EXCERPTS

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. Marzeev 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/m^2) [1 W/m^2 = 0.1 mW/cm^2 = 100 uW/cm^2].

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/cm^2. 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 layed 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 uW/cm^2
10	3-30 GHz	10 uW/cm^2
11	30-300 GHz	Not Specified

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:

$$Es = \sqrt{\sum (Ei)^2}$$

where Es = root-mean-square sum field strength; and
Ei = field strength generated by ith 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:

$$PDs = \sum PDj$$

where PDs = total power density; and
PDj = PD generated by jth 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:

$$\sum (Ei/Emi)^2 + \sum (Pj/PDmj) = 1$$

where Ei = the fields from the individual sources;
PDj = the individual PDs;
Emi = the MPL associated with the ith source; and
PDmj = the PD MPL associated with the jth 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 radiotechnical 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 Metereological 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 Retlif 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.

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/cm^2 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/cm^2 and 1 mW/cm^2 respectively. For any frequency (f) between 3 and 300 MHz, the limit is 900/f^2 mW/cm^2. 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 present 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/cm^2 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."

UPDATES

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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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 that 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.

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").

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

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.

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.

MICRO WAVE NEWS

Our 20th Year

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Dow 10,000 — Health Research 0
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, 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.

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 ∝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.

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 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

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.

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, "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."

*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 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.

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 $\propto W/cm^2$ 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, confirmed 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

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 antiwar activist and ex-husband of actress Jane Fonda, Hayden draws more media interest than the average state legislator.

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/beha/pavepaws/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 agianst 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 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>.

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 $\mu W/cm^2$ (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 $\mu W/cm^2$ (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*.

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/A93 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 effects 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."

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.

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 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.

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.

The Far Field



Kathleen MacInnes for *Microwave News*

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, Colleretto 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, Østeràs, 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. 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

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 ∝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).

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 ∝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 opening 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 ∝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/cm^2, although none exceeded the ACGIH, ANSI, IEEE and OSHA standard of 10 mW/cm^2. 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/cm^2....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, nonlethal 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 Shosteck, 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.icoh.org.sg/icoh2000.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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UPDATES

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 ∝W/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 Europe — or the major service providers.

	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%

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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Microwave Weapon Unveiled; Burning Pain To Control Crowds

The U.S. Air Force (USAF) has developed a millimeter wave weapon for crowd control. This "revolutionary" technology provides an alternative to using deadly force, said Marine Corps Col. George Fenton, the director of the Joint Non-Lethal Weapons Program, at a March 1 Pentagon briefing.

Military officials disclosed that the weapon—which they call "active denial technology"—can send a "narrow beam of energy...hundreds of yards away" and that it "penetrates less than 1/64 of an inch into the skin, quickly heating up only the skin's surface."

Although the Pentagon has finally confirmed rumors and speculation that have been circulating for more than 20 years, many key details about the microwave weapon are still under wraps. The frequency of the radiation, the power output of the millimeter wave source and the weapon's range all remain secret.

But William Arkin, a senior military advisor to Human Rights Watch, said that the transmitter operates at 95 GHz with a 100 kW source. "I have a copy of the contract" for the weapon system, he told *Microwave News*. Arkin, who is based in South Pomfret, VT, estimates that its range is approximately 200 meters, based on "back-of-the-envelope calculations."

The USAF maintains that the heat-induced pain is "identical" to that "experienced by briefly touching an ordinary light bulb." Tests on human volun-

(continued on p.10)

U.K. Doll Panel Acknowledges Weak EMF–Cancer Association

A group of British scientists, led by Sir Richard Doll, has taken a small but significant step toward acknowledging the link between power frequency electromagnetic fields (EMFs) and childhood cancer. In a report released on March 6, the National Radiological Protection Board's (NRPB) advisory group on non-ionizing radiation concludes that "some epidemiological evidence" points to "a small risk of leukemia in children" from EMF exposures.

This assessment goes beyond previous statements by the Doll panel. Its 1992 report found "no firm evidence" of a link, and follow-ups issued in 1993 and 1994 continued to express skepticism over the cancer connection (see *MWN*, M/A92, N/D93 and J/A94).

Now, Doll and his colleagues point to many recent "large and well-conducted" studies, which provide "better evidence than was available in the past." Taken together, they write, these studies "suggest that relatively heavy average exposures of 0.4 $\propto$T [4 mG] or more are associated with a doubling of the risk of leukemia in children under 15 years of age."

(continued on p.2)

The new outlook was also prompted by recent analyses in which pooled data from these epidemiological studies point to an increased risk, according to Professor Colin Blakemore of Oxford University, a member of the Doll panel. He cited the work of an international team led by Dr. Anders Ahlbom of the Karolinska Insitute in Stockholm (see *MWN,* S/O00). "It is correct and responsible to acknowledge this result," Blakemore told *Microwave News*.

But the Doll group stops short of concluding that a causal link has been conclusively established.

"We have no plausible explanation of how radiation of this sort could cause cancer and no evidence from animals or laboratory studies," Doll said at a March 6 press conference in London. Doll is internationally known for his research linking cigarette smoking to lung cancer and heart disease (see also p.11).

The epidemiological evidence on its own is currently "not strong enough to justify a firm conclusion that [EMFs] cause leukemia in children," the Doll panel states.

The U.S. National Institute of Environmental Health Sciences (NIEHS) reached a similar finding in its 1999 report on EMF health risks (see *MWN,* J/A99). It concluded that the evidence for an EMF–cancer link was "weak" overall but saw a "fairly consistent pattern" of an increased risk of childhood leukemia.

The NIEHS differed from the U.K. advisory panel, however, in stating that EMF-exposed workers ran a greater risk of developing leukemia. In contrast, the Doll group concluded that the evidence on occupational exposures and cancer — primarily leukemia and brain cancer — is "conflicting." The group also found "no reason to believe" that residential EMFs increase cancer risk in adults. (See box at right for the report's main conclusions.)

The Doll group emphasizes that the elevated risk is evident only for "prolonged" exposures above 4 mG, which it calls "intense" (see p.19). In the U.K., only a "very few children, perhaps four in 1,000," fall in this range, the report states.

In its response to the report, the NRPB noted that only two of the approximately 500 cases of childhood leukemia diagnosed annually in the U.K. could be connected to EMFs. The advisory group report "provides no additional scientific evidence to require a change in exposure guidelines," the NRPB concluded.

"The risk to children in Britain is vanishingly small," Blakemore said. For his part, Doll — who is 88 — told the *Independent* (March 7) that he would live next to a power line.

But Professor Denis Henshaw of the University of Bristol disputes the report's estimate of the EMF health risks. "We need to be looking at much more than leukemia," Henshaw told *Microwave News*. On March 5, the day before the Doll report was released, Henshaw issued his own risk analysis, which includes deaths due to lung cancer and other illnesses. It shows that power line EMFs may be responsible for as many as several hundred deaths each year in the U.K. (see table, p.3). These numbers are "comparable to the number killed on roads," Henshaw said.

Further research on EMFs and health is warranted, the Doll report states, in view of the "ubiquitous nature of power frequency EMF exposure." Priority should be given to replicating cellular studies that have shown positive results and to resolving existing uncertainties in areas such as gene expression and breast cancer in laboratory animals, the panel writes.

Conclusions of Doll Advisory Group Report

• In the absence of clear evidence of a carcinogenic effect in adults, or of a plausible explanation from experiments on animals or isolated cells, the epidemiological evidence is currently not strong enough to justify a firm conclusion that such fields cause leukemia in children. Unless, however, further research indicates that the finding is due to chance or some currently unrecognized artefact, the possibility remains that intense and prolonged exposures to magnetic fields can increase the risk of leukemia in children.

• Recent large and well-conducted studies have provided better evidence than was available in the past on the relationship between [50 Hz] magnetic field exposure and the risk of cancer.... They suggest that relatively heavy average exposures of 0.4 ∝T (4 mG) or more are associated with a doubling of the risk of leukemia in children under 15 years of age. The evidence is, however, not conclusive.

• Data on brain tumors....provide no comparable evidence of an association. There have been many fewer studies in adults. There is no reason to believe that residential exposure to EMFs is involved in the development of leukemia or brain tumors in adults.

• Although recently published studies of occupational exposure to EMFs and the risk of cancer are, in the main, methodologically sound, and some of them have considerable statistical power, causal relationships between such exposure and an increase in tumor incidence at any site are not established.

• At the cellular level, there is no clear evidence that exposure to [50 Hz] EMFs at levels that are likely to be encountered can affect biological processes. Studies are often contradictory and there is a lack of confirmation of positive results from different laboratories using the same experimental conditions.

• The most suggestive evidence of an effect of exposure to [50 Hz] magnetic fields on biological systems comes from three different areas: a) possible enhancement of genetic change caused by known genotoxic agents; b) effects on intracellular signaling, especially calcium flux; c) effects on specific gene expression.

• Those results that are claimed to demonstrate a positive effect of exposure to [50 Hz] magnetic fields tend to show only small changes, the biological consequences of which are not clear....Many of the positive effects reported involve exposure to time-averaged fields greater than 100 ∝T (1G) which are unlikely to be encountered in a domestic situation.

• Overall, no convincing evidence was seen from a review of a large number of animal studies to support the hypothesis that exposure to [50 Hz] EMFs increases the risk of cancer.

Blakemore said that more studies are "most certainly needed" to explore the possibility, suggested by Henshaw, that charged particles created by power lines could increase the inhalation of cancer-causing pollutants.

The Doll report concludes, however, that "nothing would seem to be gained" by additional epidemiological research on childhood cancer in Britain, given the limited exposures above 4 mG. But such studies "would be valuable" in countries where "greater

exposures to children occur frequently."

Britain's electric utilities welcomed the report. It confirms that "the vast majority of people in the U.K. are not at any risk," said Dr. John Swanson of the Electricity Association in London.

In contrast, Alasdair Philips, a consultant and activist based in Ely, Cambridgeshire, was critical of the report's "blinkered approach." Philips told *Microwave News* that the advisory group ignored "modern bioelectromagnetic insights that are changing the scientific paradigm."

The 179-page *Report of an Advisory Group on Non-Ionizing Radiation: ELF Electromagnetic Fields and the Risk of Cancer* is available for £33.00 including shipping. Contact the NRPB at: (44+123) 582-2742, Fax: (44+123) 582-2746, E-mail: <information@nrpb.org.uk>.

In addition to Doll and Blakemore, the members of the NRPB's Advisory Group on Non-Ionizing Radiation are: Drs. E. Grant, Microwave Consultants Ltd., London; D. Harnden, Wythenshawe Hospital, Manchester; J. Harrington, Institute of Occupational Health, Birmingham; T. Meade, Royal London School of Medicine; and A. Swerdlow, Institute of Cancer Research, London.

Henshaw's Risk Assessment for Living near Power Lines in the U.K.

Condition	Key Findings/ Risk Assessment	Predicted Excess Cases/yr
Childhood leukemia	RR=2>4 mG and 1.7>3 mG	2-8
Skin cancer	Radon aerosol theory	14
Lung cancer	Corona ion theory	250-400
Other illnesses	Corona ion theory	>1,000
Suicide		60
Mild depression	Small increase	<9,000

For details, go to:
<www.phy.bris.ac.uk/research/track_analysis/riskdoc.htm>.

Sir Richard Doll Talks About EMFs, Mobile Phones and Cancer

On March 7, Sir Richard Doll was interviewed on the Kim Hill Program *on Radio New Zealand. Excerpts appear below.*

RD: We have issued a report, which is the result of a review of all the research that's been carried out in recent years, in which we confirm what has been suspected by many people for a long time, that there is a possibility of a risk, but we say quite clearly in the report that it has not been proven. The experimental studies on cells [and] on animals provide no support at all for the idea that this radiation...could cause cancer and the human data that we have are open to a variety of interpretations. It does suggest the possibility of a risk from what are, relatively speaking, high doses and there is the possibility that it might double the risk in children, double the risk of leukemia, but it's far from established....All we can say is that we can't dismiss it....

KH: When you say high doses...what does that mean?...

RD: Well, I have to put that in technical terms, which is 0.4 ∝T [4 mG], and we have found that doses of this sort are not limited to very close proximity to power lines, and when I'm talking about close proximity I'm talking about 20-30 meters, that sort of distance, not 100 meters or further...but we have found that three quarters of the children who are exposed to such levels are nowhere near power lines. That's due to radiation from electricity but through peculiar wiring....

KH: What will [your advisory group] be doing now?...

RD: ...We continue in existence and we shall keep an eye on the situation, and if it changes we shall report to that effect, but in the next two or three years we're going to concentrate on the possible effects of mobile phones.

KH: ...In relation to the pylons and the power lines then, if there is some risk for some people, what would that be?...

RD: The only thing for which there is any real evidence is an increased risk of leukemia in children, not of other types of cancer, and not in adults. And the estimate that we would make in this country from knowledge of the number of children exposed to such levels is that it might add two cases of leukemia a year to the 500 that occur normally and of those two, they would probably not be as a result of...proximity to the power lines but one in every two years might be from proximity to... power lines, the others being from increased exposure...from radiation produced by the wiring locally....

KH: Do you ever think that that issue, the link between smoking and lung cancer, has fed a deep suspicion on the part of the public to all kinds of denials on the part of big business in terms of health?...

RD: ...I think it would be quite wrong because the evidence in relation to smoking was just in a different plane altogether to what we have now. We were talking about from the very beginning, evidence that you increase the risk twentyfold. Now, it's very difficult to do this artifici-

Doll et al. vs. U.K. Sunday Times

PYLONS ARE CANCER RISK — OFFICIAL: TOP SCIENTISTS ESTABLISH LINK. That was the headline on the front page of the U.K. *Sunday Times* (March 4) announcing the impending release of the Doll report. But science reporter Jonathan Leake had got it wrong and in the process alienated key members of the British radiation community.

Leake predicted that Sir Richard Doll would "warn that children living near electricity power lines are at an increased risk from leukemia." He didn't. "The *Sunday Times* nearly always gets things wrong and it has in this case," Doll told Radio New Zealand.

Dr. Colin Blakemore, who was quoted by Leake suggesting that new power lines be put underground to reduce EMF exposures, told *Microwave News* that the piece was "at the very least misleading," explaining that statements attributed to him were "a conflation of a number of unrelated comments."

The daily *Times* has had its own troubles getting the facts straight. On February 5, the newpaper reported that the committee overseeing the U.K. Department of Health's £7 million research program on mobile phone safety (see p.8) would include Roger Coghill — a somewhat surprising choice given his iconoclastic views. Coghill had been invited to attend a workshop hosted by the committee, not to join it.

ally...if the agent isn't actually a cause of the disease. Here we're talking about, at the most, a twofold increase and it's much, much more difficult to be certain that that is the reality than it is when you see something that is a twentyfold increase. So the two situations are just not comparable....

KH: It seems a kind of ironic commentary on society that you can still carry on buying cigarettes and smoking them and nevertheless there are huge headlines and huge concentration attached to a tiny, according to you and other people, link between ...power lines and cancer....

RD: ...I agree that the concern that people express is disproportionate....The fact is that people do get concerned with very small risks... and ignore large ones.

KH: Now as you say, you're going to start looking at the evidence against mobile phones, against and for presumably, then this is another hot issue. People are deeply suspicious of mobile phones.

RD: They are indeed.

KH: If there is a risk of mobile phones, is it the same kind of risk that might attach to power cables?

RD: It's very difficult to say because they've not been in use long enough and there really isn't the suggestive evidence in the case of mobile phones that there is in the case of the passage of electricity. There's no human evidence...I say this quite confidently...there is no human evidence at all at the present moment to suggest that there is any serious disease produced by the use of mobile phones....

Electrification Led to Jump in Childhood Cancer, Says Milham

Up to 60% of all childhood leukemia is due to residential electrification and therefore preventable, according to a new analysis by Dr. Samuel Milham Jr. and Eric Ossiander of the Washington State Department of Health in Olympia.

"The most remarkable feature of childhood leukemia has been the development of a childhood peak of incidence at ages two through four," they write in a paper to be published soon in *Medical Hypotheses*. "Worldwide, the emergence of this peak tracks electrification. Even today, places without electrification do not show this peak."

"It happened in the U.K and then in the U.S.," Milham told *Microwave News*. "It happened in Japan, but it still has not happened in parts of Africa."

The mortality rate of childhood leukemia grew from approximately 2 cases per 100,000 in the 1920s to 6-8 cases per 100,000 in the 1950s-1960s (see figure 1).

For 1928-1932, Milham found that, for those states which were 75% or more electrified, the rate of leukemia among children under five increased with age, while for the other states, the rate decreased. By 1949-1951, all states showed the leukemia peak, with the peak being greatest in those states with the highest level of electrification (see figure 2).

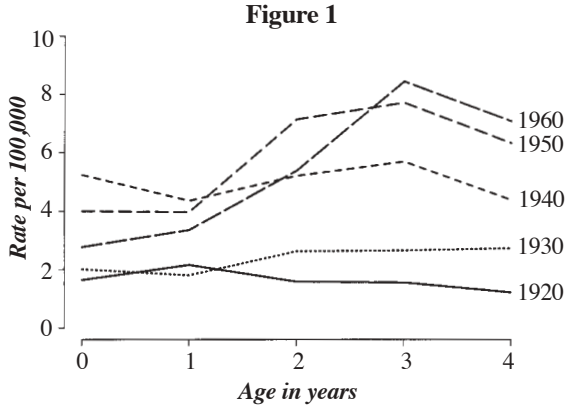
Milham's hypothesis runs counter to theories that an infectious agent or population mixing is responsible for childhood leukemia (see, for example, the March 17 issue of the *Lancet,* p.858). Milham points out that the childhood peak became apparent among Arabs in the Gaza Strip after it was seen among neighboring Israelis even though the two populations were in constant contact. He attributes the difference to the delay in the electrification of the Arab communities.

In the early 1990s, Drs. David Jackson and Robert Adair, both physicists, posited that EMFs could not be responsible for childhood leukemia because cancer rates have not kept pace with electricity consumption (see *MWN,* M/J92). But this argument has been rebuffed by many epidemiologists, including Drs. Nancy Wertheimer (see *MWN,* J/A92), Anders Ahlbom (see *MWN,* N/D 92) and David Savitz (see *MWN,* J/F93) — though Dr. Dimitrios Trichopoulos has spoken in favor of it (see *MWN,* J/F91).

Dr. Allen Kraut of the University of Manitoba, Winnipeg, found an association between rates of childhood leukemia and residential electricity consumption in Canada (see *MWN,* S/O94).

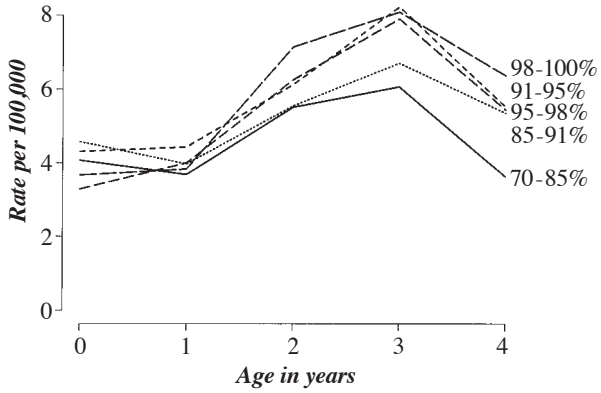
Milham was the first epidemiologist to link electrical occupations to leukemia (see *MWN,* J/A82).

Figure 1



Childhood leukemia mortality for U.S. whites by single years of age, 0-4, 1920, 1930, 1940, 1950 and 1960.

Figure 2



Childhood leukemia mortality rates in all U.S. states, 1949-51, by percent residential electrification and age at death. (States were grouped by quintile of percent of homes with electric service and rates were computed for each quintile.)

Nighttime Exposure: Key Factor For Childhood Cancer Risk

The link between childhood leukemia and magnetic fields is stronger for nighttime exposures than for fields averaged over 24 hours, according to a new study by researchers at the University of Mainz and the Technical University of Braunschweig, both in Germany. For both indices of exposure, the risk was highest for children under the age of five.

"While the association between childhood leukemia and magnetic fields was weak on the basis of median magnetic fields, it was pronounced based on exposure at night," write Dr. Joachim Schüz and coworkers in the March 1 issue of the *International Journal of Cancer (91,* pp.728-735, 2001).

"In general, our results correspond very well to the two recent meta-analyses by the teams led by Dr. Anders Ahlbom and by Dr. Sander Greenland," Schüz of the University of Mainz told *Microwave News* (see p.2 and *MWN,* S/O00).

For children exposed to 2 mG (0.2 ∝T) or more, averaged over 24 hours, the odds ratio (OR) for leukemia was 1.55, and for 4 mG or more the OR was 5.81; neither of these estimates is statistically significant, however. For average exposures between 10 pm and 6 am, the OR for leukemia was 3.21 for 2 mG or more, and 5.53 for 4 mG or more — both of these latter risk estimates are statistically significant.

Among past studies, only that by the National Cancer Institute (NCI) looked at magnetic field risks for exposures at night. The NCI team saw a "slightly higher" childhood leukemia risk for high nighttime exposures than for those over a 24-hour period (see *MWN,* J/A00).

When the German researchers limited their analysis to children four years old or younger, the OR for nighttime exposures above 2 mG was 4.48, which is significant. For those exposed to 4 mG or more at night, the OR jumped to 14.9, which, while significant, has a very wide confidence interval due to the small number of cases.

The increased risk among young children mirrors that found in Canada by Dr. Lois Green of the University of Toronto (see *MWN,* J/A99). The NCI "could not confirm" the association among young children seen in an earlier German study. That study, carried out by the same research group, covered only Lower Saxony and Berlin (see *MWN,* J/A97 and S/O97).

The results of the new study, which includes 514 children with leukemia and 1,301 controls from across all of what was formerly West Germany, are similar to those of the earlier study. When the two data sets were combined, Schüz observed "a clear dose-response relationship" for nighttime exposures.

Schüz cautioned that the strength of his results is tempered by the relatively low participation rate and the long interval between diagnoses and field measurements. The team also notes that in Germany only a small number of children are exposed to 2 mG or more — less than one fifth the number in the U.S.

Nevertheless, the German team, which includes Dr. Jörg Michaelis in Mainz as well as Drs. Karl Brinkmann and Jan-Peter Grigat in Braunschweig, recommends a precautionary policy of reducing unnecessary exposures.

The same German group has also investigated the risk of leukemia from residential 16⅔ Hz magnetic fields from railroad electrical systems — the first to do so. The group observed a "moderate, but statistically nonsignificant association" based on "few exposed subjects." These results appear in the March issue of the *British Journal of Cancer (84,* pp.697-699, 2001).

Late last year, Schüz's team published results of its survey of residential EMF exposures at both 50 Hz and 16⅔ Hz, in *Radiation and Environmental Biophysics (39,* pp.233-240, 2000).

Five Years Later, EPA Releases Draft EMF Cancer Report

The Environmental Protection Agency (EPA) has released its draft assessment of the cancer risk posed by EMFs, more than five years after the agency stopped working on it.

The draft report, dated September 8, 1995, finds that:

> [T]here is a consistent association between childhood leukemia and perhaps brain cancer and surrogates of prolonged magnetic field exposures in residences that has been observed in several studies. It is not likely a chance occurrence or an artifact of the way the studies were carried out, since it has been observed in different studies, countries and time periods and with different study designs.

The 1995 draft was released to Senator Russell Feingold (D-WI) on January 18. Feingold had made inquiries about the report last November on behalf of a constituent, David Stetzer of Blair, WI.

The EPA also sent a copy of the draft to *Microwave News*. Dr. Robert McGaughy, who was in charge of the report at the agency's National Center for Environmental Assessment in Washington, said that there are no plans to distribute it to the public.

In her cover letter to Feingold, Dr. Norine Noonan, the then assistant administrator for research and development, explained that the report had been shelved because the agency's effort had been "overtaken by events." Noonan pointed to the congressionally mandated EMF RAPID research program (see *MWN,* S/O 92 and J/A99) and the report by the National Academy of Sciences on EMFs (see *MWN,* N/D96) — both of which were under way in 1995.

Noonan assured Feingold that, "The agency was not coerced by the electric utility sector to stop working on [the] report."

The EPA began assessing the potential carcinogenicity of electromagnetic radiation in 1986. McGaughy and his team decided to classify EMFs as "probable human carcinogens" in 1990, but they were overruled by EPA managers (*MWN,* M/J90). During the next five years, work on the report continued intermittently.

In 1996, when word leaked out that the EPA had indefinitely stopped work on the report, McGaughy said that the link was stronger than in 1990 (see *MWN,* J/F96). Two years later, a copy of the 1994 draft was sent to *Microwave News,* which published its conclusions (see *MWN,* J/F98).

At press time, it was not clear what action, if any, Feingold would now take. An assistant said that the senator's staff was too busy working on campaign finance reform — the McCain-Feingold bill — to address the EMF issue.

« Wireless Notes »

The **FDA** does not have enough money to monitor the health impacts of cell phones and many other radiation-emitting devices. So says Dr. **David Feigal**, the director of the Center for Devices and Radiological Health (**CDRH**). Because of the need to transfer funds and personnel over the past 20 years, the radiological health program "cannot adequately do its job under the law," Feigal wrote in the CDRH's annual report for fiscal year 2000. Feigal also warns that the "situation is worsening." The center's precarious financial situation could explain why Feigal was evasive when **Larry King** asked him last summer whether there is enough money being spent on cell phone health research (see *MWN,* S/O00). The report, which is available on the Web at <www.fda. gov/cdrh/annual/fy2000/annualreport-2000.html>, includes an outline of the center's work on mobile phones.

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At the end of March, a draft of the **General Accounting Office** (GAO) report on mobile phone safety was being reviewed at the **FCC** and the **FDA**, according to sources at the GAO, the investigative arm of Congress. The report will be ready to be sent to Congress by the first week of May and will be available to the public soon afterwards. The investigation was requested by Sen. **Joseph Lieberman** (D-CT) in 1999; last year Rep. **Edward Markey** (D-MA) expressed interest in seeing an advance copy of the report (see *MWN,* N/D99 and N/D00).

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The **U.K. Labor government** is facing challenges on the siting of mobile phone towers. On February 8, **Archie Norman**, a Conservative Party MP from Kent who is the Tory shadow minister for the environment, wrote to local authorities urging them to prohibit construction of new towers on public property, including schools. The Labor government "has consistently failed to address the problem of monster masts invading our countryside," Norman stated. The conservatives want to revise the planning guidelines for base stations to take environmental and safety concerns into account. Such a change could have a significant impact. Plans for 3G service call for 100,000 new towers in addition to the 40,000 already in use for GSM service, according to a telecom industry analyst cited in the February 10 *New Scientist*. Last May, the independent inquiry led by Sir William Stewart recommended that local officials keep radiation from base station antennas to "the lowest practical levels" in public areas (see *MWN,* M/J00). The Labor government has been sending mixed signals on the issue. In a letter to the London *Times* (February 4), Minister for Housing and Planning **Nick Raynsford** wrote that the government "welcomed the Stewart report" and "accepted its recommended precautionary approach"; the Department of Health greeted the Stewart report with a similar statement. In late January, however, Raynsford told the House of Commons that as long as exposures do not exceed the guidelines set by ICNIRP, local authorities should not take further precautions (see *MWN,* J/F01). Ultimately, the courts may decide whether communities can adopt precautionary rules on antennas. Up to now, the government has been able to override local siting decisions it disagrees with, but this may change. Late last year, a British court held that the review process contradicts the European Convention on Human Rights because the government effectively decides whether its own policy was correctly applied. The government is appealing the decision to the House of Lords.

Italian Minister Confronts Vatican over Radio Radiation

Italian environmental officials have threatened to turn off the electricity feeding the Vatican's radio transmitters in Santa Maria de Galeria, outside Rome, unless the Holy See complies with Italy's strict RF/MW exposure limits.

A possible cancer cluster in nearby Cesano has heightened public concern about "electrosmog." Local health officials have reportedly identified eight cases of leukemia among children living within 6 kilometers (approximately 4 miles) of the transmitters — nearly double the rate in Rome. Overall cancer rates in the area are also said to be elevated.

According to the BBC (March 16), radiation levels near the facility are up to 18 V/m (85 ∝W/cm^2), well above the 6 V/m limit (see *MWN,* J/F00).

But the Vatican contends that the dozens of antennas, which broadcast the Pope's messages around the world in 35 languages, are not bound by the Italian standard because they are in Vatican, not Italian, territory. Willer Bordon, Italy's environment minister, has rejected this argument. "If someone threw something out of an embassy window, like a fridge," he told Reuters (March 16), "you would do everything you could to protect people underneath."

The Vatican Information Service has stated that it favors the less-stringent ICNIRP standard, which it calls "authoritative." Charges are pending against Vatican Radio's director, who is a priest, and its chief engineer. (See also p.14.)

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Does using a cell phone make you quick-witted or are those who can think quickly more likely to use a cell phone? That is the chicken-or-egg dilemma posed by a new study from **Hong Kong**. Dr. **Tatia Lee** and colleagues at Hong Kong Polytechnic University tested 72 teenagers, 37 of whom used GSM mobile phones. They found that users did better on one of three tests that measure human attention. Lee speculates that this might be another indication of an EMF-induced enhancement of cognitive function, as reported by Finnish, German and U.K. researchers using simulated mobile phone exposures (see *MWN,* M/A99 and M/A00). Writing in the March 26 issue of *NeuroReport (12,* pp.729-731, 2001), Lee and coworkers note that they used teenagers as subjects because "it would be almost impossible" to identify an older study group given the popularity of mobile phones in Hong Kong....Meanwhile, new experiments on the effects of human performance during and after exposure to mobile

phone radiation will soon get under way in **Australia**. The National Health and Medical Research Council (NHMRC) has awarded Dr. **Andrew Wood** of Swinburne University of Technology in Victoria A$213,570 (approximately US$107,000) for a three-year study that will include monitoring the quality of sleep of human volunteers. A second NHMRC study will give Dr. **Paul Mitchell** of the University of Sydney A$309,005 (US$155,000) to examine the long-term consequences of mobile phone use on vision, eye disease and hearing.

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Following a series of six public hearings over the last year, the **Australian Senate** committee investigating mobile phone health issues is scheduled to issue its final report by March 29. Among the items learned by committee members on questioning witnesses at their last hearing, held in Canberra on March 2, are: (1) the Mobile Manufacturers Forum (**MMF**) has allocated a little more than 3 million euros (US$2.8 million) for health research this year, out of a total MMF annual budget of 3.9 million euros (US$3.6 million), according to **Michael Milligan**, the secretary general of the MMF; (2) Dr. **John Moulder** of the Medical College of Wisconsin in Milwaukee earned approximately 8-10% of his income as a consultant to the telecom industry—when "averaged over the last couple of years"; and (3) the results of the replication of the **Adelaide mouse study** should be ready in June 2002. Dr. **Mays Swicord** of Motorola, who testified as a member of the MMF panel, said that exposures should be completed this June and that it would take a year to do the pathological analysis and to write the final report. The original experiment showed a 2.4-fold increase in lymphoma among the exposed mice (see *MWN,* M/J97). A complete copy of the 100-page transcript is available at <www.aph.gov.au/hansard/senate/commttee/comsen.htm>. (For past coverage of the senate inquiry, see *MWN,* J/F00, S/O00 and N/D00.)

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On March 5, **Qwest Communications** International Inc. recalled 11,000 mobile phones made by **Kyocera Wireless** Corp. that can exceed FCC emission standards. Kyocera's QCP-3035 model phone, which went on sale in December, can violate federal safety limits when used in analog mode outside of digital service areas. Kyocera assured Qwest and its customers that the phones "do not create a health or safety issue." Sony Electronics recalled 60,000 phones in December 1998 that also emitted too much radiation (see *MWN,* J/F99).

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Mobile phones sold in **Maryland** could be required to carry a **warning label** noting possible radiation health risks, if a bill now before the state's legislature is passed. Introduced on February 9 by Delegate **Peter Franchot** (D-Takoma Park), HB1054 would require this WARNING: "Some studies have linked cellular telephone radiation to a higher risk of brain cancer, particularly in children 16 years and younger. Use of a headset or speaker phone reduces this risk." For details of the bill, go to: <mlis.state.md.us/2001rs/billfile/hb1054.htm>.

Mobile Phone Health Effects? Medical Case Reports

A Nodule on the Salivary Gland

Two English surgeons have reported a small mass on the salivary gland of a 39-year-old male telephone engineer who was a regular user of a mobile phone. Drs. Clifford Pereira and Michael Edwards of Friarage Hospital in Northallerton claim that this is only the 21st case of nodular fasciitis in the parotid (salivary) gland to be reported in the world medical literature.

The engineer used a mobile phone, on average, for one hour a day for the last four years (an analog model for three years and a digital phone for the most recent year). The nodule grew on his right side. "Being left-handed, he usually held the phone to his right ear to enable him to write with his left hand," the doctors write.

Nodular fasciitis is a benign growth that can be surgically removed. The condition is associated with physical trauma 40% of the time, but there was no such history in this case.

Writing in the November issue of the *Journal of Laryngology & Otology (114,* pp.886-887, 2000), Pereira and Edwards recommend that, "A history of use of mobile phones should...become part of routine history taking for head and neck lesions."

Lesion in the Mouth

A British dentist is asking whether a "suspicious lesion" in the mouth of one of his patients could be connected to his use of a cellular phone. Dr. D.G. Watt of Kirkby Stephen raises this question in a letter in the September 9 issue of the *British Dental Journal (189,* p.237, 2000).

The patient observed that the condition "typically clears up when he is away from work or using a conventional telephone," according to Watt, and the pain was more severe on the right side of the patient's mouth—the side where he held the phone. A biopsy at Newcastle Dental Hospital diagnosed the lesion as a case of mild atrophic lichen planus—an inflammatory disease caused by an immune system reaction, whose causes are not well understood.

Watt asks other dentists to report whether they have "observed any possible connection between pathology and mobile telephones."

Cellular Phone Ear

An old disease is recurring in a new setting, according to Dr. Mervyn Elgart of George Washington University Medical Center in Washington.

A condition called chondrodermatitis nodularis chronicus anthelicis, a nodule on the ear, which was once caused by the large earpieces used by telephone operators and by the wimples worn by nuns, is now being reported by cell phone users who press their phones tightly to their ears.

Elgart made this observation in a letter published in the December issue of *Archives of Dermatology (136,* p.1568, 2001).

Danish Epidemiological Study Finds No Cell Phone Cancer Risk

An epidemiological study of users of mobile phones in Denmark has found "no support" for an association with brain cancer, leukemia or salivary gland cancer.

"We now have three studies and they all point in the same direction," Dr. Christoffer Johansen of the Danish Cancer Society in Copenhagen told *Microwave News*. "The hypothesis that there is a cancer risk is weakened by these studies." Johansen, who led the Danish-American study team, was referring to the recently published brain tumor studies by the National Cancer Institute (NCI) and the American Health Foundation (AHF) (see *MWN,* J/F01).

Nevertheless, Johansen stressed that, "This is not the final verdict," adding that he plans to monitor Danish cell phone users in the future to see if there are any long-term effects. Johansen observed that none of the published epidemiological studies have addressed other adverse health outcomes — he specifically pointed to Alzheimer's disease and ALS, better known as Lou Gehrig's disease.

A second study may be difficult, however. "There is no money for a follow-up study — in fact, we still have a deficit on the published study because the industry has refused to pay its bill," Johansen said.

"The issue is not closed, but if there was something large we would have picked it up," said Dr. John Boice Jr., one of the coauthors of the Danish study. He went on to point out that "it is always hard to rule out small effects from low-level exposures." Boice is with the International Epidemiology Institute in Rockville, MD, and was previously at the NCI.

Like the participants in the earlier NCI and AHF studies, most of the Danish subjects had used mobile phones for only a short time. While the study population included all mobile phone users from 1982 through 1995, 92% began using phones in 1991or later and approximately 70% had signed up for phone service in 1994-1995.

Writing in the February 7 issue of the *Journal of the National Cancer Institute (93,* pp.203-207, 2001), Johansen and coworkers note that if RF/MW exposure does in fact act as a cancer promoter, then "the intense recent use, as currently experienced by large numbers in our cohort, might be of more importance than latency or long-term use considerations."

They highlight the need for better exposure assessment in future studies. For instance, the researchers were unable to estimate the amount of time subscribers used their phones. "There was some information on outgoing calls in the data set, but we could not use it because it was too imprecise," Johansen said. There were no data on incoming calls because in Denmark these are paid for by those initiating the call.

In an accompanying editorial, Dr. Robert Park of the American Physical Society calls the Danish database "rock-solid," and says that it makes it "difficult to take issue with the report's conclusion." (See also p.19.)

Johansen's team identified essentially all users of cell phones in Denmark between 1982 and 1995 and then crosslinked them with cancer registry data. Among the more than 420,000 members of the cohort, the overall average use was 3.1 years — 3.5 years for subscribers to the analog system and 1.9 years for the digital (GSM) system.

The standard incidence ratios (SIRs) and confidence intervals (CIs) were: 0.89 (0.86-0.92) for all types of cancer; 0.95 (0.81-1.12) for cancer of the brain or nervous system; 0.97 (0.78-1.21) for leukemia; and 0.72 (0.29-1.49) for tumors of the salivary glands.

Children's Use of Phones: Opposing Views

Drs. Christoffer Johansen and John Boice, two of the coauthors of the Danish epidemiological study, have different views on whether children should use mobile phones.

"We did not include children in our study and they may have a different risk — their brains are still developing and their skulls are thinner," Johansen said in an interview. "Until we know more, children should make only short calls that are necessary." He added that many European scientists share his position.

Boice disagrees. "If there really is a health hazard, then all segments of society should be protected," he told *Microwave News*.

U.K. Plans Broad Research Program on Phones and Health

The U.K. Department of Health (DOH) is seeking a wide-ranging effort on mobile phones and health, from dosimetry to epidemiology to *in vivo* and *in vitro* exposure studies.

The request for proposals issued in early February listed the £7 million ($10 million) program's priorities. These are based on the recommendations of the Independent Expert Group on Mobile Phones. That panel, led by Sir William Stewart, called for government-sponsored studies to address the phone safety issue in a report released last May (see *MWN,* M/J00).

Stewart is also chairing the oversight committee for the DOH program. At its first meeting, held in London on February 9 and not open to the public, the committee highlighted the need for studies on pulse modulation effects and on phone radiation effects on DNA, according to a synopsis on the DOH Web site.

Researchers had to submit letters of interest by March 30. The DOH will invite some applicants to prepare detailed proposals by mid-June. Proposals for epidemiological studies will be handled on an extended timetable.

Only U.K. researchers can receive grants, although projects that involve international collaboration can be funded. The program costs are being paid on a 50:50 basis by government and industry.

The request for proposals, along with comments on specific research needs, is posted on the Internet at: <www.doh.gov.uk/mobilephones/research>. The DOH plans to issue a second call for proposals later this year.

Australia Drops Flat Limit in Draft RF/MW Standard

The Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) is proposing public and occupational limits for RF/MW radiation exposures based on the ICNIRP standard to replace its stricter, frequency-independent standard.

According to the draft released for public comment on March 5, the proposed limits are similar to ICNIRP's because ARPANSA "was not able to identify reasons why this standard should differ substantially from ICNIRP." Australia is following New Zealand, which also had a "flat" standard and has already adopted ICNIRP-based limits (see *MWN,* M/J99, S/O99 and J/F01).

As a precautionary measure, ARPANSA's draft states that it is "generally sensible to minimize exposure which is unnecessary," provided that this can be done at "modest expense" and "does not introduce other risks."

Australia has had a flat RF/MW limit since 1985 (see *MWN,* M/A86). In 1999, after long and frequently divisive debate, Standards Australia, a private body, failed to adopt a proposed standard with ICNIRP-based limits (see *MWN,* M/J99). ARPANSA then stepped in and formed an expert group to develop new guidelines for the 3 kHz-300 GHz range (see *MWN,* S/O00).

Like the ICNIRP standard, ARPANSA's proposed guidelines are designed only to protect against thermal injuries and nerve stimulation due to RF/MW radiation. According to the draft, there are "insufficient data to establish" any health hazard from low-level exposures, although "it cannot be unequivocally stated that such effects do not exist."

While both the ARPANSA proposal and the earlier flat standard are based on a whole-body average SAR of 4.0 W/Kg, they specify different limits. For example, the new standard would set a public exposure limit of 450 ∝W/cm^2 at 900 MHz, the frequency used by Australia's GSM mobile phone system, compared to the 200 ∝W/cm^2 flat limit.

Unlike the ICNIRP standard, the ARPANSA draft also specifies limits for "instantaneous" peaks — 1 ∝s for frequencies above 100 kHz. These are some 1,000 times higher than the limits for levels averaged over six minutes.

The deadline for public comments on the draft is May 11. A copy can be requested from ARPANSA by phoning (61+3) 9433-2339, and a PDF version is available on the Internet at <www.health.gov.au/arpansa/pubs/d_rf_prot_stnd.pdf>.

SAR Search: Same Phone, Different Exposures at 900 MHz and 1800 MHz

A dual-mode mobile phone can have a much higher specific absorption rate (SAR) at 1800 MHz than at 900 MHz, and vice versa, according to measurements released by the Swedish Radiation Protection Institute in Stockholm, known as SSI.

For instance, an Ericsson model T28c phone was found to have a maximum SAR, averaged over 10 g, of 1.7 W/Kg at 1800 MHz, but only 0.66 W/Kg at 900 MHz (see table at right). Conversely, a Motorola model V.3688 had more than double the SAR at 900 MHz that it had at 1800 MHz. (The SARs are accurate within ±25%, according to SSI.)

These measurements, the first to be made public for dual-mode mobile phones, were carried out for the SSI by the Institute for Mobile and Satellite Radio Technology (IMST) in Kamp-Lintfort, Germany. The phones were bought in various retail stores — they were not obtained directly from the manufacturers — SSI's Gert Anger told *Microwave News*.

"These measurements are the first part of a more detailed study," Anger said. IMST has also measured the radiated power at some distance from the phones in order to find out if there is a relationship between a phone's SAR and its ability to communicate with a nearby tower. Those results are in the process of being evaluated, he said, and will be published in a few months.

The phones were tested — under European Specification ES 59005, published by CENELEC in 1998 — while operating at their maximum power level. The maximum pulse power of the GSM phones is 2 W at 900 MHz and 1 W at 1800 MHz; the maximum for DECT cordless phones is 0.125 W. The maximum average powers are 0.25 W, 0.125 W and 0.01 W, respectively.

The SAR data, which were released by the SSI on February 23, are posted on the SSI Web site, <www.ssi.se>. The press release and background information are in Swedish.

Phones in Sweden: Maximum SARs

Maker	Model	SAR (W/Kg) 900 MHz	1800 MHz
Alcatel	One touch easy db	0.71	0.39
Ericsson	A1018s	0.56	0.76
Ericsson	A2618s	0.54	0.52
Ericsson	R310s	0.69	0.42
Ericsson	T20s	0.84	0.57
Ericsson	T28c	0.66	1.7
Motorola	T2288 EGSM	0.49	0.42
Motorola	Timeport L-ser	0.59	0.75
Motorola	V.3688	0.93	0.41
NEC	DB1400	0.81	0.89
Nokia	3210	0.63	0.25
Nokia	3310	0.67	0.34
Nokia	5110	0.63	–
Nokia	6210	0.72	0.47
Panasonic	EB-GD92	0.59	0.17
Philips	Savvy	0.55	0.33
Samsung	SGH-A100	0.69	0.43
Siemens	M35i	0.79	0.25
Siemens	S25	0.71	0.91
Sony	CMD-Z5	0.84	0.85
Ericsson	Cordl. Phone DECT	–	0.094
Samsung	SP-R5200 DECT	–	0.013

teers, the USAF stated, showed that, "Other than minor skin tenderness due to repeated exposure to the beam, there are no lasting effects."

Indeed, in its press release, the Marine Corps calls the microwave signal "a harmless energy beam."

In a review paper on the effects of millimeter waves published last year in *Health Physics,* a research group from Brooks Air Force Base (AFB) in San Antonio concluded that "irradiation of both the eyes and the skin are, for the most part, self-limiting in that the exposure will be sensed and avoided before thermal injury is incurred" (see *MWN,* J/F00). The Brooks team noted that "95% of the temperature increase produced by exposure to 94 GHz RF energy will occur in the first 1.2 mm of the skin."

"We've done a lot of research on this technology and have shown there are no harmful health effects," stated Dr. Michael Murphy, the director of the directed energy bioeffects division at Brooks, in the March 1 USAF press release.

Others are not so sure. Dr. Ross Adey, who was at the University of California, Riverside, until his retirement last year, dismisses the Brooks team's claims as "a bunch of crap."

Dr. Edward Elson, the former chief of the department of microwave research at the Walter Reed Army Institute of Research in Washington, was more circumspect. "I did an extensive review of the literature a few years ago and concluded that you don't get a perception of pain until some damage has been done," he said in an interview with *Microwave News*.

Elson went on to say that the U.S. Army had considered developing a microwave weapon in the 1970s. "We decided that it was a bad idea which wasn't worth the effort." The air force and the marines "are playing with fire," he said. "They will be on dangerous ground if they deploy this against the public." Elson predicted that those alleging injuries would file lawsuits and a legal quagmire would ensue.

Many press reports have stated that the microwave weapon will be ready for deployment in 2009. But Major David Andersen of the Marine Corps' division of public affairs said that the timing is "anyone's guess," given that the acquisition process has not yet begun.



PENTAGON "CONCEPT" OF VEHICLE-MOUNTED WEAPON.

The first official public disclosure of a microwave weapon for crowd control came in 1976 with the release of a classified Defense Intelligence Agency (DIA) report. The DIA cited a 1972 army study, which stated: "It is possible to field a truck-portable microwave barrier system that will completely immobilize personnel in the open with present-day technology and equipment."*

Over the ensuing 25 years, many have speculated about what a microwave weapon would look like and what it could do — and some have gotten close. For instance, in a July 7, 1997, special report on "Wonder Weapons," *U.S. News & World Report* featured a drawing of a tank-mounted system that is very similar to the computer-generated model released by the Pentagon, in which the microwave transmitter is mounted on a humvee (see left). *U.S. News* noted that prototypes of a microwave weapon which can discomfort or cook the enemy "reportedly exist and are ready for testing."

Military officials estimate that approximately $40 million has been spent on this technology over the last ten years. Elson believes that this figure is "unrealistically low."

The *Marine Corps Times* broke the news about what it called a "people zapper" on February 23 and its story may have prompted the military to stage its briefing earlier than first planned.

But, according to Dr. Clay Easterly of the Oak Ridge National Lab in Oak Ridge, TN, the declassification of the microwave weapon was already in progress. Easterly is a member of a National Academy of Sciences–National Research Council committee that is in the midst of assessing non-lethal weapons for the Pentagon. At the committee's February 1-2 meeting, Easterly told *Microwave News,* Fenton of the Marine Corps had said that the microwave weapon would soon be made public.

Raytheon AET in Rancho Cucamonga, CA, is the systems integrator for the millimeter wave weapon. San Antonio's Veridian Engineering, which has close ties to the USAF radiation program at nearby Brooks AFB, is doing the biological effects research.

*The DIA report was released to Barton Reppert, who was then working for the Associated Press. Paul Brodeur included excerpts of the report in *The Zapping of America,* published in 1977 by Norton.

Military Briefs

• The Air Force is investigating a cluster of amyotrophic lateral sclerosis (ALS), better known as Lou Gehrig's disease, among current and former employees of Kelly Air Force Base (AFB) in San Antonio. The cluster was first reported last October, and by late February the local ALS association had identified 66 cases of the rare neurodegenerative condition, according to the *Houston Chronicle* (February 22). The Air Force says that it hopes to complete the study, led by Lt. Col. Kenneth Cox of nearby Brooks AFB, later this year. In 1993 there was a cluster of eight ALS cases — many times the expected number — among residents of a community next to Patrick AFB in Florida (see *MWN,* J/F92 and M/J93). That cluster was never followed up.

• The Navy's Surface Warfare Engineering Facility (SWEF) in Port Hueneme, CA, does not expose the public to RF/MW radiation above ANSI/IEEE exposure guidelines either on land or at sea, according to a report released on January 18. The navy did the survey in response to public concerns over the planned expansion of SWEF, which already includes 15 powerful radars and is adjacent to a public beach and a residential neighborhood (see *MWN,* N/D99). The navy provoked fresh controversy, however, by refusing to allow a civilian expert to take part in the study (see *MWN,* M/J00). Copies of the report are available at no cost from: Office of Public Affairs, Naval Surface Warfare Center, 4363 Missile Way, Port Hueneme, CA 93043, (805) 228-6150.

Hot New Papers

Marina Pollán, Per Gustavsson and Birgitta Floderus, "Breast Cancer, Occupation and Exposure to Electromagnetic Fields Among Swedish Men," ***American Journal of Industrial Medicine, 39,*** **pp.276-285, March 2001.**

"A marked and consistent excess risk was found for machinery repairers. Increased relative risks based on few cases were also noted for librarians/archivists/curators, bank employees, nonspecified clerical workers, metal processing workers, tanners/fur dressers, policemen and custom surveillance officials. The relative risk among subjects with an estimated ELF EMF exposure above the first quartile (0.12 ∝T [1.2 mG]) was 1.31 (95% confidence interval=0.94-1.81), without a clear exposure-response pattern....An indication of an exposure-response relationship was only found among those exposed to levels over 0.2 ∝T less than one-third of the working day, that is, the group more intermittently exposed. The relative risks associated with ELF EMF exposure were slightly higher among workers younger than 65, consistent with previous observations....The application of the job-exposure matrix of ELF EMF did not yield clear evidence of an association, although an exposure-response relationship was found for workers with indications of an intermittent exposure, suggesting that short but high exposures, or large fluctuations in exposure, may be associated with an increased risk. The results do not speak against an association, since several of the occupations showing an increased incidence are characterized by a high exposure to ELF EMF." (See also *MWN,* M/J94 and S/O95.)

Lee Caplan, Elinor Schoenfeld, Erin O'Leary and Cristina Leske, "Breast Cancer and Electromagnetic Fields — A Review," ***Annals of Epidemiology, 10,*** **pp.31-44, January 2000.**

"Regarding breast cancer...the role of EMFs as a potential environmental risk factor has not been adequately explored. The few studies dealing with occupational exposure to EMFs and breast cancer have suggested a possible relationship. Although the handful of studies that evaluated residential exposure to EMFs have not shown any consistent link to breast cancer, the limitations in assessing long-term exposures do not allow any firm conclusions. Furthermore, the EMF–breast cancer link through melatonin is not only biologically plausible, but has been repeatedly verified in laboratory settings. Even though the oncogenic mechanism through which EMFs might operate is unclear, a number of plausible mechanisms involving melatonin are being entertained; these should not be dismissed simply because current knowledge does not allow us to classify EMFs as initiator or promoter, following the traditional two-stage model for carcinogenesis....Considering the incomplete knowledge of breast cancer risk factors and the importance of the disease as a public health problem, it seems justified to follow available leads; the ever-increasing amounts of EMFs in our environment should only bolster the argument. Therefore, research into a potential EMF–breast cancer link is certainly warranted, and the possibility of an association should not be discounted."

H. Huuskonen, V. Saastamoinen, H. Komulainen, J. Laitinen and J. Juutilainen, "Effects of Low-Frequency Magnetic Fields on Implantation in Rats," ***Reproductive Toxicology, 15,*** **pp.49-59, January 2001.**

"Pregnant Wistar rats were exposed to [50 Hz sinusoidal] magnetic rms field strengths of 10 or 100 A/m (13 ∝T or 130 ∝T [130 mG or 1.3 G]) or sham-exposed (controls) from day 0 of pregnancy for 24 h/day and killed during light and dark periods between 70 h and 176 h after ovulation. MFs did not influence the mean total number of implantations. The nocturnal mean serum melatonin concentration decreased by 34 and 38% at 10 and 100 A/m, respectively....In both MF-exposure groups, small but statistically significant changes in uterine ER [estrogen receptor] and PgR [progesterone receptor] densities took place during implantation. However, interpretation of the possible implications remains difficult."

Konstantina Nikita et al., "A Study of Uncertainties in Modeling Antenna Performance and Power Absorption in the Head of a Cellular Phone User," ***IEEE Transactions on Microwave Theory and Techniques, 48,*** **pp.2676-2685, December 2000.**

"A set of finite-difference time-domain (FDTD) numerical experiments modeling canonical representations of the human head/cellular phone interaction has been performed in order to investigate the effect of specific simulation details (e.g., antenna numerical representation and absorbing boundary conditions) on computed results....In evaluating the peak SAR averaged over 10 g of tissue, the related uncertainty can be of the order of 30%, while the corresponding uncertainty in assessing the 1-cell SAR_{max} value can be of the order of 40%-60%, even for well-defined canonical cases."

Ole Raaschou-Nielsen, Ole Hertel, Birthe Thomsen and Jørgen Olsen, "Air Pollution from Traffic at the Residence of Children with Cancer," ***American Journal of Epidemiology, 153,*** **pp.433-443, March 1, 2001.**

"The authors enrolled 1,989 children reported to the Danish Cancer Registry with a diagnosis of leukemia, tumor of the central nervous system, or malignant lymphoma during 1968-1991 and 5,506 control children....Average concentrations of benzene and nitrogen dioxide (indicators of traffic-related air pollution) were calculated for the relevant period, and exposures to air pollution during pregnancy and during childhood were calculated separately. The risks of leukemia, central nervous system tumors, and all selected cancers combined were not linked to exposure to benzene or nitrogen dioxide during either period. The risk of lymphomas increased by 25% (p for trend=0.06) and 51% (p for trend=0.05) for a doubling of the concentration of benzene and nitrogen dioxide, respectively, during the pregnancy. The association was

Did Sir Richard Doll Yield to Industry Pressure on Asbestos?

Barry Castleman, "Re: Doll's 1955 Study on Cancer from Asbestos," Commentary, ***American Journal of Industrial Medicine, 39,*** **pp.237-240, February 2001.**

Using a mix of historical research and detective work, Castleman seeks to explain why Sir Richard Doll changed the conclusion of his 1955 landmark paper on the risk of lung cancer from asbestos. At issue was whether a British asbestos exposure regulation, adopted in 1932, had or had not reduced workers' cancer risk. In a draft of the paper, Doll wrote that there were insufficient data to answer the question. But he changed his mind and the published paper stated that the risk had decreased. Castleman finds little support for this finding. He also describes how a major asbestos company campaigned to block publication of the paper, threatened legal action and directly pressured Doll to withdraw the paper. Nevertheless, Doll denies that the change was prompted by industry pressure. Castleman profited from a number of exchanges with Doll before communication between them broke down. Sir Richard is the chair of the Advisory Group on Non-Ionizing Radiation of the U.K.'s National Radiological Protection Board, which released a report on EMFs from power lines in March (see p.1 and p.19).

restricted to Hodgkin's disease....The concentrations of benzene estimated in this study were similar to those found outdoors in the United States."

Joachim Schüz and Simon Mann, "A Discussion of Potential Exposure Metrics for Use in Epidemiological Studies on Human Exposure to Radiowaves from Mobile Phone Base Stations," *Journal of Exposure Analysis and Environmental Epidemiology, 10,* pp.600-605, November/December 2000.

"We conducted a feasibility study to investigate if either short-term measurements of electric field strength, calculations of electric field strength or distance from nearby mobile phone base stations could be used to develop a metric reflecting an individual's exposure to radiowaves. With electric field strengths in the range of 0.012-0.343 V/m, radiowaves from mobile phone base stations were found to give a material contribution to total exposure; however, stronger signals were frequently measured from other sources such as broadcast radio and television transmitters. ...The complex propagation characteristics affecting the beams from base station antennas include shielding effects and multiple reflections from house walls and other buildings. These factors, combined with the presence of other environmental sources of radiowaves, cause distance from a base station to be a poor proxy for exposure to radiowaves indoors....[T]here is little evidence that presently justifies epidemiological studies being restricted to adverse effects of radiowaves from mobile phone base stations while neglecting radiowaves at other frequencies produced by different transmitters."

R. Shahidian, R. Mullins and J. Sisken, "Calcium Spiking Activity and Baseline Calcium Levels in ROS 17/2.8 Cells Exposed to Extremely-Low-Frequency Electromagnetic Fields (ELF EMF)," *International Journal of Radiation Biology, 77,* pp.241-248, February 2001.

"Cells were exposed to magnetic fields at various frequencies (16, 60, 120, 180) and at flux densities ranging from 3 to 717 G....[T]he present experiments have not been able to demonstrate any significant positive or negative effects of any of the fields studied on either average calcium levels or calcium spiking activity...under any of the conditions tested. Thus, the data presented provide no evidence to support the hypothesis that weak ELF EMF can alter intracellular calcium levels. If ELF EMF can alter calcium regulation in ROS 17/2.8 cells, the effect must either be extremely small, on the order of 5% or less, or occur under experimental conditions not tested in this work."

Bruce Hocking, "Microwave Sickness [MWS]: A Reappraisal," *Occupational Medicine, 51,* pp.66-69, February 2001.

"MWS has been a disputed condition. The syndrome involves the nervous system and includes fatigue, headaches, dysaesthesia and various autonomic effects....This paper describes the early reports of the syndrome from Eastern Europe and notes the skepticism expressed about them in the West, before considering comprehensive recent reports by Western specialists and a possible neurological basis for the condition. It is concluded that MWS is a medical entity which should be recognized as a possible risk for radiofrequency radiation workers."

Royal Society of Canada Panel on Wireless Health Risks

The report of the expert panel convened by the Royal Society of Canada (RSC) on "Potential Health Risks of RF Fields from Wireless Telecommunication Devices" has been published in the January issue of the *Journal of Toxicology and Environmental Health Part B: Critical Reviews (4,* pp.1-143, 2001). The report was first issued in the spring of 1999 (see *MWN,* M/J99). The RSC is still making the report available as a PDF file at no charge on its Web site, <www.rsc.ca>.

The expert panel recently updated its review and it appears in the same issue of the journal (pp.145-159). The update includes a synopsis of papers published after the original report. The panel does not, however, update its overall assessment of the status of the research findings.

Details on how to order this issue of the journal are on the Taylor & Francis Web site, <www.tandf.co.uk/journals>.

On the Internet

German Database of Bioeffects Research

The Research Center for Environmental Compatibility of Electromagnetic Fields (known as FEMU) at Germany's Aachen Institute of Technology has established an interactive database of published papers on EMFs and health. The site, **<wbldb.femu.rwth-aachen.de>**, is accessible to all at no cost. The database of more than 4,200 papers can be searched by key word and frequency range as well as by author and journal. Each citation includes a link to the study abstract archived by the U.S. National Library of Medicine on its own Web site, **<www.ncbi.nlm.nih.gov/PubMed>**. Studies are annotated with comments on their strengths and weaknesses, with space provided for the original author to respond. The database continues to grow and, according to FEMU's Frank Klubertz, the current plan is to include more than 10,000 individual papers. Among the topics covered are cancer, sleep, melatonin and electrosensitivity. Epidemiological studies are in the process of being added to the database, Dr. Joachim Schüz of the University of Mainz told *Microwave News*. Schüz is one of the project's 13 German and Austrian advisors. The site can be operated in either German or English, but most of the papers are in English. Conceived by Aachen's Dr. Jiri Silny in the early 1990s, the project is sponsored by the German government and a number of private groups, including the Research Association for Radio Applications (known by its German acronym, FGF).

Microwaves and DNA at Penn State

A survey of the long-running controversy over the possible effects of microwaves on DNA has been placed on the Web site of the Aerobiological Engineering program at Pennsylvania State University. "We were studying whether microwaves could kill airborne bacteria, as a means of disinfecting airstreams," Wally Kowalski, a doctoral candidate, told *Microwave News*. In his paper, *DNA and the Microwave Effect*, which includes an extensive list of references, Kowalski suggests that microwaves may promote DNA breaks by increasing the concentration of free radicals. This mechanism is similar to those proposed, and disputed, by others. Go to: **<www.engr.psu.edu/ae/wjk/mwaves.html>**. (For some of the early debate on DNA effects, see *MWN,* My84 and J/A87.)

2001 Conference Calendar

New Listings

November 4-8: **2001 Annual Conference of the International Society of Exposure Analysis (ISEA): Exposure Analysis — An Integral Part of Disease Prevention,** Charleston, SC. Contact: ISEA 2001, Office of CME, Medical University of South Carolina, PO Box 250189, Charleston, SC 29425, (843) 876-1925, Fax: (843) 876-1931, Web: <www.ISEAweb.org>.

November 28-30: **7th IEE International Conference on AC-DC Power Transmission,** London. Contact: ACDC01 Secretariat, Event Services, Institution of Electrical Engineers (IEE), Savoy Pl., London WC2R 0BL, U.K., (44+207) 344-5471, Fax: (44+207) 240-8830, E-mail: <acdc01@iee.org.uk>, Web: <www.iee.org.uk/Conf/ACDC>.

Major Upcoming Meetings

(For a complete list, see MWN, *N/D00 and J/F01.)*

April 30-May 4: **1st International Seminar: Measurements and Criteria for Standards Harmonization in the Field of EMF Exposure,** Varna, Bulgaria. Contact: Dr. Michel Israel, National Center of Hygiene, 15 Dimiter Nestorov St., Sofia 1431, Bulgaria, (359+2) 596-154, Fax: (359+2) 958-1277, E-mail: <M.Israel@nch.aster.net>, Web: <www.who.int/peh-emf/meetings.htm>.

May 20-23: **2nd International Symposium on Nonthermal Medical/Biological Treatments Using Electromagnetic Fields and Ionized Gases (ElectroMed 2001),** Renaissance Portsmouth Hotel, Portsmouth, VA. Contact: Nell Reece, Eastern Virginia Medical School, (757) 668-6406, Fax: (757) 668-6476, E-mail: <electromed2001@ece.odu.edu>, Web: <www.ece.odu.edu/electromed2001>.

June 10-14: **23rd Annual Meeting of the Bioelectromagnetics Society (BEMS),** Radisson Hotel, St. Paul, MN. Contact: Dr. John Male, 2412 Cobblestone Way, Frederick, MD 21702, (301) 663-4252, Fax: (301) 694-4948, E-mail: <BEMSoffice@aol.com> and <bems@delasallecenter.org>, Web: <www.bioelectromagnetics.org>.

June 10-14: **2001 American Radiation Safety Conference & Exposition (46th Annual Meeting of the Health Physics Society),** Convention Center, Cleveland, OH. Contact: HPS Secretariat, 1313 Dolley Madison Blvd., Ste. 402, McLean, VA 22101, E-mail: <dave@npc-link.com>, Web: <www.hps.org/nochps>.

July 15-19: **2001 IEEE PES Summer Meeting,** Vancouver, Canada. Contact: Yakout Mansour, B.C. Hydro, 6911 Southpoint Dr., Burnaby, BC V3N 4X8, Canada, (604) 473-2730, Fax: (604) 473-2731, E-mail: <yakout.mansour@bchydro.bc.ca>, Web: <www.ieee-spm2001.org>.

August 13-17: **2001 IEEE Electromagnetic Compatibility (EMC) Symposium International Rendezvous,** Montreal, Canada. Contact: 2001 IEEE EMC Symposium Secretariat, JPdL Destination Management, 1555 Peel, Ste. 500, Montreal, PQ H3A 3L8 Canada, (514) 287-1070, Fax: (514) 287-1248, E-mail: <emc2001@jpdl.com>, Web: <www.2001emcmtl.org>.

September 6-8: **5th International Congress of the European Bioelectromagnetics Association (EBEA),** Marina Congress Center, Helsinki, Finland. Contact: Solveig Borg, Finnish Institute of Occupational Health, Topeliuksenkatu 41 aA, FIN-00250 Helsinki, Finland, (358+9) 4747-2900, Fax: (358+9) 241-3804, E-mail: <solveig.borg@occuphealth.fi>, Web: <www.occuphealth.fi/e/project/ebea2001>.

October 22-24: **WHO/EMF Biological Effects and Standards Harmonization Regional Meeting,** South Korea. Web: <who.int/peh-emf/meetings.htm>. (Being finalized.)

October 25-28: **23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society,** Convention Center, Istanbul, Turkey. Contact: Dr. Yorgo Istefanopulos, Institute of Biomedical Engineering, Bogazici University, 80815 Bebek-Istanbul, Turkey, (90+212) 263-1540, Fax: (90+212) 257-5030, E-mail: <istef@boun.edu.tr>, Web: <embc2001istanbul.bme.boun.edu.tr>.

Meeting Notes

• A small group of researchers were invited to a seminar on ***Microwaves and Behavior*** in Paris on January 15 that was sponsored by the Mobile Manufacturers Forum (MMF).

• In each of the last two years, an international seminar has been held in China. The proceedings of ***Electromagnetic Fields and Biological Effects***, held in Xi'an October 23-26, 2000, are on the Web site maintained by Professor Zhao-Jin Cao, <www.emfhealth.com>. The 72 papers, which are available in both English and Chinese, cover a wide range of research topics as well as standards development and measurements. A number of the 13 papers from the May 4-5, 1999, seminar that was held in Beijing are also on the site, and more will be added in the future. Print copies of the 1999 and 2000 proceedings are available for US$10 and US$20, respectively, to cover postage and handling. Order from Cao, who is with the Institute of Environmental Health Monitoring within China's Ministry of Health, at <caozj@emfhealth.com>.

• The proceedings of an international workshop on ***Clinical and Physiological Investigations of People Highly Exposed to Electromagnetic Fields***, held in St. Petersburg, Russia, October 16-17, 2000, are available at no charge. Among the topics covered in the 15 papers are mobile phones, electrical hypersensitivity and clinical investigations of workers exposed to radar, radio transmitters and electric railroads. Go to: <www.niwl.se/arb/2001-03.html>. For a print copy (ask for Arbetslivsrapport 2001:03) contact: National Institute for Working Life, Publication Service, SE-11279 Stockholm, Sweden, E-mail: <forlag@niwl.se>.

• EPRI is sponsoring a ***Seminar on Electric Power Facilities and the Global Positioning System*** (GPS), which addresses the possible risks of EMI. The seminar will be taught by Michael Silva of Enertech Consultants in Campbell, CA, and will be held in May and June at four utility sites across the U.S., as well as at the EPRI campus in Palo Alto, CA. The agenda and details on the registration fee are available at <www.enertech.net/gpsseminar>. For more information, contact Enertech at (408) 866-7266. (See also p.16.)

• A set of three videotapes recorded at ***Cell Towers Forum, State of Science/State of the Law***, held last December, is available for $90.00. Contact the Berkshire-Litchfield Environmental Council, Box 552, Lakeville, CT 06039, (860) 435-2004 (see *MWN,* S/O00).

• In January 1999, the California EMF Program sponsored a by-invitation ***Workshop on EMF Epidemiology***. The papers presented have been published in a supplement (No.5) to *Bioelectromagnetics* (2001). Each of the 11 papers — some of which have been updated — includes a brief synopsis of the discussion that followed its presentation at the meeting. Among the authors are: Ahlbom, DelPizzo, Erren, Kheifets, Neutra, Poole, Savitz, Shaw and Wartenberg.

Across the Spectrum

A bowl of cornflakes can kill you — not to mention a ham sandwich or a T-bone steak. Getting vaccinated can kill you. Flying economy class can kill you, and business class isn't much better. The rubber duckie in your bathtub can kill you (and your children). And put down that cell phone, before it kills you!

— T.R. Reid, "European Health Reports Create 'Culture of Fear'," *Washington Post,* p.A1, March 1, 2001

[T]he unique contingencies of history, not the laws of physics, set many properties of complex biological systems.

— Dr. Stephen Jay Gould, professor of zoology, Harvard University, Cambridge, MA, and past president, American Association for the Advancement of Science, "Humbled by the Genome's Mysteries," *New York Times,* Op-Ed, p.A15, February 19, 2001

"To say we need another ten years of research means we will go precisely down the BSE route."

— Prof. Denis Henshaw, University of Bristol, U.K., on the report on power frequency EMFs and cancer by the U.K. Advisory Group on Non-Ionizing Radiation, quoted by Anjana Ahuja, "Live and Extremely Dangerous," *The Times* (U.K.), Section 2, p.10, March 12, 2001 (see p.1)

"We've gone from NIMBY (not-in-my-backyard) to NOPE, for not-on-planet-earth."

— David Owens, executive vice president, Edison Electric Institute, Washington, quoted by John Fialka, "Energy Industry Officials Urge President To Offer Incentives for Meeting Demand," *Wall Street Journal,* p.A8, February 22, 2001

"The seeds of what has grown in California have been sown over the United States as a whole by our failure to keep up with our (transmission) infrastructure over the past decade."

— Karl Stahlkopf, vice president, EPRI, Palo Alto, CA, quoted by Peter Behr in "Shortage of Power Lines Develops," *Washington Post,* p.A1, February 20, 2001

The Furor over Vatican Radio

"It's the grandmother of all radio stations."

— Sean Lovett, head of English-language programming, Vatican Radio, quoted by Ellen Hale, "Italian Official, the Vatican Clash over Antennas," *USA Today,* p.10A, March 27, 2001

ASSASSIN WAVES

— Sign at protest, Cesano, Italy, in photo accompanying "The Land of Sick Children and the Antenna in the Form of the Cross," *La Repubblica* (Italy), p.11, March 14, 2001

"It is contrary to morality to form unjust accusations and, without foundation, create serious alarm amongst the population."

— Father Federico Lombardi, head of Italian-language programing, Vatican Radio, quoted by Paddy Agnew, "Local Health Concern over Vatican Radio Masts," *Irish Times* (Republic of Ireland), March 14, 2001

"There is no evidence at all that radio frequencies cause cancer and other illnesses — a link that our citizens and even ministers are taking for granted."

— Dr. Paolo Vecchia, National Institute of Health, Rome, and ICNIRP member, quoted by Yaroslav Trofimov, "Italians Say Potent Vatican Radio Tower Emits Radiation That Poses Cancer Risk," *Wall Street Journal,* p.7A, March 27, 2001

"Ministers must not be more or less zealous. Rather...they must respect the constitution and the laws."

— Willer Bordon, Minister of the Environment, letter to the editor, *Corriere della Sera* (Italy), p.15, March 22, 2001

VATICAN RADIATION? BODY SNATCHERS? THIS IS ITALY?

— Headline, *New York Times,* p.A4, March 20, 2001

(See p.6.)

"MICROWAVE NEWS" FLASHBACK

Years 20 Ago

• In a letter to the *New England Journal of Medicine,* Dr. Hylar Friedman of the Army Medical Center in El Paso, TX, reports a link between microwave exposure and polycythemia, a rare blood disorder that is associated with an increased risk of leukemia.

• A workers' compensation board upholds a claim that Sam Yannon died from long-term exposure to RF radiation while he worked for New York Telephone on the 87th floor of the Empire State Building.

• The Secretary of the Navy recommends to the Secretary of Defense that the U.S. Navy's ELF communications system be scrapped.

Years 10 Ago

• NIOSH sparks controversy by absolving ELF EMFs in its study of miscarriage risks among telephone operators who used CRT VDTs even though those in the control group, who used other types of displays, had similar ELF EMF exposures.

• Prompted by "growing concerns" about EMFs, ten U.S. lawyers create the Electromagnetic Radiation Case Evaluation Team, a legal service that investigates cases for trial lawyers.

• A police officer in San Francisco sues Kustom Signals, contending that microwaves from a traffic radar gun caused him to develop melanoma in his neck.

Years 5 Ago

• EPA's Dr. Carl Blackman repeats an experiment by Dr. Robert Liburdy in which very weak magnetic fields inhibited melatonin's ability to slow the growth of human breast cancer cells.

• The telecom act, which includes a ban on state and local agencies setting RF/MW standards for mobile phone antennas that are stricter than those adopted by the FCC, is signed into law.

• British scientists show that radon decay products, which are known carcinogens, are attracted to high-voltage power lines. They argue that this may explain the apparent power line–cancer link.

"It's no different to someone asking your opinion on whether the brothel

MEDICAL APPLICATIONS

New Way To "Cook" Prostate Tumors... Microwaves have been used to shrink enlarged prostate glands for some time (see *MWN,* M/J96). Now low-frequency magnetic fields are being harnessed to treat prostate cancer. The ThermoTherapy system, developed by Ablation Technologies Inc. in San Diego, is nearing approval for clinical use in Europe and the U.S. Magnetic metal rods 1.4 cm long and 1 mm in diameter are inserted into the tumor. The patient is then exposed to a 50 kHz CW field at 50 G, which causes the rods to heat up. The heat — at least 46°C and as high as 70°C — kills the cancer cells. The heating mechanism is the same as that used in induction cooking, according to Dr. Robert Tucker, a pathologist at the University of Iowa who helped develop the therapy. "This is old technology," he said in an interview. "What we've done is to develop heating elements that can be put inside the body and left there." Because the rods stay in the body, patients can return for more treatments — which last about an hour — if their cancers return. The rods are also thermally self-regulating: Above a specific point, known as the Curie temperature, the metal is no longer magnetic and the external field will not induce a current. The controlled temperature, along with the placement of the rods in a circular array to focus the heat within the tumor, keeps damage to surrounding tissue to a minimum, Tucker said. In contrast, microwave treatment for enlarged prostates has caused serious burns in a number of patients, as the FDA noted last year (see *MWN,* N/D00). The 50 kHz frequency used in the new therapy was chosen to minimize the adverse effects of radiation exposure. "Above 200 kHz, you can have direct heating of the tissue by the field," Tucker explained, adding that fields below 50 kHz can cause nerve stimulation. Ablation Technologies is sponsoring clinical trials in San Francisco, Berlin, Germany, and Santiago, Chile. Tucker, who is a member of Ablation's board of directors, said that the treatment has been "highly effective" in these trials. He expects the therapy to be approved for use in Europe in the next few months, and said that FDA approval for more limited use in the U.S. could come within a year. Tucker noted that although the technique has so far been used only for prostate cancer, it is potentially effective for many other types of solid tumors. The prostate cancer therapy is described in a paper by Tucker and coauthors in the *Journal of Endourology (14,* pp.511-517, August 2000).

PEOPLE

Dr. **Frank Barnes** of the University of Colorado, Boulder, has been elected to the National Academy of Engineering in Washington. Barnes, the current president of the Bioelectromagnetics Society, was cited for "fundamental research on biological effects of EMFs, surgical procedures and contributions to telecommunications education."...In mid-March, Dr. **Joe Elder**, a longtime staffer at the EPA's health effects lab in Research Triangle Park, NC, retired and joined Motorola in Plantation, FL. Elder takes over as director of biological research from Dr. **Mays Swicord**, who himself joined Motorola when he retired from FDA's Center for Devices and Radiological Health in Rockville, MD (see *MWN,* J/A95). Swicord is now the director of EME Programs at the Florida Electromagnetic Research Lab. Dr. **Q. Bal-**

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— *Washington Journalism Review*

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zano, the director of the lab, retired from Motorola in February (see *MWN,* M/J00)....**Peter Harrison** of Nokia in the U.K. has stepped down as the chair of the cell phone industry's Mobile Manufacturers Forum (MMF). At the MMF's general assembly held in Kyoto, Japan, on February 28, **Jeffrey Suff** of Matsushita Communication Industrial Ltd., best known for its Panasonic brand products, was elected the new chair. Suff is based in Thatcham, west of London....Dr. **Stanley Sussman** has moved up another notch in EPRI's corporate ladder. Sussman, who used to run the electric utility group's EMF research program (see *MWN,* S/O91) and later EPRI's environment division (see *MWN,* J/F 96), has been appointed vice president of EPRI's environment product sector. EPRI is based in Palo Alto, CA....Dr. **Gerri Lee**, one of the original members of the California EMF Project, has joined Hoffmann–La Roche, the pharmaceutical giant, in Palo Alto, CA....**Vitas Anderson** has set up his own consulting firm, EME Australia Pty. Ltd. in Frankston, a suburb of Melbourne. Previously, Anderson was the project leader of the EME Safety Research group at the Telstra Research Labs in Clayton, which is also near Melbourne....Dr. **Kelly Gibney** has retired from BC Hydro. **Gregory Quan**, an occupational hygienist, is now tracking EMF issues for the Canadian utility in Burnaby....Dr. **John Graham** of the Center for Risk Analysis at the Harvard School of Public Health in Boston, who worked with George Carlo and EPRI on cell phones and EMFs, respectively, has been nominated for a senior regulatory post at the Office of Management and Budget in the new Bush administration. The appointment has been controversial, but he is expected to be confirmed by the Senate....**Robert Silliman**, a well-known RF engineer, consultant and antenna designer who was based in Washington, died on February 11 at the age of 87.

ULTRAWIDEBAND EMI

NTIA Report Sees Interference Ahead ... Ultrawideband devices hold great promise for wireless and radar applications — for instance, the technology can be used to detect buried land mines, see through walls and facilitate high-speed broadband access to the Internet. Gregory Rohde, who recently stepped down as the head of the National Telecommunications and Information Administration (NTIA), went so far as to call UWB "one of the most promising technologies of our time." But a new NTIA report finds that there is a real threat of interference to many widely used electronic systems. The federal agency concludes that the use of UWB devices below 3.1 GHz will be "quite challenging." NTIA's findings may complicate an FCC proposal, issued last May, to allow UWB devices to operate on an unlicensed basis. (The NTIA performs many of the same functions as the FCC: It coordinates the government's use of the spectrum while the FCC regulates the private sector.) UWB devices send out narrow pulses with very wide bandwidths, that is, the signal is spread out over a band of frequencies, with only a small amount of energy at any specific frequency. NTIA measurements, which are detailed in the new report, lead the agency to warn that UWB emission levels in the 960-1610 MHz band would have to be reduced a hundredfold (20 dB) from the levels proposed by the FCC. A number of different aviation radar systems might be placed at risk. "We don't see how we can accommodate UWB

below 3 GHz," NTIA's Lawrence Brunson told *Microwave News*. Brunson, one of the authors of the UWB report, said that "NTIA definitely wants to accommodate UWB, but we also want to be realistic." He said that the NTIA and the FCC will work together to find a solution to the EMI problem over the next few months. The NTIA tests showed that interference could occur over much greater distances when UWB devices are outdoors at a height of 30 meters. When asked for an example of such a case, Brunson, who is based in Washington, cited a local area network UWB transmitter placed next to a window on a high floor of an office building. In addition, there is the problem of multiple UWB devices operating near each other. Some models have been put forward to discount such an EMI threat, but the NTIA counters that these were based on "unrealistic" assumptions, which led to "misleading conclusions." John Reed, a senior engineer at the FCC in Washington, declined to comment on the NTIA report. He said that the commission had a target date for completing its final rules on licensing UWB devices by the end of the summer but conceded that might be optimistic. The report, *Assessment of Compatibility Between Ultrawideband Devices and Selected Federal Systems* (No.01-43), is available on the NTIA Web site at: <www.ntia.doc.gov/osmhome/reports.html>. Also available at this site is a second UWB report, *Assessment of Compatibility Between Ultrawideband Systems and Global Positioning System (GPS) Receivers* (No.01-45), released on March 9, which indicates that some EMI to GPS is possible under current FCC rules. In addition, the NTIA has released two background reports, *The Temporal and Spectral Characteristics of Ultrawideband Signals* (No.01-383) and *Measurements to Determine Potential Interference to GPS Receivers from Ultrawideband Transmission Systems* (No.01-384). Both can be downloaded from <www.its.bldrdoc.gov/pub/ntia-rpt>. All four reports are PDF files....*Aviation Week* (February 5) notes that the development of UWB technology was slowed in the 1980s because it could be used to detect stealth aircraft like the B-2 bomber.

RF/MW MEASUREMENTS

New Products... Narda Safety Test Solutions in Hauppauge, NY, is offering a new personal RF/MW exposure monitor, the Nardalert XT. The belt-worn device covers the spectrum from 100 kHz to 100 GHz, and sounds an alarm when radiation levels approach or exceed the exposure limit chosen by the user, according to Narda. It can store data with "selectable" averaging intervals. Narda, which acquired Wandel & Goltermann, the German meter maker, last year, is itself a subsidiary of L-3 Communications. The new monitor, which costs $1,400, can be configured for IEEE, ICNIRP or NATO as well as several other standards. For more information, contact Robert Johnson at (631) 231-1700, E-mail: <nardasts@L-3com.com>, Web: <www. narda-sts.com>....Manufacturers and test labs can fine-tune their equipment for measuring radiation leakage from microwave ovens with the updated calibration system from Holaday Industries Inc. in Eden Prairie, MN. Holaday, which was acquired last summer by ESCO Technologies Inc. in St. Louis, sells the HI-2790B for $29,900. More details are available from Beverly Gores at (952), 934-4920, Fax: (952), 934-3604, E-mail: <info@ holadayinc.com>, Web: <www.holadayinc.com>.

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As We Go To Press

FDA Sets Mobile Phone Epidemiology Meeting

The FDA has announced that there will be a public meeting April 18-19 in Cincinnati to address epidemiologic research needs related to the safety of wireless phones.

The FDA will assemble "national and international scientific experts," according to a notice published in the *Federal Register* on March 27 (p.16678). At press time, Dr. Russell Owen of FDA's Center for Devices and Radiological Health told *Microwave News* that the list of attendees had not yet been set. He added that the meeting was being held in Cincinnati to facilitate the participation of experts from NIOSH, which is located there.

The meeting is part of the Cooperative Research and Development Agreement (CRADA) between the FDA and the CTIA (see *MWN,* N/D99 and J/A00). A similar public meeting was held last summer on possible genetic effects (see *MWN,* S/O00).

For more information contact Owen at: (301) 443-7118.

Keeping Current: Follow-Up on the News

◆ The next meeting of the IEEE SCC-34 subcommittee, which is developing a standard for measuring SARs from mobile phones, is scheduled for April 10-11 in Washington. E-mail traffic among the members of the subcommittee indicates that a number of issues still need to be resolved. (See also *MWN,* J/F01.) Meanwhile, CENELEC, the European standards group, will release its SAR measurement standard soon.

◆ The editors of *USA Today* think lawyers are "racing ahead of the facts" in filing lawsuits blaming cell phones for brain tumors. The editorial and an opposing view by Joanne Suder, who is working on a number of such cases, appeared in the February 26 issue of the newspaper.

◆ The U.K.'s EMF Biological Research Trust is seeking proposals that focus on proteomics—that is, on the effects of power frequency fields on cellular proteins. The trust, which is funded by the National Grid, wants to compare the effects of EMFs with those of "established agents which produce cellular stress responses." Short applications from U.K.-based researchers were due by March 31. Further details are in an ad that ran in the back pages of the March 1 issue of *Nature*.

◆ Sweden's Drs. Lennart Hardell and Kjell Hansson Mild exchange views on cell phones and brain tumors with the U.S.' Dr. Kenneth Rothman in the March 24 *Lancet* (pp.960-961).

◆ The April issue of *Radiation Research* features two animal exposure studies on: (1) the effects of CW and pulsed radiation on brain tumors and other cancers in rats by Dr. Bernard Zook of George Washington University in Washington *(155,* pp.572-583, 2001); and (2) the effects of the Iridium signal on the stress response in mice by Dr. Ross Adey's group at the University of California, Riverside, which has now disbanded *(155,* pp.584-592, 2001). Neither set of experiments showed any significant effects; both were sponsored by Motorola. A third animal study was published in the February issue: An Air Force team from Brooks AFB found no effect of ultrawideband radiation on mammary tumors in mice *(155,* pp.369-377, 2001).

◆ On March 19, the IEEE's SCC-28 changed its name to the International Committee on Electromagnetic Safety. The move is in line with the IEEE's desire to extend its reach overseas and with the SCC-28's eagerness to be perceived as an alternative to ICNIRP.

◆ The Swedish-Norwegian team that studied mobile phone use and the prevalence of headaches has published its second set of results. They are in the February issue of *Occupational Medicine (51,* pp.25-35, 2001). For more on the first paper, see *MWN,* J/A00; for a report on the overall findings, see *MWN,* M/J98.

◆ The IEEE's Committee on Man and Radiation (COMAR) has issued a "Technical Information Statement" on human exposures to RF/MW radiation from wireless phones. See the January/February 2001 issue of the *IEEE Engineering in Medicine and Biology Magazine,* or go to: <www.seas.upenn.edu:x8080/~kfoster/comar.htm>.

◆ Five years ago, Dr. Carl Blackman reported that he, like Dr. Robert Liburdy before him, had showed that a 12 mG, 60 Hz magnetic field could block melatonin's ability to inhibit the growth of human breast cancer cells (see p.14). Blackman's findings have now been published in the February issue of *Bioelectromagnetics, (22,* pp.122-128, 2001).

◆ The Electromagnetic Energy Association is holding a conference on the *Precautionary Principle and EMFs* on May 4 in Baltimore. The keynote speaker is Ford Rowan, a crisis management consultant. For more information, call Melissa Forburger at (202) 452-1070 or go to <www.elecenergy.com>.

VIEWS ON THE NEWS

A New Theory of Relativity

Sir Richard Doll and his advisory panel have conceded that there does indeed appear to be a childhood cancer risk above 4 mG (0.4 ∝T) (see p.1). This puts them in the epidemiological mainstream. But, at the same time, they are trying to suggest that the risk has little relevance to the real world. Using tactics that George Orwell would find all too familiar, Doll portrays a weak magnetic field as exceptionally strong.

The Doll panel calls 4 mG an "intense" and "relatively heavy" exposure, which is "seldom encountered in the U.K."

Let's put 4 mG into perspective. The U.K. NRPB's standard for exposure to 50 Hz fields is 16 G. That is *4,000 times* higher than the possible leukemia threshold. This means that British children may be continuously exposed to 15,999 mG. We wonder if there is anyone in the bioelectromagnetics community who would knowingly allow their children — or indeed themselves — to be exposed to even 100 mG on a regular basis. (The ICNIRP guideline is 1,000 mG.)

After reviewing the Doll report, the NRPB said that it saw no reason to change its exposure limit.

Rough calculations indicate that some 50,000 children in the U.K. are exposed to, on average, more than 4 mG. In the U.S., where there are more people and power frequency fields are higher, hundreds of thousands of children are exposed to more than 4 mG. One survey showed that as many as 12 million Americans could be exposed to average magnetic fields of more than 4 mG (see *MWN,* M/J98).

The risk of leukemia may or may not turn out to be small (see p.4), but a central part of the message is getting lost. If a 4 mG field can play a role in the development of cancer, what else can it do?

Weapons Development and Public Health Should Not Mix

The Pentagon's new microwave weapon has been brought to you by the U.S. Air Force and Raytheon (see p.1). These are the same organizations that control the IEEE's SCC-28 committee that writes the standard for exposures to RF and microwaves.

Dr. John Osepchuk, the chair of SCC-28, worked for Raytheon for most of his professional career. And three of the other five members of the SCC-28 executive committee work either at Brooks Air Force Base or for Raytheon.

In the 1980s, during the last major revision of the IEEE standard, Osepchuk was among those who argued for doubling the limit, from 5 to 10 mW/cm^2, for frequencies above 3 GHz (see *MWN,* J/A86). The rationale — which we never understood — was to make it consistent with the infrared standard all the way up at 300 GHz. This change, though challenged, was adopted.

At the time it appeared to be somewhat of an academic concern, given the paucity of radiation sources above 30 GHz. But few were privy to the designs of military contractors. The loosening of the IEEE standard must have facilitated the development of the military's new zapper at 95 GHz.

It seems obvious, but it's worth repeating: Health standards should be written by medical and public health professionals, not those who make weapons for the military-industrial complex.

Open Letter to Robert Park

We at *Microwave News* are not "fear merchants," as you allege in an editorial in the *Journal of the National Cancer Institute (JNCI)*. Nor have we ever claimed that "cell phones are linked to cancer."

We are forced to write this open letter because you have refused to answer our messages, both by e-mail and by phone.

Rebecca Chasan, the executive editor of *JNCI,* has also refused to come to the phone. So we were unable to ask her why she picked you, a lobbyist for the American Physical Society, to comment on an epidemiological study of mobile phone users (see p.8). An odd choice for a cancer journal, though consistent with NCI's doggedly wrongheaded approach to EMF issues.

If you had done your homework and read our editorials, you would know that our position is that there is ample evidence to suggest that mobile phone radiation is biologically active. With a billion people now using hand-held devices, it is vital to resolve the health question as quickly as possible. *(Microwave News* commentaries are available to all at no cost on our Web site.)

Ours is the majority view. Your assertion that the safety of mobile phones has been fully established is belied by the large research programs that are under way across Europe.

You end your editorial by stating: "The scientific community has a responsibility to put all the evidence into perspective for the public." On this we can agree. We are left to wonder why you ignore research data that do not conform to your ideological agenda.

The following quote from a fellow physicist, Richard Feynman, may be more persuasive than anything we could say:

> [Y]ou should not fool the layman when you're talking as a scientist....I'm talking about a specific, extra type of integrity that is not lying, but bending over backwards to show how you're maybe wrong, that you ought to do when acting as a scientist. This is our responsibility as scientists, certainly to other scientists, and I think to laymen.*

* *The Pleasure of Finding Things Out: The Best Short Works of Richard P. Feynman* (Cambridge, MA: Perseus Books, 1999), p.212.

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Cell Phone–Brain Tumor Lawsuit Hangs on a Single Swedish Study

Five-Day Hearing on Scientific Evidence

A federal judge will soon decide the future of mobile phone–cancer litigation. Judge Catherine Blake will determine whether there is enough reliable scientific evidence linking cell phones to brain cancer to allow the first of many multimillion-dollar claims to be heard in U.S. courts.

Judge Blake's decision will likely turn on a single unpublished epidemiological study by Sweden's Dr. Lennart Hardell. An oncologist at Örebro Medical Center, Hardell has reported that using an analog phone increases the risk of developing brain cancer.

Dr. Christopher Newman, a 42-year-old Baltimore neurologist, blames Motorola and a number of other cell phone companies for his malignant brain tumor (see *MWN*, S/O00). At a weeklong hearing in Baltimore, attorneys from Peter Angelos's law office presented Hardell and four other experts in support of Newman's complaint. Defense lawyers, in turn, presented their own witnesses to refute the plaintiff's arguments (see p.8 for a list of the experts on both sides).

During that same week in late February, five new brain tumor suits were filed in a Washington, DC, court (see p.9).

On March 1, shortly before the end of the hearing, Blake interrupted the closing argument of Russell Smouse, one of the Angelos attorneys, to ask: "Don't all of your experts really stand or fall on whether...I am persuaded that

(continued on p.7)

Introducing Brillouin Precursors: Microwave Radiation Runs Deep

When a very fast pulse of radiation enters the human body, it generates a burst of energy that can travel much deeper than predicted by conventional models. This induced radiation pulse, known as a Brillouin precursor, is at the heart of the continuing conflict over the U.S. Air Force's (USAF) PAVE PAWS phased array radar on Cape Cod.

Brillouin precursors can also be formed by ultrawideband radiation (see also p.17) and, in the near future, by high-speed data signals.

Dr. Richard Albanese, a researcher at Brooks Air Force Base in San Antonio, is concerned that the radiation from the PAVE PAWS radar entails widespread human exposure to Brillouin precursors. In a May 23, 2000, letter to the Massachusetts Department of Public Health (MDPH), Albanese warned that this type of phased array radiation has never been tested. He has been

(continued on p.10)

EMF Cancer Concerns Take Center Stage in Power Line Fight; Minnesota Health Department Downplays Risk

Two suburbs of Minneapolis–St. Paul have denied Xcel Energy permits to upgrade a 115 kV power line to 230 kV. EMF health risks were a major factor in both decisions.

Despite these setbacks, the utility is convinced that it will prevail and has begun work on the 15-mile project. Xcel is the fourth-largest shareholder-owned utility in the U.S., with headquarters in Minneapolis.

By rebuffing the line, the towns rejected the advice of the Minnesota Department of Health (MDH), which has sought to allay health concerns raised by opponents of the line (see box at right).

Xcel contends that the upgrade would in fact result in lower magnetic field levels and is therefore consistent with a strategy of prudent avoidance. The new power line will have higher towers and a low-EMF configuration.

According to calculations presented by Xcel, after the upgrade, magnetic fields at a distance of 25 feet from the centerline will be reduced from 87 mG to 32 mG during periods of peak demand. There are 24 homes this close to the line. At 100 feet — an area that includes 85 residential buildings — fields will be reduced from 11 mG to less than 2 mG.

The Power Line Task Force (PLTF), which is leading the fight against the line, disputes these projections as unrealistically low. It contends that the line would not be safe either way.

The PLTF's long-range goal is to get rid of the SE Metro line. If the upgrade is blocked, the group believes, Xcel will eventually dismantle the existing line, which was built in 1923. Xcel counters that this will never happen.

On February 5, the city council of Sunfish Lake denied a zoning permit by a margin of 4-1. And on March 7 the Mendota Heights City Council voted 3-2 against the proposal. Last August, the town of South St. Paul approved the upgrade with the stipulation that the line be placed underground — but this requirement was dropped after Xcel filed a lawsuit.

In Mendota Heights, the city council cited "a compelling body of scientific evidence" that the upgraded line could pose a risk. Xcel had tried to preempt the council's vote, but was rebuffed by a state court on December 12. The company is appealing.

The Sunfish Lake council concluded that EMFs generated by the upgraded line would pose "unjustifiable risks" of childhood leukemia and other ailments. Although research to date "has not demonstrated a causal relationship," it stated, "the linkage and association are significant enough to require avoidance of EMFs at levels above 4 mG." Xcel is also challenging this decision in state court.

MDH's Charles Stroebel failed to sway the Sunfish Lake council. Epidemiological studies have found only "weak associations," animal studies have "consistently not shown adverse effects" and *in vitro* research has "failed to establish a plausible biological mechanism," he told the council before the vote.

Xcel had asked Stroebel to appear at the Sunfish Lake meeting, according to Ed Legge, a company spokesperson. Legge said that Stroebel supports Xcel's position that "there is no basis to deny this permit based on health effects of EMFs."

Who Advises the Health Adviser?

MDH's Charles Stroebel says the evidence for health risks from power line EMFs is "extremely weak." This assessment is the "consensus of a team of scientists" at the MDH and endorsed by Dr. Leslie Robison of the University of Minnesota. Robison worked on the NCI's EMF study and is a known EMF skeptic (see *MWN,* J/A97 and J/A98). He is a member of the NAS–NRC panel on PAVE PAWS (see p.11).

Stroebel told *Microwave News* that he has also sought advice from Dr. John Moulder of the Medical College of Wisconsin, Dr. David Savitz of the University of North Carolina and Naomi Bernheim, an administrative assistant to NIEHS' Dr. Gary Boorman.

Moulder is a consultant to Xcel. According to spokesperson Ed Legge, Moulder testified on behalf of a 345 kV power line between Minnesota and Wisconsin. And last year Moulder worked for Xcel's partner in that project, the Wisconsin Public Service Corp. He testified that IARC's system for classifying carcinogens is "outdated" (see *MWN,* S/O01, also J/A01). In that power line dispute, EMFs have not played a major role.

Stroebel told Sunfish Lake officials that the NIEHS had recently told him there has been no change in its 1999 finding that evidence for EMF health risks is "weak" and that they are best addressed through "passive regulatory action" (see *MWN,* J/A99).

Dr. Roger Conant of Sunfish Lake, who heads the PLTF, is incensed by Stroebel's actions. The MDH "is working to protect Xcel's profits rather than to protect public health," Conant told *Microwave News*. Conant, who has a doctorate in economics, is a financial consultant.

Conant says that the MDH is "out of touch" in downplaying EMF risks, because it failed to take into account a shift in expert opinion marked by the IARC decision. He also points to the conclusions of the U.K. Doll report (see *MWN,* M/A01) and the recent draft report from the California health department (see *MWN,* J/A01).

Mayor Frank Tiffany of Sunfish Lake, who cast the town's only vote in favor of the upgrade, said that in his opinion opponents are driven by fears that it will reduce property values and ruin scenic views. "EMFs are a surrogate for the real issue," Tiffany told *Microwave News*.

Dr. Martin Blank of Columbia University in New York City and Dr. Magda Havas of Canada's University of Trent in Peterborough, ON, have spoken on behalf of the PLTF. Dr. Peter Valberg of Gradient Corp. in Cambridge, MA, has supported Xcel's plan.

The MDH's position on EMF health risks is at <www.health.state.mn.us/divs/eh/emf>. The PLTF has posted numerous documents relating to the new line at <www.powerlinefacts.com>.

« Power Line Talk »

Magnetic fields are above 250 mG at the **day care center** for the staff of the Royal Women's Hospital in Melbourne, according to **Australian** news reports. Sixteen children aged ten months to four years spend the day at the center, which is located directly above the facility's electrical substation. "The tests showed that the playroom area recorded less than 10 mG, the sleeping room less than 300 mG and the rest of the center recorded less than 250 mG," said **Dale Fisher,** the hospital's general manager. Fisher downplayed fears of potential health risks. She pointed out that the levels in the sleeping room are "well under" Australia's 1,000 mG standard. "This is not really a scientific issue, it's an emotional one," she told *The Age* (March 19). Nevertheless, cots have been removed from the sleeping area. Concerns over high magnetic fields were first raised by measurements made in 1999, and a new survey conducted last year produced similar results. In a letter to *The Age* (March 21), Dr. **Magda Havas** of Canada's Trent University (see p.2 and *MWN,* J/F01) criticized the exposures as "irresponsible" and added that she would "immediately remove" her child if it were in such a high magnetic-field environment. "Haven't these administrators heard of prudent avoidance?" Havas asked.

«« »»

Logan, **Australia**, is practicing prudent avoidance with a precaution-based exposure standard. Officials in the Brisbane suburb have agreed with **Energex** Ltd. on a 4 mG limit for magnetic fields from a substation and its associated power lines. The electrical utility will take steps, including burying some lines, to keep average levels below 4 mG "where reasonably practicable." The two parties sat down to resolve their differences after Energex appealed a decision by the Logan city council to deny a zoning permit for a proposed upgrade of the substation due to possible health risks. The settlement "recognizes 4 mG as a reference point when implementing 'prudent avoidance,'" Dr. **Bruce Hocking**, an occupational physician based in Melbourne who provided an expert opinion to attorneys representing the Logan city council, told *Microwave News*. Among the experts who testified for the utility in its appeal were Dr. **Mark Elwood**, the director of the National Cancer Control Initiative, and Dr. **Andrew Wood** of Swinburne University, both in Melbourne. The evidence is "insufficient to justify deviation from current standards," Elwood told the court, in effect endorsing the 1,000 mG national limit. Donna Fisher, who led the local opposition to the upgrade, said she is "very disappointed" that Elwood, a government health adviser, had spoken on behalf of Energex. When asked by *Microwave News* for a copy of his report on the substation upgrade, Elwood replied that the court barred him from releasing it.

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Two **Swedish** researchers have published evidence that suggests that electricians in the construction trades do not have an elevated risk of committing **suicide**. Writing in the March issue of *Occupational & Environmental Medicine (59,* pp.199-200, 2002), Drs. **Bengt Järvholm** and **Anita Stenberg** of Umeå University report on a cohort study of 33,719 male electricians that shows that their suicide risk was less than that of the general population (a statistically significant result) as well as that of glass and wood workers. The researchers explain that the fact that the risk is smaller than that of the general public is not surprising since workers have fewer disabilities and long-term illnesses—that is, this is an example of the healthy worker effect. But, they point out, the same cannot be said for the comparison among the different occupations. Two years ago, a team led by **Edwin van Wijngaarden** of the University of North Carolina, Chapel Hill, found that male electrical workers exposed to EMFs were more

EPRI Planning Workshop on MMF and Miscarriage Risks

EPRI will host a workshop to review the new epidemiological results that point to an association between miscarriage risks and exposure to magnetic fields above some minimum threshold level. The meeting is scheduled for May 13 at the EPRI campus in Palo Alto, CA.

Dr. Robert Kavet, who heads EPRI's EMF program, refused to discuss the workshop, relaying a message through the press office that it is an "internal business meeting."

In fact, a number of epidemiologists and biostatisticians who work outside EPRI have been invited. Drs. De-Kun Li of Kaiser Permanente and Raymond Neutra of the California Department of Health Services, both in Oakland, and Dr. David Savitz of the University of North Carolina, Chapel Hill, all confirmed to *Microwave News* that they would be at the workshop.

In a recent paper in *Epidemiology,* Li showed that women exposed to magnetic fields of 16mG and higher have significantly higher rates of miscarriages (see *MWN,* M/J01 and J/F02). In an accompanying editorial, Savitz questioned the meaning of Li's maximum magnetic field (MMF) exposure index. The journal has subsequently featured a series of follow-up letters.

On the basis of the Li study and some additional work, the California EMF program concluded in its draft final report that magnetic fields more likely than not present a miscarriage risk — and, if so, could account for up to 40% of all miscarriages (see *MWN,* J/A01).

The objective of the workshop is to develop a research agenda for future work on EMFs and miscarriages. It is not clear whether EPRI will sponsor a new epidemiological study. In a series of commentaries, Savitz has warned that there is little to be gained from any more EMF epidemiology (see *MWN,* M/J01 and S/O01).

Li commented that his study "definitely needs replication." And Neutra cautioned that, "Those who are inclined to doubt an EMF–miscarriage link should specify ahead of time what type and amount of evidence would be required to convince them."

Among the others who have been invited to the workshop are Drs. Norman Breslow of the University of Washington, Seattle, Gary Shaw of the California Birth Defects Monitoring Program in Oakland and Gail Windham of the California Department of Health Services, also in Oakland.

likely to commit suicide (see *MWN,* M/A00). In a letter published electronically on the journal's Web site, <www.oem.bmjjournals.com>, van Wijngaarden points out that one would not expect to see an EMF-mediated difference among the three job categories given that, according to a small Swedish survey, all three groups had similar magnetic field exposures. Van Wijngaarden cites with approval one of the conclusions of the Swedish team: "Our study does not contradict the hypothesis that high exposure to EMFs may cause depression and increase the risk of suicide." Järvholm told *Microwave News* that he is preparing a reply to van Wijngaarden.

No Female Breast Cancer Risk at Low Magnetic Field Exposures

The melatonin hypothesis, which suggests that power-frequency EMF exposures can increase the risk of breast cancer, has taken a hit from one of its most prominent proponents.

Fifteen years ago, Dr. Richard Stevens put forward the idea that EMFs and/or light-at-night could be responsible for the high rates of breast cancer in industrialized countries (see *MWN,* J/F87). Last fall, Stevens, Dr. Scott Davis and Dana Mirick reported an association between working at night and breast cancer (see *MWN,* N/D01). But they now say that their study of women in the Seattle area shows no association between residential magnetic field exposures and the risk of breast cancer.

"My opinion is that the study provides evidence against a role for residential magnetic fields in the development of female breast cancer," Stevens told *Microwave News* from his office at the University of Connecticut Health Center in Farmington. But, Stevens added, "This study could not address exposures above 3-4 mG." Davis and Mirick are with the Fred Hutchinson Cancer Research Center in Seattle.

The case-control study of 813 women with breast cancer and 793 controls estimated EMF exposures with an EMDEX II meter that was placed in the women's bedrooms for two consecutive days. No elevated breast cancer risks were found.

Writing in the March 1 issue of the *American Journal of Epidemiology (155,* pp.446-454, 2002), the three researchers report that, "More than 90% of both cases and controls had mean nighttime magnetic field levels of less than 1.6 mG (0.16 μT)."

Davis told *Microwave News* that there were 21 cases and 14 controls with exposures of 4 mG or higher and that the odds ratio for this breast cancer risk is 1.4 (p=0.30).

In a previous study, Davis and Stevens found lower levels of melatonin among women exposed to weak magnetic fields at home. These results were first reported five years ago but only published last year (see *MWN,* N/D97 and S/O01).

Commenting on these melatonin findings in their new paper, Davis's team writes, "It remains unclear whether the observed effect is substantial enough to affect one's risk of developing breast cancer."

HIGHLIGHTS

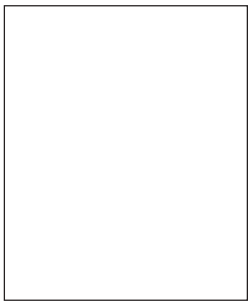
At BEMS Winter Workshop: Too Early for Epidemiology?

If Dr. Allan Frey set out to be provocative, he clearly succeeded. His talk on epidemiological studies of cell phones and cancer at the Bioelectromagnetics Society's (BEMS) annual winter workshop left some of the epidemiologists in the audience visibly exasperated.

After pointing out the shortcomings of the U.S. and Danish studies that show no cancer risk following short-term exposures, Frey asked: "Should these epidemiological studies have been done?" He wasted no time waiting for a reply. "I don't think so because the latency is not there." Frey is with Randomline, a research firm in Potomac, MD, and is a consultant to the Peter Angelos attorneys in the Newman case (see p.1 and *MWN,* J/F02).

The media interpreted the results as an all clear, Frey said, but they are "not relevant to present-day phones." He also raised some methodological criticisms. For instance, the Danish study had excluded 200,000 corporate users, which means, Frey said, that 200,000 of the heaviest users were in the comparison group, resulting in a dilution—if not a concealment—of any possible risk.

Later, Dr. Maria Feychting of the Karolinska Institute in Stockholm, who had earlier presented a detailed, critical review of many of the same cell phone studies, politely countered that the study had included most of the 5 million citizens of Denmark and that, while 200,000 may sound like a large number, it would not have much of an effect.



"I don't think the epidemiological studies should have been done."

—DR. ALLAN FREY

Drs. Joshua Muscat and John Boice Jr. were also in the audience, but the two epidemiologists stayed silent on the latency issue. Each carried out one of the mobile phone cancer studies attacked by Frey—Muscat in the U.S. and Boice with Dr. Christoffer Johansen in Denmark (see p.5 and *MWN,* J/F01 and M/A01).

"Maria said many of the same things as Allan Frey, but in a more discrete way," Dr. Richard Stevens, an epidemiologist at the University of Connecticut (see above) told *Microwave News* after the workshop.

In an interview, Feychting said that Frey's criticism is misplaced: "What he should criticize are the editorials that accompanied the Johansen and NCI studies because they are drawing conclusions that did not have support in the data presented."

The workshop was held in Washington on February 8.

« Eye on Europe »

Drs. **Christian** and **Hella Bartsch**'s paper on the effects of chronic exposure to weak GSM-like radiation on the development of **DMBA**-induced breast tumors has finally appeared in print. Researchers have been speculating about the University of Tübingen study for three years, with two replication efforts already under way (see *MWN,* J/A99 and N/D00). This is what happened: The first time the **German** team ran the experiment they found a highly significant *delay* in the development of breast tumors among the free-moving rats exposed to 100 $\mu W/cm^2$ signals (whole-body SARs=0.0175-0.07 W/Kg). The median latency for the first malignant tumor was 278 days among the RF-exposed animals compared to 145 for the controls. The results were submitted to *Radiation Research,* but then withdrawn while the experiment was repeated twice. In the subsequent studies, there was no similar delay in tumor development. The Bartsches have no explanation for why they saw the effect the first time, but not on the second or third tries. They speculate that "some unknown" chemical or physical agent may be at work and point to some "yet unidentified conditions" under which RF radiation may be "cancer protective." Asked by *Microwave News* what the unknown agent might be, Christian Bartsch pointed to the possibility that the geomagnetic field may have played a role. He noted that the first experiment had been performed in 1997-98 when solar activity was low whereas the sun was active during the next two runs. Bartsch said that, "We would very much like to start experiments under shielded conditions" but explained there is no funding to investigate such beneficial effects. Bartsch was emphatic that Deutsche Telekom, which sponsored the studies, applied "absolutely no pressure" to delay publication of the first experiment. "This was *totally* our own decision," he said. This is the second time that a major animal study found a beneficial effect. Dr. **Ross Adey** saw fewer tumors in his study of chronically exposed mice for Motorola (see *MWN,* M/J96, J/A96 and S/O99). The Bartsches close by stating that it is "important and urgent" to resolve this issue. Their paper appears in the February issue of *Radiation Research (157,* pp.183-190, 2002).

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The team led by Dr. **Christoffer Johansen** of the Danish Cancer Society in Copenhagen, which last year reported no elevated risk of brain tumors among mobile phone users in **Denmark**, has extended that finding to eye cancer (see *MWN,* M/A01). In fact, there were fewer cases of malignant ocular melanoma than expected (8 vs. 13.5) among the 400,000 Danish mobile phone users included in the brain cancer study. Early last year, Dr. **Andreas Stang** of the University of Essen in **Germany** reported that heavy users of mobile phones were more than four times more likely to develop melanoma of the eye (see *MWN,* J/F01). The German results may have suffered from recall bias or from an inability to control for UV exposures, Johansen suggests. In the same paper, his team also reports "only small and irregular changes" in the occurrence of eye cancer in the Danish population as a whole from 1943 through 1996. This stability stands "in sharp contrast" to the "exponential increase" in phone use starting in the 1980s, according to Johansen, but he also notes that the annual incidence rose from 6.1 to 7.8 cases per million for 1993-1996, which "suggests that further data are necessary to settle the issue." (Though it was higher, 7.9 per million, in 1968-1972.) Dr. **John Boice Jr.** of the International Epidemiology Institute in Rockville, MD, is a member of the Johansen team (see also p.4). These new results appear in the February 1 issue of the *British Journal of Cancer (86,* pp.348-349, 2002).

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On March 1, the **French** government reiterated an advisory to users of mobile phones, reminding them that, on a precautionary basis, parents should tell their children to limit the use of wireless phones, and that when using an earpiece pregnant women should keep the phone away from their bellies and teenagers should keep it away from their developing sex organs. The government also advised that phones should not be used while driving, even with a hands-free kit. These are the same recommendations issued last year in a report, *Mobile Telephones, Their Base Stations and Health,* prepared at the request of the health ministry (see *MWN,* J/F01)....On April 18, there will be two roundtable debates on *Mobile Phones and Health* — one on phones, the other on towers — at the Palais du Luxembourg in Paris, chaired by Senators **Jean-Louis Lorrain** and **Daniel Raoul**.

Vatican Electrosmog Case Thrown Out of Court

On February 19, an Italian court ruled that Vatican officials cannot be prosecuted for allowing RF exposures from their radio transmitters to exceed Italy's strict standards. Judge Andrea Calabria found that the three defendants had immunity under a 1929 treaty that established the Vatican as a sovereign state.

Last year citizens in Cesano, a suburb of Rome, blamed Radio Vatican for a cluster of leukemia cases in the vicinity of its powerful transmitters (see *MWN,* M/A01 and M/J01). The judicial decision did not play well in Cesano, where locals protested that the Vatican "has a license to kill."

The controversy is far from over. An epidemiological study by Dr. Paola Michelozzi and coworkers that supports some of the concerns of Cesano residents has been accepted for publication by the *American Journal of Epidemiology.* The paper is scheduled to appear early this summer.

At last year's meeting of the International Society for Environmental Epidemiology, Michelozzi, who is with the regional health authority in Rome, reported that the incidence of childhood leukemia within 6 km of the Vatican antennas was twice the expected rate — a result that was just short of statistical significance (see *MWN,* S/O01).

Also last September, a government report concluded that such a study had little hope of producing helpful insights (see *MWN,* S/O01).

In addition, there are rumors that the new government of Silvio Berlusconi will soon move to relax the Italian 6 V/m exposure limit, one of the strictest RF/MW standards in Europe (see *MWN,* J/F00).

Carlo Opens Registry for Wireless Phone Complaints

Those with health symptoms they attribute to the use of a mobile phone can now report them to Dr. George Carlo.

The Mobile Telephone Health Concerns Registry, operated by Carlo's Science and Public Policy Institute in Arlington, VA, will issue quarterly reports on the data collected over the next year. The information will be treated confidentially and distributed in aggregate.

Carlo received $250,000 for the voluntary registry last November in a partial settlement of the *Busse* lawsuit, which was filed against his Wireless Technology Research (WTR), among others, on behalf of phone users (see *MWN,* J/A01 and N/D01).

The registry is needed to fill "the void left by the regulatory agencies," Carlo told *Microwave News*. "I really blame the FDA for being asleep at the switch," he said. Carlo ran the controversial $28 million WTR program for the cell phone industry.

If the registry "raises enough red flags, the scientific community will be compelled to test the hypotheses," he explained. Carlo has long argued for "post-market surveillance" of phone users. He said that the site had 75,000 visitors in the two weeks following the launch in mid-March.

Carlo will run the site on an interim basis until it can be turned over to public health officials. No one has yet agreed to take over, however. "I've had enough, I want to move out of the wireless area as soon as I can. I am living on savings," Carlo said.

People can report their complaints by filling out a questionnaire at <www.health-concerns.org> or by calling toll free to (866) 3-SCIENCE.

WHO Director on Cell Phones: Follow Precautionary Principle

Dr. Gro Harlem Brundtland, the director general of the World Health Organization (WHO), favors a precautionary approach to the use of mobile phones, according to press reports from Scandinavia.

In an interview with *Dagbladet Norge* (March 9), a major Norwegian newspaper, Brundtland discouraged children from using mobile phones. A physician with a degree in public health, Brundtland is a former prime minister of Norway.

Jon Lidén, a communications adviser in Brundtland's office in Geneva, confirmed the accuracy of the Norwegian article to *Microwave News*.

Brundtland's outlook appears to put her at odds with the WHO International EMF Project. "Precautionary policies should not be applied to EMFs," Dr. Michael Repacholi, who oversees the project, stated recently (see *MWN,* S/O01). He could not be reached for comment.

Brundtland advises everyone to limit the amount of time on the phone, but she does not think there is enough scientific evidence to issue a formal warning.

For herself, Brundtland says that she gets a headache whenever she uses a mobile phone. "In the beginning I felt warmth around my ear. But the discomfort got worse and turned into a headache every time I used a mobile phone," Brundtland said in the interview. Making shorter calls does not help, she added. The interview was featured on the front page of *Dagbladet Norge* and was later picked up by the Swedish press.

U.S. Government Cracks Down On Bogus Phone Shields

In the first crackdown of its kind, the U.S. Federal Trade Commission (FTC) has charged two companies that market shields for mobile phones with making false claims. Others may soon be targeted for legal action.

On February 13, the FTC filed complaints in federal court against Comstar Communications Inc. in West Sacramento, CA, and Stock Value 1 (SV1) in Boca Raton, FL. The government is asking the courts to block the companies from selling shields and to force them to give consumers refunds.

The shields, which cost from $20 to $25 each, are "ultimately ineffective," according to FTC's Howard Beales. The FTC has seen "no scientific evidence" to support the claims that the shields protect phone users from radiation, said Beales, who heads its Bureau of Consumer Protection in Washington.

The FTC is not taking a position on whether wireless radiation can cause health effects. Beales cited the Food and Drug Administration (FDA), which has stated that there is no definite proof that mobile phones are harmful or that they are safe (see *MWN,* N/D99). Neither complaint filed by the FTC challenges Comstar's or SV1's statements that phone radiation is harmful.

Beales advised phone users who want to reduce their exposure to make shorter calls or use a hands-free set.

The FTC is investigating other shield sellers. "This is the beginning, not the end," Beales said. He added that, in general, "Consumers would do well to be skeptical" of phone shields.

Both Comstar's and SV1's shields are small disks of metal mesh that stick to the phone's earpiece. According to the FTC, the packaging for Comstar's NoDanger states that it is "capable of blocking up to 99% of harmful electromagnetic waves up to 2000 MHz." SV1 sold its WaveShield in packaging claiming that it "blocks up to 99% of electromagnetic radiation." Neither company's literature explains how its shields reduce exposures.

According to Beales, the FTC's investigation was prompted by the Goodhousekeeping Institute, the testing lab of *Good Housekeeping* magazine, which tested devices from Comstar, SV1 and several others and found them to be ineffective. The FTC asked the sellers to produce data to support their claims. Comstar and SV1 submitted test results, but these "did not pass scientific muster," Beales said.

Before SV1's Web site was closed in February, the company stated that its shields were tested by, among others, Coghill Research Labs in Gwent, Wales, U.K. The site quoted Roger Coghill as stating that he considered the SafeTShield to be "an effective and healthy protection" against radiation, and adding that, "I have one on my cell phone."

Copies of the two FTC complaints are available on the Internet at: <www.ftc.gov/os/2002/02/index.htm>.

Dr. Hardell's unpublished 2001 studies are scientifically valid and reliable?"

Smouse replied that there was other evidence, but conceded the importance of the Hardell testimony.

In the first of two papers submitted for publication last year, Hardell reports a statistically significant 26% increase in brain cancer among those who had used an analog cell phone for more than a year. The brain tumor risk rises to 35% and 77% among those who used such phones for five and ten years, respectively.

In the second paper, which looks only at astrocytomas—the type of tumor Newman developed—the risk is 29% above controls, but is not statistically significant. When Hardell limits his analysis to the parts of the brain closest to the phone (the occipital and temporal areas), he sees a significant, ninefold increased risk. This estimate is based on only 12 cases and 5 controls.

Hardell also reports a greater chance of developing a brain tumor, as well as an astrocytoma in particular, on the side of the head on which a phone was used (an ipsilateral tumor).

Some of these results were first presented at a London conference last June (see *MWN,* J/A01) and build on an earlier, smaller study released in a series of papers over the last three years (see below and *MWN,* M/J99, J/A99 and M/J00).

Lawyers for the cell phone industry sought to show that Hardell's unpublished studies are flawed and unreliable, as well as inconsistent with other published cell phone epidemiological studies (see also p.4).

In cross-examining Hardell, Janet Thorpe of Alston & Bird in Atlanta emphasized that both papers had been rejected by journals—an important, though not an absolute, indicator of their

(continued on p.9)

The Daubert Standard

Judge Blake's five-day hearing is known as a "Daubert hearing" after the landmark 1993 Supreme Court decision in *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, which helps define what kind of scientific evidence is allowed in court.

Under *Daubert,* the trial judge serves as the gatekeeper, who must ensure that all scientific testimony offered in court is "relevant" and "reliable."

The Supreme Court ruled that the judge must determine at the outset whether the scientific evidence "rests on a reliable foundation"—though it need not have the "general acceptance" of the scientific community. The court declined to set a "definitive checklist or test." It stated that peer review and publication are important criteria but added that publication is "not a *sine qua non* of admissibility."

Hardell's Cell Phone Epidemiological Papers: Published and Unpublished

Study 1

L. Hardell, A. Nasman, A. Påhlson, A. Hallquist and K. Hansson Mild, "Use of Cellular Telephones and the Risk for Brain Tumors: A Case-Control Study," *International Journal of Oncology, 15,* pp.113-116, July 1999.

Found no general increase in brain tumors among 209 cases and 425 controls, but did see a nonsignificant increase in ipsilateral tumors (on the side of the head where phone was used) in the temporal or occipital lobe: right side OR=2.45, CI:0.78-7.76; left side: OR=2.40, CI:0.52-10.9. Elevated risk seen only for NMT analog phones. (See *MWN,* M/J99.)

L. Hardell, A. Nasman, A. Påhlson and A. Hallquist, "Case-Control Study on Radiology Work, Medical X-Ray Investigations and Use of Cellular Telephones as Risk Factors for Brain Tumors," *Medscape General Medicine,* online publication, May 4, 2000.

Further analysis of the same data used in the 1999 paper. Risk of ipsilateral tumors in the temporal, occipital or temporoparietal regions is OR=2.42, CI:0.97-6.05. When other risk factors, for instance exposure to ionizing radiation, are taken into account, the risk of ipsilateral tumors becomes statistically significant: OR=2.62, CI:1.02-6.71. (See *MWN,* M/J00.)

L. Hardell, K. Hansson Mild, A. Påhlson and A. Hallquist, "Ionizing Radiation, Cellular Telephones and the Risk for Brain Tumors," *European Journal of Cancer Prevention, 10,* pp.523-529, December 2001.

Restates the Medscape results and reviews the Muscat, Inskip and Johansen epidemiological studies.

Study 2

L. Hardell, A. Hallquist, K. Hansson Mild, M. Carlberg, A. Påhlson and A. Lilja, "Cellular and Cordless Telephones and the Risk for Brain Tumors," unpublished manuscript, originally submitted to the *Lancet,* will appear in the June 2002 issue of the *European Journal of Cancer Prevention.*

In this much larger study, with 1,429 cases and 1,470 controls, the use of analog cell phones for longer than a year was associated with a statistically significant increased risk of brain tumors: OR=1.26, CI:1.02-1.56. For longer latency periods, the risks were higher: >5 years OR=1.35, CI:1.03-1.77; >10 years OR=1.77, CI:1.09-2.86. For ipsilateral tumors in the temporal area of the brain, OR=2.50, CI:1.28-4.88. There was no "clear" brain tumor association for users of digital or cordless phones. Among different tumor types, the risk was highest for acoustic neuromas among users of analog phones: OR= 3.27, CI:1.67-6.43.

L. Hardell, K. Hansson Mild and M. Carlberg, "Use of Cellular Telephones and the Risk for Astrocytomas," unpublished manuscript, submitted to *International Journal of Radiation Biology.*

This paper addresses the 588 patients with malignant brain tumors (414 astrocytomas) among the 1,429 cases in the second study. There was no overall increased risk for either analog or digital phones: OR=1.13, CI:0.82-1.56 and OR=1.11, CI:0.85-1.45, respectively. For astrocytomas alone, the risks were approximately the same: OR=1.29, CI: 0.87-1.90 and OR=1.11, CI:0.81-1.53, for analog and digital phones respectively. But the risk was significantly higher for ipsilateral brain tumors among analog phone users: OR=1.85, CI:1.16-2.96 for all malignant brain tumors, and OR=1.95, CI:1.12-3.39 for astrocytomas. For digital and cordless phones, the risk of ipsilateral astrocytomas was OR=1.59, CI:0.98-2.58 and OR=1.70, CI:1.06-2.74, respectively. For astrocytomas in the temporal or occipital areas, OR=9.00, CI:1.14-71.0, based on 12 cases and 5 controls.

OR = odds ratio

CI = confidence intervals

Expert Witnesses on Parade: No Secrets Allowed, But Big Payday

The experts were the stars of the Baltimore hearing. The entire multi-million-dollar *Newman* case will be decided on the credibility and reliability of their testimony.

Angelos's five expert witnesses tried to convince Judge Blake that there is enough evidence linking cell phones to brain tumors to allow the case to go to trial. Conversely, the industry lawyers used their own experts to try to disqualify each member of the Angelos team and get the case thrown out of court.

Serving as an expert can be rewarding, but it's not easy. Those who agree to testify are open to the discovery process and may be required to hand over all sorts of documents, everything from letters to personal notes. For instance, Hardell had to supply the raw data from his most recent, as-yet-unpublished epidemiological study—and then sit quietly as a lawyer picked at every data point.

The defense lawyers hit pay dirt when they obtained the rejection letters Hardell had received from the *Lancet* for this study, thereby undermining the cornerstone of Angelos's case (see p.9). The letters were projected onto a large screen for the whole court to see.

Using Cherry's own e-mails, Jane Thorpe of Alston & Bird, one of the defense firms, showed how Cherry had recruited Richter to serve in what Cherry described as "a worthy cause of global importance." By focusing on the dates of the various documents, Thorpe detailed how Richter had prepared his report in only a couple of days. Richter was forced to concede that he had not done a complete review of the cell phone literature.

Other revelations bordered on the trivial. On cross-examination, Calle was asked why she had highlighted certain passages, but not others, while reviewing one of the brain tumor epidemiological studies. She promptly conceded that there is no deep logic in what she underlines. Calle said that she now wishes she "had never highlighted anything."

How much an expert is paid is also fair game for disclosure. Stampfer said that he commands $450 an hour and that by January he had submitted bills totaling $80,000 to Alston & Bird. Stampfer assured the court that he would soon be submitting another bill, a comment that prompted a roar of laughter from the dozens of lawyers in the courtroom. (The lawyers themselves never revealed how much they are making.) Stampfer also disclosed, sotto voce, that he had consulted with defense attorneys on an asbestos case, as well as on a variety of other cases.

Just like movie stars, the experts are protected from the paparazzi and other annoyances by their lawyer-handlers. A reporter who asked Laterra for his phone number was quickly brushed aside by King "Chip" Hill III of Venable, another defense firm, who said, "You can call *me*," as he hurried Laterra out of the room.

Curt Renner of Watson & Renner, yet another defense firm, shielded Calle from a camera as he escorted her out of the courthouse. Renner later scolded the photographer for even attempting to take a picture of the epidemiologist from the American Cancer Society.

For the Plaintiff

Teaching witness.

Dr. **Neil Cherry**
Environmental Management and Research Division, Lincoln University
Canterbury, New Zealand

"Based on our results and other epidemiology and cellular and animal experimental studies, my opinion is that there is an increased risk for brain tumors in certain parts of the brain, that is, the part with the highest exposure....My opinion is that [Newman's] brain tumor was caused by his use of an analog cell phone."

Dr. **Lennart Hardell**
Department of Oncology, Örebro Medical Center
Örebro, Sweden

"My opinion is that radiofrequency radiation similar to [that] emitted from cell phones can cause DNA genetic damage or related processes in animals."

Dr. **Henry Lai**
Department of Bioengineering, University of Washington, Seattle

"Based on my reading of the bioelectromagnetics literature and my reading of the larger body of science, RFR exposure can produce biological effects that may lead to cancer development."

Dr. **Jerry Phillips**
Biological Sciences Curriculum Study
Colorado Springs, CO

"My opinion is that exposure to radiofrequency [radiation] from cellular telephones can cause cancer. Brain cancer...[in] human beings."

Dr. **Elihu Richter**
Occupational and Environmental Medicine Unit, Hebrew University School of Public Health and Community Medicine
Jerusalem, Israel

For the Defense

"My conclusion based on the epidemiological studies...and...the input of the larger scientific community is...that there's no association [between cell phone] use and brain cancer."

Dr. **Eugenia Calle**
Director of Analytical Epidemiology, American Cancer Society, Atlanta

"There's no plausible scientific connection between low-level exposure to RF power from a cell phone and subsequent biological effects."

Dr. **Christopher Davis**
Department of Electrical Engineering, University of Maryland, College Park

"There is no credible basis in the scientific literature suggesting that RFR can cause brain tumors in animals."

Dr. **Mark Israel**
Department of Genetics
Dartmouth Medical School
Hanover, NH

"[Newman's] cell phone use had nothing to do with [his] tumor....There's clearly no scientific evidence that would implicate cell phone use to brain tumors."

Dr. **John Laterra**
Department of Neurology
Johns Hopkins Medical School, Baltimore

Did not testify.

Dr. **Martin Meltz**
Department of Radiation Oncology, University of Texas Health Science Center, San Antonio

"There is no credible basis to support a causation claim between wireless phone use and brain cancers."

Dr. **Meir Stampfer**
Department of Epidemiology
Harvard School of Public Health, Boston

reliability under the legal standard set by the Supreme Court in the landmark *Daubert* case (see box on p.7).

Thorpe showed the court a letter from the *Lancet,* which notified Hardell last August that it would not publish his paper on brain tumor risks, and a December letter from the *International Journal of Radiation Biology* informing him that two of three peer reviewers had recommended the rejection of his paper on astrocytoma risks. The reviewers raised questions about the study design and the problem of recall bias. Hardell said that he had appealed both decisions.

The editors of the *Lancet* wrote back on October 9 that they were holding firm on their rejection. A consulting statistician "felt that [Hardell's] overall message was written much too forcefully," according to the letter. The appeal to the second journal is still pending.

[As we go to press, Hardell has confirmed to *Microwave News* that the *European Journal of Cancer Prevention* has accepted his brain tumor paper, originally submitted to the *Lancet,* and that it will appear in the journal's June issue. Smouse declined to comment as to whether Angelos's team had informed Judge Blake of this development.]

The defense lawyers — a dozen strong — tried to introduce the text of the peer reviews submitted to the journals, but after a great deal of legal jousting, Judge Blake ruled that they were inadmissable.

The experts for the defense argued that Hardell's epidemiological studies were badly designed, that Newman's tumor was symptomatic 18 months before the March 1998 diagnosis and that it was not located where Hardell said it was.

Dr. Meir Stampfer of Harvard testified that Hardell had used an "incorrect approach" in his analysis of the laterality of the brain tumor risk. His technique gives "a completely distorted estimate of the relative risk," Stampfer told the court.

One of the cornerstones of the defense is that Newman's use of a cell phone prior to his diagnosis in 1998 was approximately 340 hours, which is less than the estimated peak use in the studies by Drs. Joshua Muscat and Peter Inskip, neither of which showed a brain tumor risk (see p.4).

In fact, Dr. John Laterra of Johns Hopkins Hospital testified that symptoms of Newman's brain tumor were already apparent in September 1996, when he had logged only 166 hours of cell phone use.

In his closing argument, defense attorney Tom Watson of Watson & Renner in Washington told Judge Blake that "the selective listing of results barely above the null...does not meet the Daubert standard." The plaintiffs "failed to show that there was an actual increase in brain tumors except by convoluted analysis," Watson told *Microwave News*.

On behalf of the plaintiffs, Smouse closed by telling Blake that a trial is "the traditional vehicle for testing the admissibility of evidence" and asked her to allow the case to proceed.

Courts are not under a deadline to reach a decision. "Sometimes they rule from the bench and sometimes they take months. She's given no indication," Garrett Johnson, a lawyer for Motorola at Kirkland & Ellis in Chicago, told *Microwave News*.

Some other highlights from the expert testimony:

• Dr. Henry Lai said that the comet assay developed by Dr. N.P. Singh is preferred by eight out of nine researchers and is ten times more sensitive than Dr. Peggy Olive's assay. In contrast, Dr. Mark Israel testified that his lab uses the Olive method and that it is "at least as sensitive" as the Singh method.

• Dr. Jerry Phillips disclosed that Dr. Mays Swicord of Motorola asked him to change the conclusion of one of his papers on gene expression and state that any effects of RF/MW exposure are of "no physiological importance."

• Dr. Elihu Richter said that the National Cancer Institute study of brain tumors among cell phone users was done much too soon. That is like "looking for a gray hair in third graders," he claimed.

• On the ability of RF/MW radiation from a cell phone to cause biological effects, Dr. Christopher Davis said: "Underlying [all the bioeffects] is chemical change and underlying that chemical change is bond breakage which just is implausible at the incredibly tiny energies coming from a cell phone."

Five New Brain Tumor Suits

A team led by Mayer Morganroth of Detroit has brought five more brain tumor lawsuits against the wireless industry. The defendants are the leading cell phone manufacturers and service providers, as well as ANSI, the CTIA and the IEEE. The five complaints were all filed on February 25, in a Washington, DC, court. Each seeks over $1 billion in damages.

Morganroth is also representing Michael Murray, a 34-year-old Motorola technician with a brain tumor (see *MWN,* N/D01). Murray's $1.5 billion suit, originally filed in the same court last November, is now in federal court, where Judge Thomas Penfield Jackson will decide whether to return it to the DC court. Jackson presided over the Microsoft antitrust case.

Morganroth, best known for his defense work in criminal cases, has said that he will file many more similar lawsuits. He is working with Sheldon Miller of Detroit and Joanne Suder of Baltimore, who initiated the Newman case in the fall of 2000 (see *MWN,* S/O00 and p.1).

The five plaintiffs are:

• Baldassare Agro, 42, of Howell, NJ, who began using a mobile phone in 1992 and had a malignant glioblastoma removed in January 2000. He used phones made by Motorola, Nokia and Qualcomm.

• Pamela Cochran, 35, of Mt. Airy, MD, who began using a mobile phone in 1997 and had a malignant astrocytoma removed in February 2000. She used phones made by Audiovox, Motorola and Nokia.

• David Keller, 42, of Scottsdale, AZ, who began using a mobile phone in 1995 and had an acoustic neuroma — a benign tumor — removed in March 1999. He used units from Nokia, Sanyo and Sony.

• Dino Schofield, 45, of Valley Glen, CA, who began using a mobile phone in 1988 and had a malignant oligodendroglioma removed in January 1999. He used phones made by Motorola, Nokia and Panasonic.

• Richard Schwamb, 36, of Oakdale, NY, began using a mobile phone in 1995 and has had an acoustic neuroma removed. He used a Qualcomm phone.

working on Brillouin precursors for over 15 years.

The National Academy of Sciences–National Research Council has initiated a study to evaluate Albanese's theories at the request of Senator Edward Kennedy (D-MA), with funding from the USAF (see p.11 and *MWN,* J/F01 and N/D01).

Pulses of radiofrequency or microwave (RF/MW) radiation must have extremely short rise times or very rapid changes in phase in order to create Brillouin precursors on entering "lossy" materials like soil, water or living tissue. (Materials that absorb radiation are called lossy.) Once generated, the new pulses propagate without significant attenuation.

Brillouin precursors present both an advantage and a potential hazard. "They are useful for imaging because they penetrate materials that conventional radar signals do not," explains Dr. Kurt Oughstun, who has long studied the dynamics of RF/MW pulses and has collaborated with Albanese for many years (see interview below). "On the other hand, it may not be a good thing to have signals that penetrate deep into human beings."

Oughstun began investigating Brillouin precursors while a doctoral student at the University of Rochester, NY. At that time, no one thought that they were very significant, he says, but his doctoral research suggested otherwise. Oughstun now believes that Brillouin precursors can be the dominant component of some types of RF/MW pulses traveling through human tissue.

These ideas have prompted some skeptical, even derisive, reactions. Such "strange pulse effects," Dr. Robert Adair of Yale University in New Haven, CT, told Oughstun in a caustic letter last December, "simply don't exist."

Oughstun is unfazed. "I find it odd," he told *Microwave News,* "that the USAF is pushing to develop technologies that use signals that penetrate different materials, while they are ignoring the fact that these signals will also penetrate the body."

While Oughstun has received numerous grants from the USAF's Office of Scientific Research, his work appears to be ignored — or dismissed — by the USAF departments responsible for radiation safety.

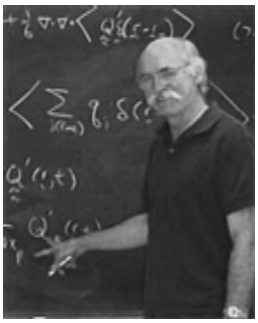
Albanese told *Microwave News* that he decided to go public after discovering that a 1999 report prepared for the MDPH by a panel of four experts ignored Brillouin pulses and the entire issue of phasing (see *MWN,* N/D98, N/D99 and M/A00).

Brillouin Precursors 101 with Professor Kurt Oughstun

Dr. Kurt Oughstun is a professor of electrical engineering and mathematics at the University of Vermont, Burlington. He has done extensive work on the propagation of extremely short electromagnetic pulses through different types of materials, and has collaborated with USAF's Dr. Richard Albanese for over 15 years. Oughstun is the author of more than 50 published papers, as well as the textbook Electromagnetic Pulse Propagation in Causal Dielectrics *with G.C. Sherman (Berlin: Springer-Verlag, 1994). A list of Oughstun's publications is available on his home page, <www.emba.uvm.edu/~oughstun>. He is on the editorial board of* IEEE Transactions on Antennas and Propagation. *The USAF has long supported his research, with no restrictions on what he can publish or present at meetings. In fact, he does not have a security clearance for access to classified information. Oughstun spoke with* Microwave News *in March.*

***MWN*:** Do you agree with Dr. Albanese that the radiation emitted by a phased array radar system is different from other sources of RF/MW radiation or from an ordinary radar?

KO: Yes, I do. Our research has shown that the electromagnetic field radiated from an antenna system like PAVE PAWS can penetrate much deeper into the human body than the radiation from a conventional radar. Let me explain why: In a phased array system like PAVE PAWS, several individual antennas radiate pulses in a specified time sequence. Within the main beam of the radar, these pulses are typically separated by short time intervals. In the side lobes outside the main beam, however, the time intervals between the various pulses will be different and the assembly of pulses can overlap each other in such a way that they may produce an extremely rapid change in phase in the electromagnetic field.



KURT OUGHSTUN'S WORK HAS BEEN SUPPORTED BY THE U.S. AIR FORCE FOR MANY YEARS.

***MWN*:** What happens when the phase changes very rapidly?

KO: The most important effect is that the radiation no longer decays exponentially in lossy materials such as water, foliage and biological tissue. In these cases, most of the RF energy is absorbed within a few centimeters. But our research shows that if a change in phase is sufficiently rapid, a quasi-static field known as a Brillouin precursor is generated when the radiation penetrates the human body. This special type of wavefield was first described by the French physicist Leon Brillouin in 1914. We have found that pulses that produce a Brillouin precursor can deliver a significant fraction of their energy deep into the tissue — much more so than can pulses from a conventional radar.[1]

***MWN*:** If the phased-array radiation is deposited deeper into the human body, what can it do when it gets there?

KO: The Brillouin precursor field is totally different from the RF/MW radiation addressed in ANSI/IEEE exposure standards. In his 1994 paper,[2] Dr. Richard Albanese described four potential mechanisms for biological tissue damage due to a Brillouin precursor. These are changes in the conformation of molecules, changes in the rates of chemical reactions, effects on membranes and thermal damage. In my opinion, the most serious may be the membrane effects. A single Brillouin precursor can open small channels through the cell membrane because, as it passes through the membrane, it can induce a significant change in electrostatic potential across that membrane.

***MWN*:** One of the contentious effects of microwave radiation is leakage through the blood-brain barrier. Do you think that PAVE PAWS radiation may be more likely to induce such leakage?

Does USAF Have Secret Health Studies on Phased Array Radiation? Tensions Surface at NAS–NRC Meeting on PAVE PAWS Radar

"I want to know the effects that the PAVE PAWS radar is having in my community," Richard Judge, an elected official from Cape Cod, MA, told the newly constituted committee of the National Academy of Sciences–National Research Council (NAS–NRC) that is investigating the possible health effects of the U.S. Air Force (USAF) radar. "We need to know why the rates of disease are higher in our community."

"We were told that there are no studies of phased array radiation, but we now believe that's not true," Judge charged at the panel's first meeting on March 15 in Washington. "We would like to see the [USAF's] electromagnetic safety program, which is classified."

Before Judge spoke, Jimmy Dishner, the executive director of the PAVE PAWS project, emphasized that he and the USAF treat any allegation that the radar might be harming the people it is designed to protect "very seriously."

In a series of presentations, USAF officials said that there is no evidence to suggest that the radar is responsible for any health problems on the cape.

"There is no plausible reason to believe that PAVE PAWS is a unique RF energy source from the point of view of the human body or any biological entity," said Dr. Johnathan Kiel of Brooks Air Force Base (AFB) in San Antonio.

None of the USAF presentations mentioned any classified health data.

Then, Dr. Richard Albanese addressed the committee over a speakerphone from San Antonio. Albanese, a career USAF researcher who reports to Kiel, is the individual most responsible for the new NAS–NRC study. Close to two years ago, he wrote to the Massachusetts Department of Public Health warning that the potential effects of the PAVE PAWS radiation are "completely unexplored" (see p.1 and *MWN,* S/O00).

Albanese said that he is "particularly concerned about brain tumors" in the communities near the radar installation.

"There are simply no *published* data sets for phased arrays," Albanese told the committee. As he repeatedly emphasized the word "published," it became apparent that there are reports classified secret that are not available without a security clearance.*

At one point, while explaining the biological importance of phasing, Albanese cut himself off and said that any further discussion would have to take place in "another setting."

Asked after the meeting about the stark contrast between his concerns and the literature reviews presented by members of the USAF team, Albanese† told *Microwave News* that, "There are two distinct tracks. There is a two-world situation at work."

The tension over secret information nearly boiled over when Judge sought to give the NAS–NRC staff copies of two of Albanese's papers, which had been obtained by Charles Kleekamp, a retired engineer who serves as a technical advisor to citizen activists on the Cape. The equations in the papers were garbled, however, prompting NAS–NRC's Dr. Rick Jostes to say that he would request original copies from the USAF.

Judge said that he was skeptical that the USAF would supply the papers and insisted that Jostes accept his copies — which he eventually did. Kleekamp said that it had taken him a year to obtain the two papers.

Albanese told *Microwave News* that the papers do not contain classified material. He explained that the USAF could nevertheless limit access to them. "Because they do not conform to USAF policy, they are able to stop them from open distribution," he said. (See also commentary, p.19.)

On April 25, the USAF will hold a classified briefing‡ in San Antonio for those members** of the NAS–NRC panel with security clearances: Dr. Larry Anderson of Battelle Labs in Richland, WA, and Dr. Robert Hansen, an RF consulting engineer based in Tarzana, CA. Dr. Evan Douple, the NAS–NRC study director, also has a clearance. Albanese himself has a "top secret" clearance.

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*The USAF has posted references to 16 Albanese papers at <www.pavepaws.org/Library.htm>. At the same location, there is a list of 39 papers by Dr. Kurt Oughstun (see p.10), which was assembled by Albanese.

†Albanese spoke to *Microwave News* as a private citizen, not on behalf of the USAF.

‡For information on the next open meetings, see p.13.

**For a complete list of committee members see *MWN,* J/F02. See also p.2.

KO: Published laboratory results have demonstrated that low-intensity electromagnetic radiation modifies the blood-brain barrier in laboratory animals. Additional work has shown that electromagnetic pulses with the same average power but different pulse characteristics result in different barrier permeabilities. Because the PAVE PAWS system can produce a sequence of Brillouin precursors in the brain — each precursor opening small channels through the cell membrane — radiation from the PAVE PAWS system may indeed be more likely to induce such leakage.

***MWN*:** Are Brillouin precursors unique to PAVE PAWS radiation?

KO: No — not at all.

***MWN*:** What other real-world radiation sources could they be associated with?

KO: As data transmission rates continue to increase, wireless communication systems will approach closer to and may, at some time in the not-too-distant future, exceed the conditions necessary to produce Brillouin precursors in living tissue.

***MWN*:** The FCC recently authorized certain types of ultrawideband (UWB) signals — for example, for imaging and for short-range communications [see p.17]. Could these signals, as well as other types of UWB, generate Brillouin precursors?

KO: Yes. In fact, some of the UWB imaging technologies being developed are based on Brillouin precursors. In the past few years, I have been modeling the behavior of Brillouin precursors in substances like soil and vegetation for the USAF. They are ideal for locating objects hidden underground or beneath a tree canopy because they can penetrate through substances that absorb conven-

tional radar, and then reflect off any metal surface that may be hidden underneath.

***MWN*:** Why do you think that these ideas have prompted such skepticism among some who work on RF/MW bioeffects?

KO: Two reasons immediately come to mind. First of all, it has been long assumed that the adverse effects of electromagnetic radiation on living beings are primarily thermal in nature. Any nonthermal effects are assumed to be comparatively insignificant. Because of this assumption, safety standards have been established based solely on thermal effects. Entire industries that use RF/MW technologies support these safety standards. Naturally, they will resist any changes prompted by the recognition of nonthermal effects.

***MWN*:** What is the other reason?

KO: The most widely accepted view of pulse dispersion is based upon the so-called group velocity approximation. Because of its inherent simplicity, many researchers have embraced this approximation without paying much, if any, attention to its accuracy. But this approximation breaks down for pulses with short rise times.

***MWN*:** What is the group velocity approximation?

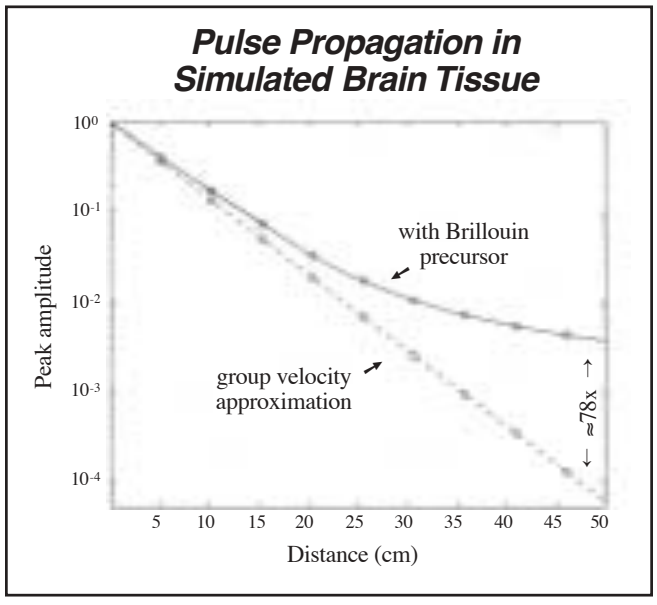
KO: It is based on the idea that the carrier frequency of the pulse dominates the behavior of the pulse. Other frequencies that are present when the pulse enters a lossy material are assumed to be negligible in comparison. But in reality, the Brillouin precursors can become the dominant field.[3]

***MWN*:** Give us an example of what happens to short-rise-time pulses with a 430 MHz carrier frequency traveling through simulated brain tissue.

KO: The group velocity approximation predicts that the pulses decay very quickly. But if you take into account the Brillouin precursors, you see that the strength of the signal is 78 times greater at a depth of 50 cm. [See figure below.]

***MWN*:** But our brains aren't that big. Do Brillouin pulses still matter?

KO: Yes, because the pulses are repeatedly reflected back and forth inside the skull cavity, resulting in an effectively long propagation distance, as well as in several hot spots due to beam focusing.



***MWN*:** Dr. Robert Adair is perhaps your and Dr. Albanese's harshest critic. How do you respond to his contention that such "strange" pulse effects "simply don't exist"?

KO: Dr. Adair's statement is simply wrong. Our research program is mathematically rigorous and we present a physically correct theoretical description of the dynamics of extremely short pulses. The work began at the University of Rochester in the 1970s and continues today at the Computational Electromagnetics Laboratory at the University of Vermont, where I work.

***MWN*:** We still don't understand how Adair, a physicist with a chair at Yale University, could say that these ideas are outlandish. Are they that esoteric?

KO: I can only guess what any person says or believes. Perhaps it is because the math used to model the behavior of Brillouin precursors — which is known as asymptotic analysis — can be very complicated. In fact, the famous Norwegian mathematician N.H. Abel is said to have called it "the invention of the devil." But the asymptotic description of pulse behavior* has been completely verified by independent numerical solutions and by carefully designed experiments. In spite of this incontrovertible evidence, many researchers continue to cling to the group velocity description.

***MWN*:** Has a Brillouin precursor ever been experimentally observed in tissue?

KO: I have not seen any lab results, but I believe that the USAF has sponsored experiments that have shown Brillouin precursors in tissue. If so, the results have not been published. I do know that researchers working under contract for the USAF have observed a beautiful Brillouin precursor in water. These experimental results were reported in 1988 by Richard Smith in "Dispersive Pulse Propagation: First Experiments," which may be found at the Defense Technical Information Center. But here again, these important results have not been published in the open literature.

***MWN*:** Why not?

KO: These experiments require some highly sophisticated technology and the USAF may be reluctant to discuss it in public. More significantly, it may also be that these results raise several health and safety issues that the USAF is unable — or perhaps even unwilling — to address at this time. To be sure, our current safety standards for exposure to pulsed electromagnetic radiation have failed to consider these critical factors.

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* This is known as the Oughstun-Sherman representation.

1. K. Oughstun, "Noninstantaneous, Finite Rise-Time Effects on the Precursor Field Formation in Linear Dispersive Pulse Propagation," *Journal of the Optical Society of America A, 12,* pp.1715-1729, 1995; P. Smith and K. Oughstun, "Electromagnetic Energy Dissipation and Propagation of an Ultrawideband Plane Wave Pulse in a Causally Dispersive Dielectric," *Radio Science, 33,* pp.1489-1504, November-December 1998.

2. R. Albanese et al., "Ultrashort Electromagnetic Signals: Biophysical Questions, Safety Issues and Medical Opportunities," *Aviation, Space and Environmental Medicine, 65 (Supplement)*, pp.A116-A120, May 1994.

3. H. Xiao and K. Oughstun, "Failure of the Group Velocity Description for Ultrawideband Pulse Propagation in a Double Resonance Lorentz Model Dielectric," *Journal of the Optical Society of America B, 16,* pp.1773-1785, 1999.

FROM THE FIELD

Meeting Notes: Italy, Russia, Japan, U.S. and Canada

• There will be two workshops during the COST281/EBEA meetings in **Rome**. ***Emerging Technologies,*** chaired by **Gerd Friedrich** of the FGF, the German mobile phone research group, will focus on 3G phone systems, which will be widely available later this year, and 4G systems, which are still on the drawing boards. ***Mobile Phones and Children,*** chaired by Dr. **Luc Martens** of Belgium's Ghent University, will address the "conjectures" in the U.K. Stewart report that children may be more at risk from cell phone radiation (see *MWN,* M/J00). Four experts are being invited to speak at each workshop (their names had not been announced at press time). Detailed descriptions of the two workshops are on the COST281 Web site, <www.cost281.org>. Attendance at some of the other COST 281/EBEA sessions will be restricted. The preliminary schedule states that the "forum and the MCM will not be open for everyone," but the criteria for attendance are not specified. Friedrich, who serves as the scientific secretary of COST281, did not respond to a request for clarification — nor did the meeting organizers at the University of Rome.

• The dates and parts of the agenda for the September EMF meeting in **Russia** have changed. The meeting will now begin a week earlier — at the request of European and American attendees, according to Andrey Vasin, the conference coordinator. A daylong roundtable, *Discussion of Results of Experiments with Chronic EMF Exposure Conducted Several Years Ago in the USSR, Which Serve as the Basis for EMF Standards in the USSR and Russia,* will take place in **St. Petersburg** on September 23. A "friendly party" will follow. "We are currently asking the Russians to give full details of the studies on which they base their standards so we can do a proper critique of them and compare their results in a much more informative and scientific manner," Dr. **Michael Repacholi**, who leads the WHO's EMF standards harmonization project, told *Microwave News*.

• The scheduled speakers at the May EMF forum in **Tokyo**, organized by the **Gauss Network**, a citizen activist group, will include Dr. **Hiroshi Yamasaki**, the former chief of the multistage carcinogenesis unit at IARC in Lyon, France. Yamasaki will review IARC's decision to classify EMFs as a "2B" carcinogen (see *MWN,* J/A01). Dr. **Neil Cherry** of New Zealand, **Libby Kelley** of the U.S. and **Anne Silk** of the U.K. are also on the program.

• This year's ***Gordon Conference on Bioelectrochemistry*** will be chaired by Dr. **Raphael Lee** of the University of Chicago. Dr. **Richard Nuccitelli**, a professor emeritus at the University of California, Davis, will serve as the vice chair. A preliminary list of speakers and their topics appears in the February 15 issue of *Science*.

• The NAS–NRC **PAVE PAWS** committee has scheduled two more meetings — both on Cape Cod, MA, the home of the USAF radar (see p.11, also p.1). On May 28-29, the panel will meet in Sandwich. There will be a **public forum** on May 28. Then, on July 15-16, the committee will meet at Woods Hole. It will hold an information gathering session open to the public. Details are posted on the NAS–NRC Web site, <www.nationalacademies.org>.

• Symposia on the **precautionary principle** are being arranged for each of two upcoming **epidemiology** conferences, both to be held in Canada in August. *Environmental Exposures, Public Health and the Precautionary Principle* will be featured at the International Society for Environmental Epidemiology meeting in Vancouver. The following week in Montreal, the International Epidemiological Association will host a session on *Evidence to Action: Science, Ethics and Precautionary Preventive Interventions*.

New Listings

May 2-5: **COST 281/EBEA Forum on European Projects, COST 281 Management Committee Meeting (MCM)** and workshop on **Emerging Technologies** (May 4) and **Mobile Phones and Children** (May 5), Rome, Italy. Contact: Dept. of Electronic Engineering, "La Sapienza" University of Rome, via Eudossiana 18, Rome, Italy. E-mail: <cost281-rome@mail.elettra2000.it>, Web: <www.cost281.org>.

May 11-12: **International Forum on Health Issues of EMFs,** Edo-Tokyo Museum, Japan. Contact: Tetsuo Kakehi, Gauss Network, Higashiyamatoshi Nakahara 3-10-1, C-201, Tokyo 207-0016, Japan, (81+425) 65-7478, Fax: (81+425) 64-8664, E-mail: <fwnp7112@mb.infoweb.ne.jp>.

July 21-26: **Gordon Research Conference on Bioelectrochemistry,** Mount Holyoke College, South Hadley, MA. Contact: Gordon Research Conferences, PO Box 984, West Kingston, RI 02892, (401) 783-4011 ext.100, Fax: (401) 783-7644, E-mail: <grc@grc.org>.

September 17-25: **3rd International Conference on EMFs and Human Health: Fundamental and Applied Research,** Moscow (September 17-20) and St. Petersburg (September 21-25), Russia. Contact: Andrey Vasin, Institute of Biophysics, (7+95) 190-5421, E-mail: <yugrigor@rol.ru>, Web: <www.pole.com.ru/news_en.htm#eng>.

September 22-26: **3rd World Congress on Microwave and Radiofrequency Applications,** Convention and Exhibition Center, Sydney, Australia. Contact: Congress Managers, (61+2) 9262-2277, Fax: (61+2) 9262-3135, E-mail: <mrfa2002@tourhosts.com.au>, Web: <www.microwave-rf.org>.

November 26-28: **Interim International Symposium on Antennas and Propagation (ISAP),** Yokosuka Research Park, Japan. Contact: Prof. Koichi Ito, c/o Inter Group Corp., Grace Inn Akasaka, 1-10-23 Akasaka Chuo-ku, Fukuoka 810-0042, Japan, Web: <www.ieice.org/cs/ap/ISAP2002>.

Selected Upcoming Meetings

(For a complete list, see MWN, *N/D01 and J/F02.)*

August 11-15: **12th Conference of the International Society of Exposure Analysis (ISEA)** and **14th Conference of the International Society for Environmental Epidemiology (ISEE),** University of British Columbia, Vancouver, Canada. Contact: Dr. Michael Brauer, UBC Conference Center, 5961 Student Union Blvd., Vancouver, BC V6T 2C9, Canada, (604) 822-1050, Fax: (604) 822-1069, E-mail: <brauer@interchange.ubc.ca>, Web: <www.conferences.ubc.ca/events/iseaisee2002>.

August 18-22: **16th International Epidemiological Association World Congress of Epidemiology,** Montreal, Canada. Contact: Congress Secretariat, c/o Events International Meeting Planners, 759 Victoria Sq., Ste.300, Montreal, PQ H2Y 2J7, Canada, (514) 286-0855, Fax: (514) 286-6066, E-mail: <iea2002@eventsintl.com>, Web: <www.iea2002.com>.

Hot New Papers

Maren Fedrowitz, Jürgen Westermann and Wolfgang Löscher, "Magnetic Field Exposure Increases Cell Proliferation But Does Not Affect Melatonin Levels in the Mammary Gland of Female Sprague Dawley [SD] Rats," ***Cancer Research, 62,*** **pp.1356-1363, March 1, 2002.**

"By using two different proliferation markers, the present study demonstrates that, at least under conditions of our experimental protocol [two-week exposure at 100 μT (1G)], MF exposure significantly enhances proliferation in the mammary epithelium of female SD rats. This effect of MF exposure occurred in the absence of any alteration in pineal or mammary melatonin levels. On the basis of numerous previous observations in experimentally induced mammary tumors in rats, an increased proliferative activity of the mammary epithelium in response to MF exposure is a likely explanation for the cocarcinogenic or tumor-promoting effects of MF exposure observed previously by us in the DMBA model of breast cancer." (See *MWN,* S/O99; also J/F99 and J/F02.)

Mel Greaves, "Childhood Leukemia," ***British Medical Journal, 324,*** **pp.283-287, February 2, 2002. (Full text available at <www.bmj.com>.)**

"Epidemiological evidence suggests that ionizing radiation, certain chemicals (such as benzene), viruses (human T cell leukemia/lymphoma virus type I, Epstein-Barr virus) and bacteria *(Helicobacter pylori)* may play a part in the development of some subtypes of leukemia and lymphoma in adults and children. Whether any of these exposures have a major role in childhood leukemia is uncertain, but large-scale case-control molecular epidemiological studies in Britain and the United States may provide answers. The U.K. children's cancer study (UKCCS)...and a parallel U.S. study have already ruled out electromagnetic fields as a major factor in leukemia etiology."

James McDevitt, Patrick Breysse, Joseph Bowman and Dina Sassone, "Comparison of Extremely-Low-Frequency (ELF) Magnetic Field Personal Exposure Monitors," ***Journal of Exposure Analysis and Environmental Epidemiology, 12,*** **pp.1-8, January 2002.**

"The EMDEX Lite and [the MultiWave System III (MW III)] provided comparable measures of TWA ELF magnetic field magnitudes in multiple job classifications and [a] variety of magnetic field environments. Although there was no significant difference in mean TWA measures, our findings indicate the maximum ELF magnetic field magnitudes measured by the EMDEX Lite were significantly lower than those measured by the MW III."

J. Deadman and C. Infante-Rivard, "Individual Estimation of Exposures to Extremely-Low-Frequency Magnetic Fields in Jobs Commonly Held by Women," ***American Journal of Epidemiology, 155,*** **pp.368-378, February 15, 2002.**

"By job category, the most highly exposed jobs (>0.23 μT [2.3 mG]) included bakery worker, cashier, cook and kitchen worker, electronics worker, residential and industrial sewing machine operator and textile machine operator. By work environment, the most highly exposed job categories were electronics worker in an assembly plant (0.70 μT) and sewing machine operators in a textile factory (0.68 μT) and shoe factory (0.66 μT)."

Michael Kanda, Quirino Balzano et al., "Effects of Ear-Connection Modeling on the Electromagnetic Energy Absorption in a Human-Head Phantom Exposed to a Dipole Antenna Field at 835 MHz," ***IEEE Transactions on Electromagnetic Compatibility, 44,*** **pp.4-10, February 2002.**

"Specific absorption rate (SAR) compliance measurements for wireless personal devices are usually performed in anatomically correct phantoms. The phantoms have a lossless spacer to model the external ear (pinna). The use of a lossless spacer has been questioned. The purpose of this paper was to study the effects of the lossy pinna by E-field and numerical assessments validated with thermal measurements....The results of this investigation using a canonical structure (rectangular box and balanced dipole) clearly show that although the location of the absorption maxima might be different, the difference in magnitude of the peak 1 g averaged SAR between the lossy and the lossless pinna is negligible. The location of the peak may shift, but actual impact of the shift on the 1 g average SAR falls within the measurement uncertainty....To keep the phantom model for cellular phone dosimetry at a reasonable geometric and maintenance level of complexity, it is suggested that the pinna be simply simulated by a thin lossless dielectric spacer. The spacer should be 4 mm thick (6 mm including the 2 mm phantom shell) and shaped like a human ear collapsed under the slight pressure of placing the cellular phone at the pinna." (See *MWN,* N/D99, J/F00 and J/F01.)

E. Fear, S. Hagness, P. Meaney, M. Okoniewski and M. Stuchly, "Enhancing Breast Tumor Detection with Near-Field Imaging," ***IEEE Microwave Magazine,*** **pp.48-56, March 2002.**

"In the next decade, microwave systems are likely to become a viable diagnostic option for many women....More so than for any other cancers, breast tumors have electrical properties at microwave frequencies that are significantly different than those of healthy breast tissues....The methods are attractive to patients because both ionizing radiation and breast compression are avoided, resulting in safer and more comfortable exams. Microwave breast tumor detection also has the potential to be both sensitive and specific, to detect small tumors and to be less expensive than methods such as MRI and nuclear medicine. The imaging process is expected to be very rapid. The key to sensitivity, specificity and the ability to detect small tumors is the electrical property contrast. In particular, we anticipate a contrast between malignancies and nor-

Magnetic Fields Decrease Rate of DNA Repair

Jacob Robison et al. (including Kim O'Neill), "Decreased DNA Repair Rates and Protection from Heat-Induced Apoptosis Mediated by Electromagnetic Field Exposure," ***Bioelectromagnetics, 23,*** **pp.106-112, February 2002.**

"Our results demonstrate that [0.15 mT (1.5 G) 60 Hz sinusoidal for time periods between 4 and 24 h] EMF exposure offers significant protection from apoptosis ($p<0.0001$ for HL-60 and HL-60R, $p<0.005$ for Raji) after 12 h of exposure and that protection can last up to 48 h after removal from the EMF....Results showed that EMF exposure significantly decreased DNA repair rates in HL-60 and HL-60R cell lines ($p<0.001$ and $p<0.01$, respectively), but not in the Raji cell line. Importantly, our apoptosis results show that a minimal time exposure to an EMF is needed before observed effects....Our studies demonstrated that EMF exposure results in a time-dependent decrease in susceptibility to heat-induced apoptotic signaling for three human cancer cell lines as well as a time-dependent decrease in DNA repair rates for two of these cell lines. Importantly, these results suggest a mechanism by which EMF exposure may influence tumor formation....These two effects of EMF exposure may combine to further increase the probability of perpetuating DNA mutations that eventually lead to cancer."

mal tissues that is more significant than the density contrast imaged by X-rays....[W]e anticipate weaker responses from benign lesions, while malignancies are expected to be the dominant feature in images." (See *MWN*, M/A00.)

Dean Yamaguchi et al., "Inhibition of Gap Junction Intercellular Communication by Extremely-Low-Frequency Electromagnetic Fields in Osteoblast-Like Models Is Dependent on Cell Differentiation," *Journal of Cellular Physiology, 190,* pp.180-188, February 2002.

"[EMFs] have been used to augment the healing of fractures because of [their] ability to increase new bone formation. The mechanism of how [EMFs] can promote new bone formation is unknown...[M]agnetic fields over a frequency range from 30 to 120 Hz and field intensities up to 12.5 G dose-dependently decreased gap junction intercellular communication in MC3T3-E1 cells during their proliferative phase of development....ELF magnetic fields may affect only less differentiated or pre-osteoblasts and not fully differentiated osteoblasts....[T]he mechanism of [EMF] inhibition of gap junction communication...may be at the level of gating gap junction channels either directly mediated by [EMFs] on gap junction proteins in the plasma membrane or indirectly via action of [EMFs] on other cellular messenger systems."

Christopher Mueller, Helmut Krueger and Christoph Schierz, "Project NEMESIS: Perception of a 50 Hz Electric and Magnetic Field at Low Intensities (Laboratory Experiment)," *Bioelectromagnetics, 23,* pp.26-36, January 2002.

"The double-blind laboratory experiment tested the hypothesis that there are subjects with the ability to perceive 50 Hz EMFs at 100 V/m and 6 μT (60 mG)...A total of 63 volunteers, 49 with [electrical hypersensitivity syndrome (EHS)] and 14 controls...had to...[judge] 10 sham and 10 exposed 2 min blocks in [a] randomized sequence....When performing 63 independent statistical tests, three significant results with $p<0.05$ are expected to occur by chance....The individual analyses...produced seven significant results...The probability to get seven or more significant results out of 63 tests is $p=0.037$....The result...indicates that a small but statistically significant number of subjects is able to detect weak 50 Hz [EMFs]...Since there was no difference in the EMF perception scores between [the EHS group and controls]...it can be assumed that the subjective hypersensitivity to electricity is not correlated with the actual ability to detect weak EMFs." (See *MWN*, N/D00).

Across the Spectrum

"At the end of the day, it is a question of which kind of a society we live in: Wherever you go you'll be faced with electromagnetic fields. If you don't dare drive your Volvo car, you don't dare take a commuter train."

—Lennart Strom, spokesperson, Volvo Car Corp., Gothenburg, Sweden, commenting on test results published by *Vi Bilägare,* a Swedish motorists' magazine, showing that magnetic fields in Volvo cars can be as high as 180mG — the highest of any of the makes tested — quoted by Anna Peltola, "Three Volvo Cars Pose Electromagnetic Risk — Study," *Reuters,* February 14, 2002 (see p.16)

Indeed, Americans have experienced the pain and suffering that can result from insufficient precaution in risk management. The health risks of smoking, the neurotoxic effects of low doses of lead, once used as an additive to gasoline, and the respiratory diseases from exposure to asbestos in the workplace — each became major public health problems in the U.S. Public health historians teach us that these problems could have been reduced or even prevented altogether if early signals of danger had stimulated precautionary measures by risk managers.

—Dr. John Graham, administrator, Office of Information and Regulatory Affairs, U.S. Office of Management and Budget, Washington, "The Role of Precaution in Risk Assessment and Management: An American's View," p.2., presented at *The U.S., Europe, Precaution and Risk Management: A Comparative Case Study Analysis of the Management of Risk in a Complex World,* a conferencce organized by the European Commission, the U.S. Mission to the European Union and others, Brussels, January 11-12, 2002

"When people have all the facts, they can deal with risk. That was the central lesson from the influential inquiry into the government's handling of the BSE crisis. What will it take to get health officials to learn it?"

—Editorial on the U.K. Department of Health's dismissal of public concerns about a possible link between vaccination for mumps, measles and rubella (MMR) and autism, "Come Clean: Britain's Stance on MMR Won't Wash, and People Know It," *New Scientist* (U.K.), February 16, 2002; BSE refers to mad cow disease

"Microwave News" Flashback

Years 20 Ago

• Massachusetts public health officials draft a maximum 200 μW/cm^2 general population standard for RF/MW radiation — the most stringent state limit in the country.

• The Ontario government investigates a cluster of miscarriages among VDT operators at Toronto's Old City Hall.

Years 10 Ago

• Women operating VDTs that emit strong magnetic fields are more likely to miscarry than those using low-field terminals, reports Dr. Maila Hietanan at the first EBEA conference in Brussels.

• An advisory panel to the U.K.'s NRPB, headed by Sir Richard Doll, concludes that "no firm evidence" exists that links exposure to ELF EMFs and cancer.

• Angered by industry remarks condemning prudent avoidance, Dr. Granger Morgan of Carnegie-Mellon University counters that the policy "is an example of using incomplete science to make a reasoned judgment in the face of uncertainty."

Years 5 Ago

• Physicists and biologists clash over the threshold for EMF effects at an NIEHS meeting. Physicists say that they only occur at 1G or above, but biologists argue they can see changes at 10-20 mG.

• Lifetime animal studies are the number one priority, the FDA tells the cell phone industry.

• At an FDA workshop on biological effects of wireless radiation, Dr. Stephen Cleary of Virginia Commonwealth University criticizes the industry. "It is ultimately frustrating that no one wants to fund this research," he says.

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UPDATES

ALLERGIES

Chromium Rashes... Splotches that break out on the cheeks of cell phone users may have nothing to do with radiation. In a case report appearing in the February issue of *Archives of Dermatology (138,* pp.272-273, 2002), Japanese doctors describe how a shiny chromium-plated phone can cause an allergic reaction in a 35-year-old woman. "Chromate is a common cause of allergic contact dermatitis," they state. They close their case study by noting that they had also recently seen two teenaged boys who had similar allergic reactions.

AUTOMOBILE EMFs

High Magnetic Fields in Volvos... Drivers of some Volvo cars can be exposed to ELF EMFs over 175 mG, according to a Swedish motorists' magazine. *Vi Bilägare* reported in February (issue No.2, 2002) that three Volvo models had the highest levels in a survey of 13 cars from eight different manufacturers. Fields up to 180 mG, primarily in the 30-70 Hz range, were measured in the V70 station wagon, and 150 mG and 120 mG EMFs were found in the S60 sedan and the S80 sedan, respectively. The highest readings in all three cars were in the area where the driver's left foot usually rests. Strong fields were also found at seat level on the driver's side (20-30 mG) and on the left rear seat (30-66 mG). The source of the fields is a cable that runs from the generator in the front of the car to the battery in the rear. According to Dr. Kjell Hansson Mild of Sweden's National Institute for Working Life in Umeå, the company has known about the problem since 1996. Indeed, at a bioelectromagnetics meeting held in Bologna, Italy, in June 1997, Dr. Yngve Hamnerius of Chalmers University of Technology and Kjetil Vedholm of the Volvo Truck Corp., both in Gothenberg, reported that ELF EMFs were approximately 10 times higher in cars with the battery in the back. In the 5 Hz-2 kHz band, the levels were below 5 mG when the battery was in the front and up to 40 mG with the battery in the rear. In a statement issued on February 15, the day after *Vi Bilägare* published its findings, Volvo Car Corp. said that it takes concerns about EMFs "with the utmost seriousness," but pointed out that the readings were "10-100 times under the recommended limits" adopted by the EU Council of Ministers (see p.15 and *MWN,* J/A 99). "There are no reasons for Volvo to take technical or other measures," the company asserted. On February 20, the company changed course and announced that, for about $200, Volvo owners in Sweden will soon have the option of installing a new electrical cable that will lower EMFs by a factor of ten. (No word yet on whether owners in other countries will be given the same offer.) While cars made by other manufacturers fared better in the *Vi Bilägare* survey, readings above 10 mG were common. Passengers in the rear seats of BMW sedans, for example, could be exposed to 25 mG. The magazine is set to publish measurements on a second set of cars in mid-April. In 1998, James Hatfield, Dr. Samuel Milham and Richard Tell reported that spinning steel-belted radial tires could produce ELF fields as high as 20 mG inside cars (see *MWN,* M/A 98)....Meanwhile, TCO Development has announced that Volvo Truck Corp. has become the first major international corporation to include the TCO'01 specifications for mobile phones used by its employees. (Volvo

Truck Corp. is independent from Volvo Car Corp., which became a subsidiary of Ford Motor Co. in 1999.) Volvo's example is being followed by a number of others, TCO stated. (See *MWN,* N/D00 and J/F01.)

MILITARY RADAR

German Veterans Go to Court... On March 26, six former soldiers with injuries stemming from working with radar sued the German Ministry of Defense for compensation. They each want lump-sum payments of at least €60,000 and larger pensions. Reiner Geulen, their Berlin-based attorney, also represents more than 700 servicemen with cancer and other ailments, who may file their own claims. Last June, after an independent commission set up by the defense ministry reported that some soldiers had been exposed to X-rays generated by high-power radars, Defense Minister Rudolf Scharping said that compensation claims would be settled in a "prompt, nonbureaucratic" manner (see *MWN,* S/O01). After reviewing a third of the 1,500 claims that have been filed, the ministry has rejected all but eight because the vast majority could not show they had been exposed to X-rays. Citing work by Dr. Eduard David of the University of Witten/Herdecke, the commission had concluded that radar radiation was unlikely to have damaged the soldiers' health. But Remo Klinger, an attorney working with Geulen, believes that RF/MW exposures should not be discounted. "Microwave radiation and X-rays together are much more dangerous than microwaves alone," Klinger told *Microwave News*. The Geulen firm also announced in March that it is working with a "major American law firm" to bring lawsuits in the U.S. against ITT, Raytheon and other manufacturers of military radar used in Germany from the 1950s through the 1970s. Geulen said that the approximately 400 plaintiffs would include Dutch, Greek and U.S. citizens in addition to German servicemen and their families. (In the 1970s and 1980s, a number of U.S. electronics companies settled a variety of radar health claims out of court; see *MWN,* D82.)

ULTRAWIDEBAND

FCC Authorizes Limited Use... On February 14, the FCC gave a green light to ultrawideband (UWB) technology for imaging, surveillance and communications. It could soon approve other applications. In its preliminary order, the FCC specified limits for UWB devices to curb interference with aviation radar and other electronic devices. The strength of the UWB signal in any specific frequency band must be less than 500 μV/m. For the 960 MHz-1.61 GHz band used by the Global Positioning System (GPS), the FCC set even stricter limits. These vary with the specific application—with the tightest rules for communication systems. Overall, the guidelines "ensure that existing and planned radio services, particularly safety services, are adequately protected," the FCC states, adding that the rules "err on the side of conservatism." The FCC's move follows months of wrangling among government agencies over potential EMI. Early last year, the National Telecommunications and Information Administration (NTIA), a branch of the Department of Commerce that coordinates the government's use of RF/MW spectrum, warned

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that even a small number of UWB devices could potentially cause air traffic control and GPS equipment to malfunction (see *MWN,* M/A01). According to the FCC, its limits are "based in large measure" on the NTIA's recommendations. The rules have apparently eased some of NTIA's concerns. Commerce Secretary Donald Evans hailed the FCC's "balanced approach," noting that it would "promote innovation" and "enhance public safety." But the Air Transport Association is still worried. The industry lobby group is not convinced that the new rules will prevent EMI to a number of systems vital to airline safety, including radar altimeters, microwave landing systems and Doppler weather radar, *Aviation Week* reported on March 4. The FCC has not yet released the final version of the UWB guidelines. In late March, an FCC official predicted that it would do so "any day now." The FCC will consider whether to relax its UWB emissions standards and allow additional applications later this year.

AS WE GO TO PRESS

Joint FCC–FDA Web Site... The FCC and the FDA will soon launch a Web site to provide information on mobile phone safety to consumers, Bruce Romano, associate chief of the FCC's Office of Engineering and Technology, told *Microwave News* in early April. Last year, Sen. Joe Lieberman (D-CT) and Rep. Ed Markey (D-MA) urged the two agencies to develop such a site after a report from the General Accounting Office, the research arm of the U.S. Congress, concluded that the public needed "clear, accurate and timely information" (see *MWN,* M/J01 and J/A01). Romano acknowledged that SAR data are often hard to access on the FCC's Web site. "We are looking into ways of making this information more accessible," he said.

Keeping Current: Follow-Up on the News

◆ Thomas Kuhn, president of the Edison Electric Institute (EEI), the main trade association of the nation's electric utilities, is poised to emerge as "one of Washington's top power brokers," according to the *Washington Post* (March 4). Kuhn was a classmate of President Bush at Yale and is particularly adept at fund-raising. The *Post* reports that the EEI paid him close to $1 million in salary and benefits last year.

◆ The U.K.'s *Daily Mail* (March 1) is reporting that locals are dubbing a road in East London "cancer street" after five people living within 90 feet of a mobile phone site developed cancer over the last seven years. Radiation measurements have not turned up anything unusual, according to Dr. Michael Clark of the NRPB.

◆ Within a decade, the USAF will put a high-power microwave (HPM) weapon on its unmanned strike aircraft, predicts *Aviation Week* (February 25). The research lab at Kirtland AFB, NM, is working on at least five HPM projects designed to zap enemy electronics, according to the usually well-informed magazine.

◆ The March 2002 *IEEE Transactions on Microwave Theory and Techniques,* the 50th anniversary issue, includes a variety of invited papers. Dr. Eleanor Adair and Ron Petersen review biological effects and exposure standards. Drs. Arye Rosen, Maria Stuchly and André Vander Vorst write on medical applications. Dr. John Osepchuk describes microwave power applications.

◆ Just when we had nearly forgotten about the still-unexplained Taos Hum (see *MWN,* M/J93 and N/D93), a similar annoying, low-pitched noise is being heard in Kokomo, Indiana. Residents have been complaining about it for over two years, according to abcnews.com (February 13).

◆ Mobile phone service providers have gotten some unwanted publicity from David Letterman, the host of CBS's popular *Late Show.* Taped in New York City and broadcast every weekday night in the U.S., the talk show is also seen in many other countries — Letterman is a favorite in Sweden. It appears that one of the local wireless companies has erected a cell tower near Letterman's office window. On his March 28 show, Letterman described the three-antenna site as "some kind of deadly X-ray radiation emitting tower." Some staff members are guessing that Letterman will soon be moving to another office.

VIEWS ON THE NEWS

Set Albanese Free

The U.S. Air Force should let Dr. Richard Albanese speak out, unfettered by military secrecy. The scientific community can then decide whether his concerns about Brillouin precursors are justified or not. That is the way the scientific process is supposed to work.

Albanese, an Air Force researcher for more than 31 years, charges that the military is engaged in human experimentation by exposing the residents of Cape Cod to an untested type of radiation from the PAVE PAWS radar. He has shown courage in speaking out when his superiors want him to keep silent.

Professor Kurt Oughstun and Albanese believe that Brillouin pulses have unique properties that allow them to travel through biological tissue with little attenuation (see p.1 and p.10).

Both Oughstun and Albanese are funded by the Air Force. While Oughstun's papers are in the open literature, much of Albanese's work on human health effects is classified secret.

We don't understand why this is so hush-hush. Is the health impact of Brillouin precursors important to our military preparedness? Does the Pentagon fear a Brillouin precursor "gap"?

More generally, why is the Air Force Electromagnetic Health and Safety (EHS) program mired in secrecy? The situation is so out of control that only two members of the National Academy of Sciences committee convened to investigate Albanese's charges are allowed to attend Air Force briefings on the EHS (see p.11).

We suspect that many of the Air Force papers are classified not because their release would be a threat to national security, but because they could force the military to do more to protect the public and those serving in the armed forces.

When you read some of Albanese's equation-laden papers — the few that are accessible — it is easy to forget that he is trained as a physician. Albanese graduated from the Columbia University medical school in 1967. In a field dominated by engineers, a medical doctor should be welcomed with open arms. After all, physicians are as rare in the radiation standard-setting committees as are intensive discussions of nonthermal effects.

Oughstun tells us that Brillouin precursors will become increasingly common as wireless data transmissions become faster and as ultrawideband technologies enter the mainstream. These insights add even greater urgency for less secrecy and for more research.

Albanese and Oughstun's concerns may be unfounded. It may turn out that some radiation pulses do travel deeper, but not deep enough to make any biological difference. Or, the pulses may not be powerful enough to do any damage however deep they do go.

But this is all speculation. The only way to know is to go to the laboratory and do the experiments.

More than a year has passed since Senator Edward Kennedy asked the Air Force to declassify Albanese's work and make it freely available. The Air Force should have done this long ago.

Precautionary Limits for EMFs: Why They Are Needed

Those who continue to resist the call for EMF precautionary limits should think about whether they would want their children to sleep at the day care center in Melbourne, Australia, where magnetic fields are close to 300 mG (see p.3).

Dale Fisher, the general manager at the hospital, must have a lot on her mind beyond EMFs. When confronted by a group of anxious mothers, she probably looked up the applicable standard. Seeing that exposures of up to 1,000 mG are allowed by Australian authorities, by ICNIRP and by the WHO, Fisher labeled the mothers' concerns "emotional" and discounted any health risk.

Numerical limits have their advantages. They give the uninitiated an easy way to gauge safety and compliance. But, once a whole body of scientific and medical literature has been boiled down to a single number, any remaining uncertainties are ignored. For instance, a number cannot communicate that an EMF standard discounts cancer risks or that a panel convened by the International Agency for Research on Cancer (IARC) unanimously classified EMFs as possible human carcinogens at levels as low as 3-4 mG, hundreds of times below the standard.

Precautionary limits — which need not have the same legal weight as other standards — give newcomers added context to reach an informed decision.

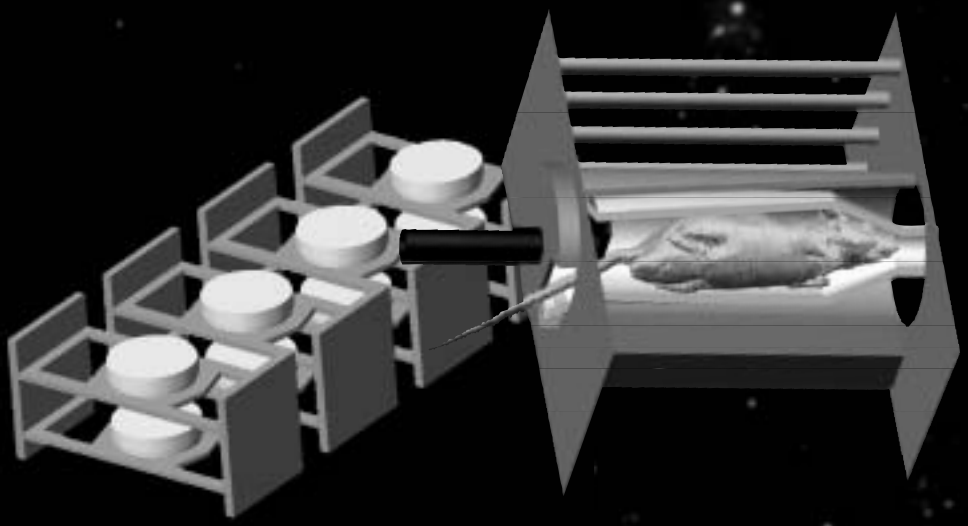
To the north of Melbourne, city officials in Brisbane show how this can be done (see p.3). In the face of the IARC decision, local activists, utility representatives and elected officials agreed on a 4 mG benchmark for upgrading an electrical substation. The agreement states that Energex, the utility, will seek to meet this standard "where reasonably practicable." The town gets its upgraded substation and those living nearby get assurances that the EMF exposures will be kept to a minimum.

Postscript: We are surprised that Mark Elwood, the head of Australia's National Cancer Control Initiative, represented Energex in its appeal. Elwood may not, as he testified, place much confidence in the EMF epidemiological evidence. But it is strange indeed that a government cancer advisor substituted his own judgment for that of IARC, the world's most widely acknowledged arbiter of what is and is not a cancer agent. If the head of the cancer control initiative does not err on the side of caution, who will?

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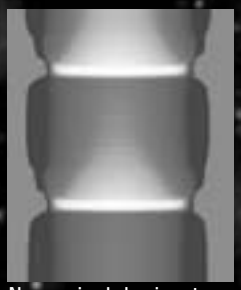
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WHO Invokes Precautionary Principle For High and Low-Frequency EMFs

What's Next Is Far From Clear

The World Health Organization (WHO) has decided that there is "sufficient evidence" to apply the precautionary principle to both power-frequency and high-frequency electromagnetic fields (EMFs).

In a draft position paper distributed at a workshop held in Luxembourg, February 24-26, Drs. Michael Repacholi and Leeka Kheifets, who run the WHO's International EMF Project, announced that they are now invoking the precautionary principle for extremely-low-frequency (ELF) EMFs and radio-frequency and microwave (RF/MW) radiation.

The precautionary principle calls for taking action to protect human and environmental health in the face of uncertain risks. While many, though not all, at the meeting agreed with WHO's decision, the big question that remains unresolved is what types of precautionary recommendations will emerge from the EMF project in Geneva.

"It could mean nothing or it could change the way people approach the EMF issue," Dr. Joel Tickner told *Microwave News* on returning from the workshop. "It all depends on the EMF group at WHO." Tickner, who has written extensively on the precautionary principle, teaches at the University of Massachusetts, Lowell.

Dr. Kenneth Foster of the University of Pennsylvania in Philadelphia, a former consultant to the WHO project who was invited to the Luxembourg meeting, contends that it is practically impossible to argue against the precau-

(continued on p.11)

U.S. NIEHS Advises: It's Okay for Children To Live Next to Power Lines

For the last six months, the National Institute of Environmental Health Sciences (NIEHS) has been telling families that children have nothing to fear from living next to power lines.

A statement posted on the institute's Web site advised:

> It doesn't matter whether or not a house is close to power lines. There is no valid association between nearby power lines and any cancer — including childhood leukemia.

On April 1, a few days after *Microwave News* made inquiries about the statement, it was removed from the NIEHS Web site. "It's probably misleading,"

(continued on p.3)

EMF Program Is "Threatened" By Lack of Funds, EPRI Says

EPRI, the U.S. electric power industry's research group, is warning its member utilities that its EMF health research program may soon come to an end due to a shortage of funds.

"The viability of the program...is threatened," EPRI warned in a December 5 statement. This and other documents recently posted on its Web site offer a rare inside glimpse of the way EPRI markets its EMF program to utility managers.

EPRI points to "severe reductions" that have impaired its "ability to participate and contribute" in the work of scientific review panels. Industry support is needed, it states, to "ensure that EPRI continues to bring to the table its invaluable leadership, experience and expertise." (See box below for EPRI's reasons for wanting to continue EMF research.)

EPRI staffers took part in panels on EMF health risks convened by NIEHS' RAPID program and by IARC (see *MWN*, J/A98 and J/A01). At this February's WHO workshop on the precautionary principle (see p.1), there were four participants who have had long-standing ties to EPRI.

Dr. Robert Kavet, the manager of EPRI's EMF program, declined to comment on the program's budget, saying only that "EPRI takes EMF issues very seriously."

The December 5 statement cites a number of issues that warrant attention, including the well-known association with childhood leukemia, as well as possible links to miscarriages and heart disease. EPRI also points to a risk assessment being planned by the WHO EMF project, the potential for public "outrage" and the possibility that exposure limits could be lowered, imposing "enormous costs" on the power industry (see below).

In January, EPRI posted another statement which leaves open the possibility that the link between EMFs and leukemia is due either to "inadvertent errors" in epidemiologic study design or to contact currents. Much of EPRI's recent EMF work has been targeted to the contact-current hypothesis championed by Kavet (see *MWN*, J/A00).

According to a series of questions and answers on EMFs posted last November on the EPRI Web site, <www.epri.com>, EPRI has spent approximately $150 million on EMF research since it was established in 1973. The posting states that EPRI is now "the sole organization in the U.S. funding a research program to address uncertainties concerning the association of EMFs with childhood leukemia."

CNN's "Medical Myths"

Myth: **Electric blankets cause cancer.**

Fact: That's like saying using electric heat in your home will cause cancer, said Dr. Susan Nelson, internist with the Ochsner Clinic in Baton Rouge, LA. The evidence backs her up. For example, researchers at the Columbia School of Public Health studied more than 2,000 women newly diagnosed with breast cancer. "There was little or no risk associated with ever having used electric blankets, mattress pads or heated water beds," the authors wrote. And they found no substantial difference with duration of use.

—"Medical Myths: Electric Blankets a Hazard to Your Health?" ***CNN Health*** **(<www.cnn.com/health>), February 9, 2003; "Nelson's expertise is in the areas of internal medicine, geriatrics, long-term care (nursing home) [and] end-of-life care (hospice and palliative care)," according to the Ochsner Clinic Web site, <www.ochsner.org>. She has also offerred CNN opinions on other medical myths, including whether knuckle-cracking causes arthritis.**

EPRI: Seven Reasons Why EMF Research Must Continue

• **The childhood leukemia issue is unresolved.** NIEHS, IARC, the U.K.'s NRPB and the California department of health have all concluded that there is a possible risk.

• **Other diseases have been implicated but not adequately studied.** Miscarriages and heart disease have also been implicated: "Potential public health impact will be much higher than that for a rare disease like childhood leukemia."

• **A critical assessment is under way.** "Severe reductions" in the EPRI program "substantially reduce our ability to participate and contribute."

• **Outrage factors are involved.** "EMF taps into public fears about an unknown, unseen and undetectable agent that pervades every home and involves children." It is also "perceived — however unfairly — as being imposed by corporate interests who evade responsibility for correcting the harm they cause."

• **Costs could be enormous.** If the U.S. adopted the Swiss or Italian ELF limits of 2-10 mG, it "would impose enormous costs on power delivery."

• **The scientific basis for existing guidelines is unclear.** "Further research would help clarify the scientific basis for guidelines and reduce the uncertainty that needs to be incorporated into safety factors."

• **"Exceedance" of exposure limits near electric power facilities has been documented.** Electric field levels have been found to exceed exposure limits within rights-of-way of 115 kV and higher transmission lines.

Sources: *Why a Viable EPRI EMF Program Is Essential* (December 2002), and *EMF Exposure Guideline Research: An Electric Power Industry Priority* (December 2002).

Male Breast Cancer Lawsuit Going to Trial in New Mexico

A lawsuit filed by two men who blame EMF exposures at work for their breast cancer will go to trial on April 14. New Mexico Judge William Lang in Albuquerque rejected defense motions to dismiss the case on March 26.

Two years ago, James Montaño and Arthur Slater filed complaints against the City of Albuquerque and Bernalillo County, the joint owners of their office building (see *MWN,* M/J01). Their basement office was next to electrical distribution equipment.

Another man who worked there also developed a breast tumor, but is not a party to this suit. About 1,300 new cases of male breast cancer are reported each year in the U.S., according to the American Cancer Society.

The men are being represented by the Bregman law firm in Albuquerque. Amy Archibeque, one of the attorneys there, said that there may be as many as 30 more claims — involving other ailments — filed on behalf of others who worked in the office.

Plaintiff experts will include: Dr. Sam Milham, an epidemiologist based in Olympia, WA, Cindy Sage of Santa Barbara, CA, and Dr. Marc Wilkenfeld of Columbia University medical school in New York City. In a survey, Sage found magnetic fields above 100 mG in the men's office.

Robert Booms of Butt, Thornton & Baehr in Albuquerque is representing the county. He declined to comment. His experts include: Dr. Alvin Markovitz, a physician based in Los Angeles, Dr. John Moulder of the Medical College of Wisconsin, Milwaukee, and Michael Silva of Enertech Consultants in Campbell, CA. Silva also surveyed the EMF levels in the office. The City of Albuquerque is being represented by its own lawyers.

NIEHS: Children Can Live Next to Power Lines *(continued from p.1)*

National Institutes of Health
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NIEHS News Features

September 2002

Do Power Lines Cause Childhood Leukemia?

NIEHS' New EMF Booklet Has the Answer

Ever since a 1979 study in Denver suggested that children living close to big power lines had a slightly higher risk of getting leukemia, the National Institute of Environmental Health Sciences and other environmental agencies have received thousands of inquiries about how far a house needs to be from a power line to be "safe" for the kids.

Electrical and magnetic fields, or EMF, are generated in the creation, transmission and use of electric power and electric devices. The earth itself produces EMF naturally. Scientists believe the earth's core produces electric currents.

A new NIEHS booklet currently being printed, "EMF Questions & Answers," says flatly that in terms of children's health, it doesn't matter whether or not a house is close to power lines. There is no valid association between nearby power lines and any cancer - including childhood leukemia, the booklet says.

Answers to questions in the booklet are based primarily on the EMF Research and Public Information Dissemination, or EMFRapid, program by NIEHS and the Institute's review of other available, peer-reviewed data worldwide. The Department of Energy administered EMFRapid, but NIEHS handled health effects research and risk assessments. The intensive NIEHS study included more than 100 cellular and animal studies and was completed in 1999 with a statement that the evidence of associations shown in some studies was "weak" and that the probability that EMF exposure "is truly a health hazard is currently small."

NIEHS Director Ken Olden reported to Congress that he saw no public health problem "warranting aggressive regulatory action" but said power companies and utilities should, as a precaution, continue siting power lines so that exposures are reduced.

The booklet incorporates information from later studies and reviews in Canada, Australia, several European counties and the World Health Organization and the National Academy of Sciences.

said Dr. Mary Wolfe, a senior scientist with the institute's environmental toxicology program. She explained that the statement had been written by a "nontechnical person." (The full statement is reproduced at left; see also *MWN,* N/D02.)

The NIEHS statement prompted some harsh reactions. "The flat denial of any relationship between power lines and cancer is simply wrong. I had expected better from NIEHS," said Dr. Nancy Wertheimer in Boulder, CO. In 1979, Wertheimer, working with Ed Leeper in Denver, was the first to point to a link between leukemia and living near high-current power lines.

Two years ago, the International Agency for Research on Cancer (IARC) classified power-frequency EMFs as possible human carcinogens, based largely on an international consensus that epidemiological studies show that children exposed to EMFs have an elevated risk of leukemia (see *MWN,* J/A01). Three years earlier, a working group assembled by the NIEHS had reached the same conclusion (see *MWN,* J/A98).

Dr. David Carpenter, the director of the Institute for Health and the Environment at the State University of New York in Albany, called the NIEHS statement "outrageous." "Is this an error or does it reveal the institute's true view?" he wondered.

During most of the 1980s, Carpenter was the executive director of the New York State Department of Health's Power Lines Project, which funded the first major replication of the Wertheimer study — by Dr. David Savitz, now at the University of North Carolina, Chapel Hill (see *MWN,* N/D86). In its final report, the project estimated that 10-15% of all childhood cancers may be attributable to magnetic fields (see *MWN,* J/A87).

« Eye on Europe »

The **U.K.**'s Mobile Telecommunications and Health Research (**MTHR**) Program officially announced on March 20 that Prof. **Paul Elliott** of the Imperial College of Science, Technology and Medicine in London has been awarded £150,449 (US$235,000) for an **epidemiological study of childhood cancer near base stations**. As we reported last December, the two-year project, which gets under way in April, will focus on leukemia and non-Hodgkin's lymphoma (see *MWN,* N/D02). Dr. **Lawrie Challis**, the chair of the committee that manages the MTHR program, said that he and the other panel members "feel strongly" that such research is needed. Epidemiological studies of the health impacts of base station radiation have been criticized (see below). MTHR also gave Elliott the go-ahead for a full-scale cohort study of brain cancer and neurodegenerative disease among phone users — the program had funded a pilot study last year (see *MWN,* J/F02). Previously, Elliott was part of a team headed by Dr. **Helen Dolk** of the London School of Hygiene and Tropical Medicine that confirmed elevated rates of childhood cancer near broadcast transmitters in Sutton Coldfield, near Birmingham, but concluded that data on cancer near 20 other U.K. transmitter sites provided "no more than very weak support" for a health risk (see *MWN,* J/F97). The third new project is an investigation of the incidence of headaches, fatigue and other symptoms, as well as effects on neuroendocrine function, among "normal" and "hypersensitive" volunteers who are exposed to RF/MW radiation. Dr. **Simon Wessely** of the New Medical School of King's College, London, received £394,247 (US$616,000) for this three-year effort, which also begins in April. In addition, MTHR will manage a research project on the **TETRA** digital radio system used by the police and emergency medical workers — this will be paid for by other government agencies (see *MWN,* N/D01). More details on these research projects, as well as those funded last year, are available on the MTHR Web site, <www.mthr.org.uk>.

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On February 4, the **Health Council of the Netherlands** called for a large-scale **epidemiological study** of people exposed to **RF radiation**. The council's EMF Committee recommended looking at those who use mobile phones and, possibly, those who live near radio or TV transmitters — but not those living near mobile phone base stations. The committee, which is chaired by Dr. **Eric Roubos** of the Catholic University of Nijmegen, explained that the radiation levels near base stations are simply too low. Members of **COST281** expressed similar reservations in a "scientific comment" released at the end of last year (see *MWN,* N/D02 and J/F03). The need for and the difficulties in carrying out epidemiological studies of people living near base stations will be the subject of a May workshop held by COST281 in Dublin (see p.12). The Dutch advisors did, however, suggest "an experimental epidemiological study into the occurrence of subjective health complaints" associated with nearby towers. The health council also called for *in vitro* research on interactions between RF/MW radiation and other chemical and physical agents, as well as dosimetry studies. To coordinate this activity, the panel called for establishing a "center of expertise" on EMFs and health. According to Dr. **Eric van Rongen,** the scientific secretary of the EMF panel, the new report presents "a somewhat broader view" of research needs than the council put forward in previous reports. But, he added, the committee's outlook on the possible health risks has not changed. Two years ago, the council endorsed established RF guidelines, such as ICNIRP's, for exposures from base stations and last year it advised against precautionary policies, such as limiting children's use of mobile phones (see *MWN,* N/D00 and J/F02; also M/J97). Van Rongen, who represents The Netherlands on COST281, told *Microwave News* that the council issued only a limited number of recommendations because there is basically no EMF research being done in The Netherlands and that "it would not be realistic to expect that large amounts of money would suddenly be made available." The government requested the report in response to concerns raised in a debate on tower-siting policies in the lower chamber of the Dutch parliament. ***Health Effects of Exposure***

Paris Adopts 2 V/m Limit for Mobile Phone Towers

The city of Paris has signed a formal agreement with its three mobile phone operators to limit residential exposures from mobile phone towers to 2 V/m, averaged over 24 hours. The limit applies to combined radiation exposure at both 900 MHz and 1800 MHz.

The new charter* was signed on March 20 by Bouygues Telecom, Orange and SFR, together with Bertrand Delanoë, the mayor of Paris. Representatives of the three companies said that less than 1% of the city's base station antennas will need adjusting to meet the new standard, according to *Libération,* a major newspaper (March 21).

The new Parisian standard appears to be even stricter than those of Switzerland (4 V/m) and Italy (6 V/m) — but these two limits specify maximum, not average, exposures. The ICNIRP limits are 41 V/m at 900 MHz and 58 V/m at 1800 MHz.

The agreement comes as a cluster of childhood cancer cases is under investigation in Saint-Cyr-l'Ecole, outside Paris. To calm growing public fears, Orange and SFR turned off their mobile phone antennas in the area, *Le Monde,* one of the country's leading newspapers, reported on March 16.

Les Echos, a national business daily, presented the results of a poll which showed that 41% of the French population is concerned about mobile phone towers (March 27). The paper noted that there are 11,000 antennas in Paris alone.

* The Paris charter is available at: <www.paris.fr/fr/actualites/antennesrelais/charte.htm>.

to Radiofrequency Electromagnetic Fields: Recommendations for Research is available in Dutch, with an executive summary in English, at: <www.gr.nl>.

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Sir **William Stewart** is back. Only a few months after resigning as the chair of the committee that oversees the **U.K.**'s mobile phone research program in order to head up the newly created Health Protection Agency (HPA) (see *MWN,* N/D02), Sir William has become the chairman of the National Radiological Protection Board (**NRPB**). He took over from Sir **Walter Bodmer** on April 1, the same day that the HPA opened for business. The NRPB had been scheduled to become part of the HPA this year, but, for legal reasons, this has been delayed until 2004 (see *MWN,* J/F02). In another major change of management, Prof. **Roger Cox** will become the director of the NRPB on August 22, replacing Prof. **Roger Clarke**, who is retiring. Cox, who works on the health impacts of ionizing radiation, joined the NRPB in 1990 and is currently the head of its radiation effects department. And finally, Dr. **Jill Meara** has been appointed a deputy director of the board; she joins Dr. **John Stather**, who has held this title since 1997.

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Germany's €8.5 million mobile phone **research** plan (see *MWN,* J/A01) has been slowed down by **money problems**. The Federal Office for Radiation Protection (**BfS**), which is managing the effort, has put a number of projects on hold until further notice in response to a directive from the finance ministry to curtail spending, Dr. **Thomas Eikmann**, a senior environmental advisor to the government, told *Microwave News*. Germany is wrestling with a budget deficit that violates the EU's fiscal rules. Some grants have been awarded — for example, Dr. **Alexander Lerchl**'s animal exposure studies are moving forward (see *MWN,* J/A02). According to those familiar with the program, the freeze primarily affects more speculative research that has a greater possibility of failing to produce conclusive results — for instance, studies on electrosensitivity. The BfS has repeatedly declined to provide details of any of the projects selected under the program. Meanwhile, funding constraints notwithstanding, the BfS has issued a second request for proposals, including submissions for animal studies on the potential of 3G phone signals to promote cancer and of GSM radiation to alter the permeability of the blood-brain barrier. In addition, the BfS would like to fund an investigation into the health and behavioral effects of base-station radiation on dairy cows (this has been a contentious issue in Germany for many years; see also *MWN,* J/A98 and N/D00). According to an announcement that appeared on its Web site, the BfS also wants to know more about SAR variations within the body and radiation levels associated with wireless local area networks and other emerging technologies. Proposals were due March 20.

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COST 281, the European mobile phone research group, and **CENELEC**, the European standards organization, are embroiled in a dispute over guidelines for EMFs and RF/MW radiation generated by **household appliances**. In its 2002 *Watchdog Report,* issued last December, COST 281 takes CENELEC to task for permitting a single appliance to produce levels as high as the ICNIRP limits, without allowing for similar fields generated by other nearby sources. Such guidelines "misuse public exposure limits," COST contends. In a letter to the EC, which authorized CENELEC to develop European product standards for non-ion-

Sweden's Radiation Protection Authority Under Scrutiny

It is the Swedish Radiation Protection Authority's (SSI) turn to be in the hot seat.

Not long after the SSI released a report that was sharply critical of Drs. Lennart Hardell and Kjell Hansson Mild's findings that mobile phones can promote brain tumors (see p.8 and *MWN,* S/O02), Swedish Television broadcast its own investigation of mobile phones and base stations — and took a close look at SSI.

The hour-long February 11 program, *Uppdrag Granskning* (*Mission: Investigate*), challenged Ulf Bäverstam, SSI's research director, to explain why the institute is downplaying possible health risks. In addition to Hardell and Mild, the show featured interviews with Drs. Bertil Persson and Leif Salford of the University of Lund (see p.15 and *MWN,* J/F 03), as well as Drs. Pietro Comba of the National Institute of Health in Rome, Dariusz Leszczynski of STUK in Helsinki and Alan Preece of the University of Bristol, among others.

Reporter Johan Winberg asked about SSI's assertion, contained in a press release, that "the current state of the science is reassuring." After much badgering, Bäverstam disavowed this view and agreed that it would be appropriate to apply the precautionary principle to mobile phone radiation.

When *Microwave News* asked for confirmation that this is now SSI policy, Bäverstam declined to respond. He did send a comment noting that if the recent work by Persson and Salford showing nerve damage following leakage through the blood-brain barrier could be repeated by others, this would help explain some of the reported biological effects. "The research in this area must therefore be followed with great interest," he said.

Swedish newspapers continue to run feature stories and letters that examine SSI's confidence in current exposure limits. On March 26, for instance, *Aftonbladet,* a leading tabloid, pitted SSI's Gert Anger, arguing that 3G base station radiation is harmless, against Lund's Persson, countering that we really know nothing about such risks.

And later this year, Mild and Hardell, joined by Drs. Michael Kundi of the University of Vienna and Mats-Olof Mattsson, who like Hardell is at Örebro University, will offer a detailed critique of the SSI report. "Mobile Telephones and Cancer: Is There Really No Evidence of an Association?" will appear in the *International Journal of Molecular Medicine*. The SSI report at the center of the controversy was written by Drs. John Boice Jr. and Joseph McLaughlin of the International Epidemiology Institute in Rockville, MD.

izing radiation, CENELEC's secretary-general, **Pieter Parlevliet**, argued that the ICNIRP limits include "a large safety factor" and that ambient fields are negligible in comparison to the 1,000 mG allowed by ICNIRP, pointing to residential surveys showing that 50 Hz EMFs are on the order of 4-6 mG. Such levels, Parlevliet wrote, are within the measurement error of the meters. COST281 Chair Dr. **Norbert Leitgeb** of Austria's University of Graz countered that **IARC** has linked exposures above 4 mG to a doubling of the risk of childhood leukemia (see *MWN,* J/A01). CENELEC's limits "convey the wrong signal to manufacturers," Leitgeb wrote. Instead, they should "be encouraged to make minimization of emissions a design criterion." Both the COST281 watchdog report and its February 3 letter to the EC, which includes excerpts from Parlevliet's letter, are available at: <www.cost281.org>.

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City officials in **Munich** are considering a novel approach to the problem of siting **mobile phone antennas** near schools, day care centers and hospitals. Base stations would be installed *on* the roofs of buildings used by such "sensitive" populations, *Süddeutsche Zeitung,* Munich's leading daily newspaper, reported on March 29. The idea is that most of the radiation will be directed to the horizon and away from children and the infirm. They would be directly underneath the antennas, where the RF levels are relatively low. "Clearly, I'll be boxed about the ears for this," Ursula Sabathil, the city councilor who introduced the plan, told the newspaper. "But sometimes one must take unpopular steps if it's better for children's health." Her proposal takes advantage of what is called the "lighthouse effect."

Motorola: Hands-Free Sets Do Reduce Radiation Exposures

Motorola researchers have formally countered claims, originally made by the U.K. Consumers' Association (CA), that hands-free sets used with mobile phones can increase radiation exposures.

In a paper published in the April issue of *Radiation Research (159,* pp.550-557, 2003), the Motorola team, headed by Dr. C.K. Chou, reports that computer simulations and measurements show that the specific absorption rate (SAR) in the ear region is approximately ten times lower when a hands-free set is used with a mobile phone.

The CA is not backing down, however. "Our practical advice remains that if you are concerned about radiation from mobiles, don't rely on a hands-free kit," Anna Butterworth, a CA spokesperson in London, told *Microwave News*.

The CA prompted international headlines in April 2000 when it warned that hands-free sets can triple the radiation exposure from mobile phones (see *MWN,* M/J00). The CA claim was based on measurements carried out by ERA Technology in Leatherhead. Despite numerous conflicting reports from other test labs, the CA has stood firm (see *MWN,* N/D00).

"No one finds the increases described by ERA," Chou, the director of Motorola's RF Dosimetry Lab in Plantation, FL, said in an interview. Chou's team charges that ERA used the wrong electric field probe to measure radiation exposures and failed to take into account effects of the user's body "which would reflect, scatter and absorb RF energy."

Dr. Philip Chadwick of MCL, a research and consulting firm based in London, is one of the many who think the CA has gotten it wrong. "Intuition, experience and analysis all would indicate that the SAR from the hands-free kit would be less than the SAR from the antenna," he told *Microwave News* in late March.

CA's Butterworth said that the association was not able to comment on developments that had occurred since it published its warning in 2000: "Given...staff changes and the fact that the last active research we did on this was well over two years ago, we're not really in a position to comment on the theory behind the research that's taken place since then."

Blake Dismisses Headset Suits

U.S. District Court Judge Catherine Blake has rejected five class-action lawsuits that would force wireless companies to provide hands-free kits and health advisories with all mobile phones.

An appeal was filed on April 2.

Blake based her March 5 decision on two key arguments. First, the Food and Drug Administration (FDA) has determined that headsets are not needed to protect users from phone radiation. Second, if the suits were allowed to proceed, state courts could impose stricter standards than those adopted by the Federal Communications Commission (FCC), thereby violating the Telecom Act of 1996 (see *MWN,* M/A96).

Blake points to FDA's Web site, which advises consumers that, "Since there are no known risks...there is no reason to believe that hands-free kits reduce risks" (see <www.fda.gov/cellphones>; also p.18). While she allows that this "does not, of course, constitute regulatory action," Blake calls it "an important indication of agency purpose and opinion."

The lawsuits, which were originally filed in state court, are being coordinated by the Peter Angelos firm in Baltimore (see *MWN,* M/J01; also N/D01). The defendants filed a motion to dismiss the suits last August.

In September, Blake dismissed Dr. Christopher Newman's claim, also filed by Angelos, that phone radiation caused his brain tumor; the decision has been appealed (see *MWN,* S/O02).

A hands-free kit is commonly included free with a phone. In September 2001, AT&T Wireless began offering free headsets to all its customers (see *MWN,* S/O01).

European and Chinese Labs Report RF-Induced DNA Breaks

New experimental results from Europe and China have rekindled interest in the ability of RF/MW radiation to induce DNA damage.

In February, at a meeting hosted by the Institute of Physics in London (see p.12), Elisabeth Diem of Dr. Hugo Rüdiger's lab at the University of Vienna announced that two different cell lines — one human and one rat — had increased single- and double-strand DNA breaks following both continuous and intermittent exposures to 1800 MHz digital phone radiation, as measured by the comet assay.

Once again, as Rüdiger previously reported for ELF EMFs, the DNA damage was greatest for the intermittent exposures — that is, when the radiation was turned on for five minutes and then off for ten (see *MWN,* S/O02). With such exposures, statistically significant increases were observed at SARs of 1.2 W/Kg and 2.0 W/Kg.

Diem believes that the effects are not due to heating. If it was a thermal effect, she explained to *Microwave News,* there would have been more DNA damage with continuous exposures. Diem ran the RF experiments in Dr. Rudolf Tauber's lab at the Free University of Berlin, using an exposure system designed and built by Dr. Niels Kuster of IT'IS in Zurich. Kuster, Rüdiger and Tauber's teams are all members of the EC's REFLEX project (see *MWN,* M/A00).

Nearly ten years ago, Drs. Henry Lai and N.P. Singh of the University of Washington, Seattle, reported increased DNA damage in brains of rats exposed to 2450 MHz continuous-wave radiation (see *MWN,* N/D94). Dr. Joseph Roti Roti of Washington University in St. Louis, working under a Motorola contract, then found no damage in RF/MW-exposed cells (see *MWN,* J/F98 and S/O99). Since then, there had been no progress toward resolving the apparent contradiction (see p.19).

The new data "certainly cannot settle the conflict" between the two groups, said Dr. Franz Adlkofer of the Verum Foundation in Munich, the coordinator of the REFLEX project. In fact, he told *Microwave News,* "Both might be right." Adlkofer suggested that some cell types may be more responsive to RF/MW radiation — as the Vienna group observed in its experiments with ELF EMFs.

In October 2001, Adlkofer reported that Tauber had seen increased DNA breaks in HL-60 cells exposed to 1800 MHz radiation, but he later voiced "doubts" about this finding (see *MWN,* N/D01 and M/J02). Now, with Diem's new results in hand, he believes that "the credibility gap is closed."

On another front, in the December issue of *Biomedical and Environmental Sciences (15,* pp.283-290, 2002), researchers at Zhejiang University medical school in Hangzhou write that exposure to "low-intensity" (5.0 mW/cm^2) 2450 MHz radiation increased the genotoxic effect of mitomycin C on human blood cells. The team saw no increase in DNA breaks in cells exposed to the radiation alone. These results appear to support that of Dr. Luc Verschaeve of VITO in Brussels (see *MWN,* N/D96). For details, contact: Dr. Ji-Liang He, <he_jiliang@hotmail.com>.

Russian Panel on Mobile Phones: Take a Precautionary Approach

On September 19, the Russian National Committee on Non-Ionizing Radiation Protection (RNCNIRP) adopted recommendations on the use of mobile phones, which appear below. They were translated into English for Microwave News *by Dr. Vladimir Binhi of the Russian Academy of Sciences' (RAS) General Physics Institute in Moscow. Binhi, a member of the RNCNIRP, is the author of* Magnetobiology: Underlying Physical Problems *(see* MWN, *M/J02).*

The RNCNIRP, which has 36 members, is chaired by Prof. Yuri Grigoriev of the Institute of Biophysics in Moscow. Other members include: O.A. Grigoriev, director, Center for Electromagnetic Safety; Prof. V.N. Nikitina, Northwestern Center of Hygiene and Public Health; Prof. Yu.P. Paltsev, Occupational Health Institute, Russian Academy of Medical Sciences (RAMS); and Prof. N.B. Rubtsova, Occupational Health Institute, RAMS.

In 1999, the RNCNIRP hosted a conference in Moscow to discuss harmonizing the exposure standards of the former Soviet bloc countries with those of the U.S. and Western Europe. Russia's limits are currently on the order of 100 times stricter than those of ICNIRP. The meeting ended without reaching any consensus (see MWN, *N/D99). Nor was any progress made at a follow-up meeting held in Moscow last September.*

1. The RNCNIRP offers the following advice on the safe use of mobile phones. These recommendations are based on the precautionary principle of the World Health Organization, published scientific and medical studies, reviews and recommendations by scientific groups and the expert opinions of members of the RNCNIRP.

1.1. Children under the age of 16 should not use mobile phones.

1.2. Pregnant women should not use mobile phones.

1.3. Those suffering from neurological disorders, memory loss or epilepsy and those with a predisposition to epilepsy should not use mobile phones. [Abridged list of conditions.]

1.4. The duration of calls should be limited to a maximum of three minutes, and after making a call the user should wait a minimum of 15 minutes before making another call. The use of headsets and hands-free systems is strongly encouraged.

2. Manufacturers and retailers of mobile phones should include the following information together with the engineering specifications:

2.1. All of the above recommendations regarding use.

2.2. All relevant health and epidemiological data on mobile phones, together with the radiation levels associated with the phone, and the name of the measurement lab.

Mobile Phones and Cancer: Two New Papers from Hardell

The research team led by Drs. Lennart Hardell and Kjell Hansson Mild of Sweden's Örebro University continues to see a cancer risk from mobile phones (see *MWN,* M/A02 and S/O02). The new results appear in two newly published papers.

A new analysis of the brain tumor data set offers a more consistent picture of the risk, Mild told *Microwave News*. "There is no question that the use of an analog phone for ten years or more leads to an increase in cancer," he said. But, Mild added, there is not the same clear indication for digital phones.

In the second paper, Hardell and Mild look at the chances of developing a neuroma, using a somewhat larger data set than in their previous papers. They continue to see a greater than threefold increased risk among users of analog mobile phones. In addition, they point out that the incidence of neuromas has risen by more than 2% a year between 1980 and 1998. Could this be related to the use of mobile phones? "It's implied — it's there to be discussed," Mild said. Mild is also with the National Institute for Working Life in Umeå. (A neuroma is sometimes known as an acoustic neurinoma or a vestibular Schwannoma.)

In their neuroma paper, Hardell and Mild present three cases of men who reported having tinnitus in only one ear — the one they used for making phone calls. The inner part of the ear is an area of high exposure to microwaves from cell phones, they note.

L. Hardell, K.H. Mild and M. Carlberg, "Further Aspects on Cellular and Cordless Telephones and Brain Tumors," *International Journal of Oncology, 22,* pp.399-407, February 2003. (See also p.5.)

L. Hardell, K.H. Mild et al., "Vestibular Schwannoma, Tinnitus and Cellular Telephones," *Neuroepidemiology, 22,* pp.124-129, March-April 2003.

Australia To Track Health Complaints of Phone Users

Australia will soon become the first country to collect health complaints attributed to mobile phones.

The registry should start operating this spring, according to Dr. Colin Roy of the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA), which is in charge of the new project.

An Australian senate panel recommended setting up the registry nearly two years ago, following its investigation into mobile phone safety (see *MWN,* M/J01). "It's an important first step," said Sen. Lyn Allison, who chaired the inquiry.

At the same time as it announced the registry on February 6, the government rejected Allison's call for a large and independent national RF research program and for a return to an earlier, more restrictive exposure standard. The other members of the senate panel did not endorse these recommendations.

"The government's response is better than nothing, but they should be doing a lot more," Allison told *Microwave News*. "For the price of two cappuccinos a year, mobile phone users could have been confident that real effort was going into the independent research," she said in a press release.

Last year, Dr. George Carlo, the head of the U.S. mobile phone industry's now-defunct research program, known as WTR, set up a health complaints registry using money from an out-of-court legal settlement (see *MWN,* M/A02). Repeated phone calls and e-mails to Carlo on the status of his registry were left unanswered.

Standards Watch

• **ICNIRP**'s "Guidance on Determining Compliance of Exposure to Pulsed and Complex Non-Sinusoidal Waveforms Below 100 kHz with ICNIRP Guidelines" has been published in the March issue of ***Health Physics*** *(84,* pp.383-387, 2003). This addresses sources like electronic article surveillance systems, demagnetizers and metal detectors. The guidelines are available on ICNIRP's Web site, <www.icnirp.org>.

• A working group appointed by **ARPANSA** has begun writing a standard addressing exposures to **ELF EMFs** (see *MWN,* S/O 02). According to Dr. **Andrew Wood** of Swinburne University of Technology in Melbourne, the chair of the nine-member panel, ARPANSA wants limits for workers and the public based on "established adverse health effects." At its first meeting, held on December 17, the working group decided to complete a draft for public comment by September 2004. Australia has no official standard for ELF EMFs, but the National Health and Medical Research Council has set interim limits of 1G for the public and 5G for workers — the same as ICNIRP's. Among the members of the working group are Thanh Dovan of SPI Powernet, Dr. Nick de Klerk of the Telethon Institute for Child Health Research in Perth and Dr. Pamela Sykes of Flinders University in Adelaide. The working group will be assisted by a 15-member consultative panel, including Dr. Mark Elwood, the director of the National Cancer Control Initiative in Melbourne, Richard Hoy of ESAA, Bruce Howard of TransGrid, Don Maisch, a consultant based in Tasmania, and Lyn McLean, the head of the EMR Association of Australia, which has pushed for more protective policies on ELF EMFs and RF/MW radiation.

• Since March 1, all mobile **RF/MW** transmitters and fixed antennas in **Australia** are subject to new regulations adopted by the Australian Communications Authority (**ACA**). The rules, which ensure that public exposures do not exceed the ICNIRP-based limits adopted by ARPANSA last year (see *MWN,* M/J02), are available at: <www.aca.gov.au>.

NCRP: Report on Wireless Safety For Building Owners Completed

The National Council on Radiation Protection and Measurements (NCRP) has completed its "letter report" on *Wireless Telecommunications Radiofrequency Safety Issues for Building Owners and Managers*.

The 37-page report, which was commissioned by McDonald's, the giant fast food company, offers guidance to corporations that control many buildings on their responsibilities for "ensuring the safety" of workers and the public exposed to RF radiation from roof-mounted antennas (see *MWN,* N/D02).

Dr. Tom Tenforde, the president of the NCRP, chaired the committee that prepared the report. The other members are: Dr. Larry Anderson, Battelle Pacific Northwest Lab in Richland, WA; Dr. Jerrold Bushberg, University of California, Davis; Richard Tell, consultant, North Las Vegas, NV; and Susan Wiltshire, JK Research Associates (emeritus), South Hamilton, MA.

The NCRP has not officially announced the release of this report. A copy is available directly from Tenforde on written request. Write to: NCRP, 7910 Woodmont Ave., Suite 400, Bethesda, MD 20814, E-mail: <tenforde@ncrp.com>.

NCRP's RF/MW Panel Will Not Recommend Exposure Limits

NCRP's reconstituted committee on RF/MW biological effects will not recommend standards for exposures of the public and workers.

"Its report will not attempt to provide an updated set of exposure limits," NCRP President Dr. Tom Tenforde told *Microwave News*. Instead the panel "will provide a detailed critique of the strengths and weaknesses of the existing RF exposure guidelines," he said.

"I feel we can still make a positive contribution," said Dr. James Lin of the University of Illinois, the chair of the committee. Lin was first asked to prepare the NCRP report nearly eight years ago.

Tenforde explained that Lin has been asked to recommend what research is needed to address any deficiencies in the current standards. In addition, the panel will consider how best to communicate RF/MW health risks to workers and the general population.

Lin said that he expects to have a report ready for NCRP review in two years.

At the end of March, the first meeting of the new committee had yet to be scheduled. Lin was waiting for his budget to be approved so that he would have the money to assemble the panel members.

Tenforde is leading the effort to raise money for the panel's work, but no formal proposals have yet been submitted. It would be "premature to discuss any sources of funding," he said.

The NCRP's decision effectively cedes standard-setting authority to the IEEE International Committee on Electromagnetic Safety (ICES), also known as SCC-28, and the International Commission on Non-Ionizing Radiation Protection (ICNIRP). Tenforde is a member of ICNIRP.

Members of the ICES leadership have long sought to replace the NCRP as the dominant U.S. group for electromagnetic radiation standards (see, for example, *MWN,* M/A96). At the same time, ICES has been competing with ICNIRP for control on the international stage (see *MWN,* J/A00).

What is now the IEEE ICES committee was run by the U.S. Navy in the 1970s and 1980s. The Navy's and the IEEE's RF/MW exposure standards have subsequently been approved by the American National Standards Institute (ANSI).

In its last major report on RF/MW health risks, issued in 1986, the NCRP recommended limits for the general public that, at the time, were five times stricter than the guidelines adopted by ANSI (see *MWN,* M/J86). Interestingly, Dr. Bill Guy, then of the University of Washington, Seattle, chaired both the NCRP and the ANSI committees.

The NCRP's directors disbanded Lin's RF/MW committee in the summer of 2001 because, they stated, the committee was taking too long to complete its report. At the time, concerns were raised regarding potential conflicts of interest because Ron Petersen, the NCRP vice president for non-ionizing radiation and a member of the board of directors, was also a member of ICES' executive committee (see *MWN,* S/O01). Last year, the board asked Lin to reconstitute the committee (see *MWN,* J/A02).

New NCRP RF Panel

The members of NCRP Scientific Committee (SC) 89-5 on the "Biological Effects of Radiofrequency Fields" are:

James Lin,* chair, University of Illinois, Chicago; Elizabeth Balcer-Kubiczek, University of Maryland, College Park; Paul Bottomly, Johns Hopkins University, Baltimore; Faith Davis, University of Illinois, Chicago; Keith Florig, Carnegie Mellon University, Pittsburgh; Om Gandhi, University of Utah, Salt Lake City; Mary Gilbert, Environmental Protection Agency, Research Triangle Park, NC; Greg Lotz,* National Institute for Occupational Safety and Health, Cincinnati.

Consultants:

Eleanor Adair,* New Haven, CT; Patricia Buffler,* University of California, Berkeley; C.K. Chou,* Motorola, Plantation, FL; George Harrison,* University of Maryland, College Park.

* Original members of the SC89-5, set up in 1995. Some changes were made five years later (see *MWN,* S/O95 and J/F00). All the panel members have doctorate degrees.

Towards Applying the Precautionary Principle: New Swiss Framework Looks Beyond Known Effects

Swiss government officials have developed a systematic framework that may be used to apply the precautionary principle to uncertain health risks. In contrast to traditional approaches, which recognize only demonstrated hazards, the Swiss model would allow the weighing of potential biological effects.

"It is not enough to ask whether something is established or not," explained Dr. Jürg Baumann, the head of the non-ionizing radiation unit at the federal environmental agency known as BUWAL. "We have tried to devise a system that is more differentiated," he said in a telephone interview from his office in Bern.

The new classification scheme assigns biological effects to one of five classes: "established," "probable," "possible," "unlikely" or "unclassifiable."

Established effects are those which have been reproduced in multiple labs, and for which a plausible mechanism exists — criteria developed and used by ICNIRP in setting its own standards.

According to BUWAL, changes in sleep patterns are examples of probable effects and increased rates of leukemia and lymphoma near radio and TV transmitters are seen as possible effects. In contrast, a general promotion of cancer is deemed unlikely and immunological effects are judged to be unclassifiable (see table below).

The framework, together with a host of examples, will be detailed in a review of the RF/MW radiation literature to be published by BUWAL this spring.

Baumann sees his new classification system as a variation on the methods used by the California EMF Program and by Germany's Radiation Protection Commission. Unlike the quantitative analysis used by the California program, the Swiss system does not attempt to assign probabilities to various health outcomes. On the other hand, it allows greater shadings than the German method.

In the California report, three scientists combined their individual numerical probabilities of various risks into a consensus statement. They stated that they were "inclined to believe" that power-frequency EMFs can cause childhood leukemia, adult brain cancer, ALS and miscarriages (see *MWN,* J/A02).

Under the German classification system, health risks are either proven, under suspicion or suggested (see *MWN,* S/O01). The panel found that only the proven hazards warrant official recognition. It did not find any suspected or suggested risks.

Drs. Martin Röösli and Regula Rapp of the Institute of Social and Preventive Medicine in Basel reviewed the RF/MW health literature for BUWAL. A synopsis of their findings appears in the Spring issue of the BUWAL magazine, *Umwelt*. The full review will be available, in German,* in April.

"The report confirms what we have been saying for several years," Baumann said. "It is absolutely clear that there is a potential for health effects at levels below the ICNIRP limits." BUWAL proposed precautionary RF/MW limits in February 1999 and the Swiss government adopted them a year later (see *MWN,* M/A99 and J/F00).

Baumann noted that Switzerland did not set these precautionary limits on the basis of potential health effects. "They were set as low as technically and economically feasible," he said, adding that, "The new classification system may provide an additional basis for precautionary action in the future."

"It's interesting that our review points to a number of effects — both probable and possible — that are below the ICNIRP standard, but only a few possible effects and no probable effects that are below our precautionary limit," Baumann said.

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* There will also be an executive summary in English, French and Italian. When released, all can be downloaded from <www.elektrosmog-schweiz.ch>.

BUWAL's Classification of RF/MW Biological Effects

Established	Probable	Possible	Unlikely	Not Classifiable
ICNIRP criteria satisfied	multiple indications of an effect	isolated indications of an effect	no evidence of an effect; multiple indications of absence of an effect	very limited or contradictory data
thermal injury	changes in EEG, reaction times and sleep cycles; symptoms linked to mobile phone use but not verified, including headaches, dizziness, fatigue, skin warmth and increased pain sensitivity	leukemia and lymphoma near radio or TV transmitters; brain tumors from mobile phone use; sleep disturbances near transmitters; electrical sensitivity in some individuals	general increase in mortality or promotion of cancer	breast or eye tumors; immunological, hormonal, cardiovascular, psychological and teratological effects; miscarriages

Source: Vera Bueller, "Electrosmog: Caution Is the Best Medicine" (in German and French), *Umwelt* (published by BUWAL), pp.22-24, Spring 2003, available for download at: <www.umwelt-schweiz.ch>. In French, the magazine is called *Environnement*.

tionary principle. "It's sacrosanct in Europe — it's like motherhood and apple pie," he said. "As a result, it could stand for anything."

As Kheifets, who drafted WHO's position paper, wrote a couple of years ago while still working for EPRI, the U.S. electric utility research group, "the precautionary principle is vague" and "the specifics of implementation make all the difference."

Dr. Paolo Vecchia, a physicist at the National Institute of Health in Rome and a member of ICNIRP, is one of the few who is "far from convinced" that the European Commission intended the principle to be applied to EMFs. He says that many of the low-impact strategies discussed in his working group are "obvious and valid for any human activity and technology."

On the first day of the meeting, after a number of invited presentations, members of the public were given the opportunity to offer their opinions. (A report on the public session is available; see first item in list at right.) Then, over the next two days, 40 invited participants met in small groups to discuss when and how the precautionary principle should be applied.

By the close of the workshop, little headway had been made on devising a blueprint for future WHO recommendations.

"There was no clear guidance on what you do and what you don't do," said Dr. Christopher Portier, who served as the chairman of the Luxembourg workshop. Portier leads the Environmental Toxicology Program at the U.S. NIEHS in Research Triangle Park, NC.

Dr. Marco Martuzzi, an epidemiologist at the WHO Regional Office for Europe in Rome who helped organize the workshop, commented that, "It's obvious that some action on EMFs is warranted, but we were not trying to draw up a plan with specific recommendations at the meeting; rather the objective was to develop a framework for devising precautionary policies."

When asked what new policies he has in mind, Repacholi would only speak in generalities. "We want to look at ways of introducing precautionary measures into the EMF arena," he told *Microwave News*. He said that the principle would become an "overarching philosophy" for development of public health policies for EMFs, as well as for other health issues confronting the WHO, such as global warming.

Pressed for specifics, Repacholi suggested rerouting a power line or placing the conductors in a low-field configuration. "Try to keep the levels down without going overboard on costs," he said. But these strategies have been cited by the WHO as examples of prudent avoidance, which Repacholi endorsed in 2001 while still resisting invoking the precautionary principle (see *MWN,* S/O01). Most observers, however, see no more than a semantic difference between the two terms.

"WHO's position is still being developed," Repacholi said, adding that he plans to post a revised position paper on the precautionary principle on the project's Web site in early spring. (Go to: <www.who.int/peh-emf/en>.)

How To Address Power Line Health Risks?

Many of those at the meeting cited the decision by the International Agency for Research on Cancer (IARC) to designate power line EMFs "possible human carcinogens" as the prime reason to invoke the precautionary principle (see *MWN,* J/A01). Indeed, this was at the top of WHO's list of policy triggers.

But that is where the consensus stopped.

As Dr. Eric van Rongen of the Health Council of the Netherlands in The Hague reported from his working group meetings on the second and third days of the workshop, precautionary strategies can range from "providing information, performing research, up to reducing limits."

On one end of the spectrum stand Switzerland and Italy, which have each adopted precaution-based exposure limits. "We set out to see what could be done with available technology," said Switzerland's Dr. Jürg Baumann, who was also in Luxembourg (see also p.10).

On the other end is the U.S., where the NIEHS is limiting its activities on power-frequency EMFs to distributing literature and attending meetings. While Portier said that he believes the current data are adequate to trigger the precautionary principle and the institute is on record as favoring precaution, NIEHS has also been advising that children can live right next to a power line (see p.1). In addition, NIEHS has all but abandoned doing EMF health research.

Sweden was the first country to favor precautionary policies

EMFs and the Precautionary Principle: Reading List

Application of the Precautionary Principle to Electromagnetic Fields (EMF), Conference of 24-26 February 2003 in Luxembourg, Rapporteur Report, 8 pp., March 20, 2003. Available at: <www.who.int/peh-emf/meetings/archive/en>. This report covers only the February 24 session, which was open to the public. The list of attendees is available at the WHO EMF project's Web site.

Q. Balzano and A. Sheppard, "The Influence of the Precautionary Principle on Science-Based Decision-Making: Questionable Applications to Risks of Radiofrequency Fields," *Journal of Risk Research, 5,* pp.351-369, 2002. See *MWN,* N/D02.

K. Foster, P. Vecchia and M. Repacholi,"Science and the Precautionary Principle," *Science, 288,* pp.979-981, May 12, 2000.

L. Kheifets, G. Hester and G. Banerjee, "The Precautionary Principle and EMF: Implementation and Evaluation," *Journal of Risk Research, 4,* pp.113-125, 2001.The entire issue is devoted to the precautionary principle. A different version of this paper is available at: <www.who.int/entity/peh-emf/meetings/southkorea/Leeka_Kheifets_principle_.pdf>

D. Kreibel, J. Tickner et al., "The Precautionary Principle in Environmental Science," *Environmental Health Perspectives, 109,* pp.871-876, September 2001.

"The Precautionary Principle," a special issue of *Public Health Reports (117,* November/December 2002), edited by J. Tickner. Includes a paper by R. Neutra and V. Delpizzo, "Transparent Democratic Foresight Strategies in the California EMF Program," pp.553-563.

WHO Regional Office for Europe, *Precautionary Policies and Health Protection: Principles and Applications,* Report on a WHO Workshop, Rome, Italy, May 28-29, 2001. Available at: <www.euro.who.int/document/e75313.pdf>. Addresses EMFs; many of those at this meeting also attended the February 2003 workshop.

for power-frequency fields. In 1995, five government agencies with responsibility for controlling human exposures endorsed a policy of prudent avoidance (see *MWN,* N/D95), which effectively bars new construction next to a power line or siting a power line in a residential neighborhood.

This February, Sweden took another step towards extending its EMF precautionary policies. According to Dr. Kjell Hansson Mild of the National Institute for Working Life in Umeå, the government, under orders from parliament, asked the Electrical Safety Agency to investigate how to reduce magnetic fields higher than 4 mG (0.4 ∝T) from power lines in residential areas. That is, the government is now considering — although somewhat reluctantly, according to Mild — applying precaution to all existing structures, not just new ones.

As for the U.K., Dr. John Swanson of the National Grid Co. refused to discuss how he or his company would view the siting of a new power line. A spokesman said that it was not "appropriate" for him to offer his opinions to the press.

Swanson was one of three industry representatives who were invited to the workshop as "observers." All who were there said that everyone present participated equally in the discussions. Repacholi explained that industry representatives cannot normally be members of any WHO working group, but he wanted all stakeholders represented at the meeting.

WHO Wary of Precautionary Policies in the Past

The decision to recommend precautionary policies marks the latest step in the evolution of WHO's outlook. In a position paper released three years ago, Repacholi stated that the requirements for invoking the precautionary principle formulated by the European Commission "do not appear to be met in the case of either power [frequency] or RF EMFs" (see *MWN,* M/J00).

After IARC labeled ELF EMFs a possible carcinogen, the WHO project still shied away from openly recommending protective measures because, it stated, "we do not know what field characteristics might be involved in the development of childhood leukemia and therefore need to be reduced" (see *MWN,* S/O01). Indeed, as late as last year, the WHO released a booklet on *Establishing a Dialog on Risks from Electromagnetic Fields* which took no position on applying the precautionary principle to EMFs (see *MWN,* N/D02).

FROM THE FIELD

Meeting Notes

• Is it the surf or the science? Whatever the reason, the **Bioelectromagnetics Society** has received a record number of abstracts for its 25th annual meeting, to be held on the Hawaiian island of Maui. An extra day has been added and the conference will now run through Friday June 27. On that last day, the U.S. National Toxicology Program (NTP) is sponsoring a special session on ***Carcinogenicity Studies of Cell Phone RF Radiation in Laboratory Studies.*** An international roster of speakers has been lined up: Germany's Clemens Dasenbrock, Switzerland's Niels Kuster and Italy's Morando Soffritti, as well as — and this should guarantee a standing-room-only crowd — Tim Kuchel and Mike Repacholi. Sparks will fly if the recent exchange of letters between these two Australians in *Radiation Research* is any guide. (Kuchel says he could not replicate Repacholi's transgenic mouse study that famously points to an RF cancer risk, but Repacholi is far from convinced that Kuchel got it right; see p.18 and *MWN,* J/F03.) NIEHS's Ron Melnick and NIST's Perry Wilson, who are designing the NTP's RF experiments, will also give presentations. Following these invited talks, there will be, as they say at the UN, a frank and open exchange of ideas.

• The abstracts of the papers presented at the **U.K.**'s **Institute of Physics** conference on *RF Interactions with Humans: Mechanisms, Exposure and Medical Applications,* held in London February 27-28, are posted on the institute's Web site. Go to: <physics.iop.org/IOP/Confs/ENV>. Among the papers is the Austrian-German team's report on RF-induced DNA breaks (see p.7).

New and Revised Listings

May 15-16: **COST281 Workshop: Mobile Phone Base Stations and Health,** Dublin, Ireland. Contact: Gerd Friedrich, FGF, Rathausgasse 11a, D-53111 Bonn, Germany, (49+228) 726220, Fax: (49+228) 7262211, E-mail: <info@fgf.de>, Web: <www.cost281.org>.

June 22-27: **25th Annual Meeting of the Bioelectromagnetics Society (BEMS),** Outrigger Wailea Resort, Maui, HI. Contact: Gloria Parsley, 2412 Cobblestone Way, Frederick, MD 21702, (301) 663-4252, Fax: (301) 694-4948, E-mail: <bemsoffice@aol.com>, Web: <www.bioelectromagnetics.org>. The program is now available on the BEMS Web site.

July 1-4: **3rd International Congress on Low and Super-Low Fields and Radiation in Biology and Medicine,** State Regional Education Center, St. Petersburg, Russia. Contact: Organizing Committee, IAI RAS, Rizhsky Pr.26, St. Petersburg, 190103 Russia, (7+812) 251-8159, Fax: (7+812) 251-9173, E-mail: <congress@valuehost.ru>, Web: <www.science-congress.com>. Will cover electromagnetic, magnetic, gravitational and acoustic fields. Among the planned symposia will be one on *Theoretical Models and Physical Mechanisms of Low-Field and Radiation Actions on Bioobjects*.

August 24-29: **World Congress on Medical Physics and Biomedical Engineering,** Convention & Exhibition Center, Sydney, Australia. Contact: Congress Managers, (61+2) 9248-0800, Fax: (61+2) 9248-0894, E-mail: <wc2003@tourhosts.com.au>, Web: <www.wc2003.org>.

Hot New Papers

Paolo Bernardi et al., "Specific Absorption Rate and Temperature Elevation in a Subject Exposed in the Far Field of Radiofrequency Sources Operating in the 10-900 MHz Frequency Range," ***IEEE Transactions on Biomedical Engineering, 50,*** **pp.295-304, March 2003.**

"The electromagnetic field inside an anatomical heterogeneous model of the human body has been computed by using the finite-difference time-domain method; the corresponding temperature increase has been evaluated through an explicit finite-difference formulation of the bioheat equation. The thermal model used, which takes into account the thermoregulatory system of the human body, has been validated through a comparison with experimental data. The results show that the peak specific absorption rate (SAR) as averaged over 10 g has about a 25-fold increase in the trunk and a 50-fold increase in the limbs with respect to the whole-body averaged SAR (SAR_{WB}). The peak SAR as averaged over 1g, instead, has a 30- to 60-fold increase in the trunk, and up to a 135-fold increase in the ankles, with respect to SAR_{WB}. With respect to temperature increases, at the body resonance frequency of 40 MHz, for the ICNIRP incident power density maximum permissible value, a temperature increase of about 0.7°C is obtained in the ankles muscle. The presence of the thermoregulatory system strongly limits temperature elevations, particularly in the body core....If thermoregulation is inhibited, a relevant increase in the blood temperature is induced, with the blood that acts as a heat carrier and spreads heat from the point where its deposition is maximum (e.g., the ankle at 40 MHz), throughout the whole body. Therefore, even if power absorption is limited to one body region, temperature elevations will occur throughout the body....[I]t has been shown that the 50 safety factor used in the guidelines for setting the 0.08 W/Kg limit on SAR_{WB} is reduced to ten when maximum temperature increases are considered."

Reprints: Dr. Paolo Bernardi, Department of Electronic Engineering, University of Rome "La Sapienza," Italy, E-mail: <bernardi@die.uniroma1.it>.

Biao Shi, Behnom Farboud, Richard Nuccitelli and Rivkah Isseroff, "Power-Line Frequency EMFs Do Not Induce Changes in Phosphorylation, Localization or Expression of the 27-Kilodalton Heat Shock Protein [HSP27] in Human Keratinocytes," ***Environmental Health Perspectives, 111,*** **pp.281-287, March 2003.**

"[W]e found that synthesis of HSP27 in human keratinocytes was not sensitive to EMF exposure. When cells were exposed to 100 ∝T [1G] EMF for 5 min, 30 min, 2 hr and 24 hr, the total levels of HSP27 demonstrated no significant change at any time point compared to the controls exposed to ambient EMF background. We further explored the possibility that the effects of EMF on heat shock proteins are specific for certain heat shock proteins or restricted to certain cell types by attempting to reproduce the results that Goodman and coworkers have reported. Our data demonstrate that the lack of HSP27 response to EMF exposure is not restricted to keratinocytes. Breast cells (HTB124) previously tested by Goodman and colleagues showed no significant change in abundance of HSP27 after exposure to EMF. Similarly, we were not able to observe any EMF-associated increase in HSP70 level using either breast cells (HTB124) or leukemia cells (HL60)....In summary, in this study we failed to detect any of a number of stress responses in keratinocytes exposed to power-line frequency EMF. Not only synthesis of heat shock proteins but also two other parameters of phosphorylation and translocation were not affected by power-line frequency EMF. Evaluation of these three parameters consistently demonstrated that EMF does not elicit the stress responses that are induced by heat shock or other environmental insults.

Low-Dose Microwaves Are Cataractogenic, Chinese Show

Juan Ye, Ke Yao, Qunli Zeng and Deqiang Lu, "Changes in Gap Junctional Intercellular Communication [GJIC] in Rabbits Lens Epithelial Cells Induced by Low Power Density Microwave Radiation," ***Chinese Medical Journal, 115,*** **pp.1873-1876, December 2002.**

"The underlying mechanisms of low-dosage microwave radiation-induced cataract remain to be investigated. Nevertheless, these studies clearly showed that both 5 mW/cm^2 and 10 mW/cm^2 microwave radiation for 3 hours [the ICNIRP exposure and the old ANSI exposure limits, respectively] caused the decreased function of Cx43 [connexin] and inhibited GJIC. Disruption of coordinated transport activity of the lens epithelial cells and inhibited delivery of ions and nutrients to fiber cells would be expected, perhaps leading to osmotic imbalance within the crystalline lens. We conclude that previously recommended microwave exposure limit is cataractogenic, and the safety remains to be tested. Our finding is expected to help to set a new standard in the future."

Reprints: Dr. Ke Yao, Department of Ophthalmology, Zhejiang University Medical School, Hangzhou, China, E-mail: <zjhzecyk@mail.hz.zj.cn>. The paper is available at: <www.cmj.org/212qk/yejuan2.htm>; there are some problems with the computer translation of certain characters, however.

Reprints: Dr. Rivkah Isseroff, Department of Dermatology, University of California-Davis School of Medicine, E-mail: <rrisseroff@ucdavis.edu>.

Cornelia Baumgardt-Elms et al., including Andreas Stang and Karl-Heinz Jöckel, "Testicular Cancer and Electromagnetic Fields (EMF) in the Workplace: Results of a Population-Based Case-Control Study in Germany," ***Cancer Causes and Control, 13,*** **pp.895-902, December 2002.**

"Incident cases (n=269) were recruited between 1995 and 1997. A total of 797 controls matched on age and region were randomly selected from mandatory registries of residents. EMF exposure was assessed for five categories in standardized face-to-face interviews using closed questions....There was no excess risk for cases who reported to have ever worked near the following: radar units (OR: 1.0; 95% CI=0.60-1.75); radiofrequency emitters (OR: 0.9; 95% CI=0.60-1.24); electrical machines (OR: 1.0; 95% CI=0.72-1.33); high-voltage lines or high-voltage electrical transmission installations (OR: 0.7; 95% CI=0.38-1.18); or visual display units or complex electrical environments (OR: 0.9; 95% CI=0.67-1.21)....EMF exposure in the workplace does not seem to be a relevant risk factor for testicular cancer in our study....In our study, in which we distinguished five exposure categories ranging from ELF to EHF, including also a category with mixed frequencies, we could not observe an increased risk for testicular cancer in any of the categories. The risks did not increase with duration of exposure and decreasing distance from the source....In conclusion, a major reason for the incongruity of reported study results on occupational exposures to electromagnetic fields and testicular cancer stems from the difficulty of accurately assessing the exposure. The difficulty is magnified by the

fact that our understanding of the biological effects of EMFs is still scant....A...limitation may lie in the fact that our study does not take into account the detailed strength of the electromagnetic field; nor does it consider the effect of pulsed vs. non-pulsed frequencies. Thus, biologically essential aspects of exposure to EMF may not be correctly represented in this quantification concept. The effect of solvents, which are considered a potential confounder, was also not investigated."

Reprints: C. Baumgardt-Elms, Department of Environment and Health, Hamburg, Germany, E-mail: <cornelia.baumgardt-elms@bug.hamburg.de>.

See also *MWN*, J/F01.

Hajime Kimata, "Enhancement of Allergic Skin Wheal Responses by Microwave Radiation from Mobile Phones in Patients with Atopic Eczema/Dermatitis Syndrome [AEDS]," *International Archives of Allergy and Immunology, 129,* pp.348-350, December 2002.

"26 patients with AEDS (14 women and 12 men, mean age 31 years, range 21-52) were studied. All of the patients were allergic to house dust mite and Japanese cedar pollen. They took no medication for 72 h prior to the study. In the microwave radiation study, 26 patients viewed a 60-min video featuring weather information, while having 26 mobile phones calling for 60 min without sound. Since it was difficult to hold the mobile phone to the ear for 1 h, it was tied around the neck by string and consequently placed 4 cm below the chin. In the control study, 26 patients viewed a 60-min video featuring weather information while having 26 mobile phones without calling....[T]he wheal responses induced by both house dust mite and Japanese cedar pollen allergens were not changed in the control study. In contrast, the responses were significantly enhanced by microwave radiation. This was not due to enhanced nonspecific irritation of the skin, as no enhancement of wheal responses was induced by control solution or by histamine in these subjects. The enhancement of wheal responses was still significant ($p<0.05$) after 2 h...but not after 4 h."

Reprints: Dr. Hajime Kimata, Unitika Central Hospital, Uji, Kyoto, Japan, E-mail: <unitikah@m12.alpha-net.ne.jp>.

Jong Hwa Lee et al., "How Much Are Anesthesiologists Exposed to Electromagnetic Fields in Operating Rooms?," *Yonsei Medical Journal, 44,* pp.133-137, February 2003.

"We measured the amount of EMF exposure that an anesthesiologist gets in the operating room [with a Holaday HI-3604 meter]. The density of the magnetic field was checked by an extremely-low-frequency field strength measurement system in the 19 operating rooms of our hospital. We measured the magnetic field intensity at a distance of 30cm, 50cm and at the place where the anesthesiologist usually stands from the center of the main monitor....The ELF intensities were 0.56-4.25 mG ([average:] 2.22±1.13 mG) at 30 cm, 0.47-3.19 mG (1.29±0.84 mG) at 50 cm and 0.41-3.02 mG (1.00±0.78 mG) at the anesthesiologist's standing points."

Reprints: Dr. Ki Jun Kim, Department of Anesthesiology, Yonsei University College of Medicine, Seoul, Korea, E-mail: <kkj6063@yumc.yonsei.ac.kr>.

Z. Weinberger and E.D. Richter, "Cellular Telephones and Effects on the Brain: The Head as an Antenna and Brain Tissue as a Radio Receiver," *Medical Hypotheses, 59,* pp.703-705, November 12, 2002.

"The frequencies for transmission and reception by cellular telephones (800-900 MHz and 1800 MHz) include wavelengths of 33-35 cm and 16-17 cm, respectively. Human heads are oval in shape, and near the ear there will be a cross-section in the head with an axis either half the wavelength of RF/MW transmissions at 900 MHz or equal to the wavelength in the case of frequencies at 1800 MHz. Therefore, the human head can serve as a lossy resonator for the electromagnetic radiation emitted by the cellular telephone....In summary, since mobile phones broadcast specifically at frequencies at which the head serves as an antenna and brain tissue serves as a demodulating radio receiver, then it is reasonable to expect effects — adverse and otherwise — from bioresonance at field strengths and specific absorption rates well below current thresholds."

Reprints: Dr. Elihu Richter, Hebrew University, Jerusalem, Israel, E-mail: <elir@cc.huji.ac.il>.

"MICROWAVE NEWS" FLASHBACK

Years 20 Ago

• A *Lancet* editorial calls a U.K. study finding a higher mortality rate among electrical engineers due to leukemia "worrisome."

• Jocelyne Leal and Jose Delgado in Madrid report that very weak pulsed magnetic fields have a "consistent and powerful" deleterious effect on developing chicken embryos.

• Sandia Lab concludes that EMP radiation from a high-altitude nuclear blast will not stop a nuclear power plant from shutting down safely. A government official calls the report an "embarrassment."

Years 10 Ago

• Architects designing the new World Bank headquarters in Washington embrace prudent avoidance and use a number of techniques to reduce EMF exposures at "very little cost."

• In its letter to *Science,* a White House radiation panel criticizes Feychting-Ahlbom's power line epidemiological study and calls EMF risks "weak and biologically implausible."

• Rep. George Miller (D-CA) introduces the Children's EMF Risk Reduction Act of 1993, which would bar utilities from exposing school children to power line fields that exceed 2 mG.

Years 5 Ago

• The U.S. Battelle Pacific Lab fails to repeat Germany's Wolfgang Löscher and Meike Mevissen experiment showing that EMFs can stimulate the development of breast cancer.

• In Texas, tests reveal that digital TV technology causes widespread EMI, which renders certain cardiac monitors "useless."

• Steel-belted radial tires can generate magnetic fields as high as 50 mG in the rear seats of automobiles, three U.S. consultants warn in a letter to *Microwave News*.

Across the Spectrum

"Irreproducible results can be blessings in disguise. It means that there's some variable that you don't understand."

— Dr. James Watson, Nobel laureate, Cold Spring Harbor Lab on New York's Long Island, in his forthcoming book *Manners and Rules for Scientists,* cited by Ricki Lewis in *The Scientist,* February 24, 2003

"Don't Let Children Talk on Cell Phones."

— Headline in *Aftonbladet,* "'Låt Inte Barn Prata i Mobil,'" January 31, 2003; Dr. Leif Salford, a neurosurgeon at the University of Lund, Sweden, is quoted by Johan Edgar (see *MWN,* J/F03)

"Passive mobile phoning, like passive smoking, may also soon be an issue."

— Dr. Leif Salford commenting on his finding that mobile phone radiation increases permeability of the blood-brain barrier at levels as much as 1,000 times lower than the ICNIRP limit, quoted by Blaine Greteman in "Wireless Worries: A New Study Provides Fresh Evidence that Mobile Phones May Damage Brain Cells, Especially in Teens," *Time* (European edition), p.47, February 24, 2003 (see *MWN,* J/F03)

A mysterious property of lightning has been confirmed. Just before a flash of lightning lights the sky, a huge blast of X rays or other high-energy particles is released. The phenomenon means physicists may have to rethink how lightning is made.

— Nicola Jones, "Lighning Strikes Release Powerful X-Ray Bursts," *New Scientist* (U.K.), p.18, February 8, 2003

I Have Seen the Future — And It's Quite, er, Colorful

If you're lucky enough to find yourself in the 18th-floor ballroom of the Beijing Hotel when the weather is clear and sunny, as it was one crisp day this past December, you'll be treated to an amazing view of the Forbidden City, Tiananmen Square, and, if you lean way out over the terrace railing, the famous portrait of Mao Zedong. I, however, wasn't looking at any of that, because the Korean guy in the chair in front of me was showing me a porno movie on his cell phone. Pretty good picture quality too....I had just caught my first really good look at our future. For there is no more convincing sign of a technology's impending arrival than a naked woman writhing on a color screen....

— James Aley, "Heads We Win, Tails We Win" (on Qualcomm's prospects in the emerging market for 3G communications technology), *Fortune,* p.142-144, March 3, 2003

"Ultimately this technology will enslave humanity."

— Katherine Albrecht, privacy campaigner and doctoral student at Harvard University, Cambridge, MA, quoted by Simon London in "Radio ID Tags Spread Waves of Anger Among Privacy Activists," *Financial Times,* p.22, March 1-2, 2003

UPDATES

IARC

New Head for Cancer Agency... In May, the WHO will appoint a new director of the International Agency for Research on Cancer (IARC), based in Lyon, France, to replace Dr. Paul Kleihues. The choice may well be important to the EMF community, given IARC's plans to review the RF cancer data in 2005, as well as for the ongoing epidemiological study on possible cancer risks from mobile phones — known as the Interphone study — being run by Dr. Elisabeth Cardis (see *MWN,* M/A00). WHO Director-General Gro Harlem Brundtland listed the 30 candidates for the top job at IARC in a March 4 letter obtained by Bo Walhjalt, a Swedish freelance investigative journalist. (The letter is at: <www.gbg.bonet.se/bwf/docs/iarclist.pdf>.) Prof. Michel Coleman of the London School of Hygiene and Tropical Medicine, Dr. Christopher Portier of the U.S. NIEHS and Sir William Stewart, the new chair of the U.K.'s NRPB (see p.5), were on the list but not among those interviewed by the WHO in Geneva on March 10. Sources told *Microwave News* that the ten finalists include Dr. Hans-Olov Adami of Sweden's Karolinska Institute and Dr. Peter Boyle of the European Institute of Oncology in Milan, as well as three senior IARC insiders: Drs. Paulo Boffetta, Elio Riboli and Harri Vainio. Adami, who has dismissed cell phone brain tumor risks and is a critic of Dr. Lennart Hardell (see p.8 and

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MWN, J/F01 and S/O01 and S/O02), received a letter of "complete and unreserved support" from Hans Wigzell, the president of the Karolinska Institute. Others, however, continue to be concerned over Adami's work as a consultant to chemical companies. Boyle was a member of the study group set up by the Italian government which discounted the leukemia risk associated with the Vatican's radio antennas in Cesano outside Rome (see *MWN,* S/O01). The U.S. had weighed in with a preference for Boyle over Portier, the sources said. An editorial in the January 18 issue of the *Lancet* called for a public discussion on "conflicts of interest, accountability and transparency" at IARC.

MEDICAL DEVICE EMI

Mobile Phones in Hospital... Some U.K. doctors believe it is time to relax restrictions on the use of mobile phones in hospitals. In an editorial in the March 1 issue of the *British Medical Journal,* Drs. Saul Myerson and Andrew Mitchell of the John Radcliffe Hospital in Oxford argued that, "[T]he evidence for serious harm is flimsy, and the hysteria that surrounds the [issue] is unjustified." They point out that more EMI is generated by emergency room handsets than by mobile phones and that the phones only cause "temporary and very localized effects." Myerson and Mitchell offer a "more sensible and considered approach," such as permitting phone use in non-clinical areas and waiting rooms. A group of London doctors made a similar plea in a letter that, coincidentally, was published the same day in the *Lancet*. They reason that advances in technology during the past decade and the *de facto* use of mobile phones by medical personnel warrant a reevaluation. (For a different view, see "Hot New Papers," *MWN,* J/F03.) In the U.S. Don Witters of FDA's Center for Devices and Radiological Health told the *New York Times* (March 27) that the center continues to receive reports of EMI from cell phones to medical devices, but "not a large number." He noted, however, that he believed that such incidents were greatly underreported because of the difficulty of tracing problems to a specific transmitter.

MICROWAVE WEAPONS

The Promise and Danger of HPM Weapons... High-power microwave (HPM) weapons are "likely to see operational deployment in the near future, probably the next decade," writes Dr. Loren Thompson of the Lexington Institute in Arlington, VA. This and other not-so-surprising predictions — "The military impact of directed-energy weapons will be revolutionary" is another example — are contained in a 58-page report that was released in February. It covers the Pentagon's "active denial" technology, or "people zapper" (see *MWN,* M/A01), as well as lasers and HPM weapons that can disable electronic equipment. *Directed Energy Weapons: Technologies, Applications and Implications* is available at no cost from the institute's Web site, <www.lexingtoninstitute.org>. The mission of the Lexington Institute is to "inform, educate and shape the public debate of national priorities" in those areas that are important for national security, as well as education and tax reform.

PEOPLE

Dr. **James Lin** of the University of Illinois in Chicago will receive the d'Arsonval Award from the Bioelectromagnetics Society (BEMS) at this summer's annual meeting (see p.12). Lin has also been named an associate editor of *Bioelectromagnetics,* the society's journal. He will take over from Motorola's Dr. **C.K. Chou** in July. More immediately, Dr. **René de Seze** of France's National Institute for the Industrial Environment and Hazards has resigned as one of the other associate editors and has been replaced by Dr. **Maila Hietanen**, a member of ICNIRP who is with the Finnish Institute of Occupational Health in Helsinki. Both Chou and de Seze will remain on the editorial board....Dr. **Dariusz Leszczynski** has been promoted and is now the director of the Radiobiology Lab at STUK, the Finnish Radiation and Nuclear Safety Authority, in Helsinki....Last fall, Dr. **Robert Tarone** joined the International Epidemiology Institute in Rockville, MD (see p.5), after 29 years at the NCI....**Jimmy Dishner** is retiring from the U.S. Air Force's civilian service. Most recently he has been the executive director of the PAVE PAWS Project on Cape Cod, MA....Dr. **Bob Ashley** and his wife, Wanda, were in a car accident in Colorado the day after Christmas. Bob Ashley escaped relatively unscathed. Wanda Ashley suffered serious injuries, but will make a fairly complete recovery. Bob Ashley resigned from Minnesota's St. Cloud State University at the end of last year and they are now back home in Tampa, FL. He reports that the other driver was allegedly talking on her cell phone when she ran a red light and smashed into his Dodge minivan. "I know the real hazard of cell phones," he told us.... **Alan Goldberg**, the law partner of **Ben Barnow**, died of a brain tumor last December at the age of 49. Goldberg and Barnow were the plaintiffs' attorneys in the *Busse v. Motorola* class action suit, originally filed in 1995. (It later turned into an invasion of privacy case; see *MWN,* J/F96, N/D01 and N/D02.) Barnow & Goldberg also represented Robert Kane in his brain tumor case against Motorola. That long-running case was filed nearly a decade ago and is still in the courts (see *MWN,* J/F94 and J/A00).

PROTECTIVE EFFECTS

Do EMFs Delay Brain Tumors?... Several labs have reported that RF/MW radiation can protect against cancer (see *MWN,* S/O02). Now researchers in Taiwan are suggesting that power-frequency EMFs may also have beneficial effects. Patients who had residential exposures above 2 mG (0.2 ∝T) were on average nearly six years older (50.6 vs. 44.8) when diagnosed with brain cancer compared to those with lower exposures, a team led by Dr. Chung-Yi Li of Fu Jen Catholic University medical school in Taipei reports in the April issue of *Bioelectromagnetics (24,* pp.218-221, 2003). This is a significant finding. The largest difference in age (nine years) was in the "unclassified" brain tumor category. EMF-exposed patients with astrocytomas were four years older at time of diagnosis (not a significant finding), but there was no age difference for glioblastomas. EMF exposure was not associated with age of diagnosis for breast cancer or for leukemia. "Is it an artifact or is there a real delay? It's hard to say one way or the other," commented Dr. Gilles Thériault of McGill University in Montreal. Li was Thériault's doctoral student. Li

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himself sounded a note of caution: "I would regard this as a hypothesis-generating study," he told *Microwave News*. "My view is that whether ELF or RF can influence cancer latency — either adversely or protectively — can only be investigated in animal models." One of Li's coauthors is Dr. Ruey Lin of National Taiwan University, who, close to 20 years ago, was the first to make the link between occupational EMF exposures and brain cancer (see *MWN,* O84).

TOWER SITING

Mayor Favors Restrictions... Seattle Mayor Gregory Nickels announced plans to prohibit cell towers in neighborhoods with single-family houses. In a March 24 statement, Nickels said that putting antennas in residential areas is "simply not a good fit." The move was prompted by citizens angry about an agreement reached last September between the city council and T-Mobile USA — with Nickels's blessing — to locate 18 antennas in communities where reception was spotty. "Seattle prides itself as a city that is technologically savvy, and this directive sets that back," a dismayed T-Mobile official told the *Seattle Times* (March 24). Any changes to the agreement would be contested, she warned.

AS WE GO TO PRESS

SARS Not SARs... The EMF seminar scheduled to be held in Guilin, China, April 18-22, has been postponed until further notice due to the outbreak and spread of severe acute respiratory syndrome, or SARS.

Norwegian Phone Report... On April 2, the Norwegian Radiation Protection Authority released a report on mobile phones and health. It is available at <www.nrpa.no>, in Norwegian only.

Keeping Current: Follow-Up on the News

◆ Word has reached us from a number of sources that Dr. Leeka Kheifets will soon be leaving the WHO EMF project in Geneva. While noting that she does want to return to California, where she worked for EPRI before moving to Geneva, Kheifets told *Microwave News* that she has not submitted her resignation and has no immediate plans to come back to the U.S.

◆ Expect to see more letters in *Radiation Research* on the Utteridge-Kuchel experiment in which transgenic mice were exposed to mobile phone radiation (see *MWN,* S/O02 and J/F03).

◆ ICNIRP has released a summary of its report on *Possible Health Risks to the General Public from the Use of Security and Similar Devices*. The project, which was sponsored by EC's Fifth Framework Program, addresses RF exposures from antitheft and RF identification (RFID) systems. The authors see no hazard, apart from possible EMI with pacemakers. Go to: <www.icnirp.org>. (See *MWN,* M/A00; also p.15.)

◆ In the March 1 issue of *Occupational Medicine (53,* pp.123-127, 2003), Australia's Drs. Bruce Hocking and Rod Westerman review a number of published case reports, including several of their own, describing neurological effects attributed to RF radiation (see, for example, *MWN,* S/O01). Their conclusion: Some of the cases described "are not consistent with" the hypothesis that heating alone can cause adverse effects.

◆ In February, the U.S. Air Force announced that its research lab has published a report on the *Biological Effects of Exposure to Ultrawideband (UWB) EM Energy* — but it is classified. For those with the appropriate security clearance, Report No.AFRL-HE-BR-TR-0248 is available from the Defense Technical Information Center.

◆ The FDA has posted on its Web site recommendations for exposure assessment work to be carried out before mobile phone epidemiological studies move forward. The posting, which is at <www.fda.gov/cdrh/wireless/fdarr.html>, was prompted by the General Accounting Office, which reminded the FDA to regularly update its Web site (see *MWN,* M/J01 and J/A01).

VIEWS ON THE NEWS

A Silly Mistake or A Leading Indicator

David Carpenter put his finger on the problem (see p.3). Did some low-level staffer at the NIEHS make a mistake in posting a notice that it is okay for children to live next to a power line? Or is it an accurate reflection of what the institute's bosses really think?

Mary Wolfe assured us it was all a misunderstanding. We find this hard to believe. We see this as a kind of Freudian slip — a window into the minds of those who set EMF policy at NIEHS.

There are strong indications that the boneheaded advice that EMFs are a non-issue reflects the view of a clique within the institute that has long believed that studying EMF health risks is a waste of time and money.

In 1992, when Congress picked the institute to lead a national research effort — the EMF RAPID program — NIEHS' Gary Boorman and his staff made it known that they would go through the motions and end up showing that the EMF cancer risk does not exist.

They then proceeded to make a hash of the whole program. The wrong studies got funded and nothing much got settled. But, at the same time, the epidemiological evidence pointing to a leukemia risk among children got stronger and stronger. It became impossible to dismiss—at least for those who were not members of the electric utility industry or the NIEHS clique (and, of course, some like-minded physicists).

Despite the clique's best efforts, an NIEHS working group concluded in 1998, at the end of the RAPID program, that EMFs were indeed possible human carcinogens. That message was immediately watered down. The NIEHS issued a press release assuring everyone that there was really nothing to worry about (see *MWN,* J/A98).

Soon afterwards, the clique floated what looked like the EMF RAPID final report, which made no mention of the cancer risk. As one advisor to the program said at the time, "You would think we were in a different universe" (see *MWN,* J/F99).

Two years ago, when the International Agency for Research on Cancer (IARC) also labeled EMFs as possible human carcinogens, NIEHS' response was silence. It announced no new research initiatives. It issued no public advisories. It offered no recommendations on how to reduce exposures. Instead, the staff began drafting a booklet that sought to allay any lingering public concerns (see *MWN,* N/D02).

Who is running the show in Research Triangle Park? Is it Ken Olden, the director of the NIEHS, who told Congress four years ago that there should be "continued emphasis" on how to reduce exposures and who portrays himself as a protector of children's health? Is it Chris Portier, the head of the institute's Environmental Toxicology Program, who says he favors applying the precautionary principle to EMFs and who was one of those on the IARC panel who argued most strongly that the EMF cancer risk is no artifact?

Or is it the clique whose members thumb their noses at the international public health community and seem to be able to run their own show behind the backs of Olden and Portier?

Whither WHO?

As the NIEHS example discussed above makes all too plain, one can endorse precaution while favoring policies that are far from precautionary. (Even now that NIEHS' crass statement has been withdrawn, the institute has nothing in place that remotely resembles a precautionary strategy.)

So, although we welcome the news that Mike Repacholi and Leeka Kheifets are now embracing the idea that the precautionary principle should be applied to EMFs (see p.1), we await the specifics before raising our glass in a toast to their new outlook — lest we later find ourselves drinking the same old wine from a new, albeit politically correct, bottle.

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In our interview with Repacholi, we asked whether he would now discourage the use of mobile phones by children, a step endorsed by U.K.'s Stewart panel three years ago. Repacholi, a member of the Stewart group, had dissented from the majority view back then (see *MWN,* M/J00). He told us that he is still not ready to agree with Stewart.

We do not expect a radical change of outlook from the WHO, but we do look forward to some serious new recommendations. The credibility of the EMF project hangs in the balance.

DNA Breaks Redux

For a long time it has been the battle of the Washington universities: Henry Lai and N.P. Singh of the University of Washington, Seattle, versus Joe Roti Roti of Washington University in St. Louis. Now come the researchers working on the EC's REFLEX project who say that they, like Lai and Singh but unlike Roti Roti, see DNA breaks after RF exposures (see p.7).

Who's right? They all may be. As Franz Adlkofer, who leads the project, reminded us, there are many variables to be considered and the effect may come and go as they change.

One thing is already clear: The only way we will ever know what RF can do to us is by doing the research.

CLASSIFIEDS

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ELF Effects Across Generations

Chronic exposure to extremely low frequency (ELF) fields may adversely affect the reproduction and development of experimental animals, according to major new multi-generation studies. The findings are controversial and inconsistent, however. The Electric Power Research Institute (EPRI), which paid for the research, has agreed to support more long-term studies.

Experiments on three generations of rats and miniature swine at the Battelle Pacific Northwest Laboratories in Richland, WA, indicate that offspring of chronically exposed animals are most at risk. Females born and bred in 60 Hz electric fields and mated with unexposed males may yield progeny with more birth defects and lower weights than controls.

The Battelle studies appear to confirm the results of three-generation studies on mice by Drs. Andrew Marino and Robert Becker in the mid-1970s (see box on p.14).

One working hypothesis for the observed effect is that ELF fields might alter the timing of hormonal secretions from the pineal gland, which could in turn affect growth and development, according to Dr. Larry Anderson of Battelle. Chronic exposure to 60 Hz fields has been shown to affect the release of melatonin from the pineal gland in rats (see B.W. Wilson et al., *Bioelectromagnetics, 2,* pp.371-380, 1981).

Long-Term v. Short-Term Studies

EPRI's decision to fund long-term replication studies on rats is a reversal of an earlier policy announced last November by Dr. Gordon Newell, an EPRI senior program manager, to pay only for short-term studies. Dr. Richard Phillips, the former director on both the rat and swine projects, publicly criticized EPRI's initial reluctance to fund chronic exposure studies in the face of the experimental results.

(continued on p.14)

Walkie-Talkie RFI in Nuclear Power Plants

Operators of nuclear power plants are experiencing a growing number of radiofrequency interference (RFI) problems, and the Nuclear Regulatory Commission (NRC) has warned that RFI could create potentially hazardous situations.

In the three most recent incidents, hand-held walkie-talkie radios caused the loss of offsite power twice in five days at the Palo Verde reactor No.1 in Arizona and once at the River Bend facility in Louisiana. At both sites, the NRC explained in a statement issued in March, walkie-talkies interfered with transceivers in the fiber optics systems.

Eric Weiss, an NRC spokesman, said that none of the incidents posed a danger to workers or to the public.

(continued on p.15)

HIGHLIGHTS

Swedish Mice Study Links VDT Radiation to External Fetal Malformations

Simulated video display terminal (VDT) radiation emissions can cause fetal abnormalities in mice, according to Swedish researchers. In Stockholm, Drs. Bernhard Tribukait and Eva Cekan, of the Karolinska Institute, and Lars-Erik Paulsson of the National Institute of Radiation Protection have reported that fetuses exposed to VDT-like pulsed magnetic fields (PMFs) experienced nearly five times the rate of malformations as unexposed controls. The results are preliminary and the study is continuing.

The findings "might indicate that PMFs of this specific type [have] teratogenic effects," the investigators concluded in a study abstract they prepared for an international VDT conference scheduled for May in Stockholm.

In a telephone interview from his office at the Department of Medical Radiobiology in Stockholm, Tribukait explained that the exposed fetuses suffered an unusual number of rare, external abnormalities. "We have to look more carefully at the external malformations," he said. According to the abstract, the rate of internal malformations was consistent with that of the control group.

The Swedish National Board of Occupational Safety and Health (NBOSH), which is sponsoring the upcoming conference, released the study abstract. At a January 30 press conference, Dr. Ricardo Edstrom, NBOSH's medical director, expressed surprise at the results, saying that they were "totally unexpected" and that "we can no longer rule out the possibility that radiation could affect fetuses," according to press reports from Stockholm. He also observed that the findings might force the Swedish government to change its VDT work regulations to protect pregnant women but nonetheless cautioned that the results cannot be applied directly to humans.

Findings Contested

Other officials at NBOSH soon challenged the findings, however, charging that the statistical analyses failed to account for deaths and resorptions among the mice litters. Following two weeks of rumors that NBOSH would retract the study results, the agency released a statement on February 13 that downplayed but did not dismiss them. The board emphasized that it would not change its regulations for VDT work.

"A later-performed analysis, based on the combinations of living malformed, dead and resorbed fetuses, does not suggest any damaging effect," the statement explained. "In conclusion," it went on, "adverse pregnancy outcome effects due to VDT work have not been demonstrated."

Tribukait rejected NBOSH's method of analyzing the data. It is "bad policy" to combine the data on resorptions, deaths and malformations because resorptions normally occur at high rates in the strain of mice used, he explained to *Microwave News*. "They cannot be combined, not by my methods."

He also said that he was opposed to NBOSH's original decision to release the study abstract and that the board did not contact him before releasing its February 13 memo. According to press reports, Edstrom released the abstract because he believed the findings were too important to withhold, but NBOSH officials did not explain why the agency contested the results just two weeks later. One Swedish scientist who has followed the study closely said that the challenge to the data was "political business."

Experimental Setup

Tribukait, Cekan and Paulsson exposed four groups of pregnant C3H mice to weak PMFs and used a fifth group as unexposed controls. They applied two types of pulses, each at field strengths of 1 or 15 microtesla (uT): a sawtooth-shaped pulse simulating the PMFs emitted by a VDT's flyback transformer and a rectangular pulse resembling one used by Drs. Jose Delgado and Jocelyne Leal in Madrid, Spain (see *MWN*, November 1983 and January/February 1986). The sawtooth pulses, at 20 kHz, had rise and fall times of 45 and 5 microseconds (usec), respectively. The rectangular pulses had a width of 0.5 milliseconds and rise and fall times of 2 usec, with a repetition rate of 100 Hz.

In the experiments, each of the five groups contained 40-60 mice and 230-340 fetuses. The researchers found nearly five times the rate of malformations in the fetuses exposed to the 15 uT sawtooth-shaped pulses, compared to the controls (3.3 percent v. 0.7 percent). For the 1 uT sawtooth pulse, 2.7 percent of the mice developed abnormalities; combining the fetuses exposed to 1 and 15 uT sawtooth pulses produced a malformation rate of 2.9 percent.

The rectangular pulses, on the other hand, produced virtually the same rate of malformations as the controls. None of the pulses significantly affected the rates of resorptions, fetal deaths or body weights.

The abstract noted that the historical rate of malformations for the C3H mice strain is approximately 1.4 percent, double the rate observed in the experimental control group. Tribukait acknowledged the low rate and attributed it to the small sample size studied so far. He emphasized, however, that external malformations in the exposed mice were of a different type than those identified in the control group.

Confusion and Controversy

Confusion surrounded the study results as labor, industry and government officials reviewed the data, seeking to resolve the conflicting NBOSH views. Elizabeth Lagerlof, an attache at the Swedish Embassy in Washington, DC, told *Microwave News* that she was swamped by inquiries.

Swedish labor officials reportedly are concerned that NBOSH's February 13 memorandum might be used to

limit research efforts on reproductive risks and other VDT-related health issues. Lagerlof said that the unions are aggressively pressing the government to fund an expanded research program. Both Tribukait and Paulsson told *Microwave News* that the experiments will continue and will be attempted in other labs, as well.

An indication that the study results were not clearly understood appeared in the popular British magazine, the *New Scientist*, which reported on February 20 that Swedish government officials had "dismissed" concerns about magnetic fields from VDTs.

Dr. John Harris, IBM's director of product and process engineering, visited the Karolinska Institute in March, while on a business trip in Europe. An IBM statement, prepared at the request of *Microwave News*, said that "Harris is one of a number of IBMers involved in discussing [the PMF] work and his meeting...simply continued that dialogue."

Radio Station Closes in Face of FCC RF Rules

Citing the high cost of compliance, the owner of a California FM radio station has given up his broadcasting license rather than comply with the Federal Communications Commission's (FCC) rules for radiofrequency (RF) radiation. Daniel Healy, the owner of KERG in Garberville, told the FCC on March 17 that compliance with the FCC's radiation standard would be "prohibitively difficult and expensive."

The station's troubles began last fall when state engineers measured RF levels atop a fire lookout tower near the KERG transmitter. They found readings that were two to three times higher than the 1 mW/cm^2 exposure limit adopted by the FCC (see *MWN*, September/October 1985). The commission, which had approved a KERG request to increase its power output from 2 kW to more than 50 kW, ordered the station to cut back to 2 kW to protect forest rangers manning the lookout.

When the rangers left the tower at the end of the fire season last fall, the FCC allowed the station to resume broadcasting at full power. The commission stipulated, however, that KERG had to devise a way to meet the exposure limit before the fire season started again this spring.

In a telephone interview, William Hassinger of the FCC's Mass Media Bureau said that he was surprised by KERG's decision to shut down. *Microwave News* tried to reach Healy at KERG a week after he gave up his license, but the station's phone had already been disconnected.

Cancer Fears on Vashon Island, Washington

Washington state health officials are examining the incidence of cancer among people living near a satellite communications complex on Vashon Island, following allegations of an abnormal pattern of brain and endocrine cancers in the area.

Donald and Marcia Montgomery reported what they believe to be a cancer cluster in Paradise Valley around a satcom earth station operated by Alascom, which handles telephone traffic between the mainland U.S. and Alaska. In a letter to the local newspaper, the *Vashon-Maury Island Beachcomber*, the Montgomerys claimed that, over the last two years, nine of their neighbors had developed cancer. Five of the cases occurred among women under forty.

Dr. Samuel Milham, an epidemiologist with the Washington State Department of Social and Health Services in Olympia, well known for his studies of workers exposed to electromagnetic fields, is looking into the number and types of cancer. Most clusters do not check out, Milham told *Microwave News*, adding that he was skeptical about this particular case because the latency period for the development of cancer was too short — the power was turned on at the Alascom station in 1983.

Jay Becker, the editor of the *Beachcomber*, said that plans are underway for a house-to-house health survey of the residents of the approximately 117 houses near the Alascom station. Preliminary data from the Fred Hutchinson Cancer Research Center indicate that Vashon residents had a normal cancer rate for the period between 1973 and 1984, according to Becker. The survey will collect data about cancer, as well as Down's Syndrome, following the confirmation of an abnormal cluster of Down's cases in Vernon Valley, NJ, where there are three satcom stations (see *MWN*, May and November/December 1985).

RCA also has built a satcom station on Vashon Island after meeting strong opposition on nearby Bainbridge Island (see *MWN*, July/August 1982). The RCA station is on a 105-acre site, while the Alascom complex is on a much smaller plot, with houses and farms nearby.

Vashon for a Quality Environment, a citizen's group, has been fighting the Alascom station for years. Recently, under pressure, Alascom agreed to complete an environmental impact statement for the station — even though it is operational. Other radiation disputes have resulted in a 1 uW/cm^2 public exposure standard from microwave sources, according to Roger Leed, a Seattle attorney for Vashon citizen and community groups.

More on ELF Fields and Cancer

Outlined below are some of the latest research developments on the possible relationship between extremely low frequency (ELF) fields and cancer.

"Something Is Going On"

A consensus is emerging that exposure to ELF fields is linked to an increased incidence of cancer, according to presentations at a *Panel Session on Biological Effects of Power Frequency Electric and Magnetic Fields* held in New York City in early February. Drs. Tom Tenforde and David Savitz both said that the growing number of studies indicate that "something seems to be going on" among workers exposed to electromagnetic fields (EMFs).

After completing a comprehensive review of ELF bioeffects, Tenforde said there is a "real need" to do epidemiological studies of electric and electronic workers. Tenforde, who is with the Lawrence Berkeley Lab in California, noted that 15 of 17 reports showed "some apparent correlation between cancer and EMFs." One complicating factor, Tenforde noted, was the absence of a consistent dose-response relationship.

Savitz, who recently joined the University of North Carolina School of Public Health in Chapel Hill after leaving the University of Colorado, echoed Tenforde's concerns. In an interview with *Microwave News*, Savitz said that, when all the existing cancer data are grouped together, there seems to be a "consistent overall increased risk." He added that while the occupational data indicate a cancer link, risks associated with residential exposure need further study before a causal association could be shown.

Savitz said that the observed links cannot be explained by any known biases: "There are positive findings that cannot be dismissed." He noted that, because exposures tend to be diluted in the study populations, "the effect may be much stronger than studies are showing." Savitz also said that one of the weaknesses of the existing data base is the lack of accurate exposure information.

The organizer of the panel session, Dr. William Feero, warned that if there are health problems associated with EMFs, "we are talking about the whole electrical economy, not just power lines."

Attendance was relatively poor, given the interest in the power line bioeffects issue: only 45 (including speakers) of the more than 2,200 registrants at the *IEEE Power Engineering Society (PES) Winter Meeting* showed up at the panel session. The PES meeting was held in New York City, February 2-7. Copies of the booklet containing the five papers presented at the panel session are available for $20.00 (prepaid), plus a $3.00 handling charge, from Single Publications Sales Dept., IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854. Order No. 86TH0139-6-PWR.

McDowall and Coleman in the UK

Two recent reports from England indicate no clear relationship between cancer and non-occupational exposures to EMFs.

In a mortality study of people living near electrical transmission facilities, Dr. Michael McDowall of the Office of Population Census and Surveys in London found a significant excess of lung cancer in women, but not in men, and a less than significant increase in leukemia among women. Overall mortality in the study population was lower than expected, and McDowall reported no excess deaths from all cancers or all leukemias. He concluded, however, that the data for acute myeloid leukemia and lymphatic cancer were "inconclusive."

Lung cancer deaths appeared to show a dose-response relationship to proximity to electrical facilities. In addition, McDowall found a higher proportion of fatalities due to lung cancer, leukemias, other lymphatic neoplasms and circulatory and respiratory diseases among those living within 15 meters of such installations. Only the lung cancer results were statistically significant.

Florida To Set Power Line EMF Rules

The Florida Department of Environmental Regulation (DER) is developing rules for the siting of transmission lines, including criteria for electromagnetic field (EMF) exposures. The action came after the state's Siting Board denied the Florida Power Corporation a permit to build a 500 kV line near Tampa, in part because the DER had not adopted EMF rules.

After a number of siting disputes, the state legislature authorized the DER to set radiation exposure standards in 1983, but never allocated the funds necessary to do the job (see *MWN*, July/August 1983 and July/August 1984). Following the March 18 decision, Governor Bob Graham agreed to make contingency money available to the DER.

According to the DER's Karen Anthony, the department is considering a number of policies for EMFs, including setting electric and/or magnetic field exposure limits and specifying a minimum right-of-way (ROW) along a power line route. Last summer, the DER recommended a 190-foot ROW for the now-rejected 500 kV Lake Tarpon-Kathleen line (see *MWN*, September/October 1985).

A workshop is planned for mid-April and rules could be set by the end of the year, Anthony said.

For more information, contact Buck Oven, DER, 2600 Blair Stone Rd., Tallahassee, FL 32301, (904) 488-0130.

McDowall noted that the exposures of the majority of the study population were relatively low. He plans to continue monitoring mortality patterns. His paper was published in the February 1986 issue of the *British Journal of Cancer, 53,* pp.271-279.

Preliminary results of a case-control study by Dr. Michel Coleman of the Imperial Cancer Research Fund at the University of Oxford showed no overall association between leukemia and residential proximity to overhead power lines, although the data did suggest a "weak positive" effect — though the relationship between risk and distance to power lines was not statistically significant.

Coleman's study population, like McDowall's, had only low exposures to EMFs: less than one percent of the cases lived within 100 meters of an overhead power line. In addition, nearly the whole distribution network in the study area consisted of underground cables of less than 132 kV.

Coleman presented his findings at the *IEE International Conference on Electric and Magnetic Fields in Medicine and Biology,* held last December in London. He told *Microwave News* that he is preparing a paper for publication.

In 1983 McDowall and Coleman independently reported an increased risk of leukemia among workers exposed to electromagnetic fields (see *MWN,* March and June 1983).

Cancer Among Swedish Telecom Workers

Continuing their investigation of cancer incidence in the telecommunications industry, Dr. D. Vagero and coworkers have identified a 2.6-fold excess risk of malignant melanoma among workers compared to the Swedish population as a whole. The risk was even higher in workplaces where soldering was done.

In a related mortality study of Swedish electrical engineers, the same research group found a greater than threefold risk of malignant melanoma, compared with that of the general population, although only three cases were reported. But the engineers' overall mortality rate was "considerably" lower than expected, as was the number of cancer deaths. Both papers appear in the *British Journal of Industrial Medicine, 42,* pp.191-195 and pp.211-212, 1985. (See *MWN,* December 1983 for a discussion of the group's first paper.)

Milham on Leukemia and Lymphoma

At a 1984 conference, Dr. Samuel Milham of the Washington State Department of Social and Health Services reported a greater than expected number of deaths due to leukemia and non-Hodgkin's lymphomas among Washington state workers employed in occupations considered to involve electric or magnetic field exposures. His paper, presented at the *5th Annual Symposium on Environmental Epidemiology* in Pittsburgh, PA, has now been published in the October 1985 issue of *Environmental Health Perspectives, 62,* pp.297-300 (see also *MWN,* July/August 1982 and May and July/August 1985).

BSD v. Clini-Therm: Hyperthermia Patent Suit

The only two manufacturers of government-approved hyperthermia systems are suing each other. In February, BSD Medical Corp. of Salt Lake City, UT, charged Clini-Therm Corp. of Dallas, TX, with patent infringement and unfair competition. Clini-Therm responded with a counterclaim, alleging that BSD's patent was invalid and that BSD was engaging in unfair competition and violating antitrust laws.

At issue is the growing market for hyperthermia systems to treat cancer. BSD was the first to win clearance from the Food and Drug Administration (FDA): in late 1983, the BSD-1000 was judged "safe and effective" and in February 1984 the BSD-300, a mobile treatment unit, was similarly approved (see *MWN,* May 1983 and January/February 1984). The BSD-1000 delivers 50 to 1,000 MHz radiation with a variety of applicators. The FDA cleared Clini-Therm's external microwave hyperthermia system last August and an interstitial system in October (see *MWN,* November/December 1985).

In its suit filed on February 4 in U.S. District Court in Dallas, TX, BSD accused Clini-Therm of copying its interstitial applicator without permission and of misrepresenting BSD's financial status. In a telephone interview with *Microwave News,* BSD President James Skinner said that Clini-Therm had insinuated to potential customers that BSD was not a viable company and had told them to avoid BSD hyperthermia systems in favor of its own equipment. BSD, which did not specify the amount of damages it is seeking, is represented by Keith Nowak of Lieberman, Rudolph & Nowak of New York City.

Clini-Therm filed its counterclaim in the same court two weeks later. It denied BSD's allegations and asked the court to declare the BSD patent invalid and to stop BSD from making false and misleading statements about Clini-Therm and its products. Clini-Therm is trying to recover damages for lost sales and punitive damages of $1.5 million.

According to James Bradley of Richards, Harris, Medlock & Andrews in Dallas, who is representing Clini-Therm, the BSD patent is invalid because it was issued erroneously. In addition, Clini-Therm charged BSD with engaging in predatory pricing policies and with violating federal antitrust laws.

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Australia Sets A Strict RF/MW Exposure Standard

The new Australian safety standard for public and worker exposures to radiofrequency and microwave (RF/MW) radiation is one of the strictest outside of the Soviet Union and Eastern Europe. Issued in 1985, the national standard is based on the "as low as reasonably achievable" — or ALARA — principle.

The developers of the standard adopted a cautious attitude towards radiation risks — especially with respect to protecting the general public:

> "Because the effects of...exposures to electromagnetic fields are only imperfectly understood, it is recommended that the levels of all electromagnetic fields to which people are non-occupationally exposed should be kept *as low as reasonably achievable*." [emphasis in the original]

A "Flat" Standard

The standard differs from those used in other "Western" countries in two crucial aspects. First, it is frequency-independent — or "flat" — between 30 MHz and 300 GHz, limiting exposures to 1 mW/cm² for workers and to 200 uW/cm² for the general public; second, it specifies special precautions to safeguard against RF shocks and burns. (See Tables below.)

MAXIMUM OCCUPATIONAL EXPOSURE LEVELS

CONDITION A

Frequency	Mean power flux density (*S*)†	
	W/m²	mW/cm²
300 kHz ≤ 9.5 MHz	100	10
> 9.5 MHz ≤ 30 MHz	9000/f^{2}*	900/f^{2}*
> 30 MHz ≤ 300 GHz	10	1

CONDITION B

Frequency	Mean power flux density (*S*)†	
	W/m²	mW/cm²
300 kHz ≤ 3 MHz	1000	100
> 3 MHz ≤ 30 MHz	9000/f^{2}*	900/f^{2}*
> 30 MHz ≤ 300 GHz	10	1

NOTE: Values of *S* are averaged over any 60-second period.

*f = frequency in megahertz.
†S = equivalent plane wave power flux density.

Condition A applies in areas in which the risks of shocks and burns exist. Condition B applies when these risks have been eliminated.

While the Australian exposure limits are the same as those of both the American National Standards Institute (ANSI) and the International Radiation Protection Association (IRPA) in the 30-300 MHz band, they are five times stricter than those of ANSI and IRPA above 1,500 MHz.

The Australian standard is similar to the safety guidelines adopted by the Johns Hopkins University Applied Physics Laboratory (JHU-APL) in 1984. The JHU-APL limits are also based on the ALARA principle and are frequency-independent from 30 MHz to 100 GHz; they are stricter, however, limiting exposures to 100 uW/cm² in that frequency range (see *MWN*, December 1984).

In a "Rationale" accompanying the Australian standard, Committee TE/7 on Hazards of Non-Ionizing Radiation explained that:

> "With the present state of knowledge and taking into account the differences in opinion as to where an increase in the maximum exposure level would be appropriate, it would be wise not to increase the maximum exposure level for this higher frequency range above 1 mW/cm² at the present time."

Like IRPA's standard but unlike ANSI's, the Australian standard specifies limits for the general public which are five times more stringent than those for workers — ANSI recommends the same levels for workers and the general public. (The rationale details why its recommendations differ from those of the ANSI standard.)

Shocks and Burn Hazards Minimized

The committee that wrote the standard devised an original solution to the vexing problem of RF shocks and burns, setting different exposure limits for environments with and without such threats. For instance, when the risk of shocks and burns is present, RF exposures below 9.5 MHz are limited to 10 mW/cm², but when the necessary precautions are taken, the standard rises to 100 mW/cm² below 3 MHz.

Other key features of the Australian standard are:

- Between 300 kHz and 300 GHz, exposures can never exceed 1000 mW/cm², no matter how short the time.
- For all exposure conditions, regardless of the field strength, an averaging time of 1 minute is used.
- For exposures between 6 and 30 minutes, the limits can be relaxed by a factor of up to 5.
- Devices operating at frequencies below 1 GHz with an output power of less than 7 watts are excluded.
- Eye examinations are recommended for non-ionizing radiation workers before and after employment and at least every five years, if not more frequently.

RF Heater Workers Are Overexposed

In a paper presented at last August's *Conference of the Australian Radiation Protection Society* in Melbourne, Dr.

(continued on p.13)

UPDATES

COMMUNICATIONS

NAB Seeks Preemption... The National Association of Broadcasters (NAB) has again petitioned the FCC to preempt state and local rules on RF/MW exposure in favor of the ANSI standard, which the commission has adopted. In a March 17 filing, the NAB argued that the growing patchwork of local regulations is damaging to broadcasters and contended that "there is no rational reason to defer consideration of federal preemption." When it rejected the NAB's last plea in September, the FCC said that it was unsure of the legal basis for preemption (see *MWN*, September/October 1985). The NAB responded that the FCC has the necessary authority under both the Communications Act of 1934 and the First Amendment to the Constitution. The NAB also urged the FCC to adopt a policy statement, concluding, "Absent new scientific evidence showing potential from public exposure to [RF] energy at levels below the ANSI guidelines, the Commission believes that significantly more stringent state or local standards, which unduly restrict [broadcast and other interstate communications] services, must be preempted."...To reinforce the urgency with which it views this matter, the NAB calls non-ionizing radiation "perhaps the most important broadcasting issue of the year" in a brochure describing its engineering conference to be held April 12-16 in Las Vegas, NV.

Portland Measurements... The EPA's Richard Tell and the FCC's Dr. Robert Cleveland are scheduled to make RF measurements in Portland, OR, the week of June 23, with the week of July 14 as a backup, in case of possible conflicts. Meanwhile, the Portland City Council has deferred action on the proposed 200 uW/cm^2 safety standard until the FCC-EPA data are available (see *MWN*, November/December 1985).

RF Warning Sign

The National Association of Broadcasters (NAB) is marketing a radiofrequency (RF) radiation warning sign to help its members comply with the Federal Communications Commission's RF safety rules.

The aluminum sign, pictured below, is 24" x 18" and is printed in yellow and black: the triangle is yellow, in accordance with the specifications adopted by the American National Standards Institute in 1981 (see *MWN*, October 1981).

The signs cost $20.00 each for NAB members and $40.00 each for nonmembers. If you order three or more, you qualify for a ten percent discount. Order from NAB Services, 1771 N St., NW, Washington, DC 20036, (800) 368-5644.



COMPATIBILITY & INTERFERENCE

ARRL To Seek EMI Labeling... The American Radio Relay League (ARRL) plans to ask the FCC to require labeling of home electronic equipment to indicate susceptibility to EMI. The move was approved by the ARRL Board of Directors at its annual meeting in January. The petition, now in draft form, is under review by the Executive Committee and is scheduled to be filed in late March. David Sumner, executive vice-president of ARRL, told *Microwave News* that the petition does not grow out of any disenchantment with the ANS C63 ad hoc committee, which recently released a progress report on the immunity of TVs and VCRs (see *MWN*, January/February 1986). That report indicated that manufacturers were designing TVs and VCRS with greater immunity to EMI, but that more progress was still needed. Sumner said that the purpose of the petition was to make sure that the public is better informed about EMI problems.

Compliance Handbook...Dash, Straus & Goodhue (DS&G), an EMC R&D lab based in Boxborough, MA, has published *Compliance Engineering 1985-1986*. The 315-page volume explains how to comply with U.S. mandatory and voluntary standards for electronic equipment, as well as with many international regulations. (It covers both EMI and ESD but not U.S. military standards.) Parts 15 and 68 of the FCC rules are reviewed in great detail — including full texts of key FCC documents. According to Glen Dash, the editor of the handbook, the 15,000-copy press run is nearly exhausted, but a limited number of copies are still available. To obtain a complimentary copy or to be on the distribution list for the next edition, write to Dash at DS&G, 593 Massachusetts Ave., Boxborough, MA 01719, (617) 263-2662.

Power Conditioners... The first edition of *The Computer Power Buyers Guide* — a directory of standby power supplies, uninterruptible power supplies, power conditioners, computer grade transformers and voltage regulators — has been published by Gregory Evans. The guide lists more than 2,000 products from 70 manufacturers, giving their technical specifications and prices. Updates are planned every six months. The guide is available for $29.95, plus $3.50 shipping and handling, from Wellspring Enterprises, 9921 Carmel Mountain Rd., San Diego, CA 92129, (619) 484-4479. Telephone orders are accepted: call (619) 484-2435.

EM Shielding... Amplifier Research has introduced a new transmission-line cell, the SET-19, to test the effectiveness of RF shielding materials. The 14x5.5-inch cell helps produce "more accurate and repeatable results than those generated by shielded-room testing," according to the company. The SET-19 has an operating bandwidth of 0-3,000 MHz and costs $6,600. For more information, contact: Amplifier Research, 160 School House Rd., Souderton, PA 18964, (215) 723-8181....Carroll Coatings Co., which entered the EMI shielding market in 1983, is offering two new specialty coatings for plastics, composites and metals. Spectraguard C-621 Conductive Silver Polyurethane Coating provides a shielding effectiveness of 78 dB from 1 MHz to 3,000 MHz, while Spectraguard C-641 Conductive Silver Acrylic Coating provides a slightly lower capability (75 dB) in the same frequency range. Both coatings also eliminate static electricity buildup; the major difference between the two is that C-641 can be used for flexible applications. For more information, contact: Carroll Coatings Co., 217 Chapman St., Providence, RI 02905, (401) 781-4942.

GOVERNMENT

Keeping Up with Washington... The Gramm-Rudman budget reduction law and concern over national defense are making it more and more difficult to follow the government's activities. On February 21, the FCC stopped publishing full texts of its proposed rules, rulemaking decisions and policy statements. FCC officials said that the move to issue only summaries in the *Federal Register* was prompted by a $4 million cut in its FY86 budget under Gramm-Rudman. According to the commission, the summaries will provide sufficient details to keep the public informed. Those who want the full texts will have to go to FCC libraries or buy the documents from the FCC's contractor, International Transcription Services, 2100 M St., NW, Suite 140, Washington, DC 20037, (202) 857-3800....At the FDA, the Gramm-Rudman law is forcing the Center for Devices and Radiological Health to turn its two newsletters, the *Radiological Health Bulletin* and the *Medical Devices Bulletin*, into bimonthlies. An FDA staffer told *Microwave News* that neither publication could resume a monthly publication schedule before FY87 (which begins October 1, 1986), if then....On a different front, *Aviation Week* reported in its March 17 issue that, two years ago, the DOD and the CIA started a disinformation program on a number of key aircraft and weapons programs. Among those affected are the Strategic Defense Initiative (SDI, also known as "Star Wars") and the Stealth bomber, which is designed to evade radar detection. Under the plan, the government is releasing "deliberately false, incomplete and misleading" technical information, according to *Aviation Week*. On March 20, the *Washington Post* reported that U.S. senators were pressing for an investigation after hearing reports that members of Congress were victims of the disinformation program at the same time that SDI staffers provided Soviet officials with a classified briefing on Star Wars. At last word, a Congressional hearing has been scheduled, but it will be closed to the public.

FCC Steps Up EMI Enforcement... The FCC's FY87 budget request includes ten new positions for field operations personnel to respond to EMI complaints and to public requests for information. The commission notes that, "The rapid development of telecommunications technology resulting from deregulation has dramatically increased interference problems in a number of services, particularly the safety services." By early March, the first signs of the new enforcement policy surfaced as Richard Smith, chief of the FCC's Field Operations Bureau, announced that the commission was stepping up its efforts to stop the illegal sale and use of linear amplifiers to boost CB transmitter power. According to FCC statistics, 57 percent of the public's complaints of EMI to home electronic equipment from CB radios can be attributed to overpowered CB stations, of which 91 percent involved linear amplifiers. Smith told the Associated Press that, "People's tolerance for interference is good until it is repeated over a long period of time; you can get pretty tired of the same guy interfering with your viewing of *Dallas* every Friday."...A further signal came from the FCC's testing program of microcomputers. According to an item in the March 24 *InfoWorld*, half of 29 micros tested — all of which had previously won FCC approval — failed to meet the commission's Part 15 emission limits. The FCC's Art Wall will not reveal which company's computers were leaking too much radiation until the testing program is completed in May.

EMC LAP Moves Forward... The NBS will proceed with its new Electromagnetics Laboratory Accreditation Program (LAP) now that a dozen labs have applied for accreditation. The LAP, which covers EMC and telecommunications testing, was officially announced last September in response to a request from Retlif Testing Labs (see *MWN*, March, June and September/October 1985). According to Jeffrey Horlick, project leader for the Electromagnetics LAP, the 12 responses justify proceeding with the LAP. Horlick is planning an April workshop for four technical experts, who will be under NBS contract to evaluate applicants. Horlick now estimates that the first labs could win accreditation by September 1. For more information, contact Horlick, NVLAP, NBS, ADMIN A531, Bldg. 101, Gaithersburg, MD 20899, (301) 921-3431....In a re-

lated development, the General Services Administration has asked the NBS to set up a new LAP to accredit laboratories that provide electrical and safety testing services. Among the standards to be codified is one for EMI filters. Comments on the proposal are due by May 12. For more information, see the NBS's March 12 *Federal Register* notice (51 *FR* 8525).

Economics of Standards... The EPA's Office of Radiation Programs has issued a request for proposals for an "Economic Analysis of Radiation Protection Standards." The successful contractor will estimate the costs and benefits of a number of possible regulations, including non-ionizing radiation exposure standards for workers and the general public. Among the other standards to be studied are those associated with radon in homes, low-level radioactive wastes, uranium mill tailings and ionizing radiation in the workplace and in the general environment. Proposals were due on February 5, and the work must be completed by September 30, 1987. For more information on Solicitation No. DU-86-C038, contact the EPA's contract officer, Vickie Presnell, (919) 541-3564.

MEASUREMENT

Time-Averaging Meter... Holaday Industries, based in Eden Prairie, MN, has introduced a new measurement system that can average radiation signals over six-minute intervals and therefore monitor compliance with the ANSI standard. The HI-5000-SX system includes the HI-3002 broadband field strength meter and the HI-3320 "datalogger." Users can see instantaneous exposure levels as well as six-minute averages. The price of the whole system is $4,990; it can also be rented for $650 per month. Individually, the HI-3002 costs $3,395 and the HI-3320 costs $1,595 (including connector cable). For more information, contact Burton Gran, Holaday Industries, 14825 Martin Drive, Eden Prairie, MN 55344, (612) 934-4920....EPA's Richard Tell has prepared a paper that describes his evaluation of the HI-5000-SX system and its use for measuring fields from broadcast sources. Tell will present the paper at the National Association of Broadcasters' (NAB) Engineering Conference on April 15 in Dallas, TX. For information on obtaining a copy of the paper, contact NAB's Publications Dept., 1771 N St., NW, Washington, DC 20036, (800) 368-5644.

Methods and Standards... Drs. Bruno Weinschel and Stephen Adam, two well-known members of the IEEE community, have edited a special issue of the *Proceedings of the IEEE* (January 1986) on "Radio Measurement Methods and Standards." This impressive collection of 44 invited papers reviews not only measurement techniques, but also the analysis and interpretation of the data. Many of the authors work at the NBS, and others give the volume an international perspective. Researchers from Australia, Canada, Denmark, England, Japan and the Soviet Union are represented. The papers will probably later be turned into an IEEE Press book. Single copies of the issue are available for $6.00 (IEEE members) or $12.00 (others) from the IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854, (201) 981-0060.

In the Near Field... Arthur Yaghjian of the Electromagnetic Sciences Division at Hanscom AFB, MA, has published "An Overview of Near Field Antenna Measurements" in the January issue of the *IEEE Transactions on Antennas and Propagation*. The well-referenced paper discusses sources of experimental error and the limitations of planar, cylindrical and spherical near field scanning....Staffers at the U.S. Army's White Sands Missile Range are writing specifications for the acquisition of an "Antenna Near Field Measurement System," covering the frequency range 100 MHz to 18 GHz and later for millimeter waves. See *Commerce Business Daily*, March 14, p.64.

MEDICAL APPLICATIONS

Aberrant Heating... Hyperthermia treatments can heat normal healthy tissue, in addition to tumors. Drs. Mark Hagmann and Ronald Levin of the NIH in Bethesda, MD, have been using computer modeling to study ways of minimizing what they call "aberrant heating." They recommend avoiding 100-500 MHz, frequencies in the resonance range; their model indicates little heating outside the desired area below 60 MHz. Conversely, they note that microwave frequencies may also be desirable since the energy does not penetrate very deeply. They urge oncologists to heed complaints from patients regarding heating in various parts of the body. Their paper, "Aberrant Heating: A Problem in Regional Hyperthermia," appears in the April issue of the *IEEE Transactions on Biomedical Engineering*.

Electric Man...*Discover* magazine has discovered Dr. Bjorn Nordenstrom and his theories about the electrical network inside the human body and its role in both the development and the treatment of diseases — especially cancerous tumors. The cover of the magazine's April issue offers a generous, though tentative, appraisal: "If he's right, he has made the most profound biomedical discovery of the century." According to Nordenstrom, a Swedish radiologist based at the Karolinska Institute in Stockholm, an injury in the body creates an alternating voltage, which drives an AC circuit, with blood vessels serving as the wiring between healthy and diseased tissue. Nordenstrom has applied his theory to the treatment of lung and breast cancers: he inserts electrodes into the tumor and into the surrounding healthy tissue and applies a low-voltage electric current. Many researchers believe Nordenstrom has had impressive results. Among the 20 patients who first received the treatment, the tumors regressed in ten cases and disappeared completely in seven others. Nordenstrom has treated 80 patients so far, without any fatalities. *Discover* asks "why the medical community has barely noticed that Nordenstrom's theory exists." A 358-page book explaining his theory, *Biologically Closed Electric Circuits: Clinical, Experimental and Theoretical Evidence for an Additional*

Circulatory System, was self-published in 1983 and has sold only 400 copies. A few scientists are aware of his work, however, and research groups in France and Japan are beginning to replicate his findings....See also Nordenstrom's paper, "Biologically Closed Electric Circuits: Activation of Vascular Interstitial Closed Electric Circuits for Treatment of Inoperable Cancers," in the *Journal of Bioelectricity, 3,* pp.137-153, 1984.

MEETINGS

Static Magnetic Fields...A workshop on the *Biophysical Effects of Steady Magnetic Fields* was held in Les Houches, France, February 25-March 6. Among the participants were Drs. A. Belossi, F. Bistolfi, J. Bouvet, Klaus Dransfeld, Richard Frankel, Abe Liboff, Robert Liburdy, Peter Semm and D. Sperber. The proceedings of the workshop will be edited by Dr. G. Maret of the Max Planck Institute in Grenoble, France, and will be published by Springer-Verlag.

Electroheat... Last December 2, the Canadian Ministry of Energy and Ontario Hydro jointly sponsored a *Radiant Wave Electroheat Workshop* in Toronto. The 11 papers presented at the meeting have now been published in a typescript volume, which is available at no charge while supplies last. Contact: Gillian MacLeod, Industrial Product Development, U4-E4, Ontario Hydro, 700 University Ave., Toronto, Ontario M5G 1X6, Canada, (416) 592-5526. Please enclose a self-addressed mailing label.

MILITARY SYSTEMS

Central OTH-B... In our last issue we reported on the U.S. Air Force's plans to prepare an environmental impact statement (EIS) for a new over-the-horizon backscatter (OTH-B) radar in Alaska. In February, the Air Force announced that it was preparing another EIS for its fourth OTH-B radar, to be located in the middle of the country. The proposed sites for the transmitter and the receiver are in Minnesota, North Dakota and South Dakota. According to the current schedule, the draft EIS for the Alaska OTH-B will be completed at the end of May and the draft EIS for the central OTH-B will be ready a month later. Meanwhile, testing has begun on the East Coast OTH-B, which should be operational by the end of 1987, and, this summer, construction will begin on the west coast OTH-B. For more information, contact Colonel James Lee, OTH-B Systems Program Office, HQ Electronic Systems Division, Hanscom AFB, MA 01731, (617) 271-5387.

STANDARDS

Revising ANSI C95.1... Subcommittee IV of the Accredited Standards Committee C95 on Non-Ionizing Radiation Hazards will review a draft revision of the 1982 ANSI RF/MW radiation safety standard at a two-day meeting, June 6-7, in Madison, WI, immediately following the Bioelectromagnetics Society annual meeting. (The dates were rescheduled from May 31-June 1.) According to John Osepchuk of Raytheon, the secretary of the subcommittee, the standard is being "significantly" revised and now includes a new requirement to limit shocks and burns from induced currents at low frequencies — changes prompted by new data from the Universities of Utah and Washington (see *MWN,* July/August 1985). A working group of the subcommittee met in Las Vegas, NV, December 4-5. At that time, members of the working group were given writing assignments to prepare the draft standard for discussion in Madison.

RF/MW Safety in Eastern Europe... Dr. Przemyslaw Czerski describes current RF/MW radiation exposure standards in Czechoslovakia, Poland and the U.S.S.R. in the most recent issue of *The Journal of Microwave Power, 20,* pp.233-239, 1985. (See also *MWN,* June 1985.) Based on informal personal communications, Czerski reports that the Council of Mutual Economic Cooperation (COMECON) is developing occupational guidelines to be adopted by member nations. He predicts that these levels will be similar to those adopted by the International Radiation Protection Association (see *MWN,* March 1984) and that they will depend on frequency and duration of exposure.

Electrosurgical Devices... The Association for the Advancement of Medical Instrumentation (AAMI) has issued a draft standard, *Electrosurgical Devices,* for public review. It covers generators, electrodes and cables which are designed to deliver RF and electrical currents for surgical applications. The standard was issued for comment in 1985, but has now been re-released after substantial revisions. Copies are available for $15.00 (AAMI members) or $20.00 (others), prepaid, plus $3.00 postage and handling, from Dawn Boots, AAMI, 1901 North Fort Myer Dr., Suite 602, Arlington, VA 22209, (703) 525-4890. Order No. HF18.

VDTs

X-Ray Emissions... Researchers at the New York University Medical Center in New York City have confirmed the findings of many other groups: almost no X-radiation is emitted by a properly built cathode ray tube (CRT). Drs. Mark Maiello, Frank Rosenthal and Naomi Harley of the university's Institute of Environmental Medicine report that operator exposures are "due to natural radioactivity and not to low-energy X-rays penetrating the tube face." Their paper appears in the February 1986 issue of *Health Physics.*

Pregnancy Risks Resources...NIOSH officials have verified a reported miscarriage cluster among VDT operators at the Alma, MI, office of the General Telephone Co. of Michigan. The report on the agency's findings cautions that the study population was too small to make the association statistically significant, however. The report, HETA 84-297-1609, is available from NIOSH, Division of Standards Development and Technology Transfer, 4676 Co-

lumbia Parkway, Cincinnati, OH 45226....A Finnish research team led by Dr. Kari Kurppa has published the final results of its epidemiological study of birth defects and VDT work (see *MWN*, January/February 1985). The study, which found no evidence that terminal operators face an increased risk of giving birth to children with defects, appears in the *Scandinavian Journal of Work and Environmental Health, 11,* pp.353-356, 1985....Officials at Health and Welfare Canada (HWC) have dismissed the conclusions reached by Dr. Hari Sharma in his report on a cluster of problem pregnancies at the Surrey Memorial Hospital in Vancouver, BC (see *MWN*, July/August 1982 and October 1984). Sharma judged that the cluster was most likely caused by non-ionizing radiation from VDTs. In their critique, HWC's Drs. S. Mohanna and Maria Stuchly, of the Radiation Protection Bureau, and Dr. G.J. Sherman of the Bureau of Epidemiology argue that Sharma's findings are "distorted and not based on scientific evidence."...In a related development, in December the Health Protection Branch of HWC sent an "Information Letter" to Canadian physicians, assuring them that VDT radiation poses no risk to terminal users. Copies of both documents are available from the Radiation Protection Bureau, HWC, 775 Brookfield Road, Ottawa, Ontario K1A 1C1, Canada.

From the UK... Humane Technology, a consulting group, has published the proceedings of a meeting on VDTs it held late last year. *A Conference on the Alleged Health Hazards of Work at VDUs: Current Industrial Relations Issues* includes 15 papers from labor, business and academic groups in the UK, covering reproductive risks, repetitive strain injuries and other musculoskeletal ailments. It is available for 17.50 Pounds (16.00 Pounds in Europe) from Humane Technology, PO Box 2, Quorn, Leicestershire LE12 8EG, UK....The British government's Health and Safety Executive (HSE) has released a ten-page pamphlet, in a question-and-answer format, that dismisses concerns about radiation emissions, reproductive risks and other long-term VDT health problems. *Working With VDUs* is available for free from the HSE, Baynard House, 1 Chepstow Place, Westbourne Grove, London W2 4TF, UK....The London-based Trades Union Congress (TUC) has reprinted labor union negotiating guidelines issued last year by FIET, the International Federation of Commercial, Clerical, Professional and Technical Employees. The *TUC Guidelines on VDUs*, covering radiation emissions, reproductive risks and visual and musculoskeletal problems, is available for 1.20 Pounds from the TUC, Congress House, Great Russell Street, London WC1B 3LS, UK.

ETC...

Units and Terminology... The International Non-Ionizing Radiation Committee (INIRC) of the International Radiation Protection Association (IRPA) is trying to bring a modicum of uniformity and harmony to the field. To this end, an INIRC working group has published a "Review of Concepts, Quantities, Units and Terminology for Non-Ionizing Radiation Protection." It covers ELF, RF, MW and optical radiation, as well as ultrasound. The working group's report, which includes a host of useful definitions and explanations and an index of quantities and units, appears in the December 1985 issue of *Health Physics*.

Odds and Ends...A team of German and Australian scientists have established that the platypus can locate and avoid objects using its sensitivity to DC fields. This is the first time electroreception has been shown in higher vertebrates; see the cover story in the January 30 *Nature*....In past issues, we have described the problem of winter depression and its treatment with bright lights. Now comes a report that the the suffering may not let up in the summer. An item in the March 8 *Science News* notes that researchers have found that summer symptoms include impulsive and violent behavior. Indeed, one expert is quoted as saying that seasonal swings are sometimes diagnosed as manic depression....Dr. David Carpenter, who has led the New York State research program on power line health effects, has been appointed dean of the School of Public Health Sciences of the State University of New York in Albany....And Dr. C.K. Chou, who was at the University of Washington in Seattle for 14 years, largely working with Dr. Bill Guy, has joined the City of Hope National Medical Center in Duarte, CA, as the head of biomedical engineering. Chou reports that he is starting a new hyperthermia program there....Last September, a high school student in Piscataway, NJ, died suddenly, apparently while making a phone call during a thunderstorm. The February 16 *New York Times* reports that investigators have concluded that the youth was electrocuted by a lightning-induced surge on the phone line, which caused his heart to stop....The stealth bomber, designed to be invisible to radar, has gained a conspicuous presence in Washington over the last few months. In a series of columns, Jack Anderson has berated the stealth bomber program as an expensive failure: the bombers may cost up to $80 billion and may still be detectable by older Soviet radars. See also the cover story in the February *Discover* magazine....The Polytechnic Institute in Brooklyn, NY, has honored Dr. Ernst Weber by renaming Poly's Microwave Research Institute as the Weber Research Institute....The March 12 *Washington Post* Health Section cites research by Larry VandeCreek of Ohio State University that shows that stress-induced stomach "butterflies" are caused by electrical activity....On March 28, UPI reported that a jury awarded more than $1 million to a woman who alleged that she had lost her psychic power after having a CAT scan. The hospital is appealing the decision....And finally, there is the case of Bruce Blair, a staffer at the Congressional Office of Technology Assessment (OTA) who wrote a report on the vulnerability of military communications to nuclear weapons, such as EMP radiation. According to the February 18 *Wall Street Journal*, he did his job too well — his OTA report was classified ultrasecret, and Blair can no longer read it, even with his top-secret clearance.

FROM THE FIELD

NAS-NRC: DOE's Research Program on EMF Safety

Excerpted below is the chapter on the safety of electric and magnetic fields (EMF) from the National Academy of Sciences (NAS) - National Research Council's (NRC) Issues in Electric Energy Systems: A Review of the DOE R&D Program. *The report was prepared by the Committee on Electric Energy Systems (EES), chaired by Andrew Corry, retired from the Boston Edison Co., and published by the National Academy Press. It was requested by the Department of Energy (DOE). To aid in its work, the committee held a two-day workshop last April which was closed to the public. A number of experts on EMF bioeffects were invited to present their views (see* MWN, *March 1985). Among the members of the committee with a special interest in EMFs are Drs. David Carpenter of the New York State Department of Health and Michael Marron of the Office of Naval Research. Copies of the full report and of the proceedings of the workshop,* Papers Presented at a Workshop on Electric Energy Systems Research, *are available for $5.00 each from the Energy Engineering Board, NRC, 2101 Constitution Ave., NW, Washington, DC 20418.*

BACKGROUND

...The impacts of EMF fields at the levels induced by transmission lines are not well understood. Unfortunately, there is a wide body of conflicting literature alleging that the effects on biological systems of EMF at levels induced by transmission lines range from the nonexistent to the catastrophic.

The physical effects of EMF induced by transmission lines include audible noise and radio and television interference. Certain types of pacemakers can be adversely affected by exposure to these fields. With respect to biological effects, it is known that bees in hives may experience physiological and behavioral problems in the presence of EMF fields and that cattle may experience small shocks from induced voltages picked up by ungrounded metallic objects.

Numerous investigators have attempted to determine to what extent the electrical and magnetic environment produced by transmission of electrical energy poses a health hazard to living organisms. Effects on the nervous system have been convincingly demonstrated in laboratory animals. The effects include altered neuronal excitability, altered levels of certain hormones affecting circadian rhythms, behavioral changes, and altered locomotor activity. It is not yet known whether these and other observed effects are caused by a direct interaction of the electric field with tissue or an indirect interaction, such as a physiological response caused by sensory perception of the fields by test animals. The nature of the physical mechanisms involved in field-induced effects is obscure and is one of the most important goals of current research.

Based on the evidence examined, including the papers presented at the Workshop, the Committee believes that much of the literature claiming that EMF is hazardous fails to meet such criteria for objective scientific research as proper experimental controls and replicability of results.

The public at large has a serious and legitimate concern for the safety of electric power facilities and does not have the information and the criteria to make scientific judgments on its own. The literature on biological testing for the full range of potential effects posed by EMF is incomplete, leaving many questions unanswered. As a result, persons and organizations who sincerely believe in the harmful scenarios can take legal action either to prevent or to slow down the construction of new transmission and distribution facilities on the grounds that harmlessness cannot be proved. These actions, if successful, can add significant costs to both the construction of new facilities and to the operation of the electric power system, and can prevent needed expansion to improve reliability and economy of service.

Unfortunately, it is impossible to prove in an absolute sense that an environmental agent such as EMF has no harmful effects under any and all circumstances. However, it is possible to provide a baseline of highly qualified research, specifically designed with electric power systems in mind, that would increase the understanding of the phenomena and would contribute to higher confidence levels for planners and builders of transmission facilities. Some of this work is being done by EPRI ($15 million is to be spent between 1985 and 1989), but however high its scientific quality may be, it will of itself not be adequate. To begin with, there is the problem of policy credibility when a party at interest sponsors the research. In addition the level of funding is limited and cannot be expected to cover all relevant research problems. Thus, additional effort is needed both to evaluate and confirm EPRI's efforts independently as well as to add to the total pool of original investigation.

COMMITTEE FINDINGS

Recommended Research Program

An EES-sponsored research program aimed at addressing potential health hazards of AC and DC transmission lines should include both a long-term basic research component and a short-term applied research component. The objective of the short-term component should be to provide an adequate basis for establishing reasonable exposure guidelines. This program should involve an intense effort focused on established effects and should be aimed at determining dose-response curves for biological effects. A second part of the program should be aimed at developing a dosimetric basis for extrapolating results from animal studies to equivalent exposures in humans. A third and final part of the short-term program should involve epidemiological research. Planning for a careful program of epidemiological studies of transmission line field health effects should begin immediately because lack of data may impede new transmission line projects.

The Committee envisions a short-term component funded at a level of $10 million a year and lasting approximately five years. This research should lead to agreement on an appropriate index for establishing exposure standards. It must be recognized that such a standard will require periodic review and revision as information becomes available about the mechanisms by which electric and magnetic fields alter biological functions.

The long-term basic research component of this program should have as its objective the determination of mechanisms between electric and magnetic fields and biological tissue. A firm understanding of these mechanisms of interaction is required for reliable extrapolation to humans of laboratory studies of field effects on animals.

The Committee envisions a long-term program funded at a level of approximately $2 million a year conducted over a period of ten or more years. The exact length of time necessary for the conduct of this basic research is difficult to estimate.

Experience in the study of the biological effects of ionizing radiation suggests that even after the mechanisms of interaction

are known, additional research will be required to address questions about the hazards of chronic exposure to very low level fields.

Critique of DOE's Current EMF Efforts

If the combined program of basic and applied research is to have any impact on the question of biological effects of transmission line fields, it is essential that funding and management of the program develop far greater stability than has existed in the past at DOE.

This research has frequently suffered from poor definition of priorities, unstable funding, lack of competition and peer-reviewed analysis of proposals, mediocre quality of investigators, inadequate dosimetry of fields, and lack of solid scientific approach to the questions requiring double-blinded exposures, dose-response studies for effects, and tests for reproducibility of results. The result is that the field is cluttered with reports drawing conclusions of questionable validity.

It is critical that the DOE program be directed by a staff that is knowledgeable about both the biological and engineering aspects of exposures to electric and magnetic fields. For the program to be competitive the investigators selected should be of the highest quality. A system of peer review for research proposals is necessary: lack of adequate peer review has contributed to the perception of the current program as limited and unimaginative. The tendency to fund current contractors whose special EMF effects capabilities may be less than desired for work in such new areas, while offering some advantages in administration of the program, severely limits its vitality and is certain to lead to ultimate failure in the adequate identification of the causes and extent of field effects on humans.

In the view of the Committee, the administration of these programs by DOE has been far below standard. This may not reflect on the persons currently responsible for administering the program, but rather the lack of specialized personnel, the instability of the funding, and other factors beyond their control.

Whatever the reasons, the result has been a program that has marginal credibility and may not have supported the most competent investigators. It is critical that this program be competitive and that contract awards be made by a peer review process on the basis only of the quality of the application and the ability of the applicant. For the program to be successful and to avoid the past difficulties, it is critical that it be directed by a staff that is knowledgeable about both the biological and engineering aspects of EMF exposure. This administrative group within DOE should be enlarged to include biologists as well as engineers.

Proper Place of the Program

While the Committee agrees on the need for a federal program of research to address issues of the safety of power transmission lines, it is not obvious where such a program should reside. The National Institutes of Health (NIH) are responsible for several programs concerned with health and human safety. However, they are not highly directed to the specific problems of the power industry and are unlikely to give the problems adequate priority. For this reason NIH is probably an inappropriate choice. Agencies with regulatory responsibility in areas including radiation and field effects (the Environmental Protection Agency and the National Institute for Occupational Safety and Health) should maintain a research program of sufficient breadth to permit intelligent exercise of that responsibility, but they cannot be expected to undertake the role of developing the specific scientific basis for regulation with respect to the electric power industry.

DOE is the most logical agency to assume responsibility for support of basic research necessary to establish exposure standards related to the electric supply system. DOE historically has assumed this responsibility and has in the past initiated a program of research on health effects of AC transmission line electric fields. Although the nature of the program and the location of responsibility for it within the organization [have] changed many times over the years, DOE has remained and should remain the major funding organization for research into the health effects of transmission line fields.

Australian RF/MW Standard

(continued from p.6)

K.H. Joyner of the Australian Radiation Laboratory noted that, "Implementation of the new standard will undoubtedly require surveys of existing facilities to be carried out. Subsequent to these surveys, and where necessary, changes to work practices and/or alteration to these facilities, such as the installation of shielding, will have to be made."

Indeed, Joyner and his colleague, Dr. M.J. Bangay, have found, in a survey of the electric and magnetic fields near 101 RF heaters, that 39 percent of the units exposed the operators to levels greater than the 1985 limits — up to ten times the standard — and that 23 percent of the heaters exposed the operators to levels that were at least ten times greater than the standard. The survey results were published in the March 1986 issue of *Health Physics*.

The Australian standard had been under development since 1978. In 1982, occupational limits identical to ANSI's were proposed, with public exposure limits ten times stricter. That proposal was opposed by the Australian Council of Trade Unions (see *MWN*, April and May 1983).

A copy of Australian Standard AS 2772-1985, *Maximum Exposure Levels – Radiofrequency Radiation – 300 kHz to 300 GHz*, is available in the U.S. for $15.00, plus $4.00 shipping and handling, from the ANSI Sales Office, 1430 Broadway, New York, NY 10018, (212) 642-4900. Orders must be prepaid. In Canada, the standard is sold by the Standards Council of Canada and in the U.K. by the British Standards Institution. It is also available directly from the Standards Association of Australia, PO Box 458, North Sydney 2060, Australia.

See also two papers that discuss the standard: "Overview and International Approaches to Radiofrequency Radiation Exposure Standards" by T.N. Swindon and "The Australian Radiofrequency Exposure Standard: Implications and Implementation" by K.H. Joyner (cited above), both published in *Radiation Protection in Australia, 3*, pp.119-121 (No.3) and pp.135-140 (No.4), respectively.

ELF Teratology (continued from p.1)

"You're doing the wrong study," Phillips told Newell. "All data since 1975 conclusively show that exposure *in utero* is not teratogenic. If you have to do a study to clear the air, do the right one."

Newell responded that EPRI had asked three "eminent" teratologists to analyze the Battelle data and they had concluded that, due to the "variability and inconsistency in the results," it was not worth another $1-2 million to explore multi-generational teratological effects. This exchange took place in Alexandria, VA, at the annual review of contractors doing research on the bioeffects of transmission lines for the Department of Energy, EPRI and New York State.

Anderson, who replaced Phillips as head of the electric field effects program at Battelle, said in an interview that Battelle had originally proposed a multi-generation exposure study, but had been turned down by EPRI.

In a telephone interview, Dr. Leonard Sagan, a senior scientist at EPRI, told *Microwave News* that Phillips had convinced EPRI to do long-term studies. "Newell's arm was twisted," he said, because "Phillips made a good point and we respect him." In 1984 Phillips left Battelle to join the Environmental Protection Agency in Research Triangle Park, NC.

Sagan added that the original decision to do only short-term studies was based on the fact that the experimental designs of the swine and rat studies were complex and different from other, more traditional, teratological studies.

The Swine Study

The swine study was designed to screen for a broad range of biological end points. Three generations of miniature swine were exposed to 30 kV/m 60 Hz fields. (The diagram below explains the design of the study; note that "farrow" means to "give birth.") Most of the results indicated no ill effects associated with ELF exposure. Adverse effects showed up only among the F1 females that were born and bred in the field, among their offspring (F2) and among the offspring of the Fo females that were rebred after being exposed for 18 months.

The significant effects were:

- Increased number of live fetuses per litter (fewer prenatal deaths) in the first breeding of Fo females, exposed for four months, compared to sham-exposed controls [Fo'];
- Increased incidence of morphological malformations and lower body weights among fetuses from exposed Fo females rebred at 18 months of exposure;
- Impaired mating performance of exposed F1 females bred at 18 months of exposure; and
- Increased incidence of birth defects and lower weights among offspring from F1 pigs bred at 18 months of exposure.

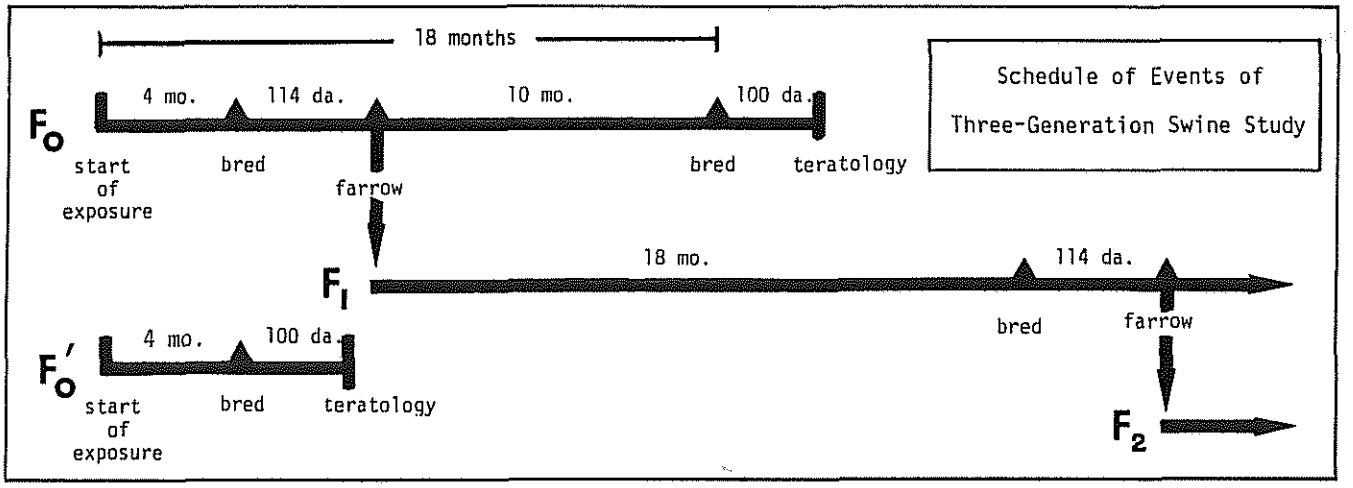
The experiments took six years to complete, and although the study was finished in early 1982, the results were not published until late 1985. Informed sources told *Microwave News* that EPRI caused the delays by repeatedly insisting on revisions in Battelle's final report.

Marino-Becker Studies

The Battelle-EPRI studies support the results of two mice studies by Drs. Andrew Marino and Robert Becker, run in Becker's lab at the VA Medical Center in Syracuse, NY, in the mid-1970s.

Marino and Becker found that mice continuously exposed to 60 Hz 3.5-10 kV/m electric fields gave birth to pups that had lower body weights and increased mortality rates. The effect was largest in the second and third generations (see *Experientia, 32,* pp.565-566, 1976, and *36,* pp.309-311, 1980).

At the time, the experiments were controversial and, later, were partly responsible for the establishment of the $5 million New York state power line bioeffects research project. A new book, *The Electric Wilderness,* by Marino and Joel Ray, describes Marino and Becker's participation in state hearings on a then proposed 765 kV power line from Canada through New York state. (The book is available for $18.75 from the San Francisco Press, PO Box 6800, San Francisco, CA 94101.)



The Rat Study

The subsequent rat study followed the same experimental design, though the exposure times were shorter: the Battelle researchers exposed the rats to an effective 60 Hz electric field of 65 kV/m for 20 hours a day. The first time the experiment was run, it revealed a teratological effect among the rat pups of females born and raised in the field similar to that identified among the miniature swine. But when this experiment was repeated, the effect did not show up.

In addition, like the swine, the F0 generation of rats showed an increase in malformations on rebreeding approximately three months after the first litters were born — this effect was significant only at the 0.12 level. Here again, when the experiment was repeated, there was no difference between the offspring of the exposed rats and those of the controls.

According to Phillips and coworkers, "The fact that the significant effects seen in the first [rat] experiment were not seen in the second may be attributed to random or biological variations, but, alternatively, may suggest that the response threshold lies at about this field strength." This conclusion was presented at the *23rd Hanford Life Sciences Symposium: Interaction of Biological Systems with Static and ELF Electric and Magnetic Fields*, held in Richland, WA, in October 1984, and will be published in the symposium proceedings, now in preparation.

EPRI Project Manager Dr. Robert Patterson characterized the rat study results as "inconclusive and suggestive" in a short review published in the June 1985 issue of the *EPRI Journal*.

The new long-term rat studies will be done simultaneously by Battelle and by the IIT Research Institute (IITRI) in Chicago, IL, using identical protocols and equipment. Anderson will be the principal investigator at Battelle and Dr. James Gerhart will lead the IITRI project.

EPRI's Newell told *Microwave News* that groups of 65-80 rats will be exposed to 10, 70 and 140 kV/m for 20 hours a day. A fourth goup will serve as controls.

Papers describing the swine and rat study results have been submitted to *Bioelectromagnetics*. EPRI has published a seven-volume report on the swine study that covers behavior (No.2); exposure and dosimetry (No.3); growth, reproduction and development (No.4); hematology and serum chemistry (No.5); immunology (No.6), and neurology (No.7), as well as a summary volume (No.1). The seven-volume report, *Biological Studies of Swine Exposed to 60 Hz Electric Fields* (EA-4318), is available for $197.50. Individually, Volumes 1, 5 and 7 cost $32.50; the others are $25.00 each. Order from Research Reports Center, Box 50490, Palo Alto, CA 94303, (415) 965-4081.

Walkie-Talkie RFI *(continued from p.1)*

Weiss cautioned that neither the agency nor the operating utilities verified the causes of the interference problems. Nevertheless, he said that the incidents were similar to numerous others already reported.

The nuclear plant RFI problem emerged in 1982 when false instrument readings indicated that an explosive bubble of hydrogen and hydrocarbons had formed inside the damaged Three Mile Island reactor No.2 in Pennsylvania. The error was later traced to RFI to the gas meter from portable radio units in the safety suits worn by the decontamination crew (see *MWN*, March 1982).

In December 1983, the NRC sent a notice to utilities that operate nuclear plants, advising them about on-site RFI. The agency warned that "the vulnerability of safety systems and nonsafety systems to inadvertent actuation or malfunction poses a significant threat to safe operation of the plant if the measures to prevent use of radio transmitters fail under emergency situations."

Though the NRC did not require utilities to "harden" their equipment, it suggested that they modify procedures to prohibit the use of radios near vulnerable devices. The notice also stated that the NRC has not adopted formal RFI protection standards and will not require further corrective action or changes in nuclear plant design.

Recent Incidents

At Palo Verde, an automatic safety system shut down unit No.1 on October 3, 1985, following the total loss of offsite power — apparently caused by a malfunction of the multiplexer in the plant's switchyard. Four days later, while the unit was not operating, the multiplexer again failed. Although walkie-talkies were blamed, Arizona Public Service, which operates the plant, did not provide the NRC with detailed information on the frequency or output power of the offending walkie-talkies. After the incidents, the utility protected the sensitive equipment.

On January 1, 1986, the River Bend plant also suffered a total loss of offsite power when two transformers were accidentally turned off; an hour later, two other transformers were also tripped. In a March 10 memo, the NRC said that two hand-held radios — one operating at 150 MHz and 4 watts and the other at 450 MHz and 5 watts — caused the trips when they were activated within 12 feet of the fiber optics systems' transceivers.

The 1983 NRC notice to utilities also listed RFI incidents at Grand Gulf, MS, Sequoyah, TN, and Farley, GA, as well as at Three Mile Island, PA. The NRC explained that solid state devices in newer nuclear plants are more susceptible to interference than the vacuum tube technology in older plants. The commission cautioned that "more cases of RFI by portable radio transmitters are likely," as old plants are retrofitted with solid state equipment.

To obtain copies of the two NRC memos — *IE Information Notice No.83-83: Use of Portable Radio Transmitters Inside Nuclear Power Plants* and *IE Information Notice No.86-15: Loss of Offsite Power Caused by Problems in Fiber Optics Systems* — write to the NRC, Public Document Room, Washington, DC 20555.

CONFERENCES

New Listings

June 5-6: **27th Conference of the Automatic RF Techniques Group (ARFTG),** Sheraton Inner Harbor Hotel, Baltimore, MD. Contact: Richard Irwin, Systems for Automatic Test, 1292 Reamwood Ave., Sunnyvale, CA 94089, (408) 734-9447.

July 28-August 1: **URSI Open Symposium on Wave Propagation: Remote Sensing and Communications,** University of New Hampshire, Durham, NH. Contact: Prof. Robert Crane, Thayer School of Engineering, Dartmouth College, Hanover, NH 03755.

August 4-8: **Gordon Conference on Magnetic Resonance in Biology and Medicine,** Tilton School, NH. See *Science* March 7, p.1180.

August 15-16: **International Symposium on Recent Advances in Microwave Technology and Future Challenges,** University of North Dakota, Grand Forks, ND. Contact: Banmali Rawat, Dept. of Electrical Engineering, Box 7165, University of North Dakota, Grand Forks, ND 58202, (701) 777-4331.

August 27-September 4: **International Conference on Large High-Voltage Electric Systems,** ASSAS University, Paris, France. Contact: CIGRE, 112 Blvd. Haussmann, 75008 Paris, France, (1) 45-22-65-12.

September 13-16: **39th Annual Conference on Engineering in Medicine and Biology,** Omni International Hotel, Baltimore, MD. Contact: Susan Leone, Suite 700, 1101 Connecticut Ave., NW, Washington, DC 20036, (202) 857-1199.

September 23-25: **8th Annual Meeting and Symposium of the Antenna Measurement Techniques Association,** Westin Hotel, Ottawa, ONT, Canada. Contact: Laurier Forget, National Research Council, Ottawa, Ontario K1A 0R6, Canada, (613) 993-9009.

March 3-5, 1987: **7th International Symposium & Technical Exhibition on Electromagnetic Compatibility,** Zurich, Switzerland. Contact: Prof. T. Dvorak, ETH Zentrum-IKT, 8092 Zurich, Switzerland, (1) 256-2790, or Prof. Ralph Showers, Dept. of Electrical Engineering, University of Pennsylvania, Philadelphia, PA 19104, (215) 898-8123.

Upcoming Meetings

May 12-15: **International Scientific Conference: Work with Display Units,** Stockholm, Sweden. Contact: WWDU, c/o Stockholm Convention Bureau, Box 1617, S-111 86 Stockholm, Sweden.

May 13-15: **2nd Annual Meeting of the Electromagnetic Energy Policy Alliance (EEPA),** Ramada Renaissance Hotel, Washington, DC. Contact: Richard Ekfelt, EEPA, 1255 23rd St., NW, Washington, DC 20037, (202) 452-1070.

May 19-22: **18th Annual Meeting of the Conference of Radiation Control Program Directors (CRCPD),** Charleston, WV. Contact: CRCPD, 71 Fountain Pl., Frankfort, KY 40601, (502) 227-4543.

May 19-24: **1986 Nuclear EMP Meeting,** University of New Mexico, Albuquerque, NM. Contact: C.W. Jones, Dikewood Corp., 1613 University Blvd., NE, Albuquerque, NM 87102.

June 1-5: **8th Annual Meeting of the Bioelectromagnetics Society (BEMS),** University of Wisconsin, Madison, WI. Contact: BEMS, PO Box 3729, Gaithersburg, MD 20878, (301) 948-5530.

June 2-4: **1986 IEEE MTT-S International Microwave Symposium,** Baltimore, MD. Contact: Marvin Cohn, c/o LRW Associates, 1218 Balfour Dr., Arnold, MD 21012.

June 8-13: **Gordon Conference on Bioelectrochemistry,** Plymouth State College, NH. Contact: Prof. Howard Wachtel, University of Colorado, Boulder, CO 80309, (303) 492-7327, or Prof. Betty Sisken, University of Kentucky, Lexington, KY 40506, (606) 258-5796. See also *Science,* March 7, p.1166.

June 16-19: **EMC Expo 1986,** Sheraton Washington Hotel, Washington, DC. Contact: EMC Expo 86, Star Route 625, PO Box D, Gainesville, VA 22065, (703) 347-0030.

June 23-27: **Conference on Precision Electromagnetic Measurements (CPEM'86),** National Bureau of Standards (NBS), Gaithersburg, MD. Contact: Norman Belecki, B146 Metrology Bldg., NBS, Gaithersburg, MD 20899, (301) 921-2715.

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New Listings

EMPRESS II: Opposition Broadens

Three U.S. senators, the U.S. House Armed Services Committee, federal and Virginia environmental officials and the Maryland House of Delegates have joined others seeking to block the Navy's proposal to site its second electromagnetic pulse radiation environment simulator for ships (EMPRESS II) on Chesapeake Bay.

Three of the four U.S. senators from Maryland and Virginia are now publicly opposed to the Navy's plan for EMPRESS II. Maryland's Senators Paul Sarbanes and Barbara Mikulski, both Democrats, wrote to Navy Secretary John Lehman on March 16, urging him to "end any further consideration of testing...[EMPRESS II] in the Chesapeake Bay" and "to seek an alternative site."

"In our view, there are still too many unknown factors to guarantee that this untested program, designed to simulate effects of a nuclear explosion, will not have an adverse impact on the bay, our Chesapeake watermen who rely on these waters for their livelihood and the bay community," the Senators explained.

Virginia's Senator Paul Trible, a Republican, also wrote to Lehman to protest the Chesapeake Bay site, calling it "ill-conceived." In his March 26 letter, Trible noted that he is "particularly concerned about the effects high-voltage electromagnetic pulses will have on individuals who live near the bay. Significant dangers to human health exist."

Republican John Warner, Virginia's senior senator, has "reserved his opinion pending the Navy's reevaluation of the project," according to an aide.

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Lawsuit Over 345-kV Line in NY

In January, 55 landowners filed a suit for more than $60 million against the New York Power Authority, claiming loss of property values due to the 345 kV Marcy-South power line. In a brief filed with the New York State Court of Claims in Goshen, the landowners allege that the line will create "a 'cancerphobia' corridor" and will destroy "the market value of land in and around that corridor."

The landowners are being represented by Michael Gurda of Gurda, Gurda & McBride in Middletown, NY. (The claims of all 55 plaintiffs have been consolidated into one trial.) Gurda told *Microwave News* that his clients are seeking a total right-of-way (ROW) of 2,400 feet around the 345 kV line to limit exposures to less than 0.5 milligauss.

The Power Authority is planning a 160-to-170-foot ROW, according to Michael Fiumarelli, the authority's manager for public affairs associated with transmission programs. In addition, there will be a 50-foot "danger zone" on each side of the ROW to protect

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HIGHLIGHTS

WHO-IRPA Health Criteria: Static and ELF Magnetic Fields

An international committee of experts has concluded that there is an "urgent need" for studies to resolve the suspected link between very weak, extremely low frequency (ELF) magnetic fields and cancer.

In a report to be issued later this year, the experts, assembled by the World Health Organization (WHO) and the International Radiation Protection Association (IRPA), also state that short-term exposures to static fields below 2 Tesla (T) are not hazardous and that induced current densities of less that 10 mA/m^2 are "unlikely" to cause "adverse health effects."

The recommendations for human exposures to time-varying magnetic fields are not based on a cancer threat. At 50/60 Hz, a current density of 10 mA/m^2 is induced by a field of approximately 5 mT; the suggested carcinogenic effects of ELF magnetic fields occur at 0.1-1 uT (0.0001-0.001 mT) – levels more than a thousand times smaller.

In addition to urging more work on the possible ELF-cancer link, the WHO-IRPA experts recommend studies on the effects of time-varying fields on the developing embryo and fetus. They pinpoint interactions at the cell membranes as worthy of special attention.

While acknowledging that studies have established that currents in the range of 10-100 mA/m^2 (from fields higher than 5-50 mT at 50/60 Hz) can cause bioeffects, the WHO-IRPA panel says that short-term exposures (a few hours) will cause only minor, transient effects on health. The consequences of long-term exposures to these levels "are not known at present," however. Above 100 mA/m^2 (greater than 50 mT at 50/60 Hz), the panel warns that "hazards to health may occur."

With respect to static fields, the committee concludes that "...available knowledge indicates the absence of any adverse effects on human health due to exposure to static magnetic fields up to 2 T." For exposure above 2 T, the panel says that it cannot "make any definitive statements about safety or hazard," but adds that short-term exposure in the range above 5 T "may produce significant detrimental effects on health."

(The WHO-IRPA panel notes that "it is difficult to correlate the internal tissue current densities with the external magnetic field strengths." The magnetic fields cited by the panel are therefore approximate and are

WHO-IRPA Conclusions

1. Only a few mechanisms of interaction of biological tissue with magnetic fields have been established. Some of the biological effects data suggest that other mechanisms may play a role, but these have yet to be confirmed experimentally. Thus, only a preliminary assessment of human health risk from exposure to magnetic fields can be made.

2. A number of lower organisms have shown a remarkable sensitivity to the earth's magnetic field, because of highly developed receptors. Similar receptors have not been found in human beings.

3. From the scientific data base on higher organisms exposed to magnetic fields, only four types of effect[s] can be regarded as established. The first three may be explained by plausible mechanisms of interaction and produce a basis for extrapolation to man. These effects are:

(a) induction of electrical potentials and magnetohydrodynamic effects within the circulatory system;

(b) the formation of magnetophosphenes with a time rate of change of magnetic field exceeding 0.3 T/s at 17 Hz; the effect depends strongly on frequency;

(c) direct stimulation of nerve and muscle cells by very short (less than 1 ms) pulses of rapidly changing magnetic fields (several thousand T/s). Current densities are estimated to exceed 1000 mA/m^2. These effects are strongly frequency dependent and may exhibit lower thresholds (100-1000 mA/m^2) under more favourable stimulus conditions (10-100 Hz);

(d) other cellular and tissue alterations when the induced current densities exceed approximately 10 mA/m^2.

4. For human exposure to static magnetic fields, it is not possible to make any definitive statement about the safety or hazard associated with short- or long-term exposure to fields above 2 T. Available knowledge suggests the absence of any measurable effect of static fields on many major developmental, behavioural or physiological parameters in higher organisms. Recent medium-term (days) studies on exposure of animals to static fields of up to 2 T have not demonstrated any detrimental effects.

5. For human exposure to time-varying magnetic fields, it seems reasonable to assume that a health risk assessment can be made on the basis of significant perturbations of biological functions caused by electric currents induced by the fields. Available data suggest that, when current densities less than 10 mA/m^2 are induced in tissues and extracellular fluids, the induction of adverse health effects is unlikely. However, the possibility of some perturbing effects occurring following long-term exposure cannot be excluded.

The time-varying fields that induce currents in the body depend critically on the waveform and pulse shape. In this regard, the peak instantaneous current densities appear to be important. Furthermore, the frequency dependence of effects produced by time-varying fields has to be taken into consideration.

generally accurate within a factor of ten.)

Environmental Health Criteria 69: Magnetic Fields was written over a number of years. A first draft prepared by Dr. Michael Repacholi was revised in May 1985 by a committee chaired by Dr. P. Czerski (see *MWN*, May 1985). The final draft was reviewed in Kiev, U.S.S.R. last summer.

In 1984, a previous WHO-IRPA committee issued a report on the health effects of ELF fields, primarily electric fields (*Environmental Health Criteria 35*). That committee, which was made up of many of the same experts, recommended that, given the uncertainties in the data base, efforts should be made to limit long-term exposures of the general population to "levels as low as can be reasonably achieved" (see *MWN*, December 1984).

According to Czerski, who is at the Food and Drug Administration's Center for Devices and Radiological Health in Rockville, MD, the WHO-IRPA report is in press and should be available by the end of the year from WHO regional offices. In the U.S., contact the WHO Publications Center USA, 49 Sheridan Ave., Albany, NY 12210. Elsewhere, contact the WHO Sales and Distribution Service, 1211 Geneva 27, Switzerland.

The members of the WHO-IRPA task group which met in Kiev are: Drs. V. Akimenko (U.S.S.R.), B.G. Bernardo (The Philippines), J. Bernhardt (F.R.G.), B. Bosnjakovic (The Netherlands), J. Dumansky (U.S.S.R.), M. Grandolfo (Italy), H. Jammet (France; co-chairman), Y.A. Kholodov (U.S.S.R.), B. Knave (Sweden), S. Mohanna (Canada), M.H. Repacholi (Australia; rapporteur), R.D. Saunders (U.K.), M.G. Shandala (U.S.S.R.; co-chairman), Ing. J. Skvarca (Argentina), D. Sliney (U.S.), T.S. Tenforde (U.S.). Annette Duchene served as the scientific secretary for the group.

The full text of the WHO-IRPA committee's conclusions is reprinted on the opposite page.

EPA-FCC Surveys Find More RF Hot Spots

Broadcast transmission towers serving Portland, OR, and Denver, CO, are producing radiofrequency (RF) hot spots in publicly accessible areas, according to surveys by the Environmental Protection Agency (EPA) and the Federal Communications Commission (FCC). In both surveys, FM radio transmissions contributed the most to ambient RF fields.

Near one tower in the Denver area, radiation levels were more than ten times greater than the American National Standards Institute's 1 mW/cm^2 guideline – used by the FCC to evaluate environmental impacts – prompting the EPA to urge the FCC to take corrective action.

Inside homes near the towers, typical levels were below 100 uW/cm^2 in Denver and below 70 uW/cm^2 in Portland.

EPA's Richard Tell and the FCC's Dr. Robert Cleveland made the measurements last year in response to public concerns over the health effects of RF radiation. The two surveys followed those carried out in Honolulu, HI and Cougar Mountain, WA (see *MWN*, January/February 1985 and January/February 1986, respectively). The Portland and Denver reports were written by EPA.

Healy Heights, Portland

In Portland, the EPA-FCC team measured fields at several locations near two broadcast towers – one with six FM stations and one with one FM and one AM station – on Healy Heights, as well as in surrounding neighborhoods, from July 28 to August 1, 1986. In addition, readings were taken near two AM radio towers in non-residential areas.

Outdoors, the maximum level identified was less than 700 uW/cm^2 near the base of one of the towers; the team measured a 500 uW/cm^2 field in a nearby publicly accessible area. EPA reports that "large areas exist where levels in excess of 100 uW/cm^2 can be found."

The EPA-FCC measurements were made before and after one of the FM stations, KBOO, installed a new antenna and raised it on the tower. Before the change, the maximum level at the base of the tower exceeded 1 mW/cm^2.

On Healy Heights, the maximum indoor level approached 200 uW/cm^2 in one residence close to the two towers, but in a housing development a little further away, typical indoor levels were below 40 uW/cm^2, though a maximum reading of 117 uW/cm^2 was found.

Radiation levels were much lower in neighborhoods further away from the antenna farm – generally less than 1 uW/cm^2.

In its report to the FCC, EPA also notes that:

- Magnetic fields near the tower bases and tuning coils of AM antennas at two towers were far in excess of the FCC-ANSI limit of 1.6 A/m – over 10 A/m in many locations. The electric field levels were below the ANSI limit of 632 V/m. These antennas were not in residential areas; EPA cautions that broadcast engineers should take care to avoid overexposure.
- Measured levels differed from calculated values. For FM readings beyond 22 meters from the tower, the readings exceeded those predicted by a computer program. The reasons for this are not clear, though the EPA report suggests the discrepancy may be related to reflections from the antenna farm. Conversely, AM readings were below those derived from worst-case models specified in FCC OST Bulletin No.65 (see *MWN*, September/October 1985).
- "Electric field values high enough to interfere with the normal operation of electronic devices were found in several of the areas surveyed," according to the report.

Multnomah County, in which Portland is located, has a general population exposure standard of 200 uW/cm^2 (see *MWN*, May and July/August 1982). The city of Portland is in the process of setting its own standard; the current proposal is 200 uW/cm^2, though previously the city's planning department had recommended a 100 uW/cm^2 exposure limit (see *MWN*, July/August 1985, November/December 1985 and March/April 1986).

Lookout Mountain, Denver

The EPA-FCC team found even higher RF levels in the Denver area during its September 1986 survey.

Tell and Cleveland measured a 10.35 mW/cm^2 hot spot near the base of an FM radio tower (KYGO) and power densities above 1 mW/cm^2 over a large nearby area, "most of which is publicly accessible," according to the report. The KYGO tower is about one-third of a mile from the main antenna farm on Lookout Mountain.

In its report, EPA urges "the FCC to order KYGO to correct these extreme values in publicly accessible areas as soon as possible."

The KYGO tower sits among a complex of buildings, including some residential facilities. In the main building, about 100 feet from the tower, the team "found maximum power densities of 59 uW/cm^2 in the laundry room, approximately 100 uW/cm^2 in the commissary and outside the dining hall and up to 300 uW/cm^2 on the patio/deck." Outside a dormitory, levels of 40-50 uW/cm^2 were measured.

Several of the broadcast towers on Lookout Mountain are also in residential areas, but levels measured there, both indoors and outdoors, were less than those near the KYGO tower. The maximum outdoor level was 580 uW/cm^2. Typical averaged indoor field levels at residences were well below 100 uW/cm^2 and most were less than 50 uW/cm^2. Two high readings in the nearby residential neighborhood – 200 and 589 uW/cm^2 – apparently resulted from measurements taken near metal objects. The measured power levels dropped off dramatically with distance from the antenna farm.

On one stretch of road between two towers which are less than a mile from the Lookout Mountain antenna farm, Tell and Cleveland found a maximum power density of 425 uW/cm^2 and levels above 200 uW/cm^2 along a 125-foot stretch of public road.

The two reports, *An Investigation of Radiofrequency Radiation Levels on Healy Heights, Portland, OR, July 28-August 1, 1986* (January 1987) and *An Investigation of Radiofrequency Radiation Levels on Lookout Mountain, Jefferson County, CO, September 22-26, 1986* (February 1987), are available from the FCC's duplicating contractor, International Transcription Services, 2100 M St., NW, Washington, DC 20037, (202) 857-3800.

Sine Waves Gain Acceptance for Electrical Stimulation

Sine waves are challenging more complex quasi-rectangular, asymmetric waveforms in the treatment of non-union fractures. Government approval of a medical device using sine waves comes at the same time as laboratory studies showing that sine waves can be as biologically active as complicated signals, if not more so. The acceptance of non-thermal effects due to sine waves has obvious implications for the health assessment of all electromagnetic devices.

Researchers and clinicians in the Departments of Bioengineering and Orthopaedic Surgery at the University of Pennsylvania in Philadelphia developed a sine wave generator operating at 60 kHz to electrically stimulate bone growth. Working with Bioelectron, Inc., of Hackensack, NJ, they successfully tested the new medical device, OrthoPak®, in a 16-center trial and won approval from the Food and Drug Administration (FDA) in February 1986 (see *Federal Register, 51*, pp. 12210-12211, April 9, 1986).

When Bioelectron originally approached the University of Pennsylvania team to develop OrthoPak, the New Jersey company favored a complex waveform. Since no one could explain *why* a complex signal might be more effective, said University of Pennsylvania Professor Solomon Pollack, "we decided to start with a signal whose frequency composition was something we *could* understand – the sine wave."

On the basis of dose-response studies using a rat model already developed by the Pennsylvania team, including Professors Carl Brighton and Jonathan Black, they soon found that a 60 kHz sine wave could stimulate bone growth. Now that the initial research is complete and OrthoPak is being marketed by Zimmer, Inc., of Warsaw, IN, the group plans to focus more energy on learning how the sine waves actually do their work.

The University of Pennsylvania clinical studies support the experimental research of Drs. Reba Goodman of Columbia University and Ann Henderson of Hunter College, both in New York City, who have shown that sine waves enhance cellular transcription in salivary gland cells of larval flies as readily as do more complex, asymmetric waves (see *MWN*, September/October 1985 and November/December 1986 and *Bioelectromagnetics, 7*, pp. 23-29, 1986, and *8*, pp. 1-7, 1987).

Others are also developing sine wave medical systems. Dr. Ewa Herbst, a Swedish researcher visiting Dr. Betty Sisken's lab at the University of Kentucky in Lexington, will present a paper at the June Bioelectromagnetics Society meeting in Portland, OR, on the efficacy of 72 Hz sine waves in healing soft tissues in rats.

Electro-Biology, Inc. (EBI), and American Medical Electronics (AME) market competing devices for treatment of non-union fractures: both use a complex signal delivered in repetitive pulses. To date, EBI is the market leader, but, according to Pollack, Bioelectron has already sold thousands of stimulators.

EBI is not fazed by the competition. Indeed, it welcomes the entry of OrthoPak into the market. Dr. Brian Pethica, an EBI corporate vice-president, told *Microwave News* that the unit is "broadly good for the industry and the field because it comes from a well-researched background."

All three devices "seem to be about as successful on a statistical basis, although there have never been any direct comparative studies," University of Pennsylvania's Black said in a telephone interview. "And, to me, that alone seems to undercut the argument for signal specificity, because the kinds of signals that these three systems produce at the non-union site are quite different."

Dr. Andrew Bassett, whose early work was the basis for the EBI signal, takes a different view. While acknowledging that the OrthoPak system works, he argued that "it may effect healing by a different mechanism that may or may not be as efficient as the EBI signal." Bassett is now the director of the Bioelectric Research Center in Riverdale, NY.

Commenting on the implications of government acceptance of sine wave-based medical technology, Louisiana State University Professor Andy Marino, the editor of the *Journal of Bioelectricity*, said in a telephone interview that, "The FDA has crossed the Rubicon in recognizing the existence of non-thermal effects, unencumbered by speculation about the unique properties of particular waveforms."

OrthoPak's sine wave technology offers at least one clear advantage over its competitors – portability. OrthoPak is a "capacitive" system, generating an electric field at the stimulation site. The EBI and AME devices are "inductive," using a primarily magnetic field to accelerate bone repair. As a result, "the power requirements for the two systems are grossly different," Pollack explained. The inductive devices depend on a rechargeable nickel-cadmium battery pack weighing several pounds. OrthoPak, which runs on a nine-volt battery, weighs only five ounces and can be mounted on a cast or a belt clip. In many cases, its compact size allows the fracture patient complete mobility.

Encouraged by this success, the University of Pennsylvania researchers now are trying to harness sine waves to treat two common ailments: osteoporosis and degenerative joint disease. They have completed one study of disuse osteoporosis in rats, "with outstanding success," according to Pollack. This summer they will complete a study of systemic osteoporosis using another rat model. The FDA has given approval for pilot studies in humans, but large-scale human studies have not yet been scheduled. Definitive experiments on degenerative joint disease – the form of arthritis that commonly develops in the elderly – are still on the drawing board.

EBI Turns to Clinical Research

Electro-Biology, Inc. (EBI), the first and most successful company to exploit electromagnetic fields (EMFs) for medical purposes, is shifting its research focus from laboratory to clinical studies. The move comes at a time when government agencies have cut back, or eliminated, their research efforts on the bioeffects of EMFs.

"We are placing increased emphasis on the exploitation of research that has already been done," Dr. Brian Pethica told *Microwave News* in a telephone interview from EBI's offices in Parsippany, NJ. Pethica, a corporate vice-president, refused to divulge specific details on EBI's research budgets – arguing these are privileged – but did acknowledge that the company is "shifting emphasis" in an effort to expand its product base. Bringing new products to market is "non-trivial," he said.

In a series of interviews, scientists who are struggling to keep their labs open, bemoaned the EBI move. Many questioned how a high-tech company that pioneered the use of EMFs could pull back from research when basic mechanisms of interaction remain largely unknown.

"The future of the whole field rises and falls on the ability to define mechanisms of action," one leading researcher, who asked for anonymity, said. "This is not the time to stop funding basic research."

Dr. Joan Abbott, EBI's director of research, said that, in the past, the company spent an "enormous amount of money without controlling the quality of the science." EBI is now focusing its efforts more carefully, she added.

Neither Pethica nor Abbott would say whether EBI's total research budget – for both clinical and lab studies – has gone up or down. Pethica did note that EBI is continuing to fund basic research in Europe.

EBI recently moved its offices and closed its in-house lab. Pethica and Abbott said that running a small independent lab was inefficient. "We felt we could get more mileage out of external research institutions," Abbott said. According to Pethica, EBI had only one doctoral-level scientist in the lab working primarily on screening studies.

Allergies to Electromagnetic Fields

Weak electromagnetic fields (EMFs) can cause allergic reactions, including convulsions, fatigue, hyperactivity and migraines, according to clinical studies by three British researchers. Laboratory experiments have shown that these sensitivities are frequency specific and can occur at extremely low intensities.

Drs. Jean Monro and Ray Choy of the Allergy and Environmental Medicine Unit at Lister Hospital in London and Dr. Cyril Smith of the Department of Electronic and Electrical Engineering at the University of Salford (near Manchester) examined individuals with multiple allergies who reacted to various types of electrical equipment, including power lines, electric typewriters, video display terminals (VDTs), hair dryers and fluorescent lights.

In an interview, Smith told *Microwave News* that by ignoring the health impacts of EMFs, "people have been looking at the world with one eye closed, seeing only chemistry with the other."

A number of the researchers' extremely sensitive patients responded to specific, weak signals even when exposed to much larger background levels at power line frequencies usually found inside buildings. In a recent paper published in *Clinical Ecology*, they point out that, "The important factor in all these electrically sensitive patients appears to be the frequency; the signal strength is of secondary importance once a critical signal strength [which can be as low as 1 mV/m] is exceeded."

The researchers have examined over 100 patients with similar allergic reactions to EMFs in London, England, and in Dallas, Texas. More recently, they exposed a number of the subjects to incremental changes in frequencies ranging from millihertz to gigahertz. While some allergic patients reacted to the signals within 15 seconds, others did not respond until later – not an uncommon phenomenon, according to Smith.

Among the patients' symptoms were:

- Extreme glandular pain and speech problems when passing underneath high-voltage power lines, and migraines and fatigue when using electric irons or toasters in humid weather or during the approach of a storm.
- Hyperactivity and severe headaches in the presence of electric light bulbs, fluorescent tubes, computer games and televisions.
- Severe headaches near VDTs and breathing problems and fainting near high-power TV transmitters.

The most sensitive patient – allergic to EMFs ranging from less than 1 Hz up to 2 GHz and to a wide range of chemicals – had convulsions when taken to within 200 meters of a power line while she was in an allergically sensitive condition. On the return trip, she experienced a similar reaction when her ambulance passed under other power lines.

Monro, Choy and Smith suggest that electrical reactions are the basis for most allergies. They believe that EMFs and chemical allergens are related: an allergy triggered by one can be neutralized by the other, and vice versa.

According to Smith, if people's responses to EMFs are statistically similar to the incidences of chemical and nutritional allergies, then approximately one person in a thousand is affected by EMFs.

Smith points out that homeopathic medicine has long recognized the importance of EMFs: "Samuel Hahnemann, the founder of homeopathy, wrote 150 years ago about the therapeutic effects of electromagnetic fields."

Among the group's recent papers are: Smith, "Clinical Effects at High Dilutions," *Proceedings of the 42nd Congress of the International Homeopathic Medical League*, March 29-April 2, 1987, Arlington, VA, pp. 272-281; Choy, Monro and Smith, "Electrical Sensitivities in Allergy Patients," *Clinical Ecology, 4*, pp. 93-102, 1987 (the journal is published by Dr. Lawrence Dickey in Fort Collins, CO); Smith and A.H. Jafary-Asl, "The Emission of Low Intensity Electromagnetic Radiation from Multiple Allergy Patients and Other Biological Systems," presented at the *International Symposium on Photon Emission from Biological Systems*, January 1986, Wroclaw, Poland; Smith, "Water – Friend or Foe?," *Laboratory Practice*, October 1985; Smith, "Electromagnetic Phenomena in Living Biomedical Systems," *Proceedings of the 6th Annual Conference of the IEEE Engineering in Medicine and Biology Society*, September 15-17, 1984. See also: Cynthia Kee, "The Waves We Live In," *The Observer* (London), March 8, 1987; Simon Best, "Laying It on the Power Line," *Guardian* (London), October 24, 1984.

For more information, contact: Dr. Jean Monro, Allergy and Environmental Medicine Unit, Lister Hospital, Chelsea Bridge Rd., London SW1W 8RH, U.K.; Dr. Cyril Smith, Department of Electronic and Electrical Engineering, University of Salford, Salford M5 4WT, U.K.

The British researchers are collaborating with Dr. William Rea, Environmental Health Center, Suite 205, 8345 Walnut Hill Lane, Dallas, TX 75231, (214) 368-4132. Rea presented a paper on "Environmental Sensitivities" at the *5th Annual International Symposium on Man and His Environment in Health and Disease*, held in Dallas, TX, in February 1987.

ELF NEWS

Florida Power Line Standards Due Out Soon

The Florida Department of Environmental Regulation (DER) plans to propose exposure standards for extremely low frequency (ELF) fields in May, according to DER's Buck Oven, who is coordinating the development of the state's power line siting rules.

Oven told *Microwave News* that DER will propose standards for electric and magnetic fields, as well as for audible noise. Although Oven would not be very specific, he did say that the the electric field exposure limit will be "in the same ballpark as existing state standards – in the 1-3 kV/m range." He would not reveal what the magnetic field proposal will be, but predicted that the audible noise standard will probably be the limiting variable; that is, by satisfying the audible noise limit, the other two standards will also be met.

In the telephone interview, Oven detailed the following schedule: DER officials are in the process of preparing a summary report, including recommendations, to present to the state's Electric and Magnetic Field Advisory Panel before the end of April. In May, the proposed rules will be released for review, to be followed by workshops and public hearings. In August, DER will submit final rules to the state's Environmental Regulation Commission – they would then be presented for adoption by the Florida Secretary of State.

The siting of power lines in Florida is at a standstill pending the completion of this rulemaking process (see *MWN*, July/August 1983, September/October 1985 and March/April 1986).

Advisory Panel Meetings

At a briefing on March 20, the advisory panel heard presentations from Drs. Dan Bracken, Philip Cole, Morton Miller, Granger Morgan, Jerry Phillips, Asher Sheppard and Karl Smith, as well as from Pierce Wood of Tampa Electric Co. At its December 12 meeting the panel heard from Drs. David Savitz and Nancy Wertheimer.

DER also commissioned an evaluation of epidemiological studies related to power line fields by Dr. Paul Leaverton, the chairman of the University of South Florida School of Public Health's Department of Epidemiology and Biostatistics. In his February 5 report, Leaverton said that "the consensus among epidemiologists conducting a similar review would conclude that the hypothesis that 'long-term exposure to low-frequency electromagnetic fields is hazardous to one's health' is still an open question." He recommends more case-controlled studies, with sufficient sample sizes to "achieve reasonable statistical power."

Meanwhile, in December, the chairman of the panel, Dr. Lloyd Beidler of Florida State University, resigned and was replaced by Dr. John Parker of Florida International University. In his letter of resignation, Beidler stated that the new governor and the head of DER would want to appoint their own chairman because "the ultimate policy related to [electromagnetic field] concerns will be a result of political as well as scientific decisions."

Sources told *Microwave News* that, in fact, Beidler was asked to stay on by Governor Robert Martinez's incoming administration, but that Beidler decided to resign anyway out of possible concern over litigation which may arise from the panel's recommendations.

For more information, contact: Buck Oven, DER, 2600 Blair Stone Rd., Tallahassee, FL 32301, (904) 487-2522.

Leeper To Market Meter

Ed Leeper will soon begin producing a hand-held meter to measure power line magnetic fields. Available in May, the meter will cost $225.00 – substantially less than currently available measuring devices.

In a telephone interview, Leeper told *Microwave News* that he designed the unit – the AC Milligaussmeter – to "provide a means by which one can track down and quantify field sources." He added that his meter "should make it easier to determine which types of power lines are the important field producers in a given locale."

For many years Leeper, a physicist, has collaborated with Dr. Nancy Wertheimer on epidemiological studies on the link between power line electromagnetic fields and cancer (see *MWN*, March 1983 and November/December 1986).

The AC Milligaussmeter measures magnetic fields down to 0.1 milligauss (mG) and has a flat response between 40 Hz and 1 kHz with an accuracy of ±5%, according to Leeper. It has 12 scales, from 0.5 mG to 2.5 G full-scale. The unit displays true rms values and has a sharp low-frequency cut-off, which filters out the spurious signals produced by movements of the hand-held coil in the Earth's magnetic field – an innovation which allows the measurement of low-intensity fields with the hand-held probe, Leeper said. The meter also has an audio output to help to identify maximum field levels.

Leeper's new unit provides an alternative to using the "Deno Meter" – designed and built by Dr. Don Deno of GE – which costs $1,200 but which also measures a number of other variables, including electric fields, current and space potential.

For more information, contact: Ed Leeper, Monitor Industries, Salina Star Route, Boulder, CO 80302, (303) 442-3773.

The Savitz Cancer Study: The Repercussions

Outlined below are some of the developments that have followed the release of Dr. David Savitz's epidemiological study linking power line magnetic fields with childhood cancer (see *MWN*, November/December 1986).

More Data Analysis

The New York State Power Line Project, which sponsored the study, has given Savitz additional funds to do more data analysis. In a telephone interview, Savitz said that he will investigate whether "the wire coding relationship holds up after adjustment for traffic density."

In addition, Savitz plans to look at people's exposure histories in greater detail. That is, he will try to determine how long subjects lived in the homes they were occupying at the time of the study.

Savitz said that he is going to wait until he has finished the analyses before submitting a paper for publication. He predicted that he will be finished by the early fall.

Reports To Be Available Soon

Savitz's final report to New York State will be available soon from the project office in Albany. The total cost of the report was not known at press time; it will be $0.25 per page.

The report on the epidemiological study of adult leukemia risks by Battelle's Dr. Richard Stevens will be available from the project office by the end of April. Stevens's final report will include Bill Kaune's *Residential Magnetic and Electric Fields Measured over 24-H Periods*, which is in itself over 100 pages long.

For more information on obtaining the Savitz, Stevens or any other New York project reports, contact: Charlene McAuliffe, Power Line Project, Department of Health, Room E-297, Empire State Plaza, Albany, NY 12201, (518) 474-7888.

(Note that Savitz and Dr. Eugenia Calle's review of epidemiological surveys of workers exposed to electromagnetic fields, which was reported in the May/June 1986 issue of *Microwave News*, has been published: see *Journal of Occupational Medicine*, *29*, pp. 47-51, January 1987.)

DOE and EPRI Workshops

Immediately following the November power line meeting in Denver, CO, the Department of Energy (DOE) sponsored a workshop on epidemiology and cancer. A report on that meeting, *Epidemiologic Studies on Electromagnetic Fields and Cancer in Humans*, has been completed. A panel of experts recommended that:

- A meeting of agency representatives involved in research funding should be held to determine whether present overall programmatic directions should be reconsidered and to explore possibilities of cooperative ventures to finance the recommended studies.
- A major concern for [DOE's Office of Energy Storage and Distribution] in the near term should be in ascertaining appropriate in vitro studies and animal models to be used in long-term studies (e.g., carcinogen assays) of ELF field effects.

Although widely circulated, the report has not been released to the public.

The Electric Power Research Institute (EPRI) held its own workshop to set research priorities on January 29-30. The recommendations of the experts assembled by EPRI, reprinted on pp. 9-12, have not been released to the public, either.

In the News

In our last issue, we quoted EPRI's Dr. Leonard Sagan as saying that it was only a matter of time before the press would report the findings of the association between power line fields and cancer.

He was right. Since Savitz released his results in November, a number of national magazines have run stories on the health impacts of power lines:

- Jeff Hecht's "Electricity Blamed for Childhood Cancers" appeared in the January 15 issue of the *New Scientist*.
- *Science News* ran Diane Edwards's "Power Line Peril?" as the cover story in its February 14 issue.
- The March 30 *U.S. News & World Report* devoted three pages to Stanley Wellborn's "An Electrifying New Hazard," including a color picture of Dr. Nancy Wertheimer and Ed Leeper.
- *Hippocrates*, a new magazine on health and medicine based in Sausalito, CA, featured an item on the Savitz study in the "Vital Signs" news section of its premier issue (May/June).

Sources told *Microwave News* that the *EPRI Journal* has prepared an article on the power line health question, but that senior management has not yet approved its publication.

Judging by the letters to the editors printed to date in response to these articles, the public reaction has been somewhat skeptical. Philip Lunnon of British Gas in London told the *New Scientist* (February 26) that he thinks researchers should look into the possibility that "birdshit" may be the agent causing the increase in cancer.

On a more serious note, Dr. H.W. Lewis, a physics professor at the University of California, Santa Barbara,

wrote to *Science News* (March 28) that the cancer-ELF link is not plausible: "One induces comparable electric fields in the body by walking through the Earth's fields at a speed a good deal less than 1 m.p.h., and children are faster than that." In contrast, Biology Professor Martin Sage of the University of Missouri in St. Louis cited Swedish and Russian studies showing that ELF fields can have biological effects.

Interestingly, the major U.S. newspapers have not picked up the story.

Australian Line May Be Delayed

In Australia, where a controversy is raging over a 220 kV line in the state of Victoria (see *MWN*, July/August 1986 and January/February 1987), the Savitz study has received a great deal of play – even more so after Professor Bruce Armstrong, the director of the National Health and Medical Research Council's Epidemiology and Preventive Medicine Research Unit, issued a report saying that the epidemiological data, though not conclusive, "cannot be dismissed as explicable by chance, bias or confounding."

As a result, there is a possibility that the 220 kV line may be delayed for three months, pending further health analyses.

NY Power Line *(continued from p.1)*

against falling trees. The Marcy-South line will be 206 miles long, running from Marcy to East Fishkill; half of the line has already been completed.

The approval of the 765 kV Marcy-North line in 1978 followed a protracted battle. One result was the setting up of the New York State Power Line Project. The Marcy-South line has also been opposed by citizen groups along the line, but past suits have been dismissed.

Gurda plans to stress the cancer risk from the power line fields. Among the expert witnesses scheduled to testify for the plaintiffs are: Drs. Robert Becker, Harris Busch, Marvin Chatkoff, Andrew Marino, Jerry Phillips and Nancy Wertheimer. Many of these experts also testified in the Houston Lighting & Power Co. trial in Texas that resulted in a $25 million award for punitive damages; that decision is under appeal (see *MWN*, November/December 1985 and November/December 1986).

No court date has yet been set, but Gurda predicted that the trial will start next fall or early winter.

In Florida, two landowners have won large awards after alleging losses associated with property adjacent to a 500 kV line. Florida Power & Light Co. has appealed those decisions to the state's Supreme Court (see *MWN*, September/October 1986).

FROM THE FIELD

EPRI's Proposed ELF Research Projects

On January 29-30, the Electric Power Research Institute (EPRI) convened a group of experts in San Diego, CA, to set research priorities for studies on the bioeffects, especially carcinogenesis, of power line electromagnetic fields. Reprinted below are their recommendations for future work in seven research areas. These grew out of discussions at the workshop and were later written up by the panel chairmen. The chairmen, and their specialties, are: Dr. John Peters of the University of Southern California, on epidemiology; Dan Bracken, a consultant, on exposure assessment; Dr. Neil Chernoff of the Environmental Protection Agency and Dr. Frank Welsch of the Chemical Industry Institute of Toxicology, on teratology; Jack Lee of the Bonneville Power Administration and Dr. William Bailey of ERI, Inc., on DC fields; Dr. Marvin Goldman of the Energy-Related Health Research Lab at the University of California, Davis, on animal carcinogenesis; Dr. Granger Morgan of Carnegie Mellon University, on risk assessment; and Dr. Tom Tenforde of the Lawrence Berkeley Lab, on mechanisms of interaction. Dr. H.B. Graves, who chaired the San Diego review, is in the process of polling those who attended as to which of the projects detailed below should have the highest priority for funding.

EPIDEMIOLOGY RESEARCH PROJECTS

...It was stressed at the meeting several times...that human studies are inseparable from exposure assessment and both must be planned and conducted concordantly....

Children's Cancer: Certainly from both a political and public health point of view, ascertaining whether electromagnetic fields (EMFs) can cause childhood cancer is an extremely important line of research. The strongest evidence points at leukemia as the major outcome of interest, but there is also evidence that brain cancer, and perhaps, other cancer sites are similarly at risk. The biggest defect in our current knowledge is an understanding of lifetime exposure even though attempts at semi-quantitative exposure assessment have provided data to support the concern. Extension of our existing knowledge will rest on better assessment of residential and public exposure encountered by children. Improved exposure assessment will provide either firmer evidence for risk or firmer evidence for lack of risk. It also seems important, at least for the time being, to focus on specific cancer sites as specificity both in the sense of diagnosis and in the sense of exposure assessment enhances our opportunity to prove hypotheses.

In more specific terms, two types of studies seem in order. The first is a more careful look at residential exposures with 24-hour measurements of EMFs and estimates of exposure based on appliance use. Likewise, estimates of exposure from schools, daycare centers, playgrounds, etc. should enter the exposure assessment effort. Following this, and depending to some extent on the outcome of the first study, a large megachild study covering a significant part of the U.S. should be considered. The Children's Cancer Study Group provides such an opportunity as there is a consortium of hospitals covering a large segment of the U.S., collaborating in case finding related to childhood cancers.

Occupational Studies: There are two primary questions that need to be answered in this area. One is whether the electrical workers identified in the published associations between leukemia and electrical work really do have exposure to higher levels of EMFs than other occupations. And the second important question is whether populations with proven high exposure for long duration really have an excess of leukemia or other cancers. Ideally, at least six conditions should be met for the latter study: (1) The population must be large enough for the study to have adequate statistical power to have a high probability of detecting an association between leukemia and EMF exposure, if one exists; (2) it must contain a significant proportion of workers exposed to EMFs considerably above background; (3) it must contain a significant portion of workers with long-term exposure; (4) written records regarding job assignments of study subjects must be available; (5) it must be feasible to measure EMF exposures of present day jobs and to infer past exposure from these measurements. This implies that the exposure in any specific job must have remained constant or be predictable, based on the job duties and location; and (6) there must be a way of identifying cases of leukemia or other cancer either through population-based disease registries or through company records (medical, insurance, etc.). It must be emphasized that any studies of occupational groups must include a strong effort to identify concomitant carcinogenic exposures, for example, solvents and PCBs.

Opportunistic Epidemiology: Efforts should be made to identify populations with higher than average exposures to EMFs. Examples of this might include electric blankets or resistance ceiling heating. If it is true that very high electric (E) and magnetic (B) fields are found under electric blankets and if high EMFs cause leukemia or other cancer, then electric blanket users should be at risk of leukemia or other cancers. This question could easily be added to existing questionnaires of case-control studies of adult leukemia, and there is no reason to think that objective reproducible information would not be forthcoming.

Life Exposures: This category probably belongs more to the exposure assessment consideration, but nonetheless the human studies are impaired by our general lack of knowledge on ambient EMF exposures encountered in various living activities. A greater knowledge of these exposures would probably result in some hypotheses that could be tested through population studies.

Costs and Time: A good study of children's cancer, particularly leukemia, taking a careful look at residential and public exposures would probably take about three years to complete and would cost approximately somewhere between $750,000 and $1,000,000. In the occupational studies, characterizing the exposure of electrical workers versus non-electrical workers would take between one and two years, and would cost approximately $250,000. The study of high exposure/long duration employees in a cohort followed by a case-control study would probably take about five years and would cost in the low millions. The opportunistic epidemiology, if attached to ongoing or planned case-control studies, would have a relatively small cost, certainly under $50,000, and would take the same amount of time to complete as the parent study. Life exposures could be studied forever. If answers are provided by the other studies that either incriminate or reduce the chance of there being a risk, then the need for such studies might be increased or decreased.

EXPOSURE ASSESSMENT PROJECTS

Occupational: •Collect occupational exposure data for 60 Hz E- and B-fields. There should be sufficient data to produce various exposure metrics. Ultimately, this will be a long-term effort with large N. Other exposure parameters should be included. Exposure from power lines should be differentiated from that due to other sources. All industry sectors should be sampled including the rapidly expanding service industries, medical services and industries using pulsed fields. The protocols and exposure data should be compatible with efforts directed at the residential and civic sectors. •Evaluate surrogate measures for occupational exposure such as: job titles, specific tasks, proximity to equipment. •Characterize the harmonic content of occupational exposures through spectral analysis at various locations. Characterize contact currents and shocks in the workplace. •Develop a small dosimeter for occupational exposure measurements. Consider the use of a biological indicator for exposure. •Identify unique exposures associated with specific locations and/or industrial processes.

Civic/Public Areas: •Collect 60 Hz E- and B-field exposure data in civic and public areas such as schools and hospitals. The data should be sufficient to generate various exposure metrics. The protocols and data should be compatible with studies in the residential and occupational sections. •Characterize 60 Hz E- and B-fields in schools and other locations such as hospitals and subways. This effort should include harmonics. Sources of exposures in public areas should be identified.

Other: •Assess need for combined exposures to E- and B-fields in animal studies. Evaluate conversion of existing E-field exposure facility to combined E- and B-field exposure facility. •Investigate combination AC and DC transmission line environment.

Laboratory: •Develop protocol to specify lab ambient environments, e.g. geomagnetic fields, 60 Hz levels, control areas. •Design a B-field exposure system with a waveform/temporal menu. This menu should reflect an effort to mimic selected aspects of human exposure. This system would then be used for 60 Hz field effects research on animals. Evaluate modification of existing E-field exposure facility. •Continue mechanistic research with exposures that vary in frequency, amplitude and temporal presentation.

Residential: •Collect 60 Hz E- and B-field exposure data. There should be enough data to produce various exposure metrics, including peak fields, time histograms, etc. The rationale for the metric(s) that are used is required. Ultimately, this will be a long-term effort with a large number of people keeping activity logs. A representative sample of society will need to be selected. Special subsets of the population that are of interest are those living near transmission lines and children. Because of the immensity of the project, an incremental approach is desired. A tractable sample size in one location would be used to establish protocols for expanding the study to several locations. •Perform B-field characterization: look for significant parameters such as diurnal variations; long-term stability; grounding systems; construction practices; geographic location; important sources related to power system and internal sources; spectral analysis to look at harmonics for both E- and B-fields. Determine appropriate meter response to characterize fields: 60 Hz or broadband. •Investigate ion penetration into residences. •Evaluate surrogate measures of residential exposure. •Perform

electric blanket exposure assessment. •Identify unique exposure situations including contact currents from appliances.

TERATOLOGY RESEARCH

Rationale: EPRI has long recognized the shortcomings of previous teratology studies and through research that it sponsored, developed E-field exposure cages free of the technical flaws of previous designs. This equipment is now being used in a teratology study in rats conducted at Battelle Northwest, where rats are exposed to 0, 10, 65 and 130 kV/m. The study was started in December, 1986.

The question was discussed whether adverse effects of B-fields on embryo development should be examined. No serious, scientifically sound studies are presently on record. The concern was voiced that EPRI is getting more and more involved in "defensive science," but with respect to B-fields, that argument was felt not to be applicable because there is no data base. The feeling was expressed that sooner or later, a B-field exposure teratology study would have to be conducted. The issue whether there should be simultaneous exposure to E- and B-fields was decided in favor of one or the other variable only to not confuse the issue and endanger the interpretability of the study results.

There is a need for EPRI to *sponsor a teratology study on B-field exposure* in the very near future. An engineering cost analysis should be initiated to decide whether it is more economical to retrofit the existing E-field exposure chambers presently used at Battelle or to design entirely new exposure chambers. It might be advantageous to combine both exposure possibilities in one piece of equipment for future experiments.

DIRECT CURRENT FIELD RESEARCH

...1. There is an important need for research to clarify the possible long-term effects of air ions and DC E-fields on laboratory animals. As with AC research, this information is needed as part of the overall data base for assessing the potential effects of HVDC transmission lines on people. Specific end points for laboratory animal research include, but are not limited to: •Survival rates; •Incidence of and progression of respiratory disease; •Levels of and/or response to neurotransmitters, e.g. serotonin; and •As a lower priority, consider the need for research on cancer and birth defects. A single, multigenerational study could address most of these end points. **Rationale:** Published results of the EPRI-sponsored air ion research by Kellogg et al. (1985) claim significant effects on mice from long-term air ion exposure, i.e., decreased lifespan. Although the research has been criticized by some on methodological grounds, one of the HVDC science advisors to the state of Minnesota (Bissel 1986) recently concluded that the Kellogg study is sufficiently plausible to deserve replication by EPRI. One of the only other studies to look at long-term air ion exposure, Hinsull et al. (1981), also reported some effects on neonatal survival and on pre-weaning growth rates of rats. Recent studies by Kellogg et al. (1985) and by Bailey and Charry (1984) found no evidence that air ion exposure influenced serotonin levels. However, a recent report by Dowdall and de Montigny (1985) suggested that such exposure can affect the sensitivity of brain cells to serotonin. This finding has now been replicated (de Montigny, personal communication). The serotonin issue, therefore, has not been fully resolved. ***Estimated Cost: $2-3 million.***

2. Short-term studies of humans are needed to assess the following: •Factors influencing perception of DC E-fields, including annoyance levels; •Mental state, including mood and performance; and •Individual differences among people in their responses to air ions. **Rationale:** Research personnel and others who work near HVDC lines report that on occasion, E-fields are noticeable and in some cases, annoying. The latter appears to be related to both field strength and weather conditions. No systematic studies using representative subjects and conditions have been done to evaluate the occurrence of, and factors influencing human perception of DC E-fields. There is also a body of controversial research suggesting that air ions can influence mood and mental state in humans. Research by Charry and Hawkinshire (1981) also indicates there may be significant differences among people in their responses to air ions. ***Estimated Cost: $200,000-$400,000.***

3. Research on HVDC electrical exposures is needed to address: •Identification of chemical ion species in power line environments compared to other situations, e.g. indoor laboratory animal environments; and •Measurements and modeling of the electrical environment where AC and DC transmission lines are in close proximity. **Rationale:** Although good information now exists on the concentrations of air ions produced by HVDC lines, information is lacking on air ion species near such lines. Also, it is important to know how air ions produced by DC lines compare to the air ion environment used in studies of laboratory animals. Preliminary information has been obtained by an EPRI-sponsored study (Georgia Institute of Technology) and this work should continue. ***Estimated Cost: $100,000-$200,000.***

4. Work should begin on study design and protocol for laboratory animal research to assess the possible effects of combined AC and DC fields comparable to those produced by adjacent AC and DC power lines. **Rationale:** Recent research, e.g. Thomas et al. (1986), Blackman et al. (1985), indicate that certain combinations of AC and DC B-fields can produce biological effects in laboratory studies which are not produced by the separate fields. A hypothesis involving cyclotron resonance has been advanced to explain the phenomenon. ***Estimated Cost: $200,000-$600,000.***

5. Work should begin to determine if there is a basis for laboratory animal research to determine if charged aerosols cause biological effects that differ from, or interact with, those that may be produced by air ions. **Rationale:** It is currently assumed that space charge, in the form of air ions and charged aerosols, leads to increased DC E-fields off the right-of-way of a DC line. Further, under some conditions, charged aerosols may be the primary component of DC E-fields off the right-of-way where residences may be located. There is little information available for assessing the possible biological effects of chronic exposure to charged aerosols. ***Estimated Cost: $50,000.***

6. Evaluate the need for and feasibility of epidemiological research involving people who live and/or work near HVDC transmission lines, possibly through a cooperative effort with individual utility groups. **Rationale:** Some preliminary epidemiological research involving HVDC lines has been done, however, with inconclusive and controversial results (e.g. Genereux and Genereux 1980, Nolfi and Haupt 1982). The New England Hydro-Transmission Corporation is investigating the feasibility of such research at the request of the states of New Hampshire and Massachusetts. ***Estimated Cost: $50,000-$75,000 (feasibility study only).***

WHOLE ANIMAL STUDIES ON CANCER ISSUES

The following are the recommended animal studies which have the goal of developing an animal model for studying the

relationship, if any, between exposure to power frequency B-fields and cancer. The review committee emphasized that careful planning, including a review or a workshop on the laboratory data base, would be necessary to generate specific hypotheses for study. "Fishing expeditions" are specifically discouraged. In vitro cellular studies may provide models for "range finding" so that some notion of a meaningful dose metric might be developed to apply in the animal studies.

1. The first study is essentially a "pilot study" and would utilize specific mouse strains selected for responsiveness to cancer-promoting agents (e.g. B6, AKR or others) using treatment groups *such as* (a) [constant exposure over days to low and high fields – the "high" being approximately ten times the "low" field strength]; (b) "Electric blanket" exposure scenario: [eight hours of high exposure followed by 16 hours of low exposure]; (c) Random amplitude and duration [exposures].
2. A "primed" system study using treatment groups *such as* the following: (a) Mouse plus leukemogen plus B-field at $\Delta t = \Delta t$ in frequency and latency; (b) Model plus promoter (e.g. estrogen); (c) Model such as nude mouse, which has immune system deficiencies; (d) Fetal exposure and examine offspring for leukemia.

RISK ASSESSMENT RESEARCH PROJECTS

Rationale: The inability to define "dose" has severely limited investigators' efforts to apply conventional risk analysis techniques to the problems of 60 Hz fields (see the various works of Morgan, et al.). While it probably does not make sense to devote much additional effort to conventional risk analysis until the science is in better shape, there are some important related activities which should be undertaken at this time:

1. Develop materials designed to assist state regulators, members of the judiciary, state legislators, electrical utility managers and others who must deal with 60 Hz field issues to structure and think about the problems they face. Such guidance must include a fair articulation of what the science does and does not say; a fair explanation of which experiences and insights gained in the context of other risks extrapolate to the 60 Hz area and which do not; a clear statement of the importance of maintaining a relative risk perspective and of establishing bounds on the problem; and a clear framing of the choices and value judgments that managers and regulators must make. It would be worth involving several different groups in work of this kind.

2. While at this stage, the central scientific questions of existence of effects, nature of mechanisms and characterization of "dose" should drive the research agenda, a risk analytic perspective may be useful in helping to establish some research priorities and in keeping the research program focused on its basic risk-related objectives. The level of effort devoted to this second task should be modest.

MECHANISMS OF INTERACTION

The following is a listing of the eight recommendations, with an asterisk placed after those areas of research that are currently funded by EPRI, DOE or other sources:
1. (*) Continued research on transmembrane signalling events and the activation by EMFs of cAMP, cellular kinases and other enzyme systems that are controlled kinases.
2. Determination of thresholds for ELF field effects using well-defined in vitro systems and quantitative biological/biochemical end points. These thresholds relate to field amplitude and frequency dependence, temporal variations in the expression of bioeffects and the magnitude of these effects as a function of exposure duration.
3. Devise a sensitive in vitro model for studying the relative potencies of various field exposure regimens (e.g., different on-off cycles using a field intensity that elicits a quantifiable effect during continuous exposures of approximately one hour duration).
4. (*) Additional work on "transcription" and "translation" effects of ELF fields, such as the altered messenger RNA expression and protein synthesis in dipteran salivary gland cells (research by Goodman, Henderson and others).
5. Replication of key experiments conducted in vitro such as the Winters/Phillips studies on growth rate and membrane receptors in human colorectal adenocarcinoma cells.
6. (*) Extend studies on the pineal gland as a potentially sensitive site of ELF field interactions. Explore melatonin interactions with other hormones (e.g., estrogen) that are known to influence cancer risk in certain tissues (e.g., the female breast).
7. Enhance efforts to develop realistic theoretical models of ELF field interactions at the cellular, membrane and molecular levels of biological organization.
8. Initiate studies on synchronized cell populations in vitro to gain information on the cell-cycle-phase dependence of ELF field interactions (i.e., to detect differential sensitivity between quiescent cycling cells, and between G-1, S and G-2 cells in cycling populations).

CONFERENCE CALENDAR

New Listings

May 15-18: **Spring Conference of the Society of Telecommunications Consultants (STC),** Sheraton Hotel, New Orleans, LA. Contact: Effie Cooper, STC, One Rockefeller Plaza, Suite 1410, New York, NY 10020, (212) 582-3909.

September 29-October 1: **9th Annual Electrical Overstress/Electrostatic Discharge Symposium,** The Peabody, Orlando, FL. Contact: Michael Martin, 3M/Static Control Systems, 2111 W. Braker Lane, Bldg.501, PO Box 2963, Austin, TX 78769, (512) 834-3117.

October 22-23: **19th Annual North American Power Symposium,** University of Alberta, Edmonton, Canada. Contact: Dr. D.O. Koval, Dept. of Electrical Engineering, University of Alberta, Edmonton, Alberta T6G 2G7, Canada, (403) 432-2481.

November 11-12: **International Monotech'87 Conference on Electrotechnologies,** Montreal, Quebec, Canada. Contact: J.P. Cristel, Canadian Committee on Electrotechnologies, 1 Westmount Sq. (525), Montreal, Quebec H3Z 2P9, Canada, (514) 931-5921.

November 13-16: **9th Annual Conference of the IEEE Engineering in Medicine and Biology Society,** Park Plaza Hotel, Boston, MA. Contact: Dr. Ronald Newbower, Dept. of Biomedical Engineering, Massachusetts General Hospital, Boston, MA 02114, (617) 726-1676.

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