRI Report

“Even though [homes] are supplied with single-phase electrical power...the currents in their ground systems are substantially phase-shifted relative to those flowing in the home wiring and appliances.”‡

With respect to commercial settings — office or laboratory spaces — Electric Research found that the degree of polarization was “highly variable from location to location and ranges from near linear to near circular.”†

Many electric motors generate fields that tend to circular polarization. Drs. Joseph Bowman and Mark Methner, both of NIOSH, have made some detailed measurements of polarization and other field variables in six factories, using Electric Research’s Multiwave II system.§ Diverse products, including aluminum, cement and plastics, are manufactured in these facilities. In general they found “a wide diversity of complex magnetic field characteristics and non-sinusoidal waveforms.”

No.TR-100061, February 1992.

‡*Bioelectromagnetics*, 16, p.403, 1995.

§Their data are scheduled to appear in the December 2000 issue of the *Annals of Occupational Hygiene*.

for six weeks to a 14 mG, circularly polarized, 50 Hz field had suppressed melatonin levels in the pineal gland as well as in blood plasma. In contrast, a similar 10 mG field that was linearly polarized had no effect. If the linear field was increased to 50 mG, there was a significant reduction in plasma, though not in pineal, melatonin in the rats.

“In our laboratory, a [linear] magnetic field is not nearly as potent a stimulus at inducing melatonin suppression in rats as is a circularly polarized magnetic field,” Kato concluded in a review paper published in 1997.*

How important a role could polarization play in the EMF–health equation? It is too early to say, but anything that would deepen the understanding of the interaction would be welcomed by many observers. “I’ve always thought that there was something we were not looking at,” said Dr. Paul Gailey of Ohio University, Athens.

Dr. Larry Anderson of Battelle Pacific Northwest Labs in Richland, WA, who has done a large number of EMF animal exposure studies, commented, “My own personal feeling is that I would not be surprised if circularly polarized fields had a differential effect over linearly polarized fields.”

But there is skepticism as to whether polarization can resolve the inconsistent results of past EMF experiments. “I don’t understand how it would explain the discrepancies in the attempts to repeat the work of [Dr. Wolfgang] Löscher and [Dr. Reba] Goodman,” said Dr. Bill Kaune of EM Factors in Richland, WA.

If it turns out that polarization is a key variable, it would mean that the National Institute of Environmental Health Sciences

(NIEHS) made a bad bet in its own multimillion dollar animal exposure studies, as well as those studies the institute funded under the EMF RAPID research program. Practically all used linearly polarized fields.

In the rationale for the animal studies, NIEHS’ Dr. Gary Boorman explained that using linearly polarized fields was simpler and cheaper. (For instance, to generate a circularly polarized field, two sets of coils are needed, while only one set is required for linearly polarized fields.) The fact that the animals would have received a more uniform exposure was not discussed. Boorman’s studies were later interpreted to show few adverse effects and have been cited by those who discount EMF health risks (see *MWN*, J/F98 and M/A98).

In contrast, the New York State Power Lines Project, which ran for most of the 1980s (see *MWN*, F81 and J/A87), required its contractors to use circularly polarized fields in order to mimic the EMF environment near transmission lines (see box, above).

“We didn’t know what the mechanism of interaction was, so we felt we had to emulate a power line field as accurately as we could,” said Dr. Michael Marron of the National Institutes of Health in Bethesda, MD. Marron was a member of the NY project’s Scientific Advisory Panel.

While Kato’s work has essentially been ignored in the design of U.S. experimental studies, it is being taken very seriously in Japan. Battelle’s Anderson visited Japan last November and in a recent interview said that, “Most of the work in Japan — and it is a sizable program — is using circularly polarized fields, a decision driven by Kato’s results.”

Burch believes his work on polarization “definitely needs to be followed up.” But his NIEHS research grant has not been renewed. Nevertheless, he remains cautiously optimistic. “I hope the pendulum will swing back so that we can continue testing this hypothesis,” he said.

* M. Kato and T. Shigemitsu, “Effects of 50 Hz Magnetic Fields on Pineal Function in the Rat,” in *The Melatonin Hypothesis: Breast Cancer and the Use of Electric Power*, edited by R.G. Stevens, B. Wilson and L. Anderson, pp.337-376, Columbus, OH: Battelle Press, 1997.

HIGHLIGHTS

PAVE PAWS Radar on Cape Cod At Center of New Controversy

In a stormy meeting on March 13 in Sandwich, MA, Cape Cod residents called for the closing of a large U.S. Air Force radar installation that overlooks the town. Many speakers blasted a state health department report on the facility as tainted by a conflict of interest, and demanded that it be withdrawn.

The PAVE PAWS radar at the Massachusetts Military Reservation is designed to warn of sea-launched missile attacks, as well as to track objects in space. There are also PAVE PAWS radars at Beale Air Force Base in California and at Clear Air Force Station in Alaska. The Cape Cod radar has been a focus of controversy since it was first proposed in the late 1970s, and local opposition has increased in recent years due to reports about Cape Cod's high cancer rates (see *MWN*, M/J87, J/F92 and J/F98).

"We've been part of an experiment that the Air Force has been conducting for more than twenty years," said Sharon Judge of the Cape Cod Coalition to Decommission PAVE PAWS.

The PAVE PAWS beam gives residents "a fraction of the exposure you'd get from a cell phone call" said USAF Captain Joe DellaVedova at the Pentagon in Washington. Still, he told *Microwave News*, the military must address civilians' concerns.

On February 25, the Defense Department released a draft Environmental Impact Statement (EIS) on upgrades to PAVE PAWS needed for a proposed National Missile Defense (NMD), a "Star Wars"-type system intended to protect against a "ballistic missile threat to the U.S. from a rogue nation." The EIS concludes that the upgrades would have "no unavoidable adverse environmental effects."

The EIS contends that the proposed changes would not alter the peak power, average power or operating frequencies of any of the PAVE PAWS radars. Currently, it states, the Cape Cod facility never exposes the public to more than 0.8 $\mu\text{W}/\text{cm}^2$ of radiation, averaged over a 30-minute period. The signal's average power is 146 kW, with a peak power of 582 kW, at 420-450 MHz. A public comment period on this EIS ends on April 17.

When Judge and other activists read the PAVE PAWS EIS, they were outraged to see that Dr. Linda Erdreich of Bailey Research Associates in New York City (see also p.16) was listed as one of its authors. Erdreich chaired a Massachusetts Department of Public Health (MDPH) panel evaluating the public health impact of the Cape Cod radar, which issued a report in late November. The state panel was formed in 1998 in response to public concern about PAVE PAWS, before the Pentagon proposed the NMD upgrade (see *MWN*, N/D98 and N/D99).

In a March 2 letter to the MDPH, Judge denounced Erdreich's work for the Pentagon as a "blatant conflict of interest." She said that the MDPH panel's report was "polluted in [its] entirety" and must be withdrawn.

The MDPH answered that in October, when it learned that Erdreich's firm might work on the PAVE PAWS EIS, it had promptly asked for her resignation. What the agency did not say, however, was that Erdreich did not in fact resign and continued to work on the report. Suzanne Condon, director of MDPH's Bureau of Environmental Health Assessment in Boston, con-

California Proposal: Hands-Free Device with All Mobile Phones

In a couple of years, all cellular phones sold in California would have to come with a hands-free device, if State Senator Tom Hayden's bill becomes law.

Introduced on February 22, SB1699 would require that consumers be given the option to buy an earpiece or headset when they purchase a mobile phone or sign a service contract. In addition, retailers would have to post a notice outlining possible health risks associated with cellular phones.

After January 1, 2002, any mobile phone sold in California would *have* to include a hands-free device, unless the State Department of Health Services determines "that cellular telephones have no adverse health effects."

"Cell phones are a part of our culture now," said Rocky Rushing of Hayden's Los Angeles office. "But the number of users has been expanding at a much more rapid pace than the research on their effects."

The Cellular Carriers Association of California thinks Hayden's bill is unnecessary. "We don't want the state of California to come out and make a statement that would be unnecessarily frightening to our customers," Stephen Carlson, the group's executive director, told *Microwave News*.

Hearings on the bill are scheduled for early April, and Rushing expects a fight. "I anticipate that industry will go into overdrive to see that this legislation is defeated," he said.

Whatever the outcome, the health issue will get attention because of Hayden's high public profile. A former anti-war activist and ex-husband of actress Jane Fonda, Hayden draws more media interest than the average state legislator.

firmed to *Microwave News* that Erdreich remained a member of the panel until its work was finished and it disbanded.

In an interview, Erdreich said that when the MDPH asked her to quit, she responded that she felt "a professional obligation" to finish drafting her section of the report, on epidemiology. After that, Erdreich said, she stepped back from an active role and let the rest of the committee — Drs. Om Gandhi, Henry Lai and Marvin Ziskin — finalize the report. "Basically I stepped down as chair," she explained.

Erdreich stressed that her work on the two projects did not overlap. "I didn't begin the EIS work until around December 1," she said.

"We believe that Erdreich was working on the MDPH report on health and safety impacts of PAVE PAWS at the same time that the Pentagon was deciding whether to give her firm a lucrative contract," said Judge. The coalition had opposed Erdreich's participation from the start, on the grounds that she had testified for the telecom industry on RF/MW health issues.

Condon said that the MDPH would not withdraw the panel's report. "It's important to avoid even the appearance of a conflict of interest," she said. "But even if you'd had a different panel, we think they would have reached the same conclusion: that there is a lack of good environmental data about PAVE PAWS."

The Air Force has agreed in principle to pay for gathering

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exposure data, Condon said, though details have yet to be worked out. She called such measurements an essential next step: "We need better environmental exposure data so we can make better recommendations about health."

The PAVE PAWS EIS can be downloaded from the Web at: <www.acq.osd.mil/bmdo/bmdolink/pdf/uewr.pdf>. The report of the MDPH expert panel is now at a new address: <www.state.ma.us/dph/behap/pacepaws/assess.htm>.

FCC RF/MW Exposure Rules Facing Supreme Court Test

The activists suing to overturn the Federal Communications Commission's (FCC) telecommunications tower-siting policies will ask the U.S. Supreme Court to hear their case.

The move was prompted by a February 18 federal court of appeals ruling that unanimously upheld the FCC's approach to setting rules on public exposures to RF/MW radiation. The court also affirmed the commission's authority to preempt state and local exposure limits.

Writing for a three-judge panel of the Second Circuit appeals court in New York City, Judge John Walker stated that the FCC had correctly relied on the expertise on RF/MW health effects of the American National Standards Institute (ANSI), the Institute of Electrical and Electronics Engineers (IEEE) and the National Council on Radiation Protection and Measurements (NCRP) (see *MWN*, S/O97).

Walker concluded that it was not "arbitrary" for the FCC to opt for limits designed to protect only against thermal injury, since this was consistent with the ANSI/IEEE and NCRP exposure standards (see *MWN*, M/J86 and M/A93). "At most," Walker wrote, new evidence of biological effects at levels below the FCC limits has "established that the existence of nonthermal effects is 'controversial,' and that room for disagreement exists among experts in the field."

Walker similarly found no error in the commission's handling of advice from federal health, environmental and worker safety agencies (see *MWN*, J/F94).

"We believe the court has ignored strong factual evidence which shows that FCC failed to assure public health protection in adopting the current...guidelines," said David Fichtenberg, president of the Ad Hoc Association (AHA), which filed suit against the FCC rules in 1997 and is mounting the high court appeal (see *MWN*, N/D97).

The AHA will be represented by the firm of Landy & Seymour in New York City. Partner Whitney North Seymour Jr. is a former federal prosecutor. James Hobson of the firm of Donelan, Cleary, Wood & Maser in Washington, who argued the AHA's appeals court case, will continue to advise the group.

The FCC also received the court's blessing for preempting state and local RF/MW health and safety rules under the 1996 telecommunications law (see *MWN*, M/A96).

The Cellular Telecommunications Industry Association, the National Association of Broadcasters and AT&T Wireless Services Inc. filed briefs in support of the FCC.

The court assigned costs in the case to the petitioners. This

The Precautionary Principle Comes to Toronto

Toronto, the largest city in Canada, may soon adopt health guidelines for RF/MW radiation from mobile phone base stations. While voluntary, the power density limits would be 100 times lower than those in Canada's national RF/MW exposure standard, Safety Code 6 (SC6) (see *MWN*, N/D99).

The proposal from Toronto Public Health (TPH), now being considered by the City Council, would ask carriers to show that radiation from new 900 MHz antennas does not exceed 6 $\mu\text{W}/\text{cm}^2$ (or 5 V/m) in places normally used by the public. At 1800 MHz, the frequency used by PCS phones, the maximum would be 10 $\mu\text{W}/\text{cm}^2$ (or 6 V/m). These levels are comparable to those specified by the new RF/MW rules in Switzerland and Italy (see *MWN*, J/F00).

"Due to the uncertainties relating to subtle and long-term effects of RF, it is prudent to keep levels of public exposure below Safety Code 6," TPH head Dr. Sheela Basrur wrote in a report dated November 29, 1999.

Basrur also pointed out that in contrast to SC6, which is based on a 50-fold protection factor, "standards set by regulatory agencies [for] other substances (such as chemicals) often incorporate a 1,000- to 10,000-fold protection factor." Adding a 100-fold margin to SC6, she noted, would bring the overall margin to 5,000, squarely within this range.

TPH proposed the limits last fall after the council asked it to consider a city tower-siting policy based on the precautionary principle (see also p.17). That request "was prompted by reports of adverse health effects at low levels of RF," said Ronald Macfarlane, an environmental health consultant who is working with TPH on the tower-siting issue.

Both Canadian federal officials and wireless industry representatives have voiced concerns about the proposal. Industry Canada argues that the city does not have the authority to regulate RF/MW exposures, but told TPH that it could accept lower limits as long as they are voluntary. The Canadian Wireless Telecommunications Association predicts that carriers would be unable to place multiple transmitters on a single tower or building, resulting in "an undesirable increase in the total number of antenna sites" (see also p.14).

At a public meeting hosted by the council on February 7, Basrur responded that she does not believe the limits would be difficult for industry to meet, pointing out that RF/MW levels "are usually more than 100 times below Safety Code 6 exposure limits" in areas accessible to the public.

The February meeting also featured talks by Dr. Henry Lai of the University of Washington, Seattle, and Mary McBride of the British Columbia Cancer Agency in Vancouver.

The council will consider the proposal in its next session, which begins in June, Macfarlane told *Microwave News*.

practice is "fairly standard" in federal suits and does not include attorneys' fees, Hobson told *Microwave News*. He added that neither the FCC nor any of the intervenors appeared to have submitted a claim for costs before the filing deadline.

The court's decision is available on the Internet at: <www.law.pace.edu/lawlib/legal/us-legal/judiciary/second-circuit.html>.

Motorola Study: No Cancer Risk For RF/MW-Exposed Employees

A study of Motorola's workforce has found no link between exposure to radiofrequency and microwave (RF/MW) radiation and mortality from brain cancer, leukemia or lymphoma.

The study included 196,000 people employed by Motorola between 1976 and 1996 for at least six months, of whom 6,000 died during the study period. Workers with only background-level exposures to RF/MW radiation accounted for 72% of all subjects, while 9% had high or moderate exposures.

Employees with high or moderate RF exposure did not show any increased cancer risk. This was true for usual exposure (the job held longest), for peak exposure (the job with the highest exposure) and for cumulative exposure (estimated in two ways).

"Our findings generally do not support threefold or higher relative risks...due to RF exposure," write Drs. Robert Morgan, Michael Kelsh and colleagues at Exponent Health Group in Menlo Park, CA, in the March issue of *Epidemiology* (11, pp.118-127, 2000). The study did not have enough statistical power, they note, to reliably detect an increase of twofold or less.

Exposure was assessed on the basis of job description, work site and the opinions of experts both inside and outside of Motorola. No measurements were taken. Almost 10,000 job titles were assigned to background, low, moderate or high exposure groups.

"We looked loosely at the sources of RF exposure" in terms of output power, Kelsh told *Microwave News*. "At the bottom was the background group, then above that was people with smaller, transitory exposures," he explained. "The highest group could have been exposed to sources with output power in the neighborhood of 50 W," with the "moderate" group falling in between. All frequencies of RF exposure were combined together.

"We recognize that the exposure assessment was a big limitation," said Kelsh. "We did what we could with job titles, based on many discussions, but it still fell far short of measurements."

Information on use of cellular phones was not included. "We had hoped that there would be a central location for data on company-assigned cell phones," Kelsh said, "but we found that the same phone could be used by different people."

A commentary in the same issue of *Epidemiology* by Dr. Russell Owen of the Food and Drug Administration's (FDA) Center for Devices and Radiological Health in Rockville, MD, points to the lack of data on mobile phone use as a particular shortcoming of the Motorola study. Owen argues that cellular phone use among Motorola employees was probably more widespread and longer-standing than among the general public, and that this would therefore be an "exceptionally informative" group to look at.

Owen reiterates the FDA's long-standing view that there are currently not enough data to conclude whether or not wireless phones pose any health risks (see *MWN*, J/A 93 and N/D99). The fact that 80 million people are using mobile phones in the U.S. alone represents "an unprecedented exposure of the population to RF energy," he writes, and even a small increase in risk "would translate into a potentially significant public health problem."

In general, Owen says, "mobile telephones have not been in widespread use long enough for long-term potential health ef-

SAR Search

• All wireless phones must comply with the FCC's 1.6 W/Kg SAR limit by **September 1** or their manufacturers must complete an environmental assessment. This requirement, which was initially announced in 1996, is cited in a public notice issued as a reminder by the commission on February 25. (All FCC licensees, including broadcasters and wireless companies, must meet the FCC's RF/MW rules by September 1.) At present, only phones brought to market after August 1, 1996, have to comply with the SAR standard, and their manufacturers have been required to submit test data to the FCC (see *MWN*, J/A96). In an interview with *Microwave News*, Dr. **Robert Cleveland** of the commission's Office of Engineering and Technology in Washington said that he does not expect the September deadline to cause a deluge of new SAR data. He pointed out that the majority of phones now sold in the U.S. are digital models, in contrast to the analog units that dominated the market four years ago. Cleveland also noted that PCS handsets have been required to meet the SAR guidelines since 1994. In its public notice, the FCC warned that anyone not in compliance after September 1 may be penalized.

fects to have emerged." This may also be true in the Motorola study of other RF sources, writes the Exponent team. "It may be too early to detect a potential RF health effect in this cohort," the paper states, given the relatively young age of employees and "the assumed long latency between exposure and cancer."

Dr. Samuel Milham, an Olympia, WA, consultant who has studied mortality of amateur radio operators (see *MWN*, N/D87 and J/F89), made this point more sharply. "Over half of the Motorola cohort worked for less than five years, and 28% were hired in 1990 or later," Milham said. "A cohort loaded with short-term workers and with workers followed for a short period of time is a formula for finding nothing."

Morgan's preliminary results were first announced at a Motorola press conference on December 17, 1993. The company told reporters that Morgan had found that its employees had a lower-than-expected rate of neurological cancers (see *MWN*, J/F94). The press conference was held the day after Motorola engineer Robert Kane appeared on the CBS program *Eye to Eye with Connie Chung*, to discuss the lawsuit he had filed that month, blaming his brain cancer on exposure to RF radiation during the development and testing of cellular phones.

The Kane suit is slowly progressing through the courts. Motorola spokesperson Norm Sandler, based in Washington, said that the next hearing in the case is scheduled for April 15.

According to Kelsh, the 1993 announcement was based on a proportional mortality study, comparing Motorola employees to the general population. "It was a first, quick look," he said, "to see if we have an epidemic here." Only later did the company decide to fund the cohort study, which did not start until 1995.

The cohort study found "a pronounced healthy worker effect," with a cancer death rate 78% of that for the population as a whole. Kelsh said that this strong effect is "probably because of the higher socioeconomic status of Motorola employees."

Using "Radar" To Detect Breast Cancer

Microwaves may soon be used to detect breast cancer. The new technique promises to miss fewer malignant tumors than X-ray mammography, without exposure to ionizing radiation.

"Microwaves may do it all: improve on X-ray both in sensitivity and in avoiding false positives," said Dr. Susan Hagness of the University of Wisconsin, Madison. In an interview with *Microwave News*, Hagness cautioned, however, that further research is needed to increase the system's accuracy.

X-ray exams, the most widely used tool for breast cancer screening and diagnosis, miss 10-40% of breast cancers, according to the National Cancer Institute. They are also prone to false positives — that is, misidentifying benign tumors as malignant.

Computer simulations indicate that microwaves could distinguish tumors as small as 2 mm in diameter and up to 5 cm below the skin. This sensitivity is "adequate to detect small cancerous tumors usually missed by X-ray[s]," Hagness and colleagues wrote in a paper published last May in *IEEE Transactions on Antennas and Propagation* (47, pp.783-791, 1999).

Hagness developed the imaging system in collaboration with Dr. Allen Taflove of Northwestern University in Evanston, IL, and Jack Bridges of Interstitial Inc. in Park Ridge, IL. (Bridges was formerly at the IIT Research Institute in Chicago.) Previously a student of Taflove's, Hagness is now working on improving the technology with Dr. Fred Kelcz, a radiologist at the

Magnet Therapy Does Not Ease Chronic Low Back Pain

The use of permanent magnets did nothing to reduce low back pain, according to a new study that appeared in the March 8 issue of the *Journal of the American Medical Association* (283, pp.1322-1325, 2000).

"This is the only randomized, double-blind, placebo-controlled study reporting the use of permanent magnets on more than a single occasion and for more than 45 minutes," stated Dr. Edward Collacott of the Veterans Affairs Medical Center in Prescott, AZ, and coworkers.

Twenty patients who had been experiencing low back pain for at least six months were treated either with a sham device or with trapezoidal, bipolar magnets of approximately 300 G for six hours a day, three days a week, for one week. After a one-week hiatus, the sham and real magnets were switched and the treatment was repeated. There were no significant changes in any measures of pain.

Last year, another small study found that magnets could help alleviate foot pain among diabetics (see *MWN*, J/F99). Collacott suggests that the difference in results may be due to the fact that the source of pain in his subjects is deeper than the peripheral nervous system involved in diabetic pain.

University of Wisconsin medical school.

Meanwhile, Interstitial has built a prototype and is testing it with simulated breast tissue, Bridges told *Microwave News*. Bridges, who holds three patents on the technology, hopes to have a microwave imaging device on the market "in a few years."

The system will have to compete with several other techniques. "There are a lot of promising new technologies," said Dr. Sharyl Nass of the Institute of Medicine's National Cancer Policy Board in Washington. In February, the institute hosted a workshop on new approaches to early breast cancer detection, but Nass said that microwave imaging was not discussed.

Indeed, General Electric Co. has received FDA approval for a new digital mammography system. A company spokesperson said that it will bring "a quantum leap" in X-ray image quality, the March 1 *Wall Street Journal* reported.

The microwave system is essentially a "breast tumor radar," according to Taflove. It consists of a computer linked to an array of small antennas that beam 6 GHz pulsed microwaves.

The peak intensity of the pulses is "a few milliwatts," according to Hagness. At this level, she said, patients' exposure to RF/MW radiation is unlikely to be detrimental.

Normal breast tissue is largely transparent to microwave radiation. In contrast, breast tumors contain more water and scatter microwaves back toward their source. The antenna array picks up these reflected signals, which are analyzed to construct a three-dimensional image showing a tumor's location and size.

The new system cannot as yet distinguish between benign and malignant tumors. This means that, like X-rays, it is prone to false positives. Hagness believes the frequency content of reflected pulses could be used to determine malignancy. She and Kelcz are exploring this possibility. Bridges, too, said that he is working to solve the problem of false positives.

The Far Field



The new magnetic back-brace had unforeseen side effects.

European Grants for Health Research on Mobile Phones and EMFs

In early March, the European Commission (EC) announced details of the five projects on the health impacts of mobile phone radiation and EMFs, funded under its Fifth Framework Program (FP5) for research and development (see *MWN*, J/F99).

A short précis of each project, together with the names and affiliations of the coordinator and participants, appears below.

All five projects are now officially under way, according to Dr. Laurent Bontoux, the EC scientific officer responsible for EMF studies under the FP5's environment and health program.

Bontoux and other members of the EC staff hosted the first meeting of the five project coordinators in Brussels on March 20. A similar meeting will be held next year when the first results of the projects begin to appear, Bontoux told *Microwave News*.

The EC funded only one of three projects supported by the Mobile Manufacturers Forum (MMF) (see *MWN*, J/A99). The project, known as PERFORM-A, will carry out a number of animal-cancer studies using 900 MHz and 1800 MHz mobile phone signals. Peter Harrison, the chair of the MMF, told *Microwave News* that the MMF "is working to find the best way to go forward with noncancer studies." Harrison is with Nokia and is based in Camberley, U.K.

Combined Effects of EMFs with Environmental Carcinogens: Molecular Changes and Genetic Susceptibility (CEMFEC)

To study a) Possible combined effects of RF/MW exposure and known mutagenic agents; b) Whether RF/MW fields similar to those emitted by mobile phones enhance tumor development in a carefully selected animal model; c) RF/MW exposure as a possible enhancer of DNA damage *in vivo*; d) *In vitro* the effects of RF/MW fields, alone or in combination with environmental chemicals, on selected cellular processes related to carcinogenesis and non-genotoxic carcinogenesis.

Coordinator: Jukka Juutilainen, University of Kuopio, Finland. **Participants:** Heinrich Ernst, Fraunhofer Institute of Toxicology and Aerosol Research, Hannover, Germany; Lauri Puranen, Center for Radiation and Nuclear Safety, Helsinki, Finland; Maria Scarfi, National Research Council, Naples, Italy; and Luc Verschaeve, VITO, Mol, Belgium.

Risk Evaluation of Potential Environmental Hazards From Low-Energy EMF Exposure Using Sensitive In Vitro Methods (REFLEX)

The objective is to carry out *in vitro* investigations of molecular and functional responses of living cells to EMFs, covering five relevant research areas: a) Genotoxic effects; b) Effects on differentiation and function of embryonic stem cells and tumor cells; c) Effects on gene expression and targeting; d) Effects on the immune system; e) Effects on cell transformation and apoptosis.

Coordinator: Franz Adlkofer, Foundation for Behavior and Environment, Munich, Germany. **Participants:** Ferdinando Bersani, University of Bologna, Italy; Francesco Clementi, University of Milan, Italy; Wolfgang Fichtner, ETH, Zurich, Switzerland; Oswald Jahn, Clinical University for Internal Medicine, Vienna, Austria; Hans-Albert Kolb, University of Hannover, Germany; Isabelle Lagroye, National University of Chemistry and Physics, Talence, France; Jocelyn Leal, Ramon y Cajal Hospital, Madrid, Spain; Dariusz Leszczynski, Center for Radiation and Nuclear Safety, Helsinki, Finland; Rudolf Tauber,

Benjamin Franklin Clinical University, Berlin, Germany; Anna Wobus, Institute for Plant Genetics and Agricultural Research, Gatersleben, Germany.

In Vivo Research on Possible Health Effects Related To Mobile Telephones and Base Stations: Carcinogenicity Studies in Rodents (PERFORM-A)

The objective is to provide research results on possible carcinogenic and cocarcinogenic effects of RF/MW radiation in animal models: a) Two-year bioassays in Wistar rats with 900 MHz GSM and 1800 MHz PCS radiation; b) Two-year bioassays in B6C3F1 mice with 900 MHz GSM and 1800 MHz PCS radiation; c) Replication of DMBA-initiated breast cancer bioassay in female Sprague-Dawley rats with 900 MHz GSM radiation; d) Replication of lymphoma bioassay in *Pim1* transgenic mice with 900 MHz GSM radiation.

Coordinator: Clemens Dasenbrock, Fraunhofer Institute. **Participants:** Antonio Dotti, RCC Ltd., Itingen, Switzerland; Robert Hruby, Austrian Research Center, Seibersdorf, Austria; Niels Kuster, Swiss Federal Institute of Technology (ETH), Zurich, Switzerland; Germano Oberto, RBM Bioscience, Coleretto Giacosa, Italy; and John Sahalos, University of Thessaloniki, Greece.

International Case-Control Study of Cancer in Relation to Mobile Telephone Use

Multicountry epidemiological case-control study of cellular phone use and tumors of the head and neck, including tumors of the acoustic nerve, the parotid gland and parts of the brain (gliomas and meningiomas). This study will also include Australia, Canada, Israel and the U.S., but the grant is for European study participants only.

Coordinator: Elisabeth Cardis, International Agency for Research on Cancer, Lyon, France. **Participants:** Anssi Auvinen, University of Tampere, Finland; Ray Cartwright, University of Leeds, U.K.; Maria Feychting, Karolinska Institute, Stockholm, Sweden; Martine Hours, University Institute of Occupational Medicine, Lyon, France; Christoffer Johansen, Danish Cancer Society, Copenhagen; Susanna Lagorio, National Institute of Health, Rome; Joachim Schüz, University of Mainz, Germany; and Tore Tynes, Norwegian Radiation Protection Authority, Østerås, Norway.

Development of Advice to the EC on the Risk to Health of the General Public from the Use of Security and Similar Devices Employing PEMFs

The objective is the production of an advisory document to the European Commission and member states addressing the issue of possible adverse effects on public health from exposure to pulsed electromagnetic fields (PEMFs) associated with electronic security and similar devices.

Coordinator: Jürgen Bernhardt, German Federal Radiation Protection Office, Oberschleissheim, Germany. **Participants:** Anders Ahlbom, Karolinska Institute, Stockholm, Sweden; Jean-Pierre Césarini, Rothschild Foundation, Paris, France; Martino Grandolfo, National Institute of Health, Rome; Frank de Gruijl, Utrecht University Hospital, Utrecht, The Netherlands; Maila Hietanen, Finnish Institute of Occupational Health, Vantaa, Finland; Rüdiger Matthes, German Federal Radiation Protection Office; Alastair McKinlay, National Radiological Protection Board, Chilton, U.K.; Michael Repacholi, World Health Organization, Geneva, Switzerland; and Laszlo Szabo, National Research Institute for Radiobiology and Radiation Hygiene, Budapest, Hungary.

(see box on p.11).

Koivisto's findings are "exciting," Dr. Alan Preece of the U.K.'s University of Bristol writes in a commentary in the same issue of *NeuroReport*. While Preece has also demonstrated that mobile phone radiation can produce a decrease in some reaction times (see *MWN*, M/A99), he told *Microwave News* that, "Koivisto's tests were more precise."

Meanwhile, German government researchers have found that exposure to mobile phone radiation leads to a significant decrease in a type of brain waves known as "slow brain potentials" (SP) during certain cognitive tests. Significant changes in electroencephalogram (EEG) readings were observed in specific areas of the brain, and the effect was repeated in a second experiment.

The team at the Federal Institute for Occupational Safety and Health in Berlin, led by Dr. Gabriele Freude, did not observe any changes in test performance, but the paper notes that SP are thought to play a role in reaction time. The Freude study appears in the January issue of the *European Journal of Applied Physiology* (see box at right).

Impact on Sleep and Headaches

The latest results are part of a growing body of evidence of possible neurological effects from wireless phone radiation. Last year a leading sleep researcher in Switzerland reported that a GSM signal caused EEG changes during sleep, comparable in size to those produced by melatonin (see *MWN*, N/D99). Volunteers exposed overnight also spent significantly less time awake after they first fell asleep. German scientists have observed changes in both EEG readings and sleep patterns (see *MWN*, M/J94 and M/J98). (With other frequencies and power levels, a Swiss-American team has used nonthermal levels of RF/MW radiation to treat insomnia; see *MWN*, M/J96.)

In 1998 a Swedish-Norwegian study pointed to another possible neurological change when it found that headaches increased significantly with the amount of time spent using a mobile phone (see *MWN*, M/J98).

No studies of cellular phones and brain activity have been carried out in the United States.

While findings of mobile phone effects on the nervous system are increasingly common, so far they do not add up to a coherent picture. The Koivisto and Preece experiments, the only two cognitive studies to date, are the most closely related. But they also differ in some important ways.

"Our basic finding, that RF/MW fields may speed up response times, is similar to the finding of Preece," Koivisto told *Microwave News*. He called the effect "rather surprising."

Preece, however, observed the strongest effect with an analog signal, and a much weaker response with a digital one. Koivisto pointed out that this contrasts with his own results, in which a digital GSM signal produced a clear-cut effect. He said that this might be because Preece's digital signal was only half as strong as that in the Finnish experiment—with an average power of 0.125 W as opposed to 0.25 W. (Koivisto did not use an analog phone.) He also noted that the exposure times were shorter in Preece's tests.

Since analog phones use a continuous signal while a digital signal is pulsed, the former generally has a higher average power.

German EEG Study

Dr. Gabriele Freude's experiments were designed to provoke specific types of brain activity. The first experiment used 20 male volunteers while the second used 19, ranging in age from 21 to 30 years.

A GSM phone with a 916 MHz signal was positioned on the left side of the head, touching the ear. Peak power from the antenna was 2.8 W, with an average power of 0.35 W. The signal was pulsed at 217 Hz with a pulse width of 577 μ s. According to staff from Deutsche Telekom in Darmstadt, SARs did not exceed 1.42 W/Kg averaged over one gram of tissue, or 0.882 W/Kg when averaged over ten grams.

The antenna was radiating during half the trials, and the order of real or sham exposure was varied. Subjects were not aware whether the signal was on or off. While researchers were not similarly "blinded," there was no verbal communication with subjects during the tests.

In both the first and second experiments, volunteers performed a complex visual monitoring task (VMT), which involved pressing a button to stop the hand of a clock as close to "12" as possible after the hand made three revolutions. In the second experiment only, two additional tasks were performed: pressing a key at regular intervals, and stopping the clock hand as soon as possible after it began to move.

In both experiments, performance was not altered by exposure to the GSM signal. But brain activity was: In both cases, slow brain potentials in the VMT task were significantly decreased during GSM exposure.

No EEG changes were observed in the two additional tasks in the second experiment.

Freude's results are presented in the January issue of the *European Journal of Applied Physiology* (81, pp.18-27, 2000).

Preece has suggested that this may account for his observation of a stronger effect with an analog phone.

While both studies found faster reaction times in exposed volunteers, they had different results on some of the same tests. Preece saw no changes in the tests of simple reaction time and vigilance, while Koivisto saw faster responses in both (see box, p.11). "I think the effect was probably there in our experiment," said Preece, "but not sufficient to stand out when analyzed alone." When Preece analyzed all "attentional tasks" (simple reaction time, choice reaction time, and vigilance) together, he found a highly significant decrease ($p=0.007$)—a stronger finding than for choice reaction time alone. "If the other results had been negative, then this result would have been weaker," Preece explained.

On the other hand, Preece and Koivisto had different findings in a test of "two-choice" reaction time. In this test, volunteers are asked to press a button to indicate whether the word flashed on a computer screen is "yes" or "no." In two separate experiments, Preece found that the reactions were faster when volunteers were exposed to mobile phone radiation. But when Koivisto performed the same test, he found no difference at all.

Preece states in his commentary that the two experiments

may involve different regions of the brain. His own RF/MW source was a model of an analog phone with an antenna located about 2 cm higher than in the newer digital models, such as the one used by Koivisto. Since the phone's radiation probably only extends about 2 cm into the brain, Preece writes in *NeuroReport*, this difference in location could mean that a different region of the brain is affected, "which could account for differences in the specific cognition responses."

Speaking at a Bioelectromagnetics Society workshop in Washington on February 4, Preece said that the statistical analysis of the data from his own experiments had been checked by a member of the U.K.'s Independent Expert Group on Mobile Phones, Sir David Cox of the University of Oxford, and that Cox agreed with his conclusions (see also p.14).

The Mechanism: Thermal or Nonthermal?

As to a possible mechanism, Preece concludes that "the weight of the evidence so far is for a small thermal response within normal physiological limits." He notes, however, that a nonthermal response is also possible, via proteins that are produced in response to stress. This would have "implications for long-term responses," he writes.

Freude and her team, however, do not believe that their results were caused by heating. "At the low average power of [0.35

W]," they write, "thermal effects at [the] cortical level can probably be excluded." They state that, "It has generally been accepted that fields not exceeding the energy of thermic noise can become [biologically] effective," but note that "knowledge of the underlying biophysical mechanisms is lacking."

Pointing to research on EMF and RF/MW effects on cell membranes — including on calcium flow, neurotransmitters and the blood-brain barrier — Freude and colleagues state that, "Interactions between mechanisms underlying slow brain potential genesis and pulsed [RF/MW] seem to be plausible at least." But they concede that this evidence "does not provide a satisfactory explanation for the findings reported in this study."

The German researchers found significant changes in EEG during a visual monitoring task (VMT) — specifically changes in slow brain potentials (see box, p.10). Six months later, they write, "this effect was replicated in [a] second experiment."

But the effect was observed only in the VMT task, not in two simpler tasks added in the second experiment. Freude notes that SP are involved in the "stage of information processing related to getting ready...for an activity to reach a particular goal." At a physiological level, she adds, SP can be seen "as an index of the allocation of resources to specific networks for the anticipated task performance."

Freude suggests that pulsed RF/MW signals may "exert an excitatory influence" on brain cells, thus "lowering [the] thresholds for neuron excitation." This would enable the same task to be completed with less need for slow brain potentials to prepare the way. This could explain why the effect observed by Freude showed up in tests that made many demands on the brain, but was not apparent in "lower-demanding" tasks such as repetitive movement of a finger.

The GSM signal produced significant changes in EEGs on both the left and right sides of the brain. Curiously, although the antenna was always positioned on the left side of the head, in both experiments there was a "more pronounced effect" on the right. "Execution and control of behavior do not correspond to single cell activity, but to neuron networks," comments Freude.

Although Koivisto did not record EEG data, he makes a similar point in discussing which areas of the brain are likely to be responsible for the effects that he observed: "Changes in any part of the interconnected system supporting attention may affect the function of other components as well."

Freude told *Microwave News* that her results were unlikely to be due to chance. "The effect is very specific," she said, both in its link to a particular task and in the locations where EEG changes are seen.

Koivisto also believes that his own findings are not just random fluctuations. "In our study," he explained, "the significant RF/MW effects were always in the same direction — speeding up responses — and all observed in attention-demanding tasks. Given this pattern of results, it is very unlikely that our results could be due to chance."

However, Koivisto wrote, "the present study does not allow for conclusions about the possible effects of long-term cellular telephone use on cognition or health." Freude also cautioned that conclusions about "human well-being and health" cannot be drawn from her experiments.

Finnish Reaction Time Study

Dr. Mika Koivisto conducted a series of cognitive tests with 48 volunteers, 24 men and 24 women, between 18 and 49 years of age.

A GSM phone was mounted on the left side of the head, with a 902 MHz signal pulsed at a frequency of 217 Hz, a pulse width of 577 μ s, and an average output power of 0.25 W. The phone's antenna was located about 4 cm away from the head, over the rear of the left temporal lobe.

Each subject went through two test sessions lasting about an hour, one with the phone signal on and the other a control session with no exposure. Half had the control session first, while the other half first had the phone turned on; the order of tasks in each test session was also varied. Subjects did not know whether or not the phone was on, although experimenters did.

Significant differences emerged in three out of fourteen measures, including simple reaction time (pressing a button as soon as a "0" appeared on the screen), vigilance (pressing a button whenever L, M or Y were seen in a series of random letters) and the time needed to compute a simple subtraction problem. With the GSM signal on, the average score on these tests was 9 to 29 ms faster. On the vigilance task, there were also significantly fewer "false alarms" (i.e., pressing the button in response to the wrong letter) when the signal was on.

The tests where no effect was seen included several word recognition tasks and tests of "choice reaction time," such as deciding whether or not a picture showed a familiar object.

The study, which was partially funded by Nokia, appears in the February issue of *NeuroReport* (11, pp.413-415, 2000).

FROM THE FIELD

Letter to the Editor

University of Bristol on Release of Henshaw Study

March 10, 2000

To the Editor:

Prof. Nick Day (MWN, J/F00) is wrong about a number of matters, not least how the confusion over the UKCCS [U.K. Childhood Cancer Study] arose. The confusion certainly did not arise from the way the Bristol team put their message across in press releases and at the London press conference on Fews et al. in the *International Journal of Radiation Biology*. I chaired that press conference.

Before inviting Prof. Denis Henshaw to present his team's findings, I made a number of points in very simple terms.

These were:

- a) What we had to report was not a scare story (childhood leukemia is a rare disease).
- b) It was a "good news" story (we were going to reveal a plausible "cause and effect" mechanism that would explain epidemiological associations between power lines and cancer. We might be able in future to avoid these causes).
- c) The mechanism involved some fairly standard physics (people have just not realized what was going on around power lines).
- d) The work was robust (many field experiments) and had been internationally refereed.
- e) It has nothing to do with the UKCCS (which was to be published the next day).
- f) I said our understanding was that that survey would be reporting only on the possible effects of *magnetic fields*. I pointed out that our study was about the very different *electric fields*. Prof. Denis Henshaw then gave a simple, straightforward account of the work in which he, *inter alia*, repeated the points made in my introduction.
- g) After his address, and within a matter of minutes of our open-

ing the meeting for questions, we were facing a barrage of misleading, irrelevant and mischievous questions from power industry spokesmen. They came armed with their own press release and they tried to hijack the press conference.

The following day, Nick Day had his press conference for the UKCCS. His press release carried a headline about power lines and cancer (not the main thrust of the UKCCS report) and asserted that the UKCCS had found no connections. Of course, as we now know, one of the tables in the UKCCS did show such connections and it appears the headline appeared without Prof. Day's knowledge or consent.

The text of the press release was drafted by a small group of three persons: A. Trehearne, Sir Richard Doll and Nick Day. We have no quarrel with the text but the headline [MAJOR STUDY FINDS NO LINK BETWEEN OVERHEAD POWER LINES AND CHILDHOOD CANCER] is identical to that on the Electricity Association website [WORLD'S LARGEST STUDY FINDS "NO LINK BETWEEN OVERHEAD POWER LINES AND CHILDHOOD CANCER"], dated the same day we released our results.

We can only speculate how this all happened and why it continues. We can begin to see how journalists, the public and even some professionals became confused and why the necessary distinction between magnetic fields and electric fields became blurred. There is an old Roman saying much used by lawyers. It is: "*Cui bono?*" I ask it now. Who benefited from the confusion? The answer is a matter of public and scientific importance. It cannot be dismissed as Nick Day has tried to do.

Sincerely,

Don Carleton

Consultant, University of Bristol, U.K.

Microwave News offered Dr. Nick Day of the University of Cambridge an opportunity to reply, but he declined, stating that he would let his results, both published and forthcoming, speak for themselves.

Hot New Papers

René de Seze, Sophie Tuffet, Jacques-Marie Moreau and Bernard Veyret, "Effects of 100 mT Time Varying Magnetic Fields on the Growth of Tumors in Mice," *Bioelectromagnetics*, 21, pp.107-111, February 2000.

"Male and female mice (Balb/c, C3H and C57/bl/6 strains) were exposed for 8 h/day from the onset of tumor until death or until the tumor volume reached a predetermined volume. Statistically significant decrease in the rate of tumor growth and increase in survival were observed in all cases....Much more attention has been given to potential effects of 50/60 Hz environmental fields on tumor copromotion. It is important to point out that the fields used in the two situations are very different: ambient magnetic fields are sinusoidal and of low strength (typically below 0.1 μ T), while fields used in tumor treatment are stronger (above 1 mT) and with high values of dB/dt (typically greater than 1 T/s)."

J. Isokorpi et al., "Effect of Power Frequency Harmonics on Magnetic Field Measurements," *Radiation and Environmental Biophysics*, 39, pp.67-71, 2000.

"[P]ower frequency harmonics may have a significant effect on magnetic field measurements. The effect depends on the meter, but in this study the effect was higher at higher magnetic field levels. The order (third or fifth) of the harmonic frequency also affects the results: The

effect was higher at the third than at the fifth harmonic frequency. One possible reason for the difference may be the proximity of the lower cut-off frequency at 50 Hz. The frequency response is probably already curved at power frequency, damping measurement results at 50 Hz, or the harmonic frequencies are overamplified. To obtain correct results for measurements from fields containing harmonic frequencies, the meter response to harmonics should be well specified."

Estelle Naumburg et al., "Prenatal Ultrasound Examinations and Risk of Childhood Leukemia: Case-Control Study," *British Medical Journal*, 320, pp.282-283, January 29, 2000.

"[U]ltrasound has been shown to cause membrane changes that could affect embryogenesis and late prenatal and postnatal development. Studies have also shown an association between exposure to ultrasound and an increased frequency of non-righthandedness, indicating that fetal development may be affected by the ultrasonic waves....[W]e performed a nationwide population based case-control study using prospectively assembled data on prenatal exposure to ultrasound....The risk of lymphatic leukemia was not influenced by either the number of ultrasound examinations or when the examination was performed....The risk of myeloid leukemia was not influenced by the number of ultrasound examinations. A slightly higher, but not significant, risk was seen for those

examined during the second trimester (odds ratio 1.42; [95% confidence interval] 0.88 to 2.29)...We could not detect any association between exposure to ultrasound during pregnancy and lymphatic or myeloid leukemia, and the results of the study are therefore reassuring."

Howard Wey, David Conover et al. (including Greg Lotz), "50 Hz Magnetic Field and Calcium Transients in Jurkat Cells: Results of a Research and Public Information Dissemination (RAPID) Program Study," *Environmental Health Perspectives*, 108, pp.135-140, February 2000.

"Although it is virtually impossible to repeat every detail of an experiment, especially when investigator judgment is a factor, we set out to replicate the results of Lindström et al. ["Intracellular Calcium Oscillations in a T-Cell Line by a Weak 50 Hz Magnetic Field," *Journal of Cellular Physiology*, 156, pp.395-398, 1993]. We selected a magnetic field with the frequency (50 Hz) and flux density (1.5 G) that produced maximum results. We attempted to eliminate selection bias by including all cells that qualified for assessment based on the minimum requirements of Lindström et al. We chose a technique that allowed us to evaluate $[Ca^{2+}]_i$ [intracellular free calcium] transients in hundreds of individual cells. Finally, we replicated our own experiments several times using different microscope objectives. In the end, we found no effect of magnetic fields on $[Ca^{2+}]_i$ transients in Jurkat cells nor did we arrive at a satisfactory explanation for why we were unable to replicate the results of Lindström et al."

J.M. Fink et al., "Microwave Emissions from Police Radar," *American Industrial Hygiene Association Journal*, 60, pp.770-776, November/December 1999.

"54 different radar [units] were evaluated. Of the 986 measurements taken, only 4 exceeded the IRPA and NCRP limit of 5 mW/cm², although none exceeded the ACGIH, ANSI, IEEE and OSHA standard of 10 mW/cm². These four measurements were maximum power density readings taken directly in front of the radar (a place where an officer who has been properly trained would never be). Additionally, it should be noted that three of those readings came from the same gun. Of the 812 measurements taken at the officers' seated ocular and testicular positions, none exceeded 0.04 mW/cm²....Until science has reasonably shown that long-term, low-power exposure is not harmful, it is recommended that prudent avoidance be considered."

NCI Power Line Epi Study: The Analysis Continues

Ruth Kleinerman et al., "Are Children Living Near High-Voltage Power Lines at Increased Risk of Acute Lymphoblastic Leukemia?" *American Journal of Epidemiology*, 151, pp.512-515, March 1, 2000.

"In the National Cancer Institute/Children's Cancer Group case-control study of childhood acute lymphoblastic leukemia (1989-1993), living in a home with a high-voltage wire code was not associated with disease risk. To further investigate risk near power lines, the authors analyzed distance to transmission and three-phase primary distribution lines within 40 m of homes and created an exposure index of distance and strength of multiple power lines (408 case-control pairs). Neither distance nor exposure index was related to risk of childhood acute lymphoblastic leukemia, although both were associated with in-home magnetic field measurements. Residence near high-voltage lines did not increase risk."

Elizabeth Hatch et al., "Do Confounding or Selection Factors of Residential Wiring Codes and Magnetic Fields Distort Findings of Electromagnetic Fields Studies?" *Epidemiology*, 11, pp.189-198, March 2000.

"In summary, our analysis found that selection bias and, to a lesser extent, confounding had detectable effects upon the results. Although several variables were strongly related to both wire codes and measurements, it seems unlikely that confounding alone can explain the findings of previous studies. Selection bias, in contrast, led to a slight overestimate of effect in our study, which was magnified when confounding was also considered, and could explain part of the association between wire codes and childhood leukemia reported in past studies."

See also *MWN*, J/A97, N/D97 and M/J98.

New Books: Short Reviews

Rüdiger Matthes, Eric van Rongen and Michael Repacholi, eds., *Health Effects of Electromagnetic Fields in the Frequency Range 300 Hz to 10 MHz*, 230 pp., \$33.00 (with shipping), Oberschleissheim, Germany: International Commission on Non-Ionizing Radiation Protection (ICNIRP), 2000. Contact: ICNIRP, Fax: (49+89) 31603289, E-mail: <matthes@bfs.de>, Web: <www.icnirp.de>.

The frequency band just above ELF has largely been ignored by health researchers. In June 1999, ICNIRP and the WHO tried to remedy this situation by sponsoring a seminar on this part of the spectrum in Maastricht, The Netherlands. This volume is a collection of papers presented at the workshop. Unfortunately, little can be said about possible health impacts, because as Dr. Jukka Juutilainen and Tuomo Eskelinen, both of Finland, point out: "There are almost no data about the effects of fields from 20 kHz to 10 MHz" — a conclusion repeated by other participants. There are papers detailing sources of exposure, both in industrial and

military environments, and on exposure standards, though one is left to wonder what the limits are based on.

Nick Begich and James Roderick, *Earth Rising — The Revolution: Toward a Thousand Years of Peace*, 289 pp., \$17.95, Anchorage, AK: Earthpulse Press, 2000. Contact: (888) 690-1277, Fax: (907) 696-1277, Web: <www.earthpulse.com>.

This book, a follow-up to Begich's exposé of the HAARP project (see *MWN*, M/J94), covers a lot of ground — perhaps too much. There are chapters on non-ionizing radiation health effects, non-lethal weapons, mind control, privacy, "strange" new technologies and much more. The authors have done a great deal of research and have 660 footnotes to show for it. Unfortunately, there are too many references to unreliable secondary sources. Begich and Roderick would have better advanced their goal of focusing more attention on the impact of modern technology if they had had a good editor.

Across the Spectrum

I quite understand how the reassurance from public bodies makes you nervous, since they have been wrong so often when it mattered, but this may be a case where they are right.

— Prof. Ernst Andersen in his weekly Q & A column, “Office E-tiquette,” answering a question on the potential hazards of mobile phone radiation, *Sunday Telegraph* (U.K.), February 13, 2000

“The public trusts national government spokesmen about the same as the tabloids.”

— Dr. Alan Preece, University of Bristol, U.K., speaking at *Radiofrequencies and Modulations Applied in Wireless Communication — Biological Effects and Safety Concerns*, Catholic University of America, Washington, February 4, 2000 (see also p.11)

“My interpretation of the research that’s been done is that there’s no proof that it causes cancer. There’s just no proof that it doesn’t. But there’s no proof, I guess, that bubble gum doesn’t cause cancer.”

— Stan Sigman, Chair, Board of Directors, CTIA, Washington, and CEO, SBC Wireless, San Antonio, on wireless phone safety research, quoted by Tom Kridel in “The Hot Seat,” *Wireless Review*, p.26, February 15, 2000

What wimps. That may well be the verdict future historians deliver on the human race at the dawn of the third millennium....The precautionary “principle” is an environmental neologism, invoked to trump scientific evidence and move directly to banning things they don’t like — biotech, wireless technology, hydrocarbon emissions.

— Editorial, “Fear of the Future,” *Wall Street Journal*, p.A18, February 10, 2000 (see also p.6 and p.17)

Dr. George Carlo, chairman of the former Wireless Technology Research LLC, funded primarily by CTIA, just will not go away.

— Allyson Vaughan, “WTR Head Calls for More Wireless Health Research,” *Wireless Week* (a trade magazine with a close relationship with the CTIA), p.10, March 13, 2000

Motorola is finally shedding its nerdy image and appealing more directly to consumers. About three years ago, Motorola executives noticed that cellular-crazy Italians opened and shut their palms when saying goodbye to friends. It was a shorthand for “Call me,” which inspired Motorola’s famous StarTac clamshell phone.

— Gautam Naik, “Motorola Still Is Struggling in Europe,” *Wall Street Journal*, p.A12, February 11, 2000

Even parents of younger children are buying the phones. On a recent day inside the Pentagon City mall, 12-year-old Angela Booker strapped on her Winnie the Pooh backpack, grabbed her mother’s hand and stepped up to the cellular phone stand. Her cheeks popped into a wide smile. She gazed at a line of phones all designed to meet her preteen tastes: black phones dressed in cotton-candy pink and glow-in-the-dark green covers, some even painted with Disney characters — Goofy, Minnie, Donald. “Mom,” she said, pointing to the phone with the deliriously happy, floppy-eared Pluto, “I want that.”

— Emily Wax, “Cellular Children: Safety Phone Takes Social Turn,” *Washington Post*, p.A17, February 17, 2000

“Bunk.”

— Paul Kurtz of the Committee for the Scientific Investigation of Claims of the Paranormal, Amherst, NY, on claims that EMFs pose health risks — #10 on Kurtz’s list of top ten hoaxes; #1 is alien abductions. Quoted by Dyan Machan in “Bah, Humbug!” *Forbes*, p.100, March 6, 2000

On the Internet

Swimming Rats

Last December, the news media put the spotlight on Dr. Henry Lai’s latest findings showing impaired memory among rats exposed to microwave radiation (see *MWN*, J/F00). In Lai’s experiment, rats must maneuver through a water maze. You can now see them doing their paddling on a video clip posted on <www.junkscience.com>. The news story comes from WNBC-TV in New York City; it was originally aired on February 9 and is archived as the “Video of the Day” for February 29. (Note that WNBC mislabels Lai as Dr. Herschel Shostek, an independent analyst, who in turn is mislabeled as Lai.)

Wireless Connections

Those surfing the Web to learn about mobile phones and health may come across the Wireless Information Resource Center at <www.wirc.org>. It provides “comprehensive, impartial and objective information” about research on health effects of phones and base stations. The center’s aim is to make “a complex issue clearer,” with the assistance of a “team of neutral scientific advisors.” WIRC’s Board of Directors includes Dr. Daniel Krewski of the University of Ottawa and Mary McBride of the British Columbia Cancer Agency in Vancouver (see also p.6). Jim Ferguson of Victoria, BC, looked up the site at Network Solutions,

the Internet registration service, and found out that the site is registered to the Canadian Wireless Telecommunications Association (CWTA) and that Carrie Moussa, listed as the administrative contact, is vice president for association affairs at the CWTA. Visitors to the CWTA Web site, <www.cwta.ca>, will find a link to the WIRC (there is no link in the other direction however). At the bottom of WIRC’s home page, there is an e-mail address for more information. “We would like to hear from you,” the WIRC encourages. When *Microwave News* asked who sponsored the site, there was no response.

FDA and NIEHS/NTP on RF/MW Testing (Redux)

Soon after we noted how to find the FDA’s nomination of RF/MW radiation for testing under the National Toxicology Program (NTP), it disappeared from the National Institute of Environmental Health Sciences’ (NIEHS) Web site (see *MWN*, N/D 99 and J/F00). Apparently, it was posted prematurely and, when discovered, was removed. On March 2, NIEHS made the nomination official with a notice inviting public comment published in the *Federal Register*, <ntp-server.niehs.nih.gov/htdocs/liason/Dec1399ICCECFR.html>. FDA’s nine-page nomination letter is thus now back on the Web, at <ntp-server.niehs.nih.gov/htdocs/Chem_Background/ExSumPdf/Wireless.pdf>. Comments on the desirability of testing are due April 30.

Conference Calendar

See also our last two issues for many more conference listings.

April 26-27: **COST 259 Workshop: The Mobile Terminal and Human Body Interaction**, Bergen, Norway. Contact: May Krosby, Telenor Research and Development, PO Box 83, N-2027 Kjeller, Norway, (47+63) 84-8341, Fax: (47+63) 81-9810, E-mail: <may-elisabeth.krosby@telenor.com>, Web: <www.telenor.no/fou/om/konferanser/cost259>.

June 8-11: **18th Annual International Symposium on Man and His Environment in Health and Disease: Special Focus on the Environmental Aspects of Cardiovascular Disease and EMF**, Omni Richardson Hotel, Dallas, TX. Contact: American Environmental Health Foundation, 8345 Walnut Hill, Dallas, TX 75231, (800) 428-2343, Fax: (214) 361-2534, E-mail: <aehf@aehf.com>, Web: <www.aehf.com/Symposium/2000symp.htm>.

June 15-21: **10th Annual Conference of the International Society for the Study of Subtle Energies and Energy Medicine (ISSSEEM)**, Boulder, CO. Contact: ISSSEEM, 11005 Ralston Rd., Arvada, CO 80004, (303) 425-4625, Fax: (303) 425-4685, E-mail: <issseem@compuserve.com>, Web: <www.issseem.org>.

July 4-7: **International Congress on Weak and Hyperweak Fields and Radiations in Biology and Medicine**, St. Petersburg, Russia. Contact: Congress Administrative Group, (7+812) 394-7885, Fax: (7+812) 394-2563, E-mail: <ata@2russia.com>, Web: <www.congress.spb.ru>.

August 11-14: **7th Annual Michaelson Research Conference**, Inn at Gig Harbor, WA. Contact: Dr. Eleanor Adair, AFRL/HEDR, 8315 Hawks Rd., Bldg. 1162, Brooks AFB, TX 78235, Fax: (210) 536-3977, E-mail: <Eleanor.Adair@he.brooks.af.mil>.

August 22-25: **2000 International Symposium on Antennas and Propagation (ISAP 2000)**, Fukuoka, Japan. Contact: Toshio Ihara, ISAP 2000, CRL/KARC, 588-2 Iwaoka, Nishi-ku, Kobe 651-2401, Japan, (81+78) 969-2115, Fax: (81+78) 969-2119, E-mail: <isap@karc.crl.go.jp>, Web: <www.crl.go.jp/pub/ISAP2000>.

August 27-September 1: **26th International Congress on Occupational Health**, Singapore. Contact: ICOH 2000 Congress Secretariat, Kent Ridge, PO Box 1076, 911103 Singapore, (65) 874-4988, Fax: (65) 779-1489, Web: <www.ich.org.sg/ich2000.htm>.

Meeting Notes

- The *International Conference on Cell Tower Siting*, to be held in Salzburg, Austria, June 7-8, has set up a Web site: <www.land-sbg.gv.at/celltower>.

- On Sunday June 11 in Munich, the day before the Bioelectromagnetics Society (BEMS) annual meeting begins, the U.S. Air Force is hosting *A Forum on RFR Standards Development and Harmonization: Point/Counterpoint*. Among the topics to be covered at this all-day session is the relevance of "so called 'nonthermal' effects"—as well as the "rationale for including the precautionary principle in science-based exposure guidelines." For more information, contact Dr. Michael Murphy at Brooks Air Force Base: <michael.murphy@he.brooks.af.mil>. And on the afternoon of the last day of the meeting, Friday June 16, there will be a public forum on recent and ongoing EMF and RF/MW health research. The BEMS program may soon be posted on the BEMS Web site: <www.bioelectromagnetics.org>.

- Dr. Bengt Knave will present a keynote address on "Electromagnetic Radiation and Health" at the *26th International Congress on Occupational Health* in Singapore this summer (see listing at left). In addition, there will be mini-symposia on ELF EMFs and on RF fields and mobile phones.

October 15-18: **2000 IEEE Conference on Electrical Insulation and Dielectric Phenomena**, Empress Hotel, Victoria, BC, Canada. Contact: Soli Bamji, National Research Council of Canada, Rm. 223, Bldg. M-50, 1500 Montreal Rd., Ottawa, K1A 0R6, Canada, (613) 990-4021, Fax: (613) 952-9366, E-mail: <soli.bamji@nrc.ca>, Web: <www.eeel.nist.gov/ceidp>.

"MICROWAVE NEWS" FLASHBACK

Years 15 Ago

- The FCC requires applicants to consider the hazards of RF/MW exposure from communications facilities.
- Polish researchers see an association between cancer rates among military personnel and their exposure to RF/MW radiation. According to the study, the risk of developing cancer increases with exposure, rising to 5.5 times the expected rate for those in their 20s.
- New tumors are found in rats exposed to microwave radiation by Dr. Bill Guy at the University of Washington, increasing the statistical significance of the results. The revised tumor counts of exposed rats and controls are 18 and 5, respectively.

Years 10 Ago

- Two new epidemiological studies point to an EMF-brain tumor link, bringing the total number of such studies to 12.
- British electric utility National Grid Co. pressures the BBC into dropping an interview with the Central Electricity Generating Board's

Dr. Robin Cox in which Cox does not deny health risks associated with living near power lines.

- Dr. Stephen Cleary of Virginia Commonwealth University in Richmond finds that RF/MW radiation at SARs of 5 and 25 W/Kg can cause human brain cancer cells to proliferate at abnormally high rates. At higher SARs, however, cell growth is suppressed.

Years 5 Ago

- Eleven families, represented by famed litigator Joe Jamail, sue Houston Lighting & Power Co., claiming that magnetic fields from power lines and building wiring caused their children's cancers.
- Citing inadequacies in the experiment's exposure system, the CTIA's Scientific Advisory Group on Wireless Technology [later WTR] defers the replication of a Lai-Singh study that shows 2.4 GHz radiation to cause DNA breaks in the brains of rats.
- A Bell Atlantic Mobile employee sues Motorola, charging that the company's cell phones caused or aggravated her brain tumor.

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PEOPLE

Gloria Parsley will become the interim executive director of the Bioelectromagnetics Society (BEMS) when Dr. **William Wisecup** retires later this year. Parsley has worked with Wisecup and the society for as long as most people can remember. Some BEMS board members would like her to take over the job on a permanent basis....Also at BEMS, Motorola's Dr. **Mays Swicord** has been named editor of the society's bimonthly newsletter. He replaces Dr. **Mary Ellen O'Connor**, who died earlier this year. **Janet Lathrop**, formerly with the now-closed electric utility industry newsletter, *EMF Health & Safety Digest*, will assist Swicord as managing editor....At the end of February, **Dr. John Male** retired from his post as project manager on EMF biological interactions at the U.K.'s National Grid Co. He will continue as administrator of the EMF Biological Research Trust, which is funded by the Grid. The trust has a research budget of about £300,000 (US\$470,000) a year and is currently supporting three projects. Drs. **Ian Glover** and **John Swanson** have taken over Male's duties at the Grid. Glover monitors EMF biological research, while Swanson serves as an expert witness....Dr. **William Bailey** has closed Bailey Research Associates of New York City, long active in EMF and RF/MW health issues (see p.5). He and Dr. **Linda Erdreich** have joined the New York office of **Exponent**, a large consulting firm. Dr. **Michael Kelsh** also works at Exponent, in Menlo Park, CA (see p.7)....*Nature* reported in its February 24 issue that budget cuts at the American Physical Society (APS) may lead to the close of Dr. **Robert Park**'s weekly tip-sheet, *What's New*, which is distributed by e-mail and on the Internet. No final decisions have yet been made. Park, who is a frequent critic of EMF health concerns, serves as the APS' Washington lobbyist and is on the faculty of the University of Maryland, College Park. He is the author of *Voodoo Science: The Road from Foolishness to Fraud*, to be published by Oxford University Press this spring.

RF/MW HEALTH STANDARDS

Cherry vs. ICNIRP...Three years ago, New Zealand's Dr. Neil Cherry released a detailed review of the RF/MW health literature and made a case for a human exposure limit in the 0.1-0.01 $\mu\text{W}/\text{cm}^2$ range (see *MWN*, M/A97). Now, Cherry has updated and revised his analysis and, while still favoring the same low exposure standards, he is taking aim directly at the ICNIRP guidelines, which he considers to be "flawed." ICNIRP's limits for public exposures are on the order of 10,000-100,000 times less strict than Cherry's recommendation. Cherry, who is at Lincoln University in Canterbury, accuses the commission of "misquoting results and inappropriately dismissing research results." Specifically, he argues that ICNIRP has ignored "the large volume" of epidemiological studies that show adverse health effects. Last year, Standards New Zealand adopted ICNIRP-based exposure guidelines and the ministries of health and environment urged their "strict application" and an end to more stringent local limits (see *MWN*, S/O99). The full text of *Criticism of the Health Assessment in the ICNIRP Guidelines for Radiofrequency and Microwave Radiation* (100 kHz - 300 GHz) has been posted on Roy Beavers's Web site: <www.emfguru.com>. A 155-page

paper copy of the document may be ordered for US\$30.00 from Dr. Neil Cherry, 46B Kilmarnock St., Christchurch 1, New Zealand, Fax: (64+3) 343-3693, E-mail: <neil.cherry@crc.govt.nz>.

TELECOM TOWERS

Precautionary Approach in Scotland...The Scottish Parliament's Transport and Environment Committee has issued a report that endorses "full planning control" of telecom masts. The committee stated that it was "not convinced" that allowing local control "would significantly slow down the roll-out of the telecom network." In its March 29 report, the committee noted that, "There is currently no conclusive scientific evidence on non-thermal effects," but also pointed to widespread public concerns. Noting that, "There is reasonable doubt about health risks," it recommended that, "A precautionary approach should be adopted at a national level allowing for local flexibility." (See also p.6 and p.14.) The committee called for more health research and stated that, "Areas such as schools, nurseries, hospitals and residential areas may be considered sensitive for environmental health reasons." In addition, it endorsed the U.K. Parliament Select Committee on Science and Technology's call for tightening the NRPB exposure standards by a factor of five (see *MWN*, S/O99). A complete copy of *Report on Inquiry into the Proposals To Introduce New Planning Procedures for Telecommunications Developments* is available on the Internet at the parliament's Web site: <www.scottish.parliament.uk/official_report/cttee/trans-00/trr00-03-01.htm>. The report contains the oral and written testimony from industry, citizen and government groups.

VISIBLE LIGHT

Myopia Not Linked to Light at Night...Last year researchers at the University of Pennsylvania reported that children who slept in a fully lighted room before the age of two were over five times more likely to become nearsighted than those who slept in darkness (see *MWN*, M/J99). Children who slept with a night light showed a smaller increase in risk for myopia, indicating a dose-response effect. But this finding is at odds with two new studies that appear in the March 9 issue of *Nature*, the same journal that published the original report. Of the 1,220 children examined by Dr. Karla Zadnik and colleagues at Ohio State University in Columbus, 20% of those who slept in darkness before age two became nearsighted, compared to 22% of those who slept with lights fully on. Only 17% of those who slept with a night light became myopic. But Zadnik found that if parents were nearsighted, they were much more likely to leave a light on in their children's room at night. "We think this may be due to parents' own poor eyesight," she said, and in *Nature* she suggests that the Pennsylvania study should have controlled for parental myopia. "Parents should be reassured by these results and not concern themselves with this unfounded risk," Zadnik said. The second new study, by Dr. Jane Gwiazda of the New England College of Optometry in Boston, comes to a similar conclusion. Gwiazda found a 20% rate of myopia among both children who slept with a night light and children who slept in darkness. There was no nearsightedness among the small number of her 213 subjects who slept with full room lighting. Here again, when both parents were myopic, the use of ambient lighting at night was

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significantly more common. “Based on these results, we question whether parents need to be concerned about causing myopia in their children by lighting their nurseries at night,” Gwiazda’s group concludes. In a reply in the same issue of *Nature*, Dr. Graham Quinn and the rest of the University of Pennsylvania team argue that no one should be too quick to throw out their findings. “There are major differences among the studies,” they write. “Early-onset myopes, who ultimately tend to become more severely affected, are overrepresented in our...[study] population.” They suggest that the absence of darkness during sleep might yet be found to accelerate the onset of nearsightedness, or to provoke it in a subset of more vulnerable children. Quinn also raises the possibility that the two new studies might be affected by reporting bias: “Our findings received widespread publicity, and parents...[might] underreport a behavior they fear could have harmed their children.” Quinn emphasizes the clear evidence that lighting can affect ocular development in animals, and argues, “Rather than offering reassurance to parents at this time,” the differences in these studies should “guid[e] the design of future research.”

CLARIFICATION

In our last issue (“Across the Spectrum,” p.14), we reprinted a quotation from Motorola’s Norm Sandler that originally appeared in the December 3 Los Angeles *Daily News*. On February 27, Sandler wrote *Microwave News* to state that he had been misquoted by the *Daily News*: “I believe the reporter chose to string together three disparate statements.” Sandler expressed concern that “the final product...might be misconstrued.”

Keeping Current: Follow-Up on the News

◆ The Bioelectromagnetics Society has decided not to award its d’Arsonval Award this year. Last year’s winner was Dr. Nancy Wertheimer (see *MWN*, J/F99).

◆ They’re back. If you thought solar power satellites, designed to beam energy down to Earth with microwaves, were the stuff of the 70s and 80s, check out the cover story of the spring issue of the *EPRI Journal*, “Renewed Interest in Space Solar Power.”

◆ Some have blamed phone towers for interfering with the navigation of homing pigeons (see *MWN*, N/D98). Dr. Jonathan Hagstrum of the U.S. Geological Survey in Menlo Park, CA, believes low frequency sound waves from the Concorde SST are responsible. His theory appears in the *Journal of Experimental Biology* (203, pp.1103-1111, 2000).

◆ For many years, Drs. Robert Pearson and Howard Wachtel have argued that air pollution from road traffic is a more important risk factor for childhood cancer than EMFs. Their argument is presented in a new report (No.TR-114231) from EPRI, which has sponsored their work, and in a paper in the February issue of the *Journal of the Air and Waste Management Association* (50, pp.175-180, 2000).

◆ In Israel, at least 18 people were injured in rioting over cellular towers near Haifa, the March 15 *Jerusalem Post* reported.

Protesters, who blame radiation from the towers for increased cancer in the area, clashed with police, attempted to dismantle antennas and threw rocks at Motorola maintenance workers.

◆ Although the Iridium satellite phone system closed down service on March 17, Motorola will not shut down its long-term animal exposure study using the Iridium signal at the Battelle Pacific Northwest Labs in Richland (see *MWN*, N/D98). “It is something that warrants to be taken to conclusion,” Motorola’s Norm Sandler told us, citing the system’s unique frequency and modulation characteristics.

◆ A demonstration will be held on April 8 at the California State Capitol in Sacramento to protest “electromagnetic harassment and torture.” For more information, contact: <lfmontgomery@excite.com>. See also <www.bestnet.org/~raven1>.

◆ A five-member advisory panel completed its report on the possible health and environmental effects of radar radiation from the U.S. Navy’s Surface Warfare Engineering Facility at Port Hueneme, CA, in mid-March, as we go to press. The report, which has been forwarded to the California Coastal Commission and the navy, was prompted by local residents’ concerns (see *MWN*, N/D99). The commission will review it at a meeting scheduled for April 10 in Long Beach.

VIEWS ON THE NEWS

Dow 10,000—Safety Research 0

The evidence is piling up. It is becoming hard to avoid the conclusion that mobile phones can affect the functioning of the brain.

Two things are most striking about the research that points in this direction, described in our cover story. The first is how much we *don't* know about these simple effects: What causes them? Do they change with long-term exposure? Are they bad for you?

The second is how basic these experiments are. The sort of cognitive studies recently conducted in Finland, Germany and the U.K. could have been done any time in the last decade. And you might think that such research would have been one of the first things on anyone's agenda.

After all, when a device is pumping RF/MW energy into a complex electrical system like the brain, it would seem natural to ask if it changes the way that system works.

Instead, no cognitive studies of mobile phones were done until the last couple of years, and none has ever been done in the United States.

The reason for this failure is not lack of money. While research has languished, wireless companies have prospered. Since the end of December 1992, the market value of just four of the largest wireless companies has increased by \$450 billion. This does not include Nokia — now one of the largest corporations in

Market Capitalization in Billions

	12/31/92	3/24/00	Increase
Ericsson	\$5.4	\$201.4	3,650%
Motorola	\$13.4	\$115.1	759%
Nextel	\$1.2	\$51.9	4,335%
Qualcomm	\$0.5	\$103.8	21,084%
Total	\$20.5	\$472.2	2,215%

Europe — or the major service providers.

In the table above, the first column reflects market values *before* news of the Reynard brain cancer lawsuit was featured on *Larry King Live* on January 12, 1993. That interview sent wireless stocks into a nosedive. If we had taken late January 1993 as the starting point, the increase would be much greater.

Total spending on safety research by the entire wireless industry — by Motorola, Nokia, Wireless Technology Research, *everyone* — adds up to less than one hundredth of one percent of the increase in value of just these four companies.

This illustrates something that we already knew: The industry's safety research effort has been many days late, and many dollars short.

Buddy, Can You Spare a Dime?

Everyone agrees we need more research on the safety of mobile phones — but nobody's making it happen.

Not the CTIA. Not the FDA. Not Congress. We need to take health research out of the deep freeze, and here's an idea how: It's time for a tax.

Just one dime a month for each of the 87 million cellular phone subscribers in the U.S. would net \$103 million a year. Once upon a time, a dime would buy you a local call at the corner pay phone. Those days are long gone, but today that dime could buy answers to the festering questions about wireless safety.

Think a dime is too steep? How about a penny? Taxing the industry one cent per user per month would add up to over \$10 million a year. Over five years, that's more than twice what was given to WTR. And that's for the U.S. alone. A similar tax in Europe would bring us answers even quicker.

These numbers help put one fact in sharp relief: Spending on safety research has been ridiculously small, compared to the financial resources of the wireless industry (see item above). It's been less than pocket change: The amount spent on health research has been more like the lint in the industry's pocket.

A tiny, tiny tax on cellular phone service fees would create a dedicated revenue stream for safety research. But it's not just the amount of money that has prevented progress. Experience shows that health research is too important to leave in commercial hands. Industry-sponsored health research seems to move more slowly than anything else in the wireless world. All too often, its pace is

set by lawyers and PR departments.

This has been a problem even with the wireless industry's best safety research program, the one conducted by Motorola. Unlike other companies, Motorola has shown leadership. The problem is that it has a huge amount of money riding on the outcome.

Both conflicts of interest and the appearance of conflict will be a constant issue with any industry-controlled program. That is why the European Union's expert group on mobile phone safety called for a "firewall" between wireless companies and decisions about research (see *MWN*, M/A97).

What we need is a truly independent research program, directed by public health professionals with no ties to the wireless industry. To be independent, that program needs a guaranteed source of research funds. If the word "tax" gives Congress a headache, just call it a "user fee."

The cost is small. The time is right.

Buddy, can you spare a dime?

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