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

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

EPA and ERMAC To Consider RF/MW Population Standard

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

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

EPA has been working on the guidance for a number of years. According to the agency's most recent regulatory agenda, published in the *Federal Register* (continued p. 3)

Cost-Benefit Meeting in Ann Arbor

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

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

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

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COST-BENEFIT MEETING

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

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

Excerpts from Invited Papers

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

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

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

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

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

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

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

Glaser & Dodge: It is also interesting to note the lack of most adverse clinical findings in Western workers who are "protected" by a recommended standard endorsed by OSHA of 10 mW/cm² for an 8 hour day, which is many times higher than either the Soviet, Czech or Polish standard

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

Groth: Cost/benefit analysis *can't* resolve the microwave problem. The primary reason is the lack of an adequate data base from which

estimates of critical variables would be derived—especially in the all-important area of potential effects on human health. [author's emphasis]

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

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

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

Koslov: I . . . violently disagree with the current ANSI draft defining mid-range as 30 MHz to 300 MHz, "ramped" to a [permissible exposure level] of 5 mW/cm² at 1.5 GHz I believe that the proposed contour is a grotesque violation of [as low as reasonably achievable], introducing considerable risk with little benefit to either the industry or military organizations involved

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

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

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

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

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

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

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

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

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

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

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

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

1. Keeping in mind the fact that the RF bioeffects issue is not unique, it is agreed that not all of the factors that are needed for a comprehensive cost-benefit analysis of the RF bioeffects issue can presently be quantified. *Some* costs and benefits can be quantified, but not *all* costs and benefits.

2. The first limitation notwithstanding, it is agreed that cost-benefit analysis can be part of the process used for making policy decisions relating to RF bioeffects. The usefulness of this and other analytical methods will vary with particular situations.

3. Those factors that *can be quantified* (within the bounds of commonly accepted quantification procedures and present-day knowledge) include:

- the costs of complying with designated standards
- the costs of undertaking medical surveillance
- the economic impact of perceived risks
- the benefits of RF technology.

4. Those factors that *cannot be quantified* (within the bounds of commonly accepted quantification procedures and present-day knowledge) include:

- the costs of possible negative consequences on the health of the general population
- the costs and benefits of perturbations in the quality of life
- the costs of ecological impacts.

5. Opinions differed on the measurability of possible short-term human health effects in the occupational setting. Some believed that such effects are quantifiable using existing methods and data bases; others believed that they are not. The possible long-term health effects of low-level occupational or general population RF exposure are *not* quantifiable at the present time.

6. In a full and responsible cost-benefit analysis, all values should be made explicit and a clear division drawn between issues that properly belong to science as opposed to those that properly belong to policy. Care must be taken to prevent science from inappropriately influencing policy, or policy inappropriately influencing science.

7. A greater understanding of the mechanisms by which RF radiation interacts with living tissue could aid cost-benefit analysis significantly.

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

Attendees

Richard Albanese, Air Force School of Aerospace Medicine (not points no. 4 & 5); Peter Baragona, Concerned Citizens of Rockaway Township, NJ; Daniel Cahill, Environmental Protection Agency (EPA); Robert Cleveland, Federal Communications Commission; Przemyslaw Czernski, Bureau of Radiological Health (BRH); Allan Frey, Randomline Inc.; Om Gandhi, University of Utah; Zory Glaser,

BRH; Edward Groth III, Consumers Union; Arthur Guy, University of Washington, Seattle; Charles Hall, Lawrence Livermore National Lab; Janet Healer, National Telecommunications and Information Administration; Howard Johnson, RCA; Don Justesen, VA Hospital, Kansas City; Gordon Kane, University of Michigan, Ann Arbor (UM); Samuel Koslov, Johns Hopkins Applied Physics Lab; James Lin, University of Illinois, Chicago Circle; Karel Marha, Ontario Hydro; Rochelle Medici, consultant; John Osepchuk, Raytheon (not point no. 7); Elliot Postow, National Naval Medical Center; Thomas Rozzell, Office of Naval Research; Matthew Shafner, O'Brien, Shafner, Garvey, Bartinik & Stuart; Nicholas Steneck, UM; Paul Strudler, National Institute for Occupational Safety and Health; Mays Swicord, BRH; Richard Tell, EPA; Art Vander, UM; Roby Enge, Navy Bureau of Medicine and Surgery; William Wisecup, Aerospace Corp.

Population Standard (continued from p.1)

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

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

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

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

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

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

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

HIGHLIGHTS

Czech Epidemiology

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

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

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

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

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

US-USSR to Discuss Measurement Standards

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

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

ELF Magnetic Fields and Suicides

A joint English-American study has identified a connection between the intensity of 50 Hz magnetic fields from high voltage power lines and suicides. In what the authors believe is the first demonstrated correlation between human behavior and

environmental fields, they have shown that there were significantly more suicides at locations with high magnetic fields.

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

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

Developments at OSHA

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

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

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

Protective Fibers

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

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

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

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

Risk Assessment at BRH

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

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

used in diagnostic devices such as NMR imaging.

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

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

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

UPDATES

Biological Effects . . . The Air Force School of Aerospace Medicine at Brooks AFB, TX, is looking for a contractor to review and assess the RF/MW bioeffects literature for a computerized retrieval system (PMRN 82-68). SRI International has already completed a pilot study of the project, and Brooks will be issuing a technical report as soon as it returns from the printer. Brooks' James Merritt expects this to be a multi-year effort and hopes it will begin early next year. . . . Meanwhile, the National Telecommunications and Information Administration (NTIA) has renewed its abstracting of the bioeffects literature. Bruce Kleinstein's Science Information Service in Philadelphia, PA, won a \$55,000, six-month contract to resume the *Biological Effects of Non-Ionizing Electromagnetic Radiation Digest*. Kleinstein worked at the Franklin Institute, which used to do the abstracting, before he went off on his own. The last issue of the digest was dated September 1980. Kleinstein hopes to have his first issue out soon. . . . The New York State Overhead Power Lines Project received 164 pre-proposals for its research funds. The Scientific Advisory Panel selected 60 applicants to submit proposals, which are due January 15. Awards should be announced in March. The panel has scheduled a meeting for February 19-21 in New York City. There will be a public meeting at that time. . . . A new journal will appear next year. The *Journal of Bioelectricity*, edited by Dr. Andrew Marino of the Department of Orthopaedic Surgery at the LSU Medical Center in Shreveport, LA, will publish "original work involving the electrical properties of biological tissue, natural bioelectrical phenomena and the interaction of non-ionizing radiation with biological systems—from DC to visible light—with particular emphasis on non-thermal interactions." The institutional rate will be \$75.00; the cost to individuals will be \$37.50. For a complimentary copy contact: Mrs. Eridania Perez, Promotion Department, Marcel Dekker, Inc., 270 Madison Avenue, New York, NY 10016. . . . University of Maryland's Leonard Taylor reviews "The Mechanisms of Athermal Microwave Biological Effects" and a team from Seattle, WA, led by Ceon Ramon describe the inhibition of *E. coli* by weak ELF magnetic fields in the third issue of *Bioelectromagnetics*. . . . In the same issue, a group from the Environmental Protection Agency led by Dr. Ralph Smialowicz reports that rats exposed to 970 MHz radiation for 22 hours a day for 70 days (SAR 2.5 W/Kg) had "significantly higher serum levels of triglycerides, albumin and total protein" compared to controls. They suggest a "non-specific stress reaction" may be responsible. And a joint study by the National Institute of Environmental Health Sciences and North Carolina State University has found that Japanese quail eggs exposed to 2.45 GHz continuous wave radiation (SAR 4.03 W/Kg)

during the first 12 days of embryology resulted in female offspring with "reduced cell-mediated immune potential and induced general leukocytosis." Males were unaffected. . . . The Department of Energy has issued two reports: *Tissue Interaction with Non-Ionizing Electromagnetic Fields*, by W.R. Adey *et al.* of the VA Hospital in Loma Linda, CA, February 1981 (No. DOE/ET/29078-T1 and DE81027654) and *Biomedical Effects Associated with Energy Transmission Systems: Effects of 60-Hz Electric Fields on Circadian and Ultradian Physiological and Behavioral Functions in Small Rodents*, Report for the Period January 1-December 31, 1980, by C.F. Ehret *et al.* of the Argonne National Lab (No. DOE/TIC/1027653 or DE81027653). They are available from the National Technical Information Service. . . . A group from the University of Utah describe an empirical relationship for energy absorption in the near field and another group from Nehru University, New Delhi, India, report their measurements of the dielectric loss in biogenic steroids at 3.3 and 9.4 GHz in the November issue of the IEEE's *Transactions on Microwave Theory and Techniques*. . . . The December issue of *Scientific American* features an article on "Magnetic Navigation in Bacteria" by Richard Blakemore and Richard Frankel.

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

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

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

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

members range from \$180 for attorneys with active cases to \$20 for the newsletter. Contact: J. Stuart Lemle, MRIAC, 1320 19th Street, NW, Washington, DC 20036.

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

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

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

Occupational Health. . . . The National Institute for Occupational Safety and Health (NIOSH) in Cincinnati, OH, is looking for a contractor to write a report listing companies in the US currently using more than 30 dielectric heaters operating in the 3-100 MHz range (RFQ 82-14). . . . The Environmental Health Directorate of the Canadian Department of Health and Welfare has issued a report, *Dielectric (RF) Heaters: Guidelines for Limiting Radio-Frequency Exposure* (No. 80-EHD-58). Copies are available from: Information Directorate, Department of National Health and Welfare, 5th Floor, Brooke Claxton Building, Ottawa K1A 0K9, Canada. . . . Two GE walkie talkies were withdrawn from use at the Toronto *Globe and Mail* last year after measurements indicated that they caused radiation levels above the current exposure standard. One of them had a recorded level of 22.5 mW/cm², according to a check by Dr. Anthony Muc of the Ontario Ministry of Labour.

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

Radar & Technology. . . . The National Highway Traffic Safety Administration (NHTSA) has decided to scrap its proposal to set per-

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

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

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munications Symposium drew over 600 participants to Atlanta on November 2-4. A company spokesman said the enthusiastic participation of the business community was the most significant trend signaled by this year's gathering. . . . A low-cost, one-meter-diameter antenna has been designed for 12 GHz direct broadcast television in Europe. The receiver system, designed by a French firm, is described in the November 17 *Electronics*. . . . RCA's auction of seven leases for transponders on its Satcom IV satellite, scheduled for a January launch, brought \$90.1 million in winning bids at Sotheby Park Bernet in New York City on November 9. FCC approval of the auction is still pending. . . . RCA successfully launched its Satcom 111-R on November 19. Satcom III disappeared soon after its December 1979 blast-off.

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

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

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

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CONFERENCE CALENDAR

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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