SHORT COURSES

January 21-24: **Millimeter Wave Systems and Technology,** Atlanta, GA. Fee: $550 (3 days), $725 (4 days). Contact: Dept. of Continuing Education, Georgia Institute of Technology, Atlanta, GA 30332, (404) 894-2400.

January 22-25: **Grounding & Shielding,** Phoenix, AZ. Fee: $815 (Optional fourth day: $235). Contact: DWCI, Star Route 625, PO Box D. Gainesville, VA 22065, (703) 347-0030. **Repeated** February 5-8: Orlando, FL; February 19-22: Boulder, CO. March 12-15: San Diego, CA.

January 28: **Electrostatic Discharge (ESD) Control,** Los Angeles, CA. Fee: $295. Contact: R&B Enterprises, 20 Clipper Rd., West Conshohocken, PA 19428, (215) 825-1960. **Repeated** March 4: San Francisco, CA; March 18: Dallas, TX.

January 28-29: **Grounding, Bonding & Shielding,** Washington, DC. Fee: $650. Contact: Continuing Engineering Education, George Washington University (GWU), Washington, DC 20052, (800) 424-9773, or (202) 676-6106 in DC. **Repeated** May 2-3.

January 30-31: **Electromagnetic Pulse (EMP) Design and Test,** Los Angeles, CA. Fee: $595. Contact: R&B, see January 28 above. **Repeated** March 6-7: San Francisco, CA; March 20-21: Dallas, TX.

February 5-8: **Modern Microwave Techniques,** Orlando, FL. Fee: $715. Contact: Contact: Linda Billard, Technology Service Corp. (TSC), 962 Wayne Ave., Suite 600, Silver Spring, MD 20910, (800) 638-2628, or (301) 565-2970 in Maryland.

February 7: **Power System Harmonics,** New York, NY. Fee: $70. Held at IEEE PES Winter Meeting, see Conference Calendar on p.12.

February 13-14: **Microwave Devices: Present and Future,** Atlanta, GA. Fee: $475. Contact: Georgia Tech, see January 21 above.

February 13-15: **Microwave Technology and Applications for Industry,** East Brunswick, NJ. Fee: $750. Contact: Robert LaGasse, IMPI, Tower Suite 500, 301 Maple Ave. West, Vienna, VA 22180, (703) 281-1515.

February 14-19: **Fundamentals of Radar Cross Section,** Orlando, FL. Fee: $745. Contact: Ann Beekman, Southeastern Center for Electrical Engineering Education, 1101 Massachusetts Ave., St. Cloud, FL 32769, (305) 892-6146. **Repeated** May 13-17: San Diego, CA ($795).

February 19-22: **Modern Microwave Measurements and Applications,** Los Angeles, CA. Fee: $845. Contact: UCLA Extension Short Courses, PO Box 24901, Los Angeles, CA 90024, (213) 825-1295.

APL RF/MW Standard *(continued from p.1)*

According to Dr. Sam Koslov, an assistant director of the lab and a longtime member of the now-defunct Electromagnetic Radiation Management Advisory Council (ERMAC), the APL standard is based on the ALARA ("as low as reasonably achievable") principle, that has won widespread acceptance in the setting of ionizing radiation safety guidelines. He explained that current trends in biological effects research suggest that an ALARA approach is warranted.

When asked why all members of the staff were covered by the same standard, Koslov said that a single standard will not affect work at the lab and it is easier to enforce.

Robert Mallalieu, who serves on the APL safety committee, agreed: "As far as I am concerned we are all ignorant about what is going on at low levels, so we should all get the same level of protection."

APL's previous safety standard, set in 1970, was 1 mW/cm^2.

The Johns Hopkins lab, located in Laurel, MD, has 2800 employees. It does $200 million of contract research a year, primarily R&D for the Department of Defense.

The full text of the APL RF/MW standard is reprinted on pp.7-8.

CONFERENCES *(continued from p.12)*

September 23-26: **4th International Conference on AC & DC Power Transmission,** London, UK. Contact: IEE, see April 16 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.

October 13-17: **5th International Meeting of the Bioelectrical Repair and Growth Society,** Park Plaza Hotel, Boston, MA. Contact: Dr. S.R. Pollack, University of Pennsylvania, 119 Towne Bldg., 220 South 33rd St., Philadelphia, PA 19104, (215) 898-8241.

December 4-5: **International Conference on Electric and Magnetic Fields in Medicine and Biology,** London, UK. Contact: IEE, see April 16 above.

December 9-13: **10th International Conference on Infrared and Millimeter Waves,** Americana Dutch Resort Hotel, Orlando, FL. Contact: Dr. Kenneth Button, MIT, Box 72, MIT Branch, Cambridge, MA 02139, (617) 253-5561.

WHO-IRPA ELF Report *(continued from p.1)*

to predict the effects of exposure. Therefore, it recommends more basic research and more epidemiological studies. In fact, the committee goes so far as to call the need for "well done" epidemiological studies "imperative."

Epidemiological studies by Wertheimer and Leeper, Tomenius et al., Milham, Wright et al., Coleman et al., McDowell, and Vagero and Olin — all of which found an increased incidence of cancer among exposed populations (see *MWN*, March, June and December 1983) — are flawed, according to the report. Although the data from these researchers "cannot be dismissed," the committee believes that "there must be considerable study before they can serve as useful inputs for risk assessment." They note that adverse effects from exposure to ELF levels normally found in the environment or the work place "have not been established."

The report states that direct interference with cardiac pacemakers has not been reported in fields below 2.5 kV/m.

Selected excerpts from the document appear on pp.6-7.

Environmental Health Criteria 35: Extremely Low Frequency (ELF) Fields, evolved from drafts prepared over a four-year period by a number of experts, including Dr. W.R. Adey, Dr. P. Czerski and J.C. Villforth of the U.S.; Drs. M.G. Shandala and V. Akimenko of the U.S.S.R.; and members of the WHO-IRPA joint ELF committee under the chairmanship of Dr. M. Repacholi of Australia. The other committee members and their home countries are: Dr. J. Bonnell, England; Dr. B. Bosnjakovic, The Netherlands; Dr. J. Cabanes, France; Dr. M. Grandolfo, Italy; Dr. B. Knave, Sweden; Dr. J. Kupfer, German Democratic Republic; Dr. R. Phillips, U.S.; Dr. A. Portela, Argentina; Dr. A. Sheppard, U.S.. A. Duchene, France; G. Ozolins, Switzerland; and Dr. M. Shore, U.S., served as the committee's secretariat.

The document will soon be available in the U.S. from the WHO Publications Center, 49 Sheridan Avenue, Albany, NY 12210, or in Canada from the Canadian Public Health Association, 1335 Carling Avenue, Suite 210, Ottawa, Ontario K1Z 8N8. Or contact the WHO Distribution and Sales Service, 1211 Geneva 27, Switzerland. The price had yet to be set at press time.

WHO-IRPA ELF HEALTH CRITERIA

Reprinted below are excerpts from the "Health Risk Evaluations" and the "Summary and Recommendations" chapters of the World Health Organization's (WHO) and International Radiation Protection Association's (IRPA) recently released Environmental Health Criteria 35: Extremely Low Frequency (ELF) Fields. *(Citations in the text have been deleted.)* *See also story on p.1.*

Health Risk Evaluation

Interactions that lead to measurable biological effects, which remain within the normal range of physiological compensation of the body and do not detract from the physical and mental well-being of human beings, should not be considered hazardous. Interactions that lead to biological effects outside the normal range of compensation of the body may be an actual or potential health hazard....

Unfortunately, the state of knowledge of the interacting mechanisms operating when biological systems are exposed to ELF fields is very limited. At present, it is impossible to furnish any theory to predict the effects of exposure to these fields. Because of this lack of information, care must be taken in attempting to predict or extrapolate effects in man from effects found in animals. Physical differences (size, shape, fur-bearing, etc.) result in marked differences in the internal field distribution and in different behavioral and homeostatic responses....

It would be ideal to make health risk evaluations on the basis of well-conceived, well-conducted, and well-analyzed epidemiological studies. Unfortunately, all such studies on human beings exposed to ELF fields have suffered from one or more deficiencies...

With such a limited scientific data base, the determination of the existence of a true threshold exposure level below which no adverse health effect occurs, cannot be made with confidence. Thus, any health risk analysis for the development of standards must inevitably adopt a phenomenological approach. In this case, a review of the literature is made to determine the lowest exposure levels at which adverse biological effects have been established. A biological effect that occurs in living organisms or animals may be detected as some general or specific alteration. If the change appears irreversible or pathological, it might be presumed that it could be hazardous to man under comparable exposure conditions. This assumption is made only because insufficient information is available on the effect or the underlying interaction mechanism to make an extrapolation to exposure conditions producing similar effects in human beings and to make a well-substantiated health risk evaluation.

The epidemiological studies suggesting a relationship between childhood or adult cancer and residence in houses at various distances from high current flow due to external electrical wiring configurations, can only be considered as preliminary because of the many criticisms that have been levelled at the studies.

The studies suggesting an association between electrical occupations (exposure to electric and magnetic fields) and cancer were analyses of occupational mortality data and subject to many sources of errors.

Thus, although these reports suggest potential adverse health effects, they cannot be evaluated in terms of health risk until the potentially confounding factors and sources of errors are eliminated. It is of concern, however, that no studies have yet been published following up these reports.

Laboratory studies on human volunteers exposed for short periods to electric fields (up to 20 kV/m) have, in general, shown no effects. The results of these studies suggest that no apparent acute effects are likely from exposure to strong electric fields. However, they cannot be used as indicators that no health effects will occur from long-term exposure (months or years).

Studies on the health status of linemen and switch-yard workers have not revealed any differences between exposed and control groups....These epidemiological studies, although among the more complete, have still suffered from a lack of numbers of persons exposed to high electric field strengths for extended periods. However, these workers are exposed to potentially the highest electric field strengths albeit for short periods of time. These studies do not provide a good data base on which to evaluate the possible health effects from long-term exposure of the general public to electric fields near transmission lines. More definitive information is needed, which in general, can only be provided through both large-scale epidemiological studies and developments in dosimetry that will make it possible to extrapolate the experimental animal results to human beings.

While attempting to arrive at general conclusions concerning the health hazards of ELF electric fields for protection purposes, the fundamental question that requires an answer is whether or not exposure to these electric fields induces any physiological or pathological effects in man.

From a careful review of laboratory studies *in vivo* and *in vitro*, and from human studies, the following conclusions can be drawn:

a. Adverse human health effects from exposure to ELF electric field levels normally encountered in the environment or the work place have not been established.

b. Some human beings feel spark discharges in electric fields of about 3 kV/m and perceive the fields between 2-10 kV/m. At present, there are no scientific data that suggest that perceiving a field produces an adverse pathological effect.

c. Exposure to ELF electric fields can alter cellular, physiological, and behavioral events. Although it is not possible to extrapolate these findings to human beings, at present, these studies serve as a warning that unnecessary exposure to electric fields should be avoided.

d. The preliminary nature of the epidemiological findings on the increased incidence of cancer among children and adults exposed to ELF fields from electric wiring and the relatively small increment in reported incidence, suggest that, although the epidemiological data cannot be dismissed, there must be considerable study before they can serve as useful inputs for risk assessment.

Conclusions and Recommendations

1. In order to relate biological findings from *in vitro* and *in vivo* studies on experimental animals to human beings, it is recommended that dosimetry studies should be continued to measure and relate external electric field strengths and internal current density distributions in the whole body of both animals and human beings.

2. From studies on man and animals, observed sensitivities are consistent with two proposed models, one on the basis of stimulation of peripheral sensory receptors in strong local electric fields at the body surface, and the other on the basis of current densities induced in the extracellular fluid. It is recommended that models be devised that correlate exposure and biological effects in terms of physical factors, such as surface electric field, tissue current density, spark discharges, and waveform.

3. The continuation of basic research on electric and magnetic field interaction mechanisms is strongly recommended. Investigations should be conducted on the possible synergism or antagonism of

field influences with physical and chemical agents, since such data are not available.

4. In some studies, restriction of ELF effects to certain "windows" in frequency and amplitude has been reported. It is recommended that the window concept be further investigated to determine the applicability of data obtained with various frequencies and waveforms, and to relate the findings to potential health detriment in human beings.

5. Studies have been performed on workers with long-term exposure to electric and magnetic fields, but no adverse health effects have been identified. However, these studies were not designed to evaluate effects on reproductive functions, or long-term carcinogenic risks. In two of the studies, electric field exposure was carefully evaluated, and it was found that average exposures in the occupationally exposed groups were remarkably low.

A suggestion of increased cancer incidence has been reported by a number of investigators who have examined occupational and general population groups exposed to electric and magnetic fields. The studies performed have serious deficiencies in epidemiological design and do not adequately characterize levels and duration of exposure.

The limited knowledge of the potential human health risk associated with exposure to electric and magnetic fields makes it imperative that well-designed epidemiological studies should continue to be undertaken to provide a firmer basis for risk assessment.

6. Occupational exposure to strong electric fields is generally intermittent and of short duration; exposed populations have been identified, and there are some limited data based on practical experience. At field strengths where spark discharges are prevalent, prolonged exposures may impair performance. Such exposures should be avoided, where possible.

7. Linemen working on energized extra- or ultra-high-voltage conductors experience extreme electric field conditions, and the use of appropriate protective clothing or devices is desirable.

8. Whilst it would be prudent in the present state of scientific knowledge not to make unqualified statements about the safety of intermittent exposure to electric fields, there is no need to limit access to regions where the field strength is below about 10 kV/m. Even at this field strength, some individuals may experience uncomfortable secondary physical phenomena such as spark discharge, shocks, or stimulation of the tactile sense.

9. It is not possible from present knowledge to make a definitive statement about the safety or hazard associated with long-term exposure to sinusoidal electric fields in the range of 1-10 kV/m. In the absence of specific evidence of particular risk or disease syndromes associated with such exposure, and in view of experimental findings on the biological effects of exposure, it is recommended that efforts be made to limit exposure, particularly for members of the general population, to levels as low as can be reasonably achieved.

10. In principle, electric and magnetic field interference with implanted cardiac pacemakers can lead to reversion to a fixed rate, but cessation of stimulation is possible. Direct interference has not been reported in fields below 2.5 kV/m. Although body currents produced by contact with a vehicle in a weaker field may cause interference, the risk of pacemaker reversion is believed to be slight.

It is recommended that pacemaker designers and manufacturers of other similar electronic equipment ensure that their devices are resistant to failures caused by electric or magnetic field-induced currents.

JHU-APL RF/MW Safety Standard

Reprinted below is the full text of the Johns Hopkins University (JHU) Applied Physics Laboratory's (APL) new health and safety standard for exposures to radiofrequency and microwave (RF/MW) radiation. The standard, adopted on October 19, 1984, replaces the lab's 1970 standard.

The APL Microwave Radiation Subcommittee recommends that the APL operating standard for permissible exposure to radiofrequency electromagnetic fields be revised to reflect evolving scientific understanding of the biological effects of non-ionizing radiation, the difficulties of properly measuring complex fields, and the desirability of a conservative safety factor. There is no evidence that permissible power levels stated in the old standard were unsafe, and this revision is intended only to increase the factor of safety over the old APL standard of 1 mW/cm^2.

The standard calls for averaging over a 0.1 hour period for all modulations. Typically, the maximum equivalent power density is 0.1 mW/cm^2 for frequencies above 30 MHz. Both mean-squared field strength and equivalent power density are specified according to frequency. These several parameters describe similar levels of exposure. Unusually high peak power levels should be noted. The safety office shall be consulted whenever the peak equivalent power density, during the pulse, is greater than 100 mW/cm^2 in any area of potential personnel exposure.

For personnel directly involved in the operation of RF equipment, exposures to higher intensity fields are permissible for very brief periods. The average power density during the period of exposure to the higher intensity fields shall not exceed ten times the values given in the exposure standard. Such exposures should be no longer than six minutes total in any one hour. Staff members responsible for the operation of various RF equipment must ensure that personnel exposures be as low as reasonably achievable below the maximum levels. The safety office must be notified if field levels are expected to approach the maximum levels so that a survey can be conducted.

Radiofrequency Exposure Limits (Averaged Over 0.1 Hour)

Frequency	Equivalent Power Density (mW/cm^2)	Mean-Squared Electric Field Strength (V/m)^2	Mean-Squared Magnetic Field Strength (A/m)^2
0.3-3 MHz	10	40,000	0.25
3-30 MHz	90/f^2	360,000/f^2	2.25/f^2
30 MHz-100 GHz	0.1	400	0.0025

(f=frequency in MHz)

This standard does not apply to emissions from consumer electronic products such as microwave ovens and hand held transceivers which are controlled by product performance standards administered by the Food and Drug Administration (FDA). It also does not address intentional exposures during the course of medical experimentation such as RF hyperthermia for cancer therapy.

Mark W. Woods, Chairman
Safety Committee

H.L. Hall, Jr.
Safety Officer

Definitions

A few definitions are required to allow a consistent interpretation of the standard. Except for Hermitian magnitude, all quantities that follow have units of mW/cm^2:

Equivalent power density: The power density of a hypothetical plane wave in free space having the same electric or magnetic field strength (Hermitian magnitude) as that measured in a complex reflective field or in an antenna near-field. Equivalent power density varies from point to point within a complex field.

Hermitian magnitude: For a vector **A**, the Hermitian magnitude is $|A|=\sqrt{A \cdot A^*}=\sqrt{AxAx^*+AyAy^*+AzAz^*}$ in which the asterisk denotes the complex conjugate. It implies a time averaging when used with the electric (**E**) or magnetic (**H**) field vector. The Hermitian magnitude provides a means of comparing fields with different polarizations.

Power density: The time average of the Poynting vector.

Poynting vector: The vector product of the electric and magnetic field vectors of an electromagnetic wave (**S=ExH**). When summed over a closed surface, the Poynting vector represents the total instantaneous power entering or leaving that surface. At a single point, the Poynting vector is generally accepted to denote the instantaneous power flow per unit area.

Discussion

Traditionally, radiation hazard standards have specified power density (mW/cm^2). This parameter is a valid indicator of potential hazard only for plane wave exposure. Under more complicated conditions, such as antenna near-fields or regions containing direct and reflected waves, true power density cannot be properly measured, and the parameter itself is not well related to potential hazard.

Mean-squared field strength, the square of the Hermitian magnitude, is an accepted indicator of hazard in a complex field. This is the quantity measured by the isotropic field probes which have become available commercially in recent years. Equivalent power density is derived from the observed level of mean-squared field strength. Although this parameter has little physical meaning, it retains the familiar units of mW/cm^2, and most isotropic field meters are so calibrated. Accordingly, the exposure limits are defined for each of three parameters: mean-squared electric field strength, mean-squared magnetic field strength, and equivalent power density.

The instrumentation used to measure potentially hazardous fields must have an isotropic probe which responds to mean-squared field strength. The only exception is for far-field zones within an RF anechoic chamber or other situations in which a simple unidirectional field exists. In those cases, true power density may be measured or calculated.

When their source is a radar, RF electromagnetic fields will have a very complex time modulation. This is caused by the combination of the transmitter's pulse modulation and the scanning of the radar's antenna. The standard calls for averaging over a 0.1 hour interval to ensure all such modulations are included.

UPDATES

BIOLOGICAL EFFECTS

EPA RF/MW Report Out... Over the last year, we have devoted a great deal of space to EPA's development of a criteria document for its guidance on public exposures to RF/MW radiation (see *MWN*, October 1983 and January/February 1984). Although EPA has now indefinitely delayed the proposed guidance, it has released the criteria document. Copies of *Biological Effects of Radiofrequency Radiation* (EPA-600/8-83-026F, September 1984) edited by Drs. Joe Elder and Daniel Cahill are available at no charge while supplies last from ORD Publications, CERI, U.S. EPA, Cincinnati, OH 45268. Afterwards, they will be available for $22.00 from the National Technical Information Service (NTIS), Springfield, VA 22161. NTIS Order No. PB 85120848.

ELF Resources... Details on the frequency and intensity windows for the efflux of calcium ions from brain tissue (in vitro) for ELF fields between 1-120 Hz, observed by Dr. Carl Blackman and co-workers at EPA, will appear in the first issue of Volume 6 (1985) of *Bioelectromagnetics*. ...DOE has released *Biological Responses to Extremely Low Frequency Electromagnetic Fields: Some Underlying Hypotheses,* (June 1984; Aerospace Report No. ATR-84-(7045)-1) by Professor H.B. Graves of Pennsylvania State University. Copies are available at no charge while supplies last from Dr. William Wisecup, Aerospace Corp., 955 L'Enfant Plaza, SW, Suite 4000, Washington, DC 20024....IITRI's J.E. Zapotosky, M.M. Abromavage and J.O. Enk have prepared a summary progress report on the ten projects that make up the Navy's ecological monitoring program on the ELF communication system for the Naval Electronic Systems Command in Washington, DC. Technical Report E06549-9 is available for $10.00 from the National Technical Information Service (NTIS), Springfield, VA 22161. IITRI has also assembled the annual reports from each of the contractors. The two-volume *Compilation of 1983 Annual Reports of the Navy ELF Communications System Ecological Monitoring Program* Technical Report No. E06549-8 is also available from NTIS, though the price has not yet been specified.

COMMUNICATIONS

Hawaii Report & Other Resources...EPA has not yet issued its report on RF/MW radiation levels in Honolulu, HI (see *MWN*, April and June 1984). An agency staffer told *Microwave News* that final editing is nearly complete and release is scheduled for December. Background information is being added to the original draft to put the measurements in context....The November *Proceedings of the IEEE* is a special issue on "Satelitte Communications Networks." Among the twenty papers is one which lists satellite locations....A subcommittee of the National Association of Broadcasters (NAB), under the chairmanship of William Wisniewski of the Mutual Broadcasting System, has issued *AM Technical Improvement*. Among its recommendations, the report urges work to mitigate existing and potential interference from RF electrical equipment, especially RF lighting devices. Copies are available from NAB's Science and Technology Dept., 1771 N St., NW, Washington, DC 20036, (202) 293-3557....A team from Kyoto University

and Nippon Telephone and Telegraph in Yokosuka, Japan, has devised a way of modelling the mean field strength in urban areas from mobile radio systems. Their analysis appears in the August *IEEE Transactions on Antennas and Propagation*.

COMPATIBILITY & INTERFERENCE

FM-Avionics Rules Due Soon... The Federal Communications Commission (FCC) and the Federal Aviation Administration (FAA) are planning to issue separate Notices of Proposed Rulemaking (NPR) by early 1985 to control FM broadcast interference with radio navigation equipment aboard aircraft. Though FM broadcasts occasionally are picked up by airplane receivers, the FCC's Ralph Haller told *Microwave News* that, "We don't know of any cases where it has actually caused a safety hazard." The FAA NPR is expected to require broadcasters to inform the agency of proposed new construction or facilities changes. According to an FAA staffer, the purpose of the new rules is to force notification at the time changes are made so that the agency can try to avert potential interference before it happens. The National Association of Broadcasters (NAB) is opposing the notification provision. The FCC's proposed rule, which according to Haller would supersede the FAA's in the event of a conflict, will set specific protection standards for receivers. Haller said that this is solely a receiver problem but that FM stations would still be required to protect FAA facilities affected by broadcasts. If the FAA disagrees with the FCC's final regulations, it can either file a petition for judicial reconsideration of the rules or change its own rules.

Struzak on ISM... Professor R.G. Struzak of the Institute of Telecommunications in Wroclaw, Poland, has published "Protection of Radiocommunications Against Interference from ISM Equipment," in the May-June issue of *Annales des Telecommunications*, the journal of the Centre National D'Etudes des Telecommunications, based in Cap D'Ail, France. Struzak, the chairman of the CCIR Interim Working Group on Radiation from ISM Equipment, which is developing new international standards for ISM emissions (see *MWN*, September 1983 and May 1984), presents a simple model of the interference problems with strategies to resolve them. He concludes with an overview of the current status of recommendations made by CCIR and CISPR.

INTERNATIONAL

Therein Lies the Rub...A BBC plan to place six 300 kW high frequency towers near Stratford-on-Avon, England, to broadcast to eastern Europe has met stiff opposition from officials of the Royal Shakespeare Theater (RST). Concerned about interference with the theater's electronic equipment — including the stage lighting console — Artistic Directors Trevor Nunn and Terry Hands have been waging their fight since the BBC proposal was announced late last year. Stratford residents are also concerned about the plan because they fear their TV and radio reception will suffer. Low power tests run by the BBC incapacitated the theater's lighting equipment and erased the electronic memories of two typewriters. In letters to *The Times* of London on June 23 and July 9, Nunn and Hands claimed that the towers, which would be built two-and-a-half miles from Stratford at Bearley Ridge, would force the theater to close. BBC officials maintain that the broadcast towers should cause minimal interference and that simple shielding could eliminate any problems. In a June 29 response to the RST, the BBC's chief engineer for external broadcasting wrote to the *Times:* "It is, of course, inconceivable that the BBC, a leading patron of the arts, would contemplate, much less pursue, any action which could have this devastating effect."

MEDICAL APPLICATIONS

More on PEMF Therapy... In our May issue, we reported on a paper describing the successful treatment of rotator cuff tendinitis (shoulder pain) with pulsed electromagnetic fields (PEMFs). In a follow-up letter published in the June 9 *Lancet*, Drs. M.J. Lunt and A.T. Barker warn that there are two mechanisms which might have confounded the double blind study by a team from Addenbrooke's Hospital and Strangeways Research Labs in Cambridge, England. In addition to magnetic and electrical interactions, Lund and Barker cite a possible heating effect from the treatment coils and the ability of the patients to distinguish between active and dummy coils. They suggest that a "bifilar" coil, with an equal number of clockwise and counterclockwise turns, could eliminate the magnetic field. Since many PEMF systems produce noise, the two researchers further argue that patients should be asked whether they think they have active or dummy coils. Barker was the lead author of another recent PEMF paper, also published in *Lancet*, which concluded that PEMFs may not be effective for the treatment of non-union tibial fractures (see *MWN*, June 1984). That paper was also addressed in the June 9 *Lancet* by Dr. David Le Vay, a practicing orthopedist, who was somewhat incredulous that PEMF therapy does not work given the available animal data and its past success in treating congenital non-unions. In a follow-up letter which appeared in the July 21 *Lancet*, Professor Brian O'Connor of the Robert Jones and Agnes Hunt Orthopedic Hospital in Oswestry, England, raised further objections to Barker's conclusions. First, O'Connor expressed surprise that the results of an interim analysis were published and warned of the dangers of extrapolating from such a small sample. He concluded: "It would be a tragedy if even one surgeon was dissuaded from using PEMFs to treat difficult non-unions as a result of Barker and colleagues' paper." Dr. W.J.W. Sharrard, one of Barker's co-authors, replied in the same issue of *Lancet* that he agreed that the "very small trial did not show that PEMFs do not have any effect," and that it would be premature to extrapolate their study to the entire population until a larger study is completed. He went on to note that the study might have been biased because a greater number of patients among those treated with PEMFs, as compared to controls, had non-unions of *both* the tibia and the fibula, a condition which Sharrard's own research group has shown to be a "detrimental factor in the treatment of tibial non-union."

Sharrard added that he believes PEMFs can have an effect; so can conservative management. His compromise is to advocate both types of treatment. In a personal communication to *Microwave News*, Dr. Andrew Bassett of Columbia University's College of Physicians and Surgeons in New York City pointed out that there are significant differences between the signals used in his studies and those reported in Barker's papers.

Diagnosing TB...A group from the University of Sheffield in England has found a way of using a microwave oven to speed up the Ziehl-Neelsen method for the diagnosis of tubercule bacilli. Slides heated with microwaves gave results that were as accurate and reliable as the classical Ziehl-Neelsen method but took only 30 seconds instead of the usual 15-20 minutes. A short letter on the new method was published in the November 3 *Lancet*.

MEETINGS

Bioeffects of Light... The New York Academy of Sciences' *Conference on Medical and Biological Effects of Light*, held October 31-November 2, was the first meeting of its kind, according to Dr. Richard Wurtman of MIT, the conference organizer. Among the 29 presentations, Dr. Alfred Lewy of the Oregon Health Sciences University in Portland reviewed the effects of bright light on human melatonin production. Dr. Norman Rosenthal of NIH in Bethesda showed how seasonal affective disorder (SAD), a winter depression, can be treated with bright, not standard indoor, light; he pointed out that no research has yet been done on the influence of the spectral content of the light. Dr. Richard Edelson of Columbia University in New York City discussed how UV-A light can activate the effectiveness of 8-methoxypsoralen in treating psoriasis. The proceedings of the conference will be available in about six months, according to an academy spokesman. Meanwhile, medical writer Jane Brody has a two-part overview of the meeting in the November 13-14 editions of the *New York Times*.

Power Systems Harmonics... The proceedings of the *International Conference on Harmonics in Power Systems* held at the Worcester Polytechnic Institute (WPI) in Worcester, MA, October 22-23, is avaiable for $50.00 (postage included). Some 40 papers are included in the volume which can be ordered from the Dept. of Electrical Engineering, WPI, 100 Institute Rd., Worcester, MA 01609....There will be a tutorial course on "Power System Harmonics," coordinated by A.A. Mahmoud of Iowa State University, at the *1985 Winter Meeting of the IEEE PES*, to be held in early February in New York City (see Conferences p.12). The registration fee is $70. The course text will also be available by mail.

Zurich EMC Symposium... The preliminary program is out for the *6th Symposium & Technical Exhibition on EMC* to be held in Zurich in early March. Six two- or three-hour workshops are scheduled for March 4-7: "EMI Control Using Computer-Aided Design," "Measurements Related to the Interaction of EM Fields with Biological Systems," "EMP Protection by Filters Combined with Surge Arrestors," "The New CISPR RFI Specification for Information Technology Equipment," " Methods and Results of Open Area Test Site Calibration," and "Existing and Required EMP Instrumentation." For more information see Conferences p.12, or contact: Herb Mertel, EMACO Inc., 7562 Trade St., San Diego, CA 92121, (619) 578-1480.

OVENS

An Exchange on Burns... Last year, Dr. Henry Fleck of Albert Einstein College of Medicine in the Bronx, NY, published a case report of burns suffered by a 51-year-old woman who accidently stuck her hands into an oven that was still operating (see *MWN*, May 1983). Dr. John Osepchuk of Raytheon has responded, charging that Fleck's "speculations about microwave oven hazards" are "an undesirable source of fear and misinformation to the non-engineer and lay person." Specifically, he writes that Tappan estimates the chance of this type of oven failure is one in 300 million (at the 95 percent confidence level) and that "it is very unlikely that the woman would receive burns in five seconds." Osepchuk reveals that the woman who suffered the burns was Helen Farmakis, who lost a suit against Tappan over this injury (see *MWN*, December 1981 and December 1982). He concludes that the "microwave oven as regulated by the FDA is practically a fool-proof device." Fleck is undaunted. He replies that, whatever the stated odds, the "oven did operate when the door was opened," and that "ovens are practically *not* foolproof, no more than cars, airplanes, trains, bridges." He also states that Farmakis had no money to appeal the jury's decision and that "the court had no other option but to affirm the jury's verdict." The Osepchuk-Fleck exchange appears in the October 1984 *Bulletin of the New York Academy of Medicine;* Fleck's original report was in the bulletin's April 1983 issue.

POWER LINES

Resources... Officials of Southern Railway have raised the issue of EMI from power lines as a reason for not siting a Virginia Electric & Power Co. high-voltage line along the railroad's right-of-way. Although this type of EMI problem has gained increasing attention among engineers, this could be the first time it has come up at a formal hearing (see *MWN*, September and December 1983). On November 26, *The Washington Post* quoted a county official as saying, "It never dawned on me that Southern would object to an overhead power line."...The November 28 *Wall Street Journal* ran a front page story on how dairy farmers are dealing with stray voltages in the midwest. Some dairy and rural electric coops have even set up the Stray Voltage Research Council....Can power lines cause allergies? Dr. Jean Munro in England thinks so; indeed, according to an October 24 article in the British *Guardian*, she believes that an electrical reaction is the basis of nearly all allergic reactions. Munro has been collaborating with Dr. Cyril Smith of the University of Salford....Over the last few months, the *IEEE Transactions on Power Apparatus and Systems* has featured a number of papers on electromagnetic effects related to power lines: June: "Electromagnetic Effects of High Volt-

age High Power Equipment," by M.M.A. Salama and R. Hackam of the University of Windsor in Windsor, Canada; July: "Application of Finite Element Method to Analysis (sic) of Induced Current Densities Inside Human Model Exposed to 60 Hz Electric Field," by a group of Japanese researchers; July: "Method for Evaluating Human Exposure to 60 Hz Electric Fields," by GE's Don Deno and Mike Silva of Enertech; August: "Measurements of Transmission Line Electric Fields in a Residential Environment," by P.D. Jacobs and F.M. Dietrich of Electric Research & Management Inc. in Pittsburgh, PA; and September: two papers on "Lightning Induced Voltages on Power Lines," "Theory" and "Experiment" by Maneck Master and Martin Uman of the University of Florida in Gainesville.

STANDARDS

Occupational Rules in Massachusetts and New Jersey ... The state of Massachusetts' Department of Labor and Industries is drafting regulations to protect workers from harmful exposures to non-ionizing radiation in the frequency range 10 kHz-100 GHz. The proposal, which will be the subject of public hearings during the first half of next year, is identical to the 1982 ANSI standard, except that, like the ACGIH guidelines, it covers frequencies down to 10 kHz. Facilities maintained by the federal government are exempted. All employers who are currently using radiating equipment, such as radio and TV stations, radar units, RF heaters and sealers, industrial microwave ovens, mobile communications equipment with an output power of more than 100 watts, and diathermy and hyperthermia units, must notify the state within 12 months after the rules are adopted. Users of new equipment must give prior notification. For more information contact: Frank Archibald, Division of Occupational Hygiene, Massachusetts Dept. of Labor and Industries, 1001 Watertown St., West Newton, MA 02165, (617) 727-3982....A subcommittee of the New Jersey Commission on Radiation Protection is also working on developing occupational exposure limits. The group will submit its recommendations to the commission before next summer. Earlier this year, the state adopted the 1982 ANSI standard for general population exposures (see *MWN*, April 1984). For information, contact Eugene Fisher, Bureau of Radiation Protection, 380 Scotch Road, Trenton, NJ 08628, (609) 292-8392.

SAE on Susceptibility...SAE has completely revised its recommended practice for *Electromagnetic Susceptibility Procedures for Vehicle Components (Except Aircraft)*. The new standard, designated J1113 and dated June 1984, was prepared by the SAE EMI Standards and Test Methods Subcommittee, under the chairmanship of Myron Crawford of NBS. J1113 will be published in the 1985 edition of the SAE Handbook. It covers the testing and measurement of transients as well as radiated and conducted emissions — making them consistent with ISO standards. Crawford is submitting the new standard to ANS C63 for consideration as a national standard. For more information, contact SAE Customer Service, Dept. 346, 400 Commonwealth Dr., Warrendale, PA 15096, (412) 776-4970.

IEC Electroheat Standard... The International Electrotechnical Commission (IEC) has issued Publication 519-1 *Safety in Electroheat Installations, Part 1: General Requirements, 1984*. The new standard covers a host of different types of equipment, including those using low and high frequency non-ionizing radiation. Copies of the standard will be available soon from the International Sales Dept., ANSI, 1430 Broadway, New York, NY 10018, (212) 354-3300.

VDTs

NIOSH Reproductive Study...NIOSH will discuss plans for its epidemiological study of reproductive risks among 2000 female VDT workers at a public meeting on December 17. In preparation for the meeting, the agency has distributed a limited number of copies of the draft protocol for the study. The document states that no radiation measurements will be made in the course of the study, unless "an excess of abnormal pregnancy outcomes is identified." According to the protocol, the study "should have a 90 to 95 percent chance of detecting an increase in spontaneous abortions of about 1.6 times that in an unexposed population, and a similar chance of detecting an increase in total major birth defects in liveborns of 3.0 to 3.5 times that in unexposed groups. The ability to detect a single common birth defect, such as cleft palate, is limited to relative risks of 14 fold." According to the current schedule, the completion date is April 1988. Dr. Teresa Schnorr is leading the NIOSH effort.

IBM Study Released...IBM has published a summary report of VDT emission measurements by Dr. Arthur Guy of the University of Washington, Seattle, despite an earlier policy that the document was for internal use only (see *MWN*, September 1984). The report focuses on pulsed very low frequency magnetic fields and concludes that there are no health hazards associated with non-ionizing radiation emissions from VDTs. Guy discusses apparent similarities between the VDT fields and very weak magnetic fields found by Dr. Jose Delgado's research group to cause developmental abnormalities in chick embryos. "None of the combinations used [by Delgado's team] for producing the effects had characteristics that simultaneously matched the VDT magnetic field waveform," Guy wrote. This conclusion, which has already been cited by NIOSH researchers in their November draft protocol for the agency's epidemiological study (see above), will no doubt have to be reevaluated in light of a recently released correction from Delgado's group (see p.2). For a copy of the IBM summary, contact Les Szabo, Corporation Information, IBM, Old Orchard Rd., Armonk, NY 10504, (914) 765-6408.

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CONFERENCES

1985 Conference Calendar

January 3-5: **2nd International Conference on Clinical and Basic Factors Influencing Bone Growth,** Los Angeles, CA. Contact: Dr. Andrew Dixon, UCLA School of Dentistry, Center for Health Sciences, Los Angeles, CA 90024, (213) 825-9187.

January 14-15: **Symposium on Dielectric Phenomena in Honor of the 70th Birthday of Professor Robert H. Cole,** Providence, RI. Contact: Dr. Edward Greene, Dept. of Chemistry, Brown University, Providence, RI 02912, (401) 863-1193.

January 23: **A Review of the State-of-the-Art in EMC in Commercial and Military Electronics,** LA Airport Hilton, Los Angeles, CA. Contact: Ms. Terry Cantine, Eaton Corp., 5340 Alla Rd., Los Angeles, CA 90066, (213) 822-3061.

January 23-25: **RF Technology Expo,** Disneyland Hotel, Anaheim, CA. Contact: Kathy Kriner, RF Tech Expo, 6530 S. Yosemite St., Englewood, CO 80111.

February 3-8: **1985 Winter Meeting of the IEEE Power Engineering Society,** Penta Hotel, New York, NY. Contact: J.G. Derse, 1030 Country Club Rd., Bedminster, NJ 07921, (201) 725-4388.

March 5-7: **6th Symposium & Technical Exhibition on Electromagnetic Compatibility,** Zurich, Switzerland. Contact: EMC Symposium & Exhibition, ETH Zentrum-IKT, 8092 Zurich, Switzerland, 256-27-90.

March 21-22: **IMTC/85: Instrumentation/Measurement Technology Conference,** Hyatt Regency, Tampa, FL. Contact: Dr. Robert Ashley, Sperry Corp., PO Box 4648, Clearwater, FL 33518, (813) 577-1900, ext. 2228.

April 3-4: **21st Annual Meeting of the National Council on Radiation Protection and Measurements,** Washington, DC. Contact: NCRP, Suite 1016, 7910 Woodmont Ave., Suite 1016, Bethesda, MD 20814, (301) 657-2652.

April 16-17: **8th International Colloquium on the Prevention of Occupational Risks due to Electricity,** London, UK. Contact: International Fire Security & Safety Exhibitions & Conferences Ltd., Cavendish House, 128/134 Cleveland St., London W1P 5DN, UK, (01) 387-5050.

April 16-19: **4th International Conference on Antennas and Propagation (ICAP 85),** Coventry, UK. Contact: Institution of Electrical Engineers (IEE), Savoy Place, London WC2R 0BL, UK, (01) 240-1871, ext. 222.

April 17-19: **3rd International Conference on Developments in Power System Protection,** London, UK. Contact: IEE, see above.

April 24-27: **3rd European Workshop on NMR in Medicine,** Copenhagen, Denmark. Contact: Dr. S.B. Petersen, Dept. of Neurology 2082, State University Hospital, Rigshopitalet, Blegdamsveg 9, DK 2100 Copenhagen 0, Denmark.

April 29-May 2: **23rd International Magnetics Conference,** St. Paul, MN. Contact: R.O. McCary, GE, Corporate R&D, Schenectady, NY 12345, (518) 385-5436.

May 4-7: **5th Annual Meeting of the North American Hyperthermia Group,** Biltmore Hotel, Los Angeles, CA. Contact: NAHG, 925 Chestnut St., Philadelphia, PA 19107, (215) 574-3153. Held in conjunction with the Radiation Research Society Meeting.

May 5-9: **33rd Annual Meeting of the Radiation Research Society,** Biltmore Hotel, Los Angeles, CA. Contact: RRS, 925 Chestnut St., Philadelphia, PA 19107, (215) 574-3153.

May 6-9: **IEEE 1985 International Radar Conference,** Washington, DC. Contact: J.Q. Adams, ITT-Gilfillan, M/S 45, 7821 Orion Ave., PO Box 7713, Van Nuys, CA 91409, (818) 988-2600, ext. 6903.

May 14-16: **Test & Measurement World Expo,** Convention Center, San Jose, CA. Contact: Meg Bowen, T&M Expo, 215 Brighton Ave., Boston, MA 02134, (617) 254-1445.

May 15-18: **1st Annual Meeting of the Electromagnetic Energy Policy Alliance,** Inter-Continental Hotel, San Diego, CA. Contact: Richard Ekfelt, EEPA, 1800 M St., NW, Washington, DC 20036, (202) 452-1070.

May 19-23: **17th Annual Meeting of the Conference of Radiation Control Program Directors,** Milwaukee, WI. Contact: CRCPD, 71 Fountain Place, Frankfort, KY 40601, (502) 227-4543.

May 20-24: **8th International Conference on Electricity Distribution,** Brighton, UK. Contact: IEE, see April 16 above.

May 26-31: **30th Annual Meeting of the Health Physics Society,** Chicago, IL. Contact: HPS, Suite 300, 1340 Old Chain Bridge Rd., McLean, VA 22101, (703) 790-1745.

June 4-6: **1985 IEEE MTT-S International Microwave Symposium,** St. Louis, MO. Contact: John Bogdanor, McDonnell Aircraft, Dept. 313, St. Louis, MO 63166, (314) 232-3936.

June 10-12: **International Aerospace and Ground Conference on Lightning and Static Electricity,** Paris, France. Contact: Lawrence Walko, USAF, AFWAL/FIESL, Wright Patterson AFB, Dayton, OH 45433 in US; or Dr. Joseph Taillet, ONERA, BP 72, 92320 Chatillon, France.

June 11-13: **6th Annual Meeting of the Canadian Radiation Protection Association,** St. John, New Brunswick, Canada. Contact: John Paciga, New Brunswick Electric Power Commission, PO Box 10, Lepreau, New Brunswick, Canada E0G 2H0, (506) 659-2102, ext. 324.

June 16-20: **7th Annual Meeting of the Bioelectromagnetics Society,** Hilton Hotel, San Francisco, CA. Contact: BEMS, 1 Bank St., Suite 307, Gaithersburg, MD 20878, (301) 948-5530.

June 17-21: **1985 North American Radio Science Meeting and International IEEE/AP-S Symposium,** University of British Columbia, Vancouver, Canada. Contact: Mr. K. Charbonneau, Conference Services, National Research Council, Ottawa, Ontario Canada K1A 0R6, (613) 993-9009.

June 24-29: **8th International Symposium on Bioelectrochemistry and Bioenergetics,** Bologna, Italy. Contact: C. Bonfiglioli, Institute of Botany, Via Irnerio 42, 40126 Bologna, Italy, (051) 234376.

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

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 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,** Kyoto International Conference Hall, Kyoto, Japan. Contact: Professor Kazuaki Takao, Dept. of Electrical Engineering, Kyoto University, Kyoto 606, Japan.

August 26-28: **1985 International Symposium on Antennas and EM Theory,** Beijing, China. Contact: Professor Mao Yukuan, Northwest Telecommunication 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 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. *(continued on p.5)*

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

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A list of recently published reports appears on page 8 of this issue. This feature will alternate with the conference calendar which will run again next month.

MICROWAVE-DRUG SYNERGY

Every time a new microwave effect is reported, subsequent research produces a host of conflicting and contradictory results. The latest example of this phenomenon is synergy between tranquilizing drugs and microwave radiation, a topic which stimulated much interest at the September Bioelectromagnetics Society (BEMS) meeting in San Antonio. Recent experimental data have thrown previous proposals about drug-microwave interactions into disarray.

In spring 1979, John Thomas, Linda Burch and Stephen Yeandle of the Naval Medical Research Institute published a paper in *Science* (*203,* 1357, 30 March 1979) showing that pulsed 2.45 GHz radiation enhanced the action of chlordiazepoxide, better known by its brand name, Librium. Librium, one of the most popular drugs on the market, is a close structural relative of diazepam or Valium,

(continued p. 5)

Wall Street Tunes In

New uses for electromagnetic radiation are hot news, if *The Wall Street Journal*'s regular Friday column on technology is any gauge. In recent months the column has featured five innovative applications.

Two products are already on the market. The October 31 column headlined induction stoves that use a magnetic field to heat any cookwear containing iron. Manufacturers claim induction is a cool, energy-efficient way to cook and they forecast large sales for the appliance. The popularity of microwave ovens might be the basis for their optimism. The ovens are already a commercial success, but a new feature, announced January 16, might entice even more buyers. Some Panasonic models now offer a humidity sensor that allows the oven's microprocessor to adjust cooking time and power level.

(In a story appearing December 10, the *Journal* noted that the Department of Energy's pending minimum efficiency standards for major appliances may speed the development of talking microwave ovens. Manufacturers will add sophisticated electronic controls that increase product convenience, efficiency, and repairability to compensate for energy-saving demands that impair performance. The Sanyo Electric Trading Company has already developed an oven that can announce its power setting.)

These advances in the kitchen have outpaced the microwave plans of the auto industry. An anti-collision radar system and a new method for producing "lean burning" engines are two applications whose time has yet to come. An update on a long-dreamed-of radar system to warn drivers of approaching trouble ran on August 1. Six weeks later a less spectacular, but potentially more valuable, idea made the news: by simulating a flame inside the engine, microwaves can help fuel burn more efficiently without producing extra pollution.

The November 7 Technology column highlighted a truly big idea: the possibility of turning the sea around Cape Cod into a giant antenna for submarine communications—a potential substitute for the Navy's hard-to-site ELF antenna, Project Seafarer. Stanford University scientists are working on this concept.

CWA Cancer Cluster

An investigation by federal officials failed to identify a connection between a cluster of cancer cases among a group of AT&T long lines workers at Ragerville, Ohio and microwave radiation, according to a soon-to-be-released National Institute for Occupational Safety and Health (NIOSH) report.

Word of the cluster emerged early last year when James Cole, president of Communications Workers of America local No. 4354, requested an investigation of five cancer cases, including two deaths, among a group of eight workers. In addition to checking microwave radiation levels, Cole asked for an examination of possible polychlorinated biphenyl (PCB) and asbestos contamination, and tests of drinking water wells at the site.

Of the five cases, four were company employees, and the fifth was a cleaning woman, working for a contract service. Three of the employees developed colon cancer, and the fourth had cancer of the larynx. The cleaning woman and one of the colon cancer cases died.

A team from NIOSH and the Occupational Safety and Health Administration (OSHA) made a site visit last March. Bob Curtis of OSHA surveyed microwave and radiofrequency radiation levels, but found no indication of excessive exposures. Checks for PCB's and asbestos and Ames tests of drinking water samples were also negative.

Dr. Sandy Leffingwell, an epidemiologist with NIOSH's Division of Surveillance, Hazard Evaluation and Field Studies, found that this was an unusual but accidental cluster of cases, not related to the work site, but noted that "we really don't know what we are dealing with here." Leffingwell stated that 18 people had worked at the local over the last ten years, and that the first cancer had been identified in the early 1970's.

Cole believes that there must have been some kind of microwave or carcinogenic hazard at the work site: the source has either been eliminated or is still there. "I suspect there could still be a hazard, but we aren't sophisticated enough to measure it or find it," he said. Only three people are now working at the Ragersville site; the cut back is unrelated to the cancer cluster, according to Cole.

Cole said that the maximum NIOSH reading was 0.1 mW/cm^2, but he stressed that the levels could be higher, depending on working conditions. "New technology and design have decreased the levels in recent years," he added. He said that when he worked at the station years ago, the exposure levels were probably much higher.

That possibility was confirmed by Bob Curtis, who noted that the exposures at the local could have been higher before the equipment had been converted to solid state. Previously, the equipment required more maintenance, which could have resulted in greater exposures. "Today, the exposures would be lower," he said, "unless the worker cuts into a hot waveguide, and even then the exposure would be for a short duration."

The radiation at the long line local would have been in the 2-10 GHz range, according to Curtis. He stressed that retrospective predictions on worker exposures are notoriously difficult.

Leffingwell said that further epidemiological investigations of long line workers would be frustrated by the way AT&T kept its employment records. No additional studies are now planned.

The NIOSH report should be released by the end of February, depending on the backlog at the NIOSH printer.

NIOSH Epidemiology

NIOSH is about to begin its long-planned epidemiology of workers exposed to RF radiation from heat sealers.

Terry Leet and Dr. Sherry Sullivan, two epidemiologists in NIOSH's Cincinnati office, and Clinton Cox, an industrial hygiene engineer, were about to select a suitable study population at the end of January. Results will not be ready for publication before the end of 1982.

The NIOSH team had already made 10 to 15 surveys of workers exposed to RF sealers in various plants.

Leet has taken over from Elizabeth Egan who worked on the study since 1979 and has now left NIOSH to go to medical school.

Medical Surveillance

Researchers at the Rocky Mountain Center for Occupational and Environmental Health at the University of Utah have just completed a study on recommended medical examinations for workers exposed to non-ionizing radiation.

The report, *An Evaluation of Medical Surveillance for Workers Exposed to Microwave/Radiofrequency Radiation*, was submitted to the Occupational Safety and Health Administration's (OSHA) Health Response Team office in Salt Lake City. It will now be reviewed in Utah and in Washington and be available for distribution in a few weeks.

Dr. Mark Nichols, a resident at the Center, and Dr. Bill Rom, its Director, wrote the study for OSHA. Recommendations include a list of tests that should be administered annually to chronically exposed workers or to persons who have experienced high-level, acute exposures.

Mount Sinai Epidemiology

Drs. Arthur Frank and Robert Refowitz, two members of Dr. Irving Selikoff's Environmental Sciences Laboratory at the Mount Sinai Medical Center in New York City, are planning an epidemiology of workers exposed to microwave radiation.

As a first step in identifying a suitable study population, Frank and Refowitz, working with behavioral toxicologist, Jose Valcuikas, are designing a questionnaire to assess workers' problems related to non-ionizing radiation. A separate, though related, questionnaire is planned for workers exposed to microwave radiation, radiofrequency radiation, video display terminals (VDT's), and, in the future, lasers.

A sample questionnaire is now being tested among communication workers. The presidents of the 40 long line locals of the Communication Workers of America were sent the survey in order to learn about the CWA membership and any special complaints they may have. The Mount Sinai researchers are anxiously awaiting the responses.

Frank and Refowitz are interested in possible radiation effects on the eyes and the reproductive system of exposed workers, as

well as neurobehavioral changes. In addition, they would like to test the hypothesis that males exposed to non-ionizing radiation have a much greater tendency to father female children.

The Mount Sinai group is thinking about holding a research conference on microwave radiation late this year or next year.

WISH Seminar

Trade union representatives from around the country participated in the Worker Insitute for Safety and Health (WISH) seminar on non-ionizing radiation and laser hazards last September 7-10 in Park City, Utah. Among the labor groups present were the Communication Workers of America, the International Union of Operating Engineers, the United Brotherhood of Carpenters, and the Newspaper Guild.

Other participants included Sheldon Samuels from the Industrial Union Department of the AFL-CIO, Arthur Frank from Mount Sinai, Walter Gundaker from BRH, Bob Curtis from OSHA, and Paul Brodeur, who wrote the briefing manual for the meeting, *The Health Hazards of Radiofrequency, Microwave, and Laser Radiation*.

All 110 attendees supported the following resolution on microwave/radiofrequency radiation standards:

> WHEREAS numerous U.S. industries have demonstrated callous disregard of the hazards posed to their employees by the rapidly spreading use of equipment producing microwave and radiofrequency radiation, and
>
> WHEREAS the existing OSHA standard of 10 milliwatts per centimeter squared is generally recognized as totally inadequate to protect workers against these hazards, and
>
> WHEREAS NIOSH and ANSI (management's standard setting organization) are in the process of recommending that the standard be lowered to one milliwatt per centimeter squared for the most hazardous part of the microwave/radiofrequency spectrum and
>
> WHEREAS the guideline in Russia and some other countries ranges from 10 to 200 microwatts per centimeter squared, far below even the recommended U.S. standard,
>
> THEREFORE, BE IT RESOLVED THAT this WISH seminar of trade unionists representing workers employed in a number of these industries urges OSHA to promptly lower the standard, not merely to the inadequate level proposed by NIOSH and ANSI, but to a level that will give US workers protection at least equal to that enjoyed by those of any other country, and
>
> BE IT FURTHER RESOLVED THAT OSHA be urged to vigorously enforce its radiation standards.

Future WISH activities include co-sponsoring a training course in Ohio next month and developing questionnaires for persons working with microwave/radiofrequency and VDT radiation, in collaboration with Dr. Frank.

Ohio Training Course

There will be a one-day training course on microwave and radiofrequency radiation and lasers at Ohio State University in Columbus on Saturday March 14th.

The course, sponsored by the Labor Education and Research Service of OSU and the Ohio AFL-CIO in cooperation with the Workers Institute for Safety and Health (WISH), the Industrial Union Department of the AFL-CIO, the CWA, the Carpenters, and the Operating Engineers will be similar to last September's WISH seminar (see story above). But given the limited time available, the schedule will be somewhat shortened. The morning session will focus on the types of health effects associated with non-ionizing radiation, and the afternoon will consist of workshops on the measurement and control of radiation hazards. Paul Brodeur is the tentatively scheduled luncheon speaker.

For more information, contact the course organizer, Jack Pompei, an industrial hygienist with the Labor Education and Research Service, at 614-422-8157.

NBC Precautions

Last spring a National Broadcasting Company report recommended that radiation-warning signs be posted on transmitting antennas of minicam trucks and that working personnel avoid positioning themselves within 6 feet of an antenna in the direction of its beam. The study, completed by the NBC Engineering Department in New York City with assistance from the Occupational Safety and Health Administration, was requested by Local 11 of the National Association of Broadcast Employees and Technicians.

As of January 1981, NABET officials have yet to see the report, although NBC has assured them that all measurements were below OSHA guidelines. Some, but not all, of the mobile units now have warning signs. The action only affects New York City operations and personnel.

CWA Training Session

The Communication Workers of America held the first of a series of training programs on occupational safety and health in New York City last January 12-16. Some 85 local union officials learned about the risks associated with VDT's and microwave and radiofrequency radiation, among other topics. The meeting was held in cooperation with Cornell University's School of Industrial and Labor Relations.

On the subject VDT's, the union representatives heard Michael Smith of NIOSH, David Eisen of the Newspaper Guild, and Tobi Bergman of the New York Committee for Occupational Safety and Health (NYCOSH). Smith presented some results from the NIOSH survey of VDT's in San Francisco. The complete report is due to be published soon. Eisen described the Guild's contract negotiations to guarantee its members better ways to work with VDT's. Bergman highlighted NYCOSH's efforts to bring companies and employees together on VDT problems. (Last year, NYCOSH published a booklet on VDT's: *Health Protection for Operators of VDTs/CRTs*.) After these presentations, the meeting broke up into workshops, which focused primarily on ergonomic issues.

Robert Curtis and Alfred Owyang of OSHA gave lengthy presentations on microwave/RF and laser hazards in the workplace.

CWA is organizing three more training sessions. Two will be held in May—in Columbus, Ohio and in Birmingham, Alabama. The final one will be in San Francisco next August.

Comments on the Proposed BRH/FDA Standard for Diathermy Products

The proposed performance standard for microwave diathermy products (45 *Federal Register* 50359, July 29, 1980) elicited 17 sets of comments last fall. The standard is designed to guarantee the safety and effectiveness of microwave therapeutic heat treatment and includes the following key provisions:

- a diathermy product must be capable of delivering a specific absorption rate of 235 W/kg to standardized phantoms.
- a device may not leak more than 10 mW/cm² at 5 cm from the applicator.
- equipment manufactured before the effective date of the standard is excluded from regulation.
- microwave diathermy products used for cancer therapy (hyperthermia treatment) are included under the standard, though variances could be granted. (The Bureau was particularly interested in receiving comments on such exemptions.)

Comments were due September 29, 1980, though the deadline for written submissions was extended a few weeks.

The following is a brief synopsis of the comments received by the Bureau of Radiological Health. The comments were obtained by *Microwave News* through the Freedom of Information Act.

Cancer Therapy

The appropriateness of regulating cancer treatment devices was addressed in a majority of the comments. The response of the **RCA Corporation**, which urged exemption for experimental devices used in hyperthermia treatment, was typical of the criticisms received. **George Kiessling**, Director of Product Safety Plans and Programs, concluded that "applying the regulations to microwave hyperthermia research devices would have the effect of substantially impeding valuable research into the thermal treatment of tumors." He did recognize that regulation of commercial microwave diathermy products, as proposed, is desirable.

The **BSD Corporation** of Salt Lake City also found the proposed standard reasonable for physical therapy devices but not for cancer treatment units.

Dr. **Francis Mahoney**, Program Director for Radiation at **NIH's Division of Cancer Treatment**, wrote that the standard would be overly restrictive for units intended for cancer therapy research.

Drs. **Haim Bicher, Fred Hetzel**, and **Taljit Sandhu** from the **Henry Ford Hospital's** Department of Therapeutic Radiology discussed specific problems with applying the standard to cancer therapy. Treatment frequencies, power density limits, and various safety controls were found unacceptable or inappropriate for cancer treatment.

Professor **John Fazekas**, of **Thomas Jefferson University Hospital**, expressed his doubts about the desirability of applying the standard to cancer therapy. He felt safety in clinical hyperthermia hinged on experienced and knowledgable investigators.

University of Washington Medical School

Three separate sets of comments were received from the University of Washington School of Medicine. Professors **Arthur Guy** and **Justus Lehmann** both stated that a performance standard for equipment used in cancer therapy is a poor substitute for competency of the professionals overseeing treatment. Dr. Guy would have prefered an exposure standard to a performance standard: "It is very naive to think a performance standard based on very limited models will be a substitute for the required complex interdisciplinary judgments coupled with the application of well-developed exposure guidelines in reducing the dangerous side effects for the patient and the equipment operators."

Dr. Lehmann accepted the standard for standardized applications but said it does not provide adequate safeguards against overexposure of the patient or the operator: "We feel that it is essential that the standard include limitations as to the use of this equipment so that it can be used only either under the direct supervision of a knowledgeable physician, or by a knowledgeable physical therapist."

The third response, from Professor **C.K. Chou**, stated that, while it was desirable to eliminate unnecessary radiation exposures, "the usefulness of diathermy will be reduced by an over-restrictive performance standard."

Operator Risks

The **American College of Radiology** stressed that operators giving hyperthermia treatments must have sufficient knowledge and training but opposed regulating the equipment: "As a new developing treatment, it is important that physicians with special expertise supervise microwave diathermy treatments for cancer." The group thought regulations for operators should be set as soon as possible.

Both Dr. **Carlos Perez**, of the **Washington University** School of Medicine, and Dr. **Ned Hornback** of **Indiana University's** Department of Radiation Oncology expressed similar opinions. Dr. Hornback advised that, "the exposure levels of all personnel operating equipment should be included in the regulations and current accepted levels of exposure should be adhered to."

Standard Physical Therapy

The need for regulation of existing equipment, which is exempt from proposed regulation, was expressed by Dr. **Julian Henley-Cohn** and by Dr. **Louis Slesin** and **Martha Zybko**. Henley-Cohn argued against imposing the standard on cancer treatment devices. Slesin and Zybko questioned the wisdom of the FDA decision to double the proposed leakage limit from 5 mW/cm² in an earlier draft of the rule to 10 mW/cm² in the current draft.

John Osepchuk, consulting scientist for the **Raytheon Company**, and **Robert Kruse**, President of **AAMED, Inc.**, of Forest Park Illinois, opposed the standard as an unnecessary and harmfully restrictive measure. Dr. Osepchuk stated that the FDA has not established the need for a standard and that this regulation would create an adverse economic impact on the industry.

The **American Physical Therapy Association** supported the standard and in addition requested "immediate attention be focused on requirements essential for operators of microwave diathermy products" to insure the patient's safety.

Drs. **G.M. Samaras** and **R.G. Slawson** of the Martha V. Filbert Radiation Center at the **University of Maryland** Hospital supported the standard "for all microwave diathermy products, regardless of their proposed clinical application." The 30 minute maximum timer period, however, was deemed an impractical restriction for cancer treatment diathermy.

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MICROWAVE-DRUG SYNERGY

(continued from p. 1)

the country's largest selling tranquilizer with some eight million prescribed users and many more unofficial ones. Thomas's widely circulated report caused considerable agitation; if low levels of radiation from a typical radar could intensify the action of a common drug, a new significant risk might exist. Soon a number of other labs were busy trying to replicate and extend Thomas's experiment. (See Table.)

Librium v Valium

At the September conference, Robert Johnson presented the findings of Professor A.W. Guy's group at the University of Washington Medical School. Funded by the Office of Naval Research, they repeated Thomas's experiment using Valium. With the same pulsing characteristics, frequency and average power levels, they found a 30 to 40 percent reduction in sleeping time and an increase in animal feeding. These results were in line with what was expected. However, a few minutes later, John Schrot, a member of Thomas's research team, reported that they had also tested Valium and found *no* microwave-drug synergy. To make matters more complicated, Thomas had also tried continuous wave instead of pulsed radiation and had again found no synergy. (Some of these results have recently been published: *Neurobehavioral Toxicology, 2,* 131, 1980.)

Many biological effects occur at lower power levels for pulsed as compared to continuous radiation, so the failure to get a positive result after continuous wave exposure was not so startling. But a difference beween Valium and Librium, very similar drugs belonging to the benzodiazepine drug family, defied simple explanation. As Thomas wrote in his abstract: "The lack of interaction between diazepam and the pulsed microwave field suggests that drug class alone does not adequately predict outcome."

Robert Johnson offered the hypothesis that two distinct processes were at work in the synergy. In the first week of irradiation, the microwaves counteract the debilitating action of Valium, followed by appetite stimulation during the second week. Nevertheless, he and his colleagues at the University of Washington will be doing some reassessing in light of the conflicting results presented in San Antonio.

Replications Attempted

Even Thomas's original experiment did not survive the meeting unchallenged. G. Rufus Sessions of the Department of Microwave Research at Walter Reed Army Institute of Research reported that he had failed to replicate the Librium study using higher power densities (10 and 20 mW/cm²). His experimental design was quite different, however. Sessions used a variable interval performance test and 915 MHz radiation. These changes could explain the lack of response.

In an interview at the Naval Medical Research Institute last October, Dr. Thomas noted that he had successfully replicated the Librium synergy experiment. He admitted that he had been surprised by the failure to get a positive result with Valium, and offered as a possible explanation an animal's different response to the two drugs. Librium will increase its response rate as compared to baseline behavior, while Valium has an opposite effect.

(continued p. 6)

Summary Table of Microwave-Drug Experiments

Study	Type of Study	Power Density mW/cm² (average)	Frequency	Type of Field	Drug	CW/PW	Results
Thomas (1979)	F.I. Feeding	1.0	2.45 GHz	Near	CDZ	2usec, 500pps	Enhanced Behavioral Effect
Thomas (BEMS)	F.I. Feeding	1.0	2.8 GHz	Near	CDZ DZ DZ CPZ	CW 2usec, 500pps CW 2usec, 500pps	No Effect No Effect No Effect No Effect
Guy (BEMS)	Feeding & Sleeping	1.0	2.45 GHz	Circularly Polarized	DZ	2usec, 500pps	30-40% Reduction in Sleeping Time Increase in Feeding
Battelle (BEMS)	F.I. Feeding	1.0	2.88 GHz	Far	CDZ	3usec, 300pps	None Yet (see text)
Sessions (BEMS)	V.I. Feeding	10 & 20	0.915 GHz	Circularly Polarized	CDZ	2usec, 500pps	No Effect

F.I. = Fixed Interval; V.I. = Variable Interval
CDZ = Chlordiazepoxide (Librium); DZ = Diazepam (Valium); CPZ = Chlorpromazine (Thorazine)

GOVERNMENT

CONGRESS

The Library of Congress' Congressional Research Service (CRS) has published "High Voltage Electric Power Transmission Lines: Impact on Public and Environmental Health" by Kenneth Bogen (Report No. 80-199, November 7, 1980). The 20-page report includes a detailed chronology and bibliography. Bogen has also updated a six-page "Mini Brief" on this subject —with the same title (Number MB80222, December 9, 1980).

The CRS is planning a similar report on the potential hazards associated with extremely low frequency radiation emitted by the Project Seafarer antenna, the Navy's proposed submarine communication system. The schedule for completing this study will depend on Congressional interest.

AGENCIES

Federal Aviation Administration

Plans are underway for phasing in the Microwave Landing System (MLS) which will replace the Instrument Landing System (ILS) now used at airports to guide planes during poor visibility conditions. The MLS operates at frequencies above the VHF/UHF frequencies used in ILS.

The new system offers four essential advantages over the ILS: 1. a common system for civil and military use; 2. a frequency band that will be free of frequency congestion problems; 3. a system that provides a high quality guidance signal that is relatively free from local terrain and structure effects; and 4. an ability to provide multiple paths for various classes of aircraft.

The total estimated cost in today's dollars of the MLS including aircraft equipment exceeds $2 billion according to Martin Olson, Chairman of the MLS Transition Plan Working Group. A few selected airports could have the MLS by 1985.

FAA held four public, regional hearings this January to elicit comments and suggestions on how to proceed with the major task of phasing in the MLS throughout the US. Written comments were due by February 10 (45 *Federal Register* 75041, November 13, 1980). Olson reported that all hearing participants supported the new system: "Generally, people felt MLS offers a beneficial technology that should be implemented as soon as possible."

FAA has released a number of reports on the MLS:

1. *An Analysis of the Requirements for, and the Benefits and Costs of the National Microwave Landing System (MLS),* by William C. Reddick *et al.*, June 1980, in 2 volumes (Report No. FAA-EM-80-7). A brief "Executive Summary" of the report is also available.
2. *The Microwave Landing System Transition Plan, Draft,* October 20, 1980, 203 pages.
3. *Guide to Microwave Landing System Implementation Strategies,* November 1980, 15 pages.

For additional information write to: Mr. Marvin Olson, APO-320, Chairman, MLS Transition Plan Working Group, FAA, Room 939, 800 Independence Avenue, SW, Washington, D.C. 20591

Federal Communications Commission

On January 19th, the FCC reallocated 130 MHz of radio spectrum to allow the development of a Digital Eletronic Message Service (DEMS). The new service will provide business and government offices with a two-way, data and document communication system within and among major US cities.

The intercity transmissions will be authorized under existing FCC rules for point-to-point and satellite microwave links. The

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(continued from p. 5)

Originally Thomas had intended to test a few representative members of each major drug class, but has had to redesign his work plan. Soon he will do a run with a new tranquilizer, still in pre-clinical testing, with a structure falling roughly between that of Librium and Valium. In 1981, Thomas's lab will begin to experiment with monkeys.

A fourth group, at the Battelle Pacific Northwest Laboratories, is specifically trying to replicate Thomas's Librium experiment. Apart from small changes in frequency and pulsing parameters, a major difference in the Battelle study design is the use of far field instead of near field exposures. This experiment by R.H. Lovely and R.D. Phillips had just begun in September, and no firm results were reported in San Antonio. In a December telephone interview, Dr. Lovely said that he had finished two complete runs at 1 mW/cm² and found no synergistic action. The next step is to increase the power to 4 or 8 mW/cm². If a field of 8 mW/cm² causes too much disruption for the animal, the group will use 4 mW/cm². If no synergy is found at the higher power level, Lovely will go to exposures in the near field.

Other Drugs

Thomas's *Science* paper was not the first report of drug-microwave synergy. Cleary and Wangeman showed reinforcement between pentobarbitol and continuous wave microwaves in 1975, and Servantie and co-workers found that microwaves affected the action of curare-type drugs in 1974. In late 1979, Thomas published a paper showing synergy between pulsed microwaves and dextroamphetamine (*Radio Science, 14,* 253, 1979). In San Antonio, Thomas reported no synergy between pulsed radiation and Thorazine (chlorpromazine).

The Navy program on the interaction between microwaves and common drugs is part of a long-term risk assessment for servicemen simultaneously exposed to multiple physical and chemical agents aboard ship.

Where are we now? As Elliot Postow, whose office at the Navy Medical Research and Development Command is funding both Thomas and Battelle, put it: "no clear picture is emerging, and at this point, all bets are off."

intracity links will be handled by the new Digital Termination Systems (DTS).

The FCC decision is the result of a 1978 petition by the Xerox Corporation for spectrum space for a new common carrier service. Under the proposed Xerox system, a customer's terminal would feed into a transceiver connected to a rooftop antenna. The antenna would be in two-way communication with a city-wide substation. A narrow microwave beam would connect the substation to an earth station for transmission to other cities.

The reallocation affects frequencies between 10.55 and 10.68 GHz. The Commission is also considering allocating space in the 17.7-19.7 GHz band for DTS.

Litton Industries had also wanted to use the 10.6 GHz area for a new microwave oven. Litton claims that this higher frequency (most ovens operate at 2.45 GHz), does a better job of browning meat and heating small amounts of food.

Neighboring spectrum space in the 10 GHz region is allocated to police radar, radioastronomy, and point-to-point radio services.

Other companies that have filed for experimental licenses for DEMS-type systems are Digital Communications Corporation and Federal Express. The Commission is reserving some spectrum space for small companies.

The decision will be published in the *Federal Register* within a few weeks. A final rule for the DTS, first proposed in August 1979, will appear as an appendix to the FCC decision.

Federal Trade Commission

The FTC banned Litton ads that claim its microwave ovens are preferred by independent service technicians. The January decision upholds last year's findings of an Administrative Law Judge that the company's surveys of technicians were biased and misleading. The Commission also provided some guidelines for properly using surveys in advertising.

The ads, which ran from 1976 to 1978 in more than 100 national and local newspapers and magazines, stated that technicians chose Litton ovens over other brands. For example, copy placed in a November 1976 issue of *Newsweek* declared: "Quality is No. 1 at Litton! 76% of the independent microwave oven service techicians surveyed recommend Litton." Only authorized Litton service agents were interviewed, however.

The Commission's Opinion is available from the Public Reference Branch, Room 130, FTC, 6th Street and Pennsylvania Avenue, NW, Washington, DC 20580, (202) 523-3598.

National Highway Traffic Safety Administration

NHTSA has proposed performance standards for speed measuring radar devices used by the police (46 *Federal Register* 2097, January 8, 1981).

The standards, developed for NHTSA by the National Bureau of Standards, specify performance requirements for transmission frequency, frequency stability, input current stability, output power stability, and the width of the antenna beam. Each device would have to be free of erroneous signals in the presence of CB and police radio signals and other interfering sources.

According to the NHTSA notice, the standards are designed to diminish litigation over the devices' reliability and accuracy.

For further information contact: Ronald Engle, Enforcement and Emergency Services Division, NHTSA, 400 Seventh Street, SW, Washington DC 20590, (202) 472-4913.

National Institute for Occupational Safety and Health

NIOSH received 81 responses to its RFQ for two television scripts on the risks associated with VDT's. Rather than evaluate all those submissions, NIOSH withdrew the proposal. According to Ray Sinclair of NIOSH's Division of Training and Manpower Development in Cincinnati, the writing will now be done in-house, with a little help paid for on a purchase order basis. The TV shows are due to be completed by October 1, 1981.

National Telecommunications and Information Administration

The Electromagnetic Radiation Management Advisory Council (ERMAC) has postponed its February meeting. One reason for the delay is that the advisory committee's charter, which ran out last December, must be renewed before a meeting can be announced, according to Janet Healer, ERMAC member and NTIA Program Manager for non-ionizing radiation. It is not clear when the paperwork will be completed and the meeting scheduled.

On another front, the hiring freeze instituted by the Reagan administration has put a hold on the hiring of a replacement for Bob Frazier, ERMAC's ex-Executive Secretary, who resigned last year to go work for the Federal Aviation Administration.

ERMAC is assembling all the documents on the irradiaton of the US embassy in Moscow released at the last ERMAC meeting (see *Microwave News*, January 1981) together with the ERMAC recommendations. They will be published as a NTIA report.

Navy

The Naval Surface Weapons Center in Dahlgren, Virginia is seeking better ways to monitor electromagnetic fields aboard ship. Specifically, the Center is soliciting information on ways to (a) measure the E-component of the incident field from all directions and polizarizations; (b) measure the H-field component at low frequencies; and (c) measure equivalent power densities for 10 uW/cm^2 to 200 mW/cm^2 in the frequency range 300 kHz to 40 GHz. *Commerce Business Daily,* December 24, 1980 and repeated January 21, 1981.

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The Naval Surface Weapons Center in Silver Spring, Maryland may decide to develop a lightweight, expendable S-band, RF transmitter no bigger than 5 inches in diameter and 40 inches in length and weighing no more than 40 pounds. The transmitter would produce at least 25 kW pulsed peak power at about 800 pulses per second and a 3 microsecond pulse width with a 0.0024 duty cycle. The transmitter would be able to survive a 200 G rocket launch.

AROUND THE COUNTRY

NY State Transmission Lines Study

This year the New York State Department of Health (NYSDOH) will begin a 5-year, $5 million contractual study on the human health effects of electromagnetic radiation from overhead transmission lines.

All program decisions will be made by an administrating Board composed of the Commissioner of NYSDOH, and the Chairmen of the Power Authority of the State of New York, (PASNY) and of the Public Service Commission (PSC). An advisory Panel of experts chosen by the Board will determine areas of needed research, review and recommend applications for research contracts, evaluate the progress of funded projects, and write an annual report. At the end of the funding period, currently scheduled for no later than July 1987, the Panel will prepare a summary report for the Board.

The tentative selections for the Panel, as of the end of January, were:

Ernest N. Albert, Ph.D., Professor of Anatomy, The George Washington University Medical Center

Antony C. Fraser-Smith, Ph.D., Senior Research Associate, Stanford Electronics Laboratories

Alan J. Grodzinsky, Sc.D., Associate Professor of Electrical and Bioengineering, Massachusetts Institute of Technology

Michael Marron, Ph.D., Professor of Chemistry, University of Wisconsin Parkside

Alice O. Martin, Ph.D., Assistant Professor of Obstetrics and Gynecology, Prentice Women's Hospital

Michael A. Persinger, Ph.D., Professor of Psychology, Laurentian University

Michael L. Shelanski, M.D., Ph.D., Professor and Chairman, Dept. of Pharmacology, New York University Medical Center

Arthur C. Upton, M.D., Professor and Chairman, Dept. of Environmental Medicine, New York University Medical Center

Edward R. Wolpow, M.D., Assistant Clinical Professor of Neurology, Harvard Medical School

Dr. Maria Reichmanis, a research physicist at the VA Medical Center in Syracuse, NY, has been hired as the study's Scientific Research Coordinator.

Because Panel selection has taken longer than anticipated, the initial schedule for getting the study underway has been pushed back three months. A request for proposals will be issued by April 1 and funded research projects should begin by October 1. These dates may be revised when the Panel sets the final timetable.

The RFP will be available from Administrator, Overhead Transmission Lines Project, NYSDOH, Division of Laboratories and Research, Empire State Plaza, Albany, NY 12201. Update information on the project will be provided by Dr. David Carpenter, the Executive Secretary and non-voting member of the Panel, NYSDOH, Empire State Plaza, Albany, NY 12201.

REPORTS

RECENTLY RECEIVED

BRH

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DC Bioeffects

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L. David, *A Study of Federal Microwave Standards*, Department of Energy, August 1980, No. DOE/ER/10041-02.

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A.R. Valentino, *Environmental Assessment for the Satellite Power System (SPS) Concept Development and Evaluation Program (CDEP)*, Department of Energy, August 1980, No. DOE/ER-0069.

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IARC Finds ELF EMFs Are Possible Human Carcinogens

A working group assembled by the International Agency for Research on Cancer (IARC) has unanimously concluded that power-frequency magnetic fields are possible human carcinogens. This finding, announced on June 27 in Lyon, France, is based on the consistent association between childhood leukemia and residential exposure to extremely-low-frequency electromagnetic fields (ELF EMFs).

The makeup of the IARC panel spanned all sides of the EMF controversy

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— from those who openly believe that EMFs promote cancer to industry consultants who are skeptical of any such connection. "We all agreed," said Dr. Larry Anderson. EMFs have now been formally designated "2B Possible Carcinogens." (For a list of the members of the working group and their affiliations, and examples of each type of IARC carcinogens, see p.2.)

"There was a unanimous feeling about it," said Dr. Jan Stolwijk. Dr. Maria

(continued on p.2)

Germans Withdraw Mobile Phone Effect on Blood Pressure

A German neurologist has withdrawn a report stating that mobile phone radiation can raise the blood pressure of the phone user. "The original result had nothing to do with electromagnetic fields," Dr. Stefan Braune told *Microwave News*.

In a research letter published in the June 20, 1998, issue of the *Lancet*, Braune and coworkers at the University Neurological Clinic in Freiburg and at Deutsche Telekom announced that digital signals from a GSM phone could significantly increase the blood pressure of healthy human volunteers (see *MWN*, J/A98). The effect was reported in newspapers around the world.

"There is no evidence that EMFs can influence the central nervous system, blood vessels or any other structure," Braune said in an interview this July. He said that he has repeated the experiment and found the same change in blood pressure, but he now believes that the effect is due to the subjects' physical change in position during the experiment, not to some external stimulus.

A manuscript with his new experimental findings and a reinterpretation of the old data has been submitted for publication and is currently under review.

(continued on p.12)

Stuchly, who remains unconvinced that magnetic fields are responsible for promoting leukemia in children, nevertheless joined the others in voting for the 2B designation. "The epidemiological data are there and it is hard to dismiss them," she said.

Dr. Vincent DelPizzo believes that the cancer evidence is stronger than do any of the other panelists. He cast the only vote that there is "sufficient" human evidence for childhood leukemia, which implies that EMFs are *known* human carcinogens. "I am sure that the childhood leukemia finding cannot be attributed to chance, bias or confounding," he said. (See table below for definitions of "sufficient," "limited" and "inadequate"; for more on DelPizzo's views, see p.5.)

The IARC decision follows similar reviews by panels in the U.S. and the U.K. In 1998, a working group of the National Institute of Environmental Health Sciences (NIEHS), using the same IARC criteria, also classified EMFs as 2B possible human carcinogens, a view that NIEHS Director Kenneth Olden later endorsed in his report to Congress (see *MWN,* J/A98 and J/A99). Earlier this year, an advisory committee to the U.K. National Radiological Protection Board chaired by Sir Richard Doll, also acknowledged the possible link between EMFs and cancer (see *MWN,* M/A01).

The childhood leukemia studies have had a major impact on all of these prior assessments. The Doll report was heavily influenced by the two recent pooled analyses: one led by Dr. Anders Ahlbom and the other by Dr. Sander Greenland (see *MWN,* S/O 99 and S/O00). The IARC panel was similarly swayed, according to both Stolwijk and Dr. Elizabeth Hatch. "The Ahlbom analysis was found to be most impressive," noted Stolwijk.

Much more surprising was the IARC panel members' view of the animal data. They came close to finding "limited" support for a cancer association based on the animal exposure experiments. Seven members voted that there was "limited" evidence of a cancer risk, with 12 voting that the evidence was "insufficient" to back up that designation.

On one side, Dr. Christopher Portier argued that an increase in C-cell thyroid cancers observed in a series of two-year bioassays of male rats could not be dismissed. On the other side, Dr. David McCormick, who ran the bioassays for the National Toxicology Program (NTP) — a program that Portier now helps administer — finds these data less than convincing.

"When we have one finding in one sex of one species, it is likely to be spurious," McCormick said. He stressed that there was no suggestion of cancer in mice or female rats. "My interpretation is that the animal work is negative."

IARC Panel and Observers

MEMBERS: **Larry Anderson**, Battelle Pacific Northwest National Laboratory, Richland, WA; **William Bailey**, Exponent, New York City; **Carl Blackman**, Environmental Protection Agency (EPA), Research Triangle Park, NC; **Nick Day**, University of Cambridge, U.K.; **Vincent DelPizzo**, California EMF Program, Oakland; **Pascal Guénel**, National Hospital, Saint-Maurice, France; **Elizabeth Hatch**, Boston University School of Public Health; **Jukka Juutilainen**, University of Kuopio, Finland; **Leeka Kheifets**, EPRI, Palo Alto, CA; **Abraham Liboff**, Oakland University, Rochester, MI; **David McCormick**, IIT Research Institute, Chicago; **Meike Mevissen**, University of Bern, Switzerland; **Kjell Hansson Mild**, National Institute for Working Life, Umeå, Sweden; **Junji Miyakoshi**, Kyoto University, Japan; **Jørgen Olsen**, Danish Cancer Society, Copenhagen, Denmark; **Christopher Portier**, National Institute of Environmental Health Sciences, Research Triangle Park; **Richard Saunders**, National Radiological Protection Board, Chilton, U.K.; **Joachim Schüz**, University of Mainz, Germany; **Jan Stolwijk**, Yale University School of Medicine, New Haven, CT; **Maria Stuchly**, University of Victoria, Canada; and **Bernard Veyret**, University of Bordeaux, France. **OBSERVERS** *(nonvoting)*: **Norbert Hankin**, EPA, Washington; **Michael Repacholi**, World Health Organization, Geneva, Switzerland; Dr. **Morando Soffritti**, Ramazzini Foundation, Bologna, Italy; and Dr. **John Swanson**, National Grid Co., Leatherhead, U.K.

IARC Carcinogens: Definitions and Examples

Category	Evidence*	Chemical and physical agents
1: CARCINOGEN	Sufficient† in humans	Asbestos, benzene, dioxin, hepatitis C virus, radon, vinyl chloride. Total number of agents: 87.
2A: PROBABLE CARCINOGEN	Limited‡ in humans and sufficient in animals	Benzo[a]pyrene, formaldehyde, PCBs, ultraviolet (A,B&C) radiation. Total number of agents: 63.
2B: POSSIBLE CARCINOGEN	Limited‡ in humans and less than sufficient in animals	Carbon tetrachloride, chloroform, coffee, DDT, ELF EMFs, lead, PBBs. Total number of agents: 236.
3: UNCLASSIFIABLE	Inadequate§ in humans and limited‡ or inadequate in animals	Coal dust, fluorescent lighting, mercury, parathion, phenol, saccharin, tea, xylene. Total number of agents: 483.
4: PROBABLE NONCARCINOGEN	Suggests lack of carcinogenicity in humans	Caprolactam (only one).

*Primary criteria; for full definitions, see: <http://193.51.164.11/Monoeval/Eval.html>.

†Defined as: A positive relationship has been observed and chance, bias and confounding can be ruled out with reasonable confidence.

‡Defined as: A positive relationship has been observed, but chance, bias and confounding cannot be ruled out.

§Defined as: Available studies are of insufficient quality, consistency or statistical power, or no data on carcinogenicity in humans are available.

Sources: For lists of agents in each category: <http://193.51.164.11/monoeval/crthall.html>. For more on IARC, see: <www.iarc.fr>; also *MWN,* J/A98.

IARC's Main Conclusions on EMFs

A working group of 21 scientific experts from ten countries met in Lyon to evaluate possible carcinogenic hazards to human beings from exposures to static and extremely-low-frequency (ELF) electric and magnetic fields. This volume is the first in a planned series of two IARC Monograph volumes on various kinds of non-ionizing radiation in the frequency range below that of visible light.

ELF magnetic field exposures result from proximity to electric power transmission lines, household wiring and electric appliances and are in addition to the exposure that results from the earth's magnetic field. Magnetic fields are measured in units of microTesla (∝T); the earth's static magnetic field varies from 25 ∝T at the equator to 65 ∝T at the poles.

Since the first report suggesting an association between residential electric and magnetic fields and childhood cancer, notably leukemia, was published in 1979, dozens of studies have examined this association. Overall, for the vast majority of children who are exposed to residential ELF magnetic fields less than 0.4 ∝T, there is little evidence of any increased risk for leukemia. There is no evidence that electric fields are associated with childhood leukemia, and there is no consistent relationship between childhood brain tumors or other childhood solid tumors and residential ELF electric and magnetic fields. However, pooled analyses of data from a number of well-conducted studies show a fairly consistent statistical association between childhood leukemia and power-frequency residential magnetic field strengths above 0.4 ∝T, with an approximately twofold increase in risk. This is unlikely to be due to chance, but may be affected by selection bias. Therefore this association between childhood leukemia and high residential magnetic field strengths was judged limited evidence for excess cancer risk in exposed humans.

There is no consistent evidence that residential or occupational exposures of adults are related to excess risks of cancer at any site, although in one Swedish study combined residential and occupational exposures were associated with a significantly increased risk for all leukemia subtypes except chronic lymphocytic leukemia. Evidence for excess cancer risks of all other kinds, in children and in adults, as a result of exposure to ELF electric and magnetic fields was considered inadequate.

Numerous studies to investigate carcinogenicity of magnetic fields have been conducted in experimental animals. These have included long-term bioassays of exposures to magnetic fields alone, and exposures of rats and mice to magnetic fields in combination with known carcinogens. Bioassays of magnetic fields alone generally were negative, although one study that was conducted in both mice and rats of both sexes showed non-exposure related increases in thyroid C-cell tumors in male rats only. Multistage carcinogenesis studies showed no consistent enhancement of chemically initiated mammary tumors in rats or of skin tumors in mice. Magnetic fields had no effects on the incidence of chemically initiated liver tumors in rats or of leukemia/lymphoma in mice or rats. Overall, evidence for carcinogenicity of ELF magnetic fields in experimental animals was judged inadequate. No data on carcinogenicity to animals of static magnetic fields, or of static or ELF electric fields, were available to the working group.

Although many hypotheses have been put forward to explain possible carcinogenic effects of ELF electric or magnetic fields, no scientific explanation for carcinogenicity of these fields has been established.

Overall, ELF magnetic fields were evaluated as possibly carcinogenic to humans (Group 2B), based on the statistical association of higher-level residential ELF magnetic fields and increased risk for childhood leukemia. Static magnetic fields and static and ELF electric fields could not be classified as to carcinogenicity to humans (Group 3).

"My personal conclusion is that the C-cell cancers are not a random observation," countered Portier. The NTP study found that male rats had significantly higher rates of C-cell thyroid cancer at two different dose levels (20 mG and 2 G), and at a third level (10 G), the increase was just short of significance (p=0.055) (see *MWN,* M/A98).

The IARC vote on the animal data stands in sharp contrast to that of the NIEHS working group three years ago. Both based their evaluations on essentially the same experiments, yet not one of the 30 NIEHS panel members voted for "limited" evidence of carcinogenicity in animals. Indeed, eight voted that they believed there was a *lack* of an effect, with five of them filing a minority statement that any suggestion of an effect on animals was totally insupportable.

When the NTP bioassay results were first announced, they were seen as somewhat suspect because the experiments were the first to use a new animal diet. Some reviewers claimed that the rate of thyroid cancer in the control rats was unnaturally low and that if it had been higher, the excess in the exposed animals would disappear.

"There are now enough historical data to show that the EMF increases were clearly not a random fluke," Portier said. He explained that over the last three years, ten other bioassays have been completed with the new diet, and the thyroid cancer rates among the controls have been consistent with those in the original series of EMF experiments.

Somewhat surprisingly, there was much less discussion of the German breast cancer studies carried out at the School of Veterinary Medicine in Hannover by Drs. Wolfgang Löscher and Meike Mevissen. "We agreed to disagree on the significance of the mammary cancer data," said Mevissen. She explained that there was a consensus that both her studies and those by Anderson at Battelle were well done and that there was no simple explanation for the different results (see *MWN,* M/A98 and S/O99).

Reactions and Responses

There have been few public responses to the IARC decision by U.S. government agencies. "The regulatory agencies have to decide what to do about the risks," said NIEHS' Portier. "It's time for the public policy debate."

If so, it will probably get under way at the Environmental Protection Agency (EPA). The agency's Norbert Hankin, who was an observer in Lyon, said that the IARC decision is getting a lot of attention at the EPA. "It's not something the agency can ignore," he said.

Because the IARC decision received little press attention, public reaction was muted. "I was surprised that we did not get any calls on it," said Rick Loughery, director of environmental affairs at the Edison Electric Institute in Washington. He noted that, "EMFs are no longer the hot national public policy issue they were from the late 1980s through the mid-1990s. The issue has been pushed back onto the local level."

The World Health Organization's (WHO) EMF project is working on revising its fact sheet. "All options are being discussed," said WHO's Dr. Michael Repacholi, who was also in Lyon as an observer. A draft will be sent out for review; he expects to release it by the end of August.

In a statement to its members, EPRI in Palo Alto, CA, noted that the IARC panel's conclusions "will help guide the selection of topics for research priorities." The utility group added that, "EPRI work in relevant areas is being planned or is already under way." This analysis was signed by Dr. Leeka Kheifets, an IARC panel member, in one of her last acts before moving to Geneva to work for Repacholi at the EMF project.

A number of observers in Australia and New Zealand said that they were not surprised by the IARC decision. Keith Orchison, the managing director of the Electricity Supply Association of Australia (ESAA), with headquarters in Sydney, commented that the IARC classification is "not new" and is "consistent with the findings of other major scientific reviews." The ESAA was one of the very few organizations anywhere in the world to issue a public comment on the IARC decision.

In a widely circulated e-mail, Dr. Andrew McEwan, the scientific director of New Zealand's National Radiation Laboratory in Christchurch, advised that the "classification is not unexpected." He went on to note that, "The associations are very weak, and the fact that there is no support from laboratory studies to suggest that ELF fields are in any way involved with cancer weighs aginst the possibility that it is a carcinogen."

The report of the IARC EMF panel will appear as volume 80 of its monograph series on cancer risks next spring, according to IARC's Dr. Robert Baan. For more information, go to <monographs.iarc.fr>.

Liboff: A More Sophisticated View of EMFs Is Needed

On his return from Lyon, Dr. Abraham Liboff of Oakland University, a member of the IARC review panel, offered the following perspective on the panel's deliberations. Liboff is a coeditor of the forthcoming journal Electromagnetic Biology and Medicine *(see p.11)*.

There are a number of reasons to welcome the new IARC designation that recognizes ELF magnetic fields as a possible agent for childhood leukemia. This is certainly not a revelation that comes out of the blue, the question having first been raised some 22 years ago. Nevertheless, IARC is a highly respected organization whose conclusions are important to the media and to regulatory bodies.

As a participant in the process that led to this decision, I was greatly impressed by the leadership of Dr. Jerry Rice and his staff at IARC. It is not easy to keep 20 or so highly opinionated experts on track, to be firm about the deadline yet fair in hearing all sides.

It is ironic that the IARC decision is in part based on data contained in the 1997 report by Linet et al. [see *MWN,* J/A97], arguably the most important single coffin nail in the subsequent cessation of federal funding in this area. To reach its conclusion, IARC relied on a pooled analysis [*see MWN,* S/O00] that included the Linet data. It will be interesting to see whether the mainstream media, which acted in lockstep at the time to (incorrectly) declare that the Linet study "proved" that there was no association between power line magnetic fields and childhood leukemia, will now act to correctly report the facts, namely that the Linet study instead provides evidence for an association for 60 Hz mean residential magnetic fields at levels of 0.4 ∝T [4 mG] and above.

The IARC decision again illuminates one disturbing aspect of the question of electromagnetism and cancer that the scientific community has recognized over the years but has not been able to come to grips with. This is the catch-22 problem related to the disconnect between epidemiologist and laboratory scientist. On the one hand, the ultimate verdict concerning EMFs and cancer must come out of epidemiology. On the other hand, there will continue to be limited progress in untangling this question if the epidemiologist fails to heed the clues that arise in the laboratory. From what I observed at IARC, it is clear that some epidemiologists still regard EMFs as merely one more physical agent, different only in name from hazardous chemicals or ionizing radiation. Accordingly, they continue to stick with the traditional paradigm that "more is worse." But, contrary to this view, experimental evidence continues to build showing that ELF magnetic fields can interact in decidedly nonlinear ways with tissue. (Again, this is hardly new information, having first been reported by Adey's group in the mid-1970s.) Many epidemiologists are unaware (or even worse, dismissive) of those reports indicating ELF "windows" or "resonances," a fact reflecting a general lack of awareness as to the extra interactive possibilities attached to EMFs.

This lack of sophistication concerning EMF interactions was fully evident in the IARC deliberations. Consider the fact that no special mention was made of two reports that are very well known to the bioelectromagnetics community — Harland and Liburdy[1] and the replicate study by Blackman et al.[2] — both of which bear directly on the key question as to whether very weak ELF magnetic fields are implicated in breast cancer. Even though these studies were particularly relevant to the issue of residential magnetic fields, they were indiscriminately grouped with other ELF experiments whose results reflected widely different types of exposure conditions. It is little wonder, therefore, that the laboratory evidence, as a whole, was classified as "inconsistent," leaving the unwarranted impression that no clear conclusion was possible.

A more sophisticated reading of such pertinent experiments might not have changed the overall verdict from "possible" to "probable" human carcinogen, but it would have better served the public in conveying a more complete picture as to the potential hazards connected to ELF magnetic fields.

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1) J. Harland and R. Liburdy, "Environmental Magnetic Fields Inhibit the Antiproliferative Action of Tamoxifen and Melatonin in a Human Breast Cancer Cell Line," *Bioelectromagnetics, 18,* pp.555-562, 1997.

2) C. Blackman, S. Benane and D. House, "The Influence of 1.2 ∝T, 60 Hz Magnetic Fields on Melatonin- and Tamoxifen-Induced Inhibition of MCF-7 Cell Growth, *Bioelectromagnetics, 22,* pp.122-128, 2001.

California Report: EMFs Likely Cause of Cancers, Miscarriages

Power-frequency EMFs are more likely than not to cause childhood leukemia and adult brain cancer, according to three researchers at the California EMF Program. Drs. Raymond Neutra, Vincent DelPizzo and Geraldine Lee also consider it likely that EMFs cause miscarriages, in which case, they estimate, magnetic fields would account for as much as 40% of all spontaneous abortions.

Amyotrophic lateral sclerosis (ALS) is another probable EMF effect, the researchers believe. EMFs may also be responsible for a number of other illnesses — but these outcomes are less likely (see box at right).

In an accompanying analysis of policy options, they conclude that some "inexpensive" measures to reduce exposures could be justified on cost-benefit grounds even if EMFs are responsible for "only a few percent of the annual background California deaths." Such mitigation measures, including restringing power lines and changing wiring in homes and schools, would cost an estimated $480 million if implemented in California.

In an interview with *Microwave News,* Neutra cautioned that the state's Department of Health Services (DHS), which oversees the EMF program, "has decided not to make any policy recommendations at this time." Rather, it is opting "just to present the possible implications of the research."

Neutra is the director of the $7 million EMF research effort, authorized by the state Public Utilities Commission in 1993 (see *MWN,* N/D93). DelPizzo became the research director in 1995, and Lee has run its educational and technical assistance work, and led an epidemiological study on miscarriages (see p.18).

The draft report and policy analysis were made available for public comment on July 13, more than two months after the PUC blocked their planned release on May 7 (see *MWN,* M/J01).

In the next few months, Neutra said, the documents will be revised to incorporate public comments and suggestions from the program's scientific advisory panel, after which they will be submitted to the director of the DHS for approval, "probably sometime early next year." At that point, the DHS could issue the risk evaluation as an official report. But until it does so, he stressed, "This is the best judgment of three people who have been immersed in this issue for more than ten years."

The report's estimates of the chances of various health effects are based on the individual opinions of Neutra, DelPizzo and Lee. They are presented anonymously, but with enough clues to determine who is who. Neutra later confirmed their identities and said that the probabilities will be directly attributed to the individuals in future drafts. "We wanted to depersonalize it," he said.

For some outcomes, such as childhood leukemia, their estimates of causality were quite different, while for others, such as ALS, the range was tight. DelPizzo's estimates are well above Lee's and Neutra's for several outcomes, and include two that are close to 100 (see table at left). "If environmental EMFs have enough energy to promote childhood leukemia, it follows that other effects are more credible," DelPizzo explained in an interview.

The California researchers note that, using IARC criteria, they would classify EMFs somewhere betweeen "2B: possible" and "1: human carcinogen" for childhood and adult leukemia (see p.1). They would classify adult brain cancer, miscarriages and ALS as possible (2B) risks.

One of the team's most striking estimates is that up to 40% of miscarriages may be caused by EMFs. "This is potentially of great public health importance," Lee told *Microwave News*. "But this is a first-cut estimate and we need to learn a lot more before we can use this in making policy," said Lee, who is now with the pharmaceutical firm AstraZeneca (see p.17).

Overall, the three researchers contend that the other health

California EMF Program: Assessment of Health Risks

- It is *more than 50% possible* that EMFs at home or at work could cause a very small increased lifetime risk of childhood leukemia, adult brain cancer and ALS.
- It is *more than 50% possible* that EMFs at home or at work could cause a 5-10% added risk of miscarriage.
- It is *10-50% possible* that residential or occupational EMFs could be responsible for a small increased lifetime risk of male breast cancer, childhood brain cancer, suicide, Alzheimer's disease or sudden cardiac death.
- It is *very unlikely (2-10%) but not impossible* that residential or occupational EMFs could be responsible for even a small fraction of birth defects, low birth weight, neonatal deaths or cancer generally.
- It is at least *10-50% possible* that residential or occupational EMFs could be responsible for a small increased lifetime risk of adult leukemia or female breast cancer, and one [researcher] gave a degree of confidence that was higher.

Estimates of "Degree of Confidence"

The risk estimates reported above are the consensus opinions of three DHS scientists. The table below presents the individual researchers' estimates on which the consensus figures are based.



Reviewer #2: Dr. Raymond Neutra

Outcome	Confidence of causality (%)		
	Dr. Vincent DelPizzo (#1)	Dr. Raymond Neutra (#2)	Dr. Geraldine Lee (#3)
Childhood leukemia	99	55	75
Adult leukemia	85	52	40
Childhood brain cancer	45	11	20
Adult brain cancer	98	52	70
Female breast cancer	51	11	15
Male breast cancer	45	40	20
Miscarriage	80	52	65
ALS (Lou Gehrig's disease)	60	60	55
Alzheimer's disease	40	20	15

risks attributable to EMF exposures are "extremely small," so that "the vast majority of highly exposed individuals (95-99.9%)" would not develop cancer or ALS as a result.

In California, they write, approximately four children would die from leukemia resulting from EMF exposures each year, and 24,000 pregnancies would end in miscarriages. No estimates are given for EMF-related deaths from adult brain cancer or ALS.

Neutra will chair a session on the report at the ISEE conference in Germany on September 4 (see p.13) and present his team's findings at the annual meeting of the Society for Risk Analysis in Seattle, December 2-5.

The full text of *An Evaluation of the Possible Risks from Electric and Magnetic Fields (EMFs) from Power Lines, Internal Wiring, Electrical Occupations and Appliances* is available on the program's Web site, <www.dhs.ca.gov/ehib/emf>, along with *Policy Options in the Face of Possible Risk from Power Frequency EMFs*. Print copies are available from the City Copy Center in Oakland; call (510) 763-0193 for information on the price and delivery cost. The deadline for comments is September 10. The EMF program will hold a public workshop in Sacramento on August 16 and in Los Angeles on August 21 to answer questions. There will also be a "telephone workshop" on August 22 from 1 pm to 4 pm. Call (510) 622-4434 for details on how to participate.

HIGHLIGHTS

« Wireless Notes »

On July 23, Chicago Judge **Stephen Schiller** gave his blessing to a tentative settlement between **George Carlo**'s WTR and the attorneys for the class of cell phone users in the long-running ***Busse vs. Motorola et al.*** "human experimentation" lawsuit (see *MWN,* J/F96, N/D97, M/A99 and J/A00)*.* Over the objections of Motorola and the other defendants, which include the **CTIA** and Epidemiology Resources Inc. (**ERI**), Carlo and his Science and Public Policy Institute will receive $250,000 to set up a registry of adverse health effects among users of cell phones who wish to voluntarily report "maladies," such as brain tumors and leukemia. The volunteer nature of the registry is key because the *Busse* litigation centers on the claim that ERI, in the course of doing an epidemiological study for WTR and CTIA, collected information without the informed consent of the phone users. Carlo will also now get access to a $150,000 fund to cover any future legal expenses. The money will be paid by WTR's insurance company, which wants to settle. It has already spent $600,000 of the $2 million policy defending Carlo, leaving $1.4 million to be split between Carlo and the plaintiffs' lawyers at **Barnow & Goldberg**. A proposal to make Carlo's book on cell phone health risks available at half-price was rejected by the judge. Ben Barnow and Alan Goldberg told *Microwave News* that even if they are awarded the close to $1 million left after Carlo gets his $400,000, they will not have recouped the investment they made over the last six years of litigation. Objections to the proposed settlement must be filed by September 26. Schiller will hold a "settlement fairness hearing" on November 13, when the court will also consider Barnow & Goldberg's petition for legal fees. The text of the draft settlement appeared in *USA Today* on July 26 and is on the Web at <www.bussewtrsettlement.com>. (See also p.19.)

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Telecommunications towers are becoming targets of political protest, leading to violent confrontations. On July 4, an elected representative in **Cyprus** was arrested on a British military base on the island for storming a radio tower that is being built for intelligence gathering. He climbed onto the 190-meter structure and stayed there for several hours. In the rioting sparked by his arrest, dozens of automobiles were destroyed and a police station was ransacked. According to the July 14 *Irish Times,* the Cypriot legislature later unanimously adopted a resolution that work on the tower be halted in view of "serious concern" about health risks of radiation. On July 14, in **Scotland**, a "gang" knocked down a mobile phone base station near Port Glasgow that had been opposed by people living nearby, the BBC reported (July 16). The attack, which took place in the middle of the night, caused £25,000 (approximately US$35,000) in damage, according to the wireless carrier Orange. Starting in late July, mobile phone towers in Scotland will be subject to full planning control.

German Radiation Official: Kids Should Not Use Phones

The head of the Federal Radiation Protection Office in Germany says that children should not use mobile phones and recommends that others minimize their use.

"Parents should keep their children away from this technology as much as possible," Wolfram König told the *Berliner Zeitung* (July 31). While there is no evidence of harmful effects, he said, questions about health "urgently" need to be answered (see p.10).

König, a member of Germany's Green Party, called for restrictions on base station antennas near kindergartens, schools and hospitals. He also suggested labeling phones with SAR information, echoing a recent proposal from the German environment ministry.

At the end of last year, the German Academy of Pediatrics made a similar recommendation, as did the British Medical Association this spring (see *MWN,* J/F01 and M/J01). The U.K.'s Stewart panel was the first to call for limiting children's use of phones, in May 2000 (see *MWN,* M/J00).

Last year, anger over cellular towers near Haifa, **Israel**, prompted local residents to hurl rocks at Motorola maintenance workers (see *MWN,* M/A00).

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Sen. **Joe Lieberman** (D-CT) and Rep. **Ed Markey** (D-MA) have asked the General Accounting Office (**GAO**) to continue to watch over how the federal government deals with the potential health risks posed by mobile phones. After the GAO report was released in May, the two legislators wrote to the FCC, FDA and NIH urging them to implement GAO's "sensible" recommendations "expeditiously" (see *MWN,* M/J01). The agencies replied — in very general terms — that they would continue their efforts. But Lieberman and Markey are not satisfied. In a July 30 letter, they asked the GAO to monitor the agencies' progress. The responses "raise our concern that the recommendations made by the GAO have not yet been fully addressed and will require some follow-up," they wrote. (On July 20, the **FDA** posted a revised *Consumer Update on Wireless Phones* on its Web site, <www.fda.gov/cdrh/ocd/mobilphone.html>; it is little changed from previous editions.)

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The siting of cellular towers in the U.S. is decided at the local level on a case-by-case basis because the **FCC** usually grants automatic approval. Now, two large environmental groups want the FCC to look at the overall impact of the towers. It is "beyond dispute" that telecom towers "create significant environmental impacts at the local, regional and national level," state the **Friends of the Earth** (FOE) and the **Forest Conservation Council** in a series of petitions they have filed since March. The petitions call for a programmatic environmental impact statement (EIS) "addressing the direct, indirect and cumulative impacts" of the FCC's tower-siting policies. In addition to effects on wildlife and water quality, the groups want the FCC to assess "adverse public health and safety concerns resulting from increased human exposure to RF radiation." Brian Dunkiel of FOE in Burlington, VT, told *Microwave News* that the legal arguments may be stronger for a review of effects on wildlife but insisted that his organization places equal emphasis on health. (FOE Scotland has long advocated stricter controls on the placement of cellular towers; see p.6 and *MWN,* M/J99.) To put pressure on the FCC, the forest council and FOE are also challenging more than 30 separate tower applications, which, they contend, provide "entirely inadequate" information on potential environmental effects. The approval of the disputed towers is on hold, an FCC spokesperson said, while the commission decides how to respond to the groups' demands. John Talberth of the forest council explained that blocking specific applications is necessary because others who have asked the FCC to look into the environmental effects of telecom towers in general have been ignored. "This is the only way to get the FCC to pay attention," Talberth said in an interview from his office in Santa Fe, NM. He added that the forest council will continue to object to tower applications until the FCC responds. The commission has not been anxious to address this issue. In November 1999, Jamie Clark of the U.S. **Fish and Wildlife Service** asked the FCC to prepare an EIS, contending that tower construction had "almost no environmental oversight" on possible effects on migratory birds. The FCC turned her down.

Angelos's Experts in Mobile Phone–Brain Cancer Suit

Peter Angelos's law firm in Baltimore will call seven experts to testify on behalf of Dr. Chistopher Newman, who claims that his brain tumor was caused by mobile phone radiation (see *MWN* S/O00 and J/F01). The dates currently scheduled for their depositions are given in parentheses.

Dr. Neil Cherry EMF research (August 1-2)	Lincoln University Canterbury, New Zealand
Dr. John Conomy Neurology (August 16)	Health Systems Design Chagrin Falls, OH
Dr. Gunnar Heuser Neurology (August 20-21)	NeuroMed and NeuroTox Associates, Agoura Hills, CA
Dr. Henry Lai Biology (August 14-15)	University of Washington Seattle, WA
Dr. Andrew Marino Biology (July 20-21)	Louisiana State University Medical Center, Shreveport, LA
Dr. Jerry Phillips Biology (August 23-24)	Biological Sciences Curriculum Study, Colorado Springs, CO
Dr. Elihu Richter Epidemiology (August 8-9)	Hebrew University Jerusalem, Israel
Dr. Barry Singer Oncology (August 3-4)	Norristown, PA

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Opponents of federal tower-siting policies are gearing up for another legislative campaign. At a July 12 briefing in Washington, congressional staffers heard reports on public concerns about the proliferation of wireless antennas from **Janet Newton** of the EMR Network in Cabot, VT, **Deb Carney** of Golden, CO, and **Libby Kelley** of the Council on Wireless Technology Impacts in Novato, CA. Dr. **Theodore Litovitz** of the Catholic University of America presented an overview of RF/MW health effects research. In September, after Congress' summer recess, Rep. **Thomas Tancredo** (R-CO) will join the three members of the Vermont delegation in seeking to repeal the preemption clause of the 1996 Telecommunications Act. They will also move to protect local authority on digital television (DTV) antenna siting and to sponsor safety research. Vermont's Rep. **Bernie Sanders** (Ind) and Sens. **Patrick Leahy** (D) and **James Jeffords** (Ind) have mounted similar efforts in the past — all of which have failed (see *MWN,* N/D97, S/O98 and S/O99).

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In a lawsuit now before a federal judge in California, **Gibb Brower** of San Diego contends that radiation from his mobile phone caused his brain cancer. His attorney **Carl Hilliard** quietly filed the suit on April 19 to beat a statute of limitations deadline. In a revised complaint, filed on August 2, Hilliard points out that **Ericsson**, **Nokia** and **Motorola**, among others, have obtained a num-

ber of patents for phones designed to reduce radiation exposures. These patents have not been much of a secret (see *MWN,* N/D96 and S/O99), but Hilliard believes that they are indicative of the manufacturers' bad faith. "The patents speak for themselves. These folks have the ability to protect consumers from being radiated and they're unwilling to spend a couple of bucks to do so. It's outrageous," he told *RCR Wireless News* (June 4). The **British press**, never shy to play up the latest news pointing to the health dangers of mobile phones, quickly spread the word. MOBILE FIRMS PATENT CANCER SHIELDS ran the headline on the front page of the June 11 *Times*. The same day, the BBC quoted Nokia patent applications, filed in 1995 and 1998, which acknowledged that "uncertainty" about phone safety was affecting the "speed of growth" of the market. The companies sought to limit the PR damage. Motorola's patents "were not motivated by concerns about potential health issues," the company told the BBC. A Nokia spokesperson explained to a British television audience that, "A third of our employees are engaged in research and development and it is a natural course of business that they file for patents." Meanwhile, Hilliard is fighting a Motorola motion to move the Brower case to federal court.

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Radiation from mobile phone **towers** is being blamed for a variety of health problems in a lawsuit filed in Indiana state court on July 27. Attorney **John Hamilton** filed the complaint on behalf of four families whose homes in South Bend are near three towers owned by local telecom companies. The familes claim that the radiation has caused maladies ranging from sleep disturbances and memory loss to "multiple tumors" and a miscarriage. In addition to monetary damages, they want one of the towers to be removed and the radiation from the antennas to be reduced to background levels on each of their properties. The families also allege that the value of their homes has been diminished by "the public's growing concern" about possible health effects, and by the towers' unsightly appearance. Adverse impacts on property values have been alleged — with support from tax assessors — in litigation over phone towers in Illinois and Texas (see *MWN,* M/A99).

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Stealth aircraft can be detected with mobile phone **towers**, claims Roke Manor Research, a U.K. engineering firm in Romsey, west of London. Signals transmitted by towers and reflected by the flat undersides of the planes, which are invisible to conventional radar, can be picked up with an antenna array and a laptop, all from the back of a Land Rover. The location can be pinpointed within 10 meters, according to the June 11 *Daily Telegraph*. The U.S. military begs to differ. On July 2, *Aviation Week,* known for its access to Pentagon sources, reported that "U.S. Air Force specialists" predict the system would have a limited range and be plagued with false alarms. And even if the technology could perform as claimed, an official said, the Air Force could disable such location detection systems with a **directed-energy weapon** that produces a "squirt" of high-power microwaves from an air-launched cruise missile. So don't expect your hand-held phone to work if the country goes to war.

Proteomics: Finns Find RF Has Major Impact on Gene Expression

The gene research revolution may soon settle some very old arguments about the health effects of electromagnetic radiation.

In the first application of the powerful new techniques of proteomics to RF biological effects, Dr. Dariusz Leszczynski has found that relatively weak mobile phone radiation altered the production of numerous proteins in cultured human cells. About 15% of the proteins were affected, he said.

Leszczynski and his research group* are with the Finnish Radiation and Nuclear Safety Authority, known as STUK, in Helsinki.

"This is a pretty dramatic change," Leszczynski told *Microwave News* during a break at the Bioelectromagnetics Society's annual meeting in St. Paul, MN, in mid-June. "It suggests that a large number of systems are responding to a nonthermal radiation exposure."

The expression of nine genes was changed by 6- to 13-fold and that of some 20-30 other genes changed by a factor of two, Leszczynski said.

Leszczynski cautioned that "the physiological relevance of these changes is unknown" and that "we have repeated the experiment three times but we need to do it again three more times." But, he added, "I believe that the effects we see on the expression of proteins and also the fact that there was a threefold increase in protein phosphorylation are real responses to mobile phone radiation."

The Finnish research team exposed human endothelial cells, EA.hy926, for one hour to a 900 MHz GSM signal at an average SAR of 1.8-2.5 W/Kg and then compared the expression of 2,400 genes in exposed and sham cells.

The exposure system was built by Dr. Kari Jokela of STUK and later checked by Dr. Niels Kuster of IT'IS in Zurich. Leszczynski noted that with an average SAR of 2 W/Kg and a cooling system for the cell culture dishes, there is no temperature increase — at least on a macro-scale. While allowing that some heating cannot be excluded, Leszczynski believes that it would be very small and localized — as well as undetectable with present technology.

"I am convinced that the changes that we are observing are nonthermal effects of RF/MW radiation," he said.

The Finnish work is part of the REFLEX project, a set of *in vitro* experiments sponsored by the European Commission research program on mobile phones and health (see *MWN,* M/A00).

The ability to monitor changes in so many different genes simultaneously is a radical departure from past methods in which specific genes must be selected at the outset of the experiment. This genomic technique is a powerful new addition to the developing science of proteomics† — the systematic cataloguing and study of the proteins produced by the genes within a cell.

* Sakari Joenväärä, Jukka Reivinen, Pia Kontturi and Hanna Tammio.

"A lot of the past controversies will be put to rest using these new genetic techniques," commented Dr. Jerry Phillips, a staff biologist at the Biological Sciences Curriculum Study in Colorado Springs, CO. Phillips's own studies on gene expression, carried out in Dr. Ross Adey's lab in Loma Linda, CA, were part of the ongoing debate on the effects of power-frequency EMFs.

The most contentious of these EMF disputes concerned the work of Drs. Reba Goodman of Columbia University and Ann Henderson of Hunter College, both in New York City, which was challenged by Dr. Jeffrey Saffer of the Battelle labs in Richland, WA, and Adam Lacy-Hulbert of the U.K.'s University of Cambridge (see *MWN,* J/A94, J/F95 and M/J95). Both sides maintained their positions and the issue remains unresolved.

Now the U.K.'s EMF Biological Research Trust may break the deadlock. Last spring the trust, which is funded by the National Grid, requested proposals to use proteomics to shed light on possible mechanisms of interaction (see *Nature,* March 1).

In late July, Dr. John Male, the administrator of the trust in South Croydon, south of London, said that no funding decisions had yet been made.

†To learn more, see *The Promise of Proteomics: Leading the Way to 21st Century Medicine,* published earlier this year by the New York Academy of Sciences. A copy can be downloaded from <www.nyas.org>.

Latest Swedish Brain Tumor Study Points to Long-Term Risk

The longer one uses a mobile phone, the greater the risk of developing a brain tumor, according to the latest epidemiological analysis by Drs. Lennart Hardell and Kjell Hansson Mild of Örebro University in Sweden.

Hardell and Mild found a 26% increase in benign brain tumors among those who had used an analog phone for more than a year before diagnosis. The risk rose to 35% after five years and to 77% after ten years. All these estimates are statistically significant.

"The increasing risk with tumor induction period — or latency — and the number of hours of use are in agreement with carcinogenesis," Hardell told *Microwave News*. "These findings do certainly strengthen the result."

Mild agrees. "There is a consistency to our results," he said in an interview. Mild is also with the National Institute for Working Life in Umeå.

No increased risk was observed for hand-held digital phones. But Hardell and Mild point out that these phones have not been in use long enough for such risks to be ruled out. There was no excess risk associated with cordless phones that have a power output of 10 mW.

Of the 2,561 cases of brain tumors identified in four regions of Sweden, 540 had died and 35 were too sick to contact. Of the 1,617 patients included in the study, 88% of the cases and 91% of the controls completed the 21-page questionnaire.

There was also an increased risk of malignant tumors, Hardell said, but it was not significant. He pointed to a 40-60% split between malignant and benign brain tumors among the cases.

"We did not include the deceased because we did not think the relatives could give us good answers on the use of phones," Mild said, adding that they might analyze the data on those who had died in a separate, follow-up study.

This is the third mobile phone paper by Hardell and Mild and the first to point to a general increased incidence of brain tumors. Previously, they had shown that there is a greater chance of developing a tumor on the side of the head the phone was used (see *MWN,* M/J99 and M/J00).

The new study once again supports the hypothesis that there is a greater chance of developing a tumor on the side of the head where the phone is used. The risk is two-and-a-half times that of controls, a statistically significant increase. This is approximately the same level of risk as reported by the Örebro team last year.

The new study covers brain tumors that were diagnosed between 1997 and June 30, 2000. The earlier papers investigated tumors reported between 1994 and 1996.

Mild said that the new results, which he and Hardell first presented at a mobile phone conference in London on June 6, have been submitted to the *Lancet*.

Acoustic Neuromas and Cell Phones: Differing Results

The new Swedish study by Hardell and Mild found more than three times the expected number of acoustic neuromas, benign tumors of the eighth cranial nerve — it connects the brain to the inner ear.

But, soon afterwards, Dr. Joshua Muscat of the American Health Foundation in Valhalla, NY, announced that his study did not show a greater risk of this.

In a paper presented at the annual meeting of the Society for Epidemiologic Research in Toronto, June 13-16, Muscat said that among users of cell phones for three years or more the odds ratio for acoustic neuromas was 1.6, but with a confidence interval (CI) that was far short of significance (0.5-4.3). For those who had used mobile phones for less than three years, the risk was lower than expected.

"There is no real association with short-term exposures," Muscat told *Microwave News*. He said that he will soon submit these results for publication. Muscat's findings for brain tumors, which are part of the same cell phone study, were published in the *Journal of the American Medical Association* last December (see *MWN,* J/F01).

Hardell and Mild's odds ratio for acoustic neuromas is 3.27 (CI=1.67-6.43) — it increases to 3.50 (CI=0.73-16.9) for those who used a phone for ten years or more prior to diagnosis.

Mild noted that the first sign of an acoustic neuroma is hearing loss or tinnitus and that, "We found an excess of hearing loss in our study of subjective symptoms among mobile phone users" (see *MWN,* M/J98 and J/A00).

And Muscat pointed out that in his study the acoustic neuromas occurred more often on the side opposite the one used for the phone. But, he explained, this may be because hearing loss prompted moving the phone to the other ear.

Germany Eyes Precautionary RF/MW Limits for Cell Towers

Germany may soon follow Italy and Switzerland in adopting strict exposure limits for radiation from mobile phone base stations. The Green Party wing of the federal government wants tighter standards but is facing resistance from the wireless industry and radiation control officials.

"We want a change in philosophy — namely, to establish the precautionary principle in the area of EMFs," said Simone Probst, a deputy environment minister and Green Party member, at a June 21 conference on mobile phones and health. This change, Probst continued, entails keeping emissions from towers "as low as possible" in places where people spend time, supporting more research on health effects (see box at right) and making information on phone SARs more available to the public.

On July 1, the Federal Environment Ministry issued a press release confirming that it is "currently considering whether to adopt precautionary limits to supplement the existing guidelines," possibly based on the current Swiss standard. But the ministry stressed that, "Deliberations have not yet ended, decisions have not been made."

The wireless industry is already on record as opposing more stringent standards. Precautionary limits below those now in force are "not supported by science," contended T-Mobil, a Darmstadt-based wireless carrier that was formerly part of Deutsche Telekom, in a statement released in May (see *MWN,* M/J01).

The ministry noted that the Radiation Protection Commission (known by its German acronym, SSK), an expert panel that advises the government, will offer its own recommendations. The SSK's principal expert on non-ionizing radiation is Dr. Jürgen Bernhardt, who is also the current vice chair and a past chair of ICNIRP. Bernhardt declined a request for comment from *Microwave News,* but he is likely to oppose any change that would undermine the existing limits, which are based on ICNIRP's guidelines (see *MWN,* S/O97).

Although the environment ministry has stated that its decision will be based "in part" on the SSK's recommendations, their relations have been strained. The commission's chair, Dr. Maria Blettner, an epidemiologist at the University of Bielefeld, resigned in May because the ministry had ignored the SSK's advice, according to the newspaper *Tageszeitung* (June 11).

Some of Blettner's work has concerned the question of mobile phone safety (see *MWN,* N/D99), but according to the *Tageszeitung* (May 17) her break with the environment ministry was primarily over its insistence that depleted-uranium munitions used by NATO forces in the former Yugoslavia could pose a major health hazard. Blettner declined to comment.

Other members of the SSK may be open to lower limits. One panelist, Christian Küppers of the environmental advocacy group Öko-Institut in Darmstadt, told *Microwave News* that stricter limits based on the Swiss model "would be appropriate for Germany." But he noted that his group favors "protected areas" around hospitals, kindergartens and schools (see also p.14).

Others want still tougher limits. In a report prepared for T-Mobil, the Ecolog Institute in Hannover called for a 1 ∝W/cm^2 (2 V/m) maximum exposure level, citing evidence of potentially harmful effects at levels as low as 20 ∝W/cm^2 (8.7 V/m).

Switzerland's precautionary limit for 900 MHz radiation from mobile phone towers is 4 ∝W/cm^2 (4 V/m), more than 100 times lower than ICNIRP (see *MWN,* J/F00). Similar rules for RF/MW radiation have been adopted in Italy and in other parts of Europe (see *MWN,* J/F00, J/A00 and S/O00).

The Social Democrats (in German, SPD), the dominant member of the governing coalition, have long advocated minimizing exposures to non-ionizing radiation and basing standards on the precautionary principle (see *MWN,* S/O97).

If Germany should adopt stricter limits, it would mark a sea change in policy. In 1999, Germany voted for a resolution of the European Union Council of Ministers that endorsed the much looser ICNIRP guidelines as the basis for harmonizing member states' limits (see *MWN,* J/A99).

The environment ministry has been working for some time on revising the 1997 exposure ordinance, but it initially focused on closing gaps and resolving ambiguities. To explain the new openness to more sweeping changes, Probst cited "strong public concerns" and "scientific uncertainties" created by research findings of physiological and psychological effects from low-level exposures.

The Greens' support for precautionary measures is not limited to exposure limits. The environment ministry is also looking for ways to make more information on phone users' radiation exposures available to the public.

Phone makers announced in May that, starting later this year, they will include SAR information in the user instructions inside the box (see p.11). The environment ministry suggested that a "low radiation" label for phones whose SARs do not exceed 25% of the 2.0 W/Kg ICNIRP limit would be more "consumer-friendly." A Nokia spokesperson said that labels would be "unfair," according to the May 14 *Stuttgarter Nachrichten*.

Germany Set To Launch Mobile Phone Research Effort

Germany will soon begin a three-to-four-year research effort on mobile phone safety with a total cost of approximately 8.5 million euros (US$7.4 million).

"The federal government wants to intensify its research activities because in the years ahead we will face great challenges in this area," said Simone Probst, a senior environmental official, at a conference hosted by the Federal Radiation Protection Office in Salzgitter on June 21.

On June 13, the German cabinet increased the environment ministry's budget for research on non-ionizing radiation to 2.2 million euros (US$1.7 million) for 2002. A similar level of support is anticipated for each of the following three years. The budget proposal now goes to the Bundestag, Germany's parliament, where approval is considered likely.

The radiation protection office will administer the program with oversight by the environment ministry. The emphasis will be placed on mechanisms of interaction, epidemiology and dosimetry, according to the ministry.

CENELEC Okays SAR Protocols; IEEE, FCC Move Forward

Test protocols for measuring specific absorption rates (SARs) from mobile phones have finally been completed in Europe and will soon be finished in the U.S.

On July 3, the technical board of CENELEC gave final approval for its SAR standards*—both the test method and the 2 W/Kg limit originally specified when the European Council of Ministers adopted the ICNIRP standard in 1999 (see *MWN,* J/A99). The 19 member countries must now publicize the standards by September 1 and formally adopt them by March 1, 2002.

With this test standard in place, Ericsson, Motorola and Nokia have announced that they will make SAR information more readily available. For instance, Ericsson stated that all new phones will have "easy-to-read and up-to-date SAR information in the packaging" after October 1.

In the U.S., the IEEE SCC-34 subcommittee 2 on SAR measurement techniques is on the verge of finishing its protocol. "The previous draft was approved, but there were over 1,000 comments," Howard Bassen of the FDA's Center for Devices and Radiological Health in Rockville, MD, told *Microwave News*. "We've addressed the vast majority of the objections and I think we should finalize it at our next meeting, in Ottawa." A final ballot will be completed before the subcommittee meets September 17-19, he said.

On June 29, the Federal Communications Commission (FCC) issued its own interim measurement guidelines† for mobile phones. The commission, which has been under intense pressure to adopt an SAR test method to facilitate monitoring compliance with its 1.6 W/Kg SAR limit, decided not to wait until the SCC-34 standard was completed.

"We do plan to use the SCC-34 standard when it is finalized," said Dr. Robert Cleveland of the FCC's Office of Engineering and Technology (OET) in Washington. But, he added, "It will still take at least six months for the IEEE to approve the standard, and there is always the chance that will someone object."

Until the FCC adopts the final SCC-34 standard, manufacturers are being advised to use the interim test method. "For standard equipment, we recommend applicants follow the new procedures to expedite the approval process," Kwok Chan of the FCC OET told *Microwave News*. Otherwise, he said, they will be evaluated on a case-by-case basis, which will take more time.

The CENELEC and IEEE SCC-34 test protocols are essentially the same, with only a few differences. Dr. C.K. Chou of Motorola in Plantation, FL, explained that a working group, with members from both committees, harmonized the two standards.

* CENELEC is the European Committee for Electrotechnical Standardization. It is composed of the 15 member states of the European Union, as well as the Czech Republic, Iceland, Norway and Switzerland. There are two standards: EN50360 and EN50361. EN50360 specifies the ICNIRP SAR limit of 2 W/Kg averaged over 10 g; and EN50361 defines the measurement method. CENELEC standards can be ordered from the secretariat in Brussels at (32+2) 519-6871, Fax: (32+2) 519-6919 or from <www.cenelec.org>.

† The test method is in Supplement C of the FCC's OET Bulletin 65, which is on the Web as a pdf file at <www.fcc.gov/oet>.

Coming in 2002: "Electromagnetic Biology and Medicine"

Electro- and Magnetobiology is being revamped with a new name, new editors and a new mission.

Beginning next year, the journal will be called *Electromagnetic Biology and Medicine* and will be edited by Drs. Abe Liboff and Boris Pasche. The current editor, Dr. Stephen Smith of the University of Kentucky, is retiring but will remain on the editorial board.

"There will be a new emphasis on electromedicine," said Liboff, an emeritus professor of physics at Oakland University in Rochester, MI. "We will publish more clinical studies and add clinicians to the editorial board."

"We will strive to cover medical and clinical developments with scientific rigor," Pasche said. "But we also want to make the journal a center of lively discussion."

Pasche, who has both an MD and a PhD, recently set up a lab at the Northwestern University Medical School in Chicago to do cancer research. For nearly 20 years, Pasche has worked on the use of low levels of amplitude-modulated 27.12 MHz radiation to treat insomnia and anxiety disorders (see *MWN,* M/J96).

This is the third title for the journal, which was founded by Dr. Andrew Marino of Louisiana State University Medical Center in 1982 as the *Journal of Bioelectricity*.

Marcel Dekker will continue to publish the journal. There will be three issues in 2002 and four in 2003.

New Book: Using Mobile Phones Like Russian Roulette

> You pick up the phone, once, twice, ten times a day—or only a few times a month. But each and every time you're gambling that "this time" won't be the occasion when the radiation causes irreparable damage to your brain. It only takes a seemingly small trauma at a very small location to result in tissue damage, DNA damage or chromosome mutations....
>
> It is cellular telephone Russian roulette. Go ahead and make the call. Do you feel lucky today?

These are the closing paragraphs of Robert Kane's new book, *Cellular Telephone Russian Roulette: A Historical and Scientific Perspective*. Apart from this rather dramatic ending, most of the 235-page book is a sober analysis of dosimetric and biological issues related to mobile phones. There is also a detailed discussion of radiation exposure standards. In all, Kane includes 195 footnotes.

Kane is not a disinterested party. He is a former Motorola research engineer who in December 1993 sued the company, alleging that he had developed a brain tumor from testing a prototype cellular phone (see *MWN,* J/F94). The case continues today. Last year, the case was dismissed by a Chicago court (see *MWN,* J/A 00), but Kane's lawyers at Barnow & Goldberg in Chicago will soon file papers in their appeal.

Kane's book is available for $12.95 from Vantage Press. To order call: (800) 882-3273.

Braune is now practicing medicine in Prien, not far from Munich.

Dr. Torsten Gailus of Deutsche Telekom in Darmstadt, a co-author of the original *Lancet* report, told *Microwave News* that he "fully agrees" with Braune's new interpretation and conclusions. Gailus added that he is now a project manager for network technologies and no longer works on radiation health issues.

Even before the retraction, researchers at the Federal Institute for Occupational Safety and Health (FIOSH) in Berlin had raised concerns that blood pressure monitors might be susceptible to electromagnetic interference (EMI).

At a workshop held in Berlin last November, Dr. Peter Ullsperger and FIOSH coworkers reported that mobile phone radiation can "definitively alter" the measurement of blood pressure by a Finapres monitor — the same instrument that was used by Braune. Ullsperger noted that Braune's experimental design did not allow a 2-meter separation between the mobile phone and the Finapres blood pressure monitor. (At a distance of 2 meters, the radiation signal from the phone would be sufficiently attenuated to make EMI very unlikely.)

Dr. Alan Preece of the U.K.'s University of Bristol, who attended the Berlin workshop and who works on mobile phone cognitive effects (see *MWN,* M/A99), said that he has found that many types of medical equipment are susceptible to EMI. "Our ultrasound monitor was badly upset by GSM radiation," he said, pointing out that analog signals pose much less of a problem.

Preece is not surprised by the withdrawal of the Braune results. "I was skeptical when I first read the study because of the small sample size and the fact that the tests were not run blind," he said in an interview.

Meanwhile, a team working under Dr. Maila Hietanen at the Finnish Institute of Occupational Health in Helsinki is investigating whether 900 and 1800 MHz mobile phone radiation can affect the blood pressure and cardiac function of human volunteers. Tests on the first 20 of 60 planned subjects have been completed, according to the institute's Anna-Maija Hämäläinen, but the results are not yet available.

The proceedings of the Berlin workshop, *Is Central Nervous Information Processing Influenced by Electromagnetic Fields of Mobile Phones?,* will be published as a FIOSH report later this year. For details, check FIOSH's Web site, <www.baua.de>.

FROM THE FIELD

Hot New Papers

V. Keetley et al., "Neuropsychological Sequelae of 50 Hz Magnetic Fields," ***International Journal of Radiation Biology, 77,*** **pp.735-742, June 2001.**

"The effects of occupational levels of [28 ∝T (280 mG) circularly polarized] 50 Hz magnetic fields on cognitive function were studied on 30 human volunteers....Subjects sat at a desk within the coils where they undertook a series of verbal and written tests of cognitive function. After these tests were concluded (~30 min) subjects were either exposed or sham-exposed to fields (double-blinded) for 50 min. A second set of tests...was administered 20 min from the start of this period. Each subject returned after seven days to repeat the sequence, but with the opposite field/sham status....In summary, the data are suggestive of detrimental effects on cognitive processes, particularly short-term learning and executive functioning. However, larger sample sizes are required to demonstrate statistically a more specific pattern of cognitive effects."

Hrvoje Lalić, Andrica Lekić and Biserka Radošević-Stašić, "Comparison of Chromosome Aberrations in Peripheral Blood Lymphocytes from People Occupationally Exposed to Ionizing and Radiofrequency Radiation," ***Acta Medica Okayama, 55,*** **pp.117-127, April 2001.**

"The genotoxic effects of occupational exposure to ionizing and non-ionizing radiation were investigated in 25 physicians and nurses working in hospitals and in 20 individuals working at radio-relay stations.... The data showed that total number of chromosome aberrations in people exposed to ionizing and radiofrequency radiation...were almost equally higher than those of non-irradiated subjects....Acentric fragments comprised the most frequently seen type of aberration....A positive correlation between the total number of chromosome aberrations and cumulative 6-years dosage was also found. The data emphasized the dangerous effects of prolonged exposure to both types of radiation and indicated that chromosomal aberration analysis should be obligatory for individuals working at radio-relay stations....The findings in this study are particularly interesting, because both groups of workers were exposed to doses of ionizing and non-ionizing radiation that were well below the accepted standards for exposure to radiation....[T]he examinees working in radio-relay stations were exposed to the power and frequency of electromagnetic waves that usually did not exceed the permitted values of 10 W/m^2. The analysis was made by blind as-

Phone Radiation and Cancer: A Proposed Mechanism

Peter French, Ronald Penny, Jocelyn Laurence and David McKenzie, "Mobile Phones, Heat Shock Proteins and Cancer," ***Differentiation, 67,*** **pp.93-97, June 2001.**

"[T]here is a testable mechanism by which mobile phone exposure could lead to cancer, and that link is via the heat shock response. Mobile phones emit RF energy at levels which are demonstrably potentially capable of triggering the heat shock response. Recurrent exposure through frequent mobile phone use could lead to chronic expression of [heat shock proteins] in the exposed brain tissue of regular mobile phone users. Chronic overexpression of heat shock proteins is reported to be associated with both induction and promotion of cancer....It is therefore critical that the hypothesis that RF energy at mobile phone-relevant SAR levels acts as a cell stress on human brain cells and tissues is tested experimentally as a potential mechanism for cancer development. Such a mechanism provides a solid hypothesis for the observed nonthermal effects of RF radiation on mammalian cells, and would need to be considered in designing future epidemiological studies." (See also *MWN,* S/O00.)

sessment of exposure....However, it should be noted that the present study was conducted on a small sample of examinees and in order to be verified, would need to be replicated, in particular as regards the effect of radiofrequency radiation." (Full text available at: <www.lib.okayama-u.ac.jp/www/acta/acatcontents55_2.htm>.)

Ingrid Nordenson, Kjell Hansson Mild et al., "Chromosomal Aberrations in Peripheral Lymphocytes of Train Engine Drivers," ***Bioelectromagnetics, 22,*** **pp.306-315, July 2001.**

"A pilot study of 18 engine drivers indicated a significant difference in the frequency of cells with chromosomal aberrations (gaps included or excluded) in comparison with seven concurrent referents (train dispatchers) and a control group of 16 office workers. The engine drivers had about four times higher frequency of cells with chromosome-type aberrations (excluding gaps) than the office workers ($p<0.01$) and the dispatchers ($p<0.05$)....In a follow-up study, another 30 engine drivers showed an increase ($p<0.05$) in the frequency of cells with chromosome-type aberrations (gaps excluded) as compared with 30 referent policemen....[T]he results of the two studies support the hypothesis that exposure to MF at mean intensities of 2-15 ∝T [20-150 mG] can induce chromosomal damage." (See also *MWN,* J/F85, S/O88 and J/A96.)

Pascale Fabbro-Peray, Jean-Pierre Daures and Jean-François Rossi, "Environmental Risk Factors for Non-Hodgkin's Lymphoma [NHL]: A Population-Based Case-Control Study in Languedoc-Roussillon, France," ***Cancer Causes and Control, 12,*** **pp.201-212, April 2001.**

"The following factors were independently and significantly related to NHL as a result of the multivariate analysis: a previous hematopoietic malignancy (OR_a=11.5, 95% CI 2.4-55.4), a history of hives (OR_a=1.7, 95% CI 1.2-2.2), benzene exposure >810 days (OR_a=4.6, 95% CI 1.1-19.2), daily welding (OR_a=2.5, 95% CI 1.2-5.0) and activity of radio operator (OR_a=3.1, 95% CI 1.4-6.6)....Younger age at onset was also associated with an increased risk of NHL. On the other hand, duration of exposure showed a paradoxical and unexplained protective effect.... The odds ratio associated with [radio operator activity] remained increased after adjustment for all other factors. As with welding, younger age at onset increased the risk, while duration of exposure decreased the risk....The paradoxical protective effect of duration of exposure for these two factors could be explained by measures taken in the French industry. Indeed, the mobility of workers is encouraged when their occupations appear to pose a high risk to their health; and welding is considered a high risk activity for the eyes."

P. Boscolo et al., "Effects of Electromagnetic Fields Produced by Radiotelevision Broadcasting Stations on the Immune System of Women," ***Science of the Total Environment, 273,*** **pp.1-10, June 12, 2001.**

"The object of this study was to investigate the immune system of 19 women with a mean age of 35 years, for at least two years (mean=13 years) exposed to EMFs induced by radiotelevision broadcasting stations in their residential area. In September 1999, the EMFs (with range 500 kHz-3 GHz) in the balconies of the homes of the women were (mean ± S.D.) 4.3 ± 1.4 V/m. 47 women of similar age, smoking habits and atopy composed the control group, with a nearby resident EMF exposure of < 1.8 V/m....We may conclude that exposure to EMFs induces a modification of immune parameters in humans. EMF exposure inhibits a Th1-like cytotoxic immune response without a dose-response effect, while the enhancement of a Th2-like immune response is not demonstrated. "

Meeting Notes

Thermoregulation Workshops

Dr. Joe Elder is helping organize a *Temperature Workshop* for the WHO EMF project to be held in Geneva, October 16-17. Elder, who recently retired from the EPA and joined Motorola's research labs in Plantation, FL, as director of biological research, told *Microwave News* that a small number of biologists will be invited to help define temperature limits for cells, tissues and organs. "These limits are not necessarily RF-induced," he said. One of the objectives will be to produce a WHO report. Dr. Eleanor Adair of Brooks Air Force Base in San Antonio is putting together a second workshop on thermal regulation, which will address RF/MW effects. Members of both ICNIRP and IEEE SCC-28 will attend, she said. That meeting will be held next spring, but other details including title and date have yet to be finalized.

EBEA Meeting in Helsinki

The European Bioelectromagnetics Association (EBEA) is set to meet in Helsinki, September 6-8. The preliminary scientific program is at <www.occuphealth.fi/e/project/ebea2001>.

Radio Vatican, EMFs & Mobile Phones

On September 4, Italian researchers will present the latest epidemiological results of a study on childhood leukemia rates near the Radio Vatican antennas in Cesano outside Rome at the *13th Conference of the International Society for Environmental Epidemiology* (ISEE2001). The meeting will be held in Garmisch-Partenkirchen, which is an hour south of Munich. The same day, Dr. Anders Ahlbom will review the EMF–cancer association and WHO's Dr. Michael Repacholi will discuss the role of transients in the development of childhood leukemia. That afternoon, Dr. Raymond Neutra will chair a session on the results of the California EMF Program (see p.5) titled "The Marriage of Epidemiology and Decision Analysis." In a planned poster presentation, Drs. Andreas Stang and Karl-Heinz Jöckel of the University of Essen will give advice on how to deal with the media on a "sensational topic" like the health effects of mobile phones. One tip: "Become immune to unqualified critics, especially from people who have never read the publication." In January, they published a paper on the possible link between mobile phones and eye cancer (see *MWN,* J/F01). A copy of the program and abstracts of the papers are available at the conference's Web site: <www.gsf.de/epi/gap2001/ISEE>. The abstracts are also in the July issue of *Epidemiology.* For more information about the meeting, call: (49+89) 5482340 or fax: (49+89) 54823444.

Olden in Australia

Dr. Kenneth Olden, the director of the U.S. NIEHS, was the special guest speaker at a July 6 workshop sponsored by the Electricity Supply Association of Australia (ESAA) in Melbourne. Olden reviewed the EMF RAPID program and his report to Congress (see *MWN,* J/A99).

Across the Spectrum

I believe, in the ultimate analysis, that it is hubris to think that no phenomenon is valid unless we understand its mechanism of action.

— Dr. T.V. Rajan, chairman, department of pathology, University of Connecticut Health Center, Farmington, noting that digitalis was used for 200 years to treat cardiac problems without any idea of the mechanism of action, and that "billions of human doses" of diethylcarbamazaine have been dispensed to treat lymphatic diseases over the last 50 years even though "we have absolutely no idea how the drug works," in a commentary, "The Myth of Mechanism," *The Scientist,* p.6, June 25, 2001, also available at <www.the-scientist.com/yr2001/jun/comm_010625.html>

"Physicists in particular have lost a lot of clout, and they've even lost a lot of esteem in the public eye, and I think that's reflected in the fact that they're now being more ignored in their advice."

— Dr. David Cassidy, science historian, Hofstra University, Hempstead, NY, quoted by James Glanz, "Sure, It's Rocket Science, But Who Needs Scientists?" *New York Times,* Week in Review, p.1, June 17, 2001

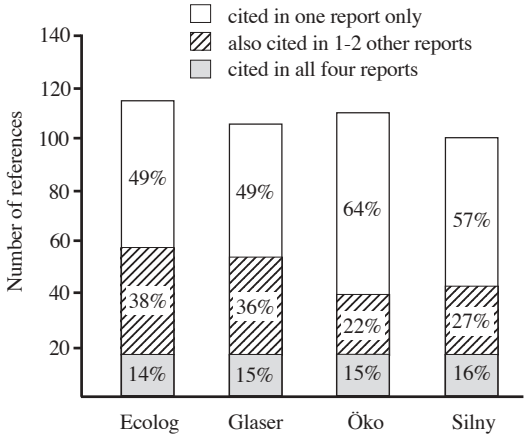
"The law is very clear. The health factor is not something that a zoning board in New Jersey has jurisdiction over. But we all recognize that the government has done studies and set standards in the past that have come back to haunt us. So that perception of there being a health risk lurking out there makes people uncomfortable, uneasy, and therefore not as prone to purchasing a home and spending the same amount of money they would if the tower wasn't there."

— Bruce Whitaker, lawyer, Ramsey, NJ, who represents homeowners fighting a proposed Verizon and AT&T cellular tower in nearby Ho Ho Kus, quoted by George James, "The Gift of Gab Comes at a Cost — As Cell Phone Use Grows, So Do Battles Over Towers," *New York Times,* New Jersey, p.10, June 24, 2001

"We understand the technology to a certain extent, but not 100%."

— Statement of Sony, quoted by Alexandra Harney and Christopher Brown-Humes, "Sony's Handset Gremlins Spell Trouble for Ericsson Alliance: A String of Recalls Has Hit the Japanese Giant's Reputation and Shares," *Financial Times* (U.K.), p.21, July 11, 2001 (see p.18 and *MWN,* J/F99)

Each Singing from a Different Song Book

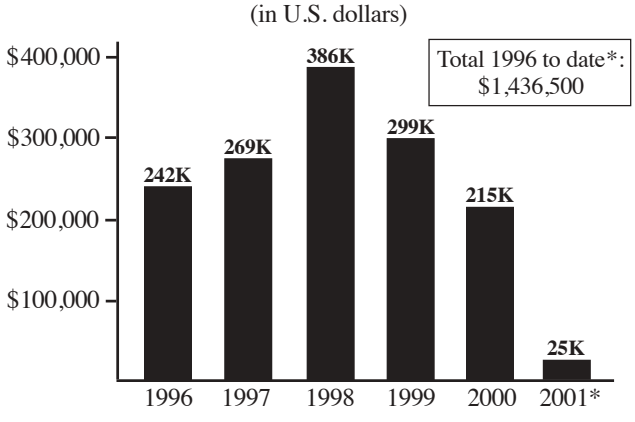


— Comparison of references to the scientific literature in reports on mobile phone radiation and health completed last year by the Ecolog Institute, Hannover; Dr. Roland Glaser, Humboldt University, Berlin; the Öko-Institut, Darmstadt; and Dr. Jiri Silny, University of Aachen. Adapted from an analysis prepared by the Jülich Research Center for T-Mobil, a Darmstadt-based wireless carrier which also commissioned the four reports. The reports and the Jülich analysis, which was added to the Web on July 5, 2001, are available in German at <www.fz-juelich.de/mut/projekte/pro_emf.html> (see p.10; also *MWN,* M/J01)

"Everyone likes power, but no one likes power generation or delivery."

— Spencer Abraham, U.S. Secretary of Energy, at the Edison Electric Institute's annual meeting, on June 5 in New Orleans, quoted by Kathleen Davis, "Gridlock: America's Regional Transmission Structures Scout for Solutions," *Electric Light & Power,* p.18, July 2001

Funds Received by the WHO EMF Project



Source: WHO International EMF Project * Through May 7

"Dangerous? Yes, I *definitely* think it's dangerous. Could you hold on? I have another call."

— Frank Bruno, in his car, Long Island, NY, on using a mobile phone while driving, quoted by Michael Powell, "NY to Motorists: Put the Phone Down and Drive, Buddy," *Washington Post,* p.A3, June 29, 2001

Michael Persinger, a professor of neuroscience at Laurentian University in Sudbury, Ontario, has been conducting experiments that fit a set of magnets to a helmet-like device. Persinger runs what amounts to a weak electromagnetic signal around the skulls of volunteers. Four in five people, he said, report a "mystical experience, the feeling that there is a sentient being or entity standing behind or near" them. Some weep, some feel God has touched them, others become frightened and talk of demons and evil spirits. "That's in the laboratory," Persinger said. "They know they are in the laboratory. Can you imgine what would happen if that happened late at night in a pew or mosque or synagogue?"

— Shankar Vedantam, "Tracing the Synapses of Our Spirituality," *Washington Post,* p.A1, June 17, 2001

UPDATES

ITALY

A Guide... Italy has been a hotbed for concerns over non-ionizing radiation, as we have reported in our last two issues. *Elletrosmog,* as it is called there, has prompted some of the strictest exposure standards in Europe. Luca Ramacci and Giovanna Mingati have written a detailed guide to the health and regulatory issues. They cover ordinances and judicial decisions at both the national and local levels. *Inquinamento Elettromagnetico (Electromagnetic Pollution),* 255 pages, costs L.32,000 (approx. US$15.00) from Sistemi Editoriali, based near Naples. (It is only available in Italian.) To order, call (39+081) 8043920, Fax: (39+081) 8043851, or go to: <www. sistemieditoriali.it>.

MELATONIN

MRI Gives Up on Melatonin Hypothesis... Power-frequency magnetic fields do not depress melatonin levels in humans. So say Drs. Charles Graham and Mary Cook on retiring from the Midwest Research Institute (MRI) in Kansas City, MO. For 20 years, Graham directed MRI's EMF research lab, where volunteers were exposed under carefully controlled conditions to investigate possible impacts on behavior, cardiac function and, most recently, on melatonin. He never saw a consistent melatonin effect, but he had long maintained that it would be premature to dismiss the EMF–melatonin link (see *MWN,* M/A97, N/D99 and J/F00). Now, Graham has changed his mind. "We've looked at both men and women across different age groups, field intensities and exposure durations," he told *Microwave News* in June. "One would expect to see some hint of an effect, but we didn't." In his final melatonin studies, Graham, working with Cook and MRI's Dr. Antonio Sastre, exposed volunteers to a circularly polarized 28.3 ∝T (283 mG) 60 Hz field on one of two nights spent at the lab. The field was switched on or off every hour, and during the "on" hours it cycled on and off at 15-second intervals. As a control, each volunteer spent the other night at the lab with EMF levels no higher than 2 mG. They found no EMF-related changes in melatonin levels in hourly blood samples or in concentrations of the melatonin metabolite 6-OHMS in urine samples taken the following morning. The findings for women aged 19-35 years appear in the May issue of *Environmental Health Perspectives (109,* pp.501-507, 2001), while the results for older women are in press at the *Journal of Pineal Research*. The issue may be settled at MRI — which, in any case, has no money to continue such research — but others are not yet ready to throw in the towel. "While the experimental studies of acute exposure have not shown a suppression, the observational studies in real-world settings generally have," Dr. Richard Stevens of the University of Connecticut, Farmington, told *Microwave News*. (Stevens was the first to formulate the melatonin hypothesis linking breast cancer to EMFs and/or light-at-night; see *MWN,* J/F 87.) One of these observational studies was carried out by Stevens and Dr. Scott Davis of the Fred Hutchinson Cancer Research Center in Seattle, who found melatonin suppression among women exposed to power line fields at home (see *MWN,* N/D97). Their paper will soon appear in the *American Journal of Epidemiology*. Dr. James Burch of Colorado State University, Ft. Collins, who has himself reported melatonin suppression among utility workers (see *MWN,* M/A97 and M/A00), sides with Stevens. "Obviously, there's a big difference between exposures in a lab and in a real-world environment," Burch said in an interview. MRI's Sastre countered that he and Graham and Cook are well aware of such variations. "Could it be harmonics or transients? We cannot rule that out," he told *Microwave News*. But the MRI team argues that such possibilities are speculative and points to the "inherent lack of control over potentially confounding variables in field studies." They contend that their findings are "consistent with a growing body of evidence" indicating that EMFs have "little or no effect" on melatonin. Sastre, who has now assumed the helm at MRI's EMF lab, is willing to live with the remaining uncertainties. "It's time to move on," he said.

"MICROWAVE NEWS" FLASHBACK

Years 20 Ago

• Breaking ranks with ANSI and NIOSH, the EPA considers adopting a frequency-independent RF/MW exposure standard in order to simplify enforcement.

• The Electromagnetic Radiation Management Advisory Council finds that former personnel at the U.S. embassy in Moscow can anticipate no deleterious biological effects from MW exposures.

Years 10 Ago

• Telephone line workers have higher mortality rates from leukemia than other telephone company employees, report Dr. Genevieve Matanoski and colleagues at the Johns Hopkins University public health school in Baltimore.

• Dr. Gilbert Omenn, of the University of Washington, Seattle, the chairman of the Electric Power Research Institute's scientific advisory panel, ranks the public health risks of EMFs as similar to those associated with "eating peanut butter."

• Michelle and Ted Zuidema sue San Diego Gas & Electric, charging that EMFs caused their daughter to develop kidney cancer and that the utility's power lines lowered the value of their home.

Years 5 Ago

• Exposure to electric fields is a potentially critical factor to understanding cancer risk, says Dr. Tony Miller of the University of Toronto after finding that utility workers exposed to high levels of magnetic *and* electric fields have 11 times the expected rate of leukemia.

• The FCC adopts final health and safety regulations for exposure to RF/MW radiation similar to those recommended by the NCRP ten years earlier, including a requirement that the SAR of all new cell phones not exceed 1.6 W/Kg.

• Taking a cue from fellow TV man Jon Palfreman, John Stossel argues that people get much more radiation from moonlight than power lines. Dr. Charles Polk calls the argument "propaganda."

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NEUROSTIMULATORS

Diathermy Alert... Medtronic has issued a safety alert to warn users of its neurostimulation devices that they risk "severe injury or death" if they are treated with shortwave, microwave or ultrasound diathermy. Energy from the diathermy unit can be transferred to the neurostimulator and cause extensive tissue damage. In its May 18 alert, Medtronic cites two cases of patients with implanted deep brain stimulator systems who received shortwave diathermy therapy and suffered severe brain damage. Both became comatose. The alert is at <www.medtronic.com/neuro/diathermy_alert/alert_patients.html>.

PEOPLE

Dr. **Asher Sheppard**, a consultant based in Redlands, CA, is the new president of the Bioelectromagnetics Society (BEMS). Dr. **Frank Prato,** of the University of Western Ontario in London, Canada, will take over from Sheppard at next year's BEMS meeting, which will be held in Quebec City, Canada, June 23-27. Drs. **Stefan Engstrom**, **Leeka Kheifets**, **Joseph Roti Roti**, **James Ryaby** and **Shoogo Ueno** have been elected to the BEMS board of directors....Dr. **Laurent Bontoux** has moved to the Directorate of Science Strategy of the European Commission's Joint Research Center in Brussels. Previously he was with DGXII on Science, Research and Development. **Callum Searle** of DG Research will now be monitoring the EC mobile phone studies...On July 13, **Ron Petersen** accepted a buyout offer and retired from Lucent Technologies-Bell Labs in Murray Hill, NJ. He will continue to work with numerous standards groups: Petersen is vice president for non-ionizing radiation at the NCRP, chairs IEEE SCC-34 on Electromagnetic Energy Product Performance Safety and is the executive secretary of IEEE SCC-28, the International Committee on Electromagnetic Safety. **Paul Testagrossa** and **Alice Fahy-Elwood** remain members of Lucent's RF/MW group. ...Professor **Veli Santomaa**, a principal scientist at Nokia's research center in Helsinki, is retiring on September 1. He has been at Nokia, the world's leading manufacturer of mobile phones, for seven years....Dr. **Gene Sobel** has left the West Coast to become the director of statistics for the NCI gynecologic oncology group at the Roswell Park Cancer Institute in Buffalo, NY....A team led by Dr. **James Burch** of Colorado State University in Ft. Collins has won the Adolph Kammer Merit in Authorship Award from the American College of Occupational and Environmental Medicine (ACOEM) for a paper on the importance of polarization in suppressing melatonin levels in electric utility workers. The award recognizes the most outstanding paper published in ACOEM's *Journal of Occupational and Environmental Medicine*. The paper was the subject of a cover story in *Microwave News* last year (see *MWN*, M/A00; see also p.15)....Dr. **René de Seze** has moved from the University of Montpellier in Nimes to the National Institute for the Industrial Environment and Hazards (INERIS) in Verneuil-en-Halatte, which is north of Paris. De Seze has also recently been appointed an associate editor of *Bioelectromagnetics*.... Dr. **Dean Astumian** has joined the physics department at the University of Maine, Orono. Previously, he was at the University of Chicago. Astumian's article "Making Molecules into Motors" appears in the July issue of *Scientific American*....In our last

issue we reported that Dr. **Gerri Lee**, formerly with the California EMF program (see p.5 and p.18), was now working for Hoffman-LaRoche. She has recently joined AstraZeneca, a large drug company, as a senior epidemiologist. She will be dividing her time between the two coasts....Dr. **David Erwin**, 55, died of can-cer on June 1. His career at Brooks Air Force Base (AFB) in San Antonio began in 1977. He worked on microwave health effects for 15 years. At the time of his death, he was the Director of the Air Force Institute for Environment, Safety and Occupational Health Risk Analysis.

STANDARDS

New Chair at SCC-28... Dr. John Osepchuk is retiring as the chair of IEEE SCC-28, the International Committee on Electromagnetic Safety, on September 1. Dr. Eleanor Adair of Brooks AFB, presently the cochair, will take over from Osepchuk. Ron Petersen will continue as executive secretary (see p.16). Osepchuk said that he will be an ex officio member of the SCC-28 Executive Committee. Meanwhile, Dr. John D'Andrea of the Naval Health Research Center at Brooks AFB, the cochair of subcommittee 4 on safety standards for human exposures, said that he expects to have a complete draft of the revised ANSI/IEEE RF/MW exposure standard by the late fall.

THE NETHERLANDS

Health Council: New Report, Same Advice... The Health Council of the Netherlands concludes that power-frequency EMFs are "not likely" to cause childhood leukemia — even though pooled data analyses led by Drs. Anders Ahlbom and Sander Greenland show a "consistent association" (see p.2). In its first annual update on EMFs and RF/MW radiation, a 12-member panel chaired by Dr. Eric Roubos of the University of Nijmegen reviews those studies that have appeared since last year, when the council issued two detailed reports that discounted health risks from EMFs and GSM radiation (see *MWN,* M/J00 and N/D00). The panel states that it finds no reason to alter its earlier conclusions. The full text of *Electromagnetic Fields: Annual Update 2001* is available in Dutch and English at <www.gr.nl>.

VIDEOS

StrayVoltage... Stetzer Electric has produced a video that presents the concerns of Wisconsin farmers over stray voltage. The 20-minute video, *Beyond Coincidence: The Perils of Electrical Pollution,* details what has happened to a number of farm families and their cattle. A copy of the video tape is available for $12.00 (including shipping) from Stetzer Electric Inc., 520 West Broadway, PO Box 25, Blair, WI 54616, (608) 989-2571, Fax: (608) 989-2570, Web: <www.stetzerelectric.com>.

NRPB on Mobile Phones... The U.K.'s National Radiological Protection Board has produced a 30-minute video, *Mobile Telephony and Health,* on the current state of knowledge on the possible impacts of phones and towers. A copy is available for £6.00 from: Information Services, NRPB, Chilton, Didcot, Oxon OX11 0RQ, U.K., or by phone from Jane True at (44+1235) 822742.

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As We Go To Press

U.K. Panel: TETRA Mobile Radio Safe

It is "unlikely" that radiation from digital mobile radios used by public safety services poses any special health risks, according to a report prepared for the U.K.'s National Radiological Protection Board (NRPB).

The board's Advisory Group on Non-Ionizing Radiation, chaired by Sir Richard Doll, issued its findings on the terrestrial trunked radio, or TETRA, system on July 31.

The radios have a power output of up to 3 W, operating at 400 MHz, pulse modulated at 17.6 Hz. The review was prompted by last year's Stewart commission report (see *MWN,* M/J00), which flagged 16 Hz as a potentially troublesome modulation frequency, based on evidence of effects on calcium ions.

The Doll panel reached a different conclusion. Calcium ion effects are "much disputed," its report states, adding that "no associated health risk has been identified." The panel calls for new studies to resolve the issue.

While acknowledging that experimental data on users' radiation exposures are "very limited," Doll's group predicts that SARs from TETRA handsets will not exceed 10 W/Kg — the limit specified by the NRPB for all users of mobile phones and by ICNIRP for occupational exposures only.

Alasdair Philips, a consultant based near Cambridge, lambasted the Doll panel's conclusions. "They basically still think of people as dead slabs of meat with a cooling system," he told the BBC (July 31).

The full text of the 40-page report is at <www. nrpb.org.uk>.

Keeping Current: Follow-Up on the News

◆ In our last issue, we highlighted the new epidemiological study on EMF-induced spontaneous abortions by Dr. De-Kun Li of Kaiser Permanente, which will appear in the November issue of *Epidemiology.* Li also wrote a summary of his results for the California Department of Health and it is available now in Appendix 6 of the draft report of the EMF Program (see p.5). Appendix 5 is Dr. Gerri Lee's companion miscarriage study. Go to: <www.dhs.ca.gov/ehib/emf/RiskEvaluation/riskeval.html>.

◆ Dr. Gerard Hyland's 40-page report for the European Parliament, *The Physiological and Environmental Effects of Non-Ionizing Electromagnetic Radiation,* can be downloaded from the Web site of Caroline Lucas, a Green Party member of the parliament from the U.K. Go to: <www.carolinelucasmep.org.uk/news/mobilemasts_11072001.asp>.

◆ The July issue of *Epidemiology* (pp.472-473) has a spirited exchange on the pooled analysis of childhood leukemia data by UCLA's Dr. Sander Greenland and coworkers (see p.2 and *MWN,* S/O99). Kent Jaffa of PacifiCorp in Salt Lake City, UT, writes that the study is "unreliable" because of problems with pooling methods. The Greenland team counters that Jaffa's arguments are based on "errors of logic, statistics and fact."

◆ On July 4, Sony pulled 560,000 mobile phones off the Japanese market because a design flaw caused the battery to overheat. The company put the cost of the recall at ¥12 billion, or $97 million. In 1998, Sony recalled 60,000 phones that could exceed FCC exposure guidelines (see *MWN,* J/F99). (See also p.14.)

◆ Richard Capriola of Weinstock & Scavo in Atlanta filed a class-action lawsuit in Georgia state court on June 8 to ensure that every mobile phone comes with a hands-free kit. The Atlanta firm is working with Peter Angelos's legal team (see *MWN,* M/J01).

◆ On June 15, Australia's National Health and Medical Research Council (NHMRC) announced its latest grant for research on mobile phone safety: A$300,000 (US$155,000) to Dr. Kathy Rose of the University of Sydney for a two-year study on vision and hearing effects. In Adelaide, exposures have been completed and tumors are being tallied in the NHMRC-funded repeat of the Repacholi mouse study, according to the July 25 *Advertiser* (see *MWN,* M/J97 and M/A01).

◆ At any given daytime moment during the week, about 500,000 drivers of passenger cars are talking on hand-held cell phones, according to a survey by the National Highway Traffic Safety Administration, released on July 23.

VIEWS ON THE NEWS

'EMFs Are Possible Carcinogens' Is Not News — Or Is It?

IARC is the most influential authority on what may cause cancer. So it was surprising that, when its EMF panel classified power-frequency fields as possible carcinogens (see p.1), a lot of journalists chose to look the other way.

A search of the English-language press turned up just one news article, in Australia's *Canberra Times*. Some European papers — for example, France's *Le Figaro* and Sweden's *Svenska Dagbladet* — ran short items. In the U.S., there was only silence.

What are we to make of this utter lack of interest? Could it be that the general and scientific press have a double standard when it comes to covering EMFs?

Two of the IARC panelists, Dr. Nick Day of the U.K. and Dr. Elizabeth Hatch of the U.S., had previously released their own epidemiological studies, both of which were widely reported as showing *no* leukemia risk in children. Yet this summer in Lyon, they agreed with the others that EMFs are possible carcinogens.

The *New Scientist* greeted Day's 1999 study with an editorial headlined IT'S OFFICIAL. POWER LINES DON'T GIVE CHILDREN LEUKEMIA. When IARC issued its press release in June, the magazine ignored it.

After Hatch's and Dr. Martha Linet's 1997 NCI study was published, *Science*'s Gary Taubes suggested that it would be the obituary for the EMF–cancer link. At press time, *Science* has yet to announce the resurrection.

Clearly, the IARC decision *is* news — news that should not be ignored. It's time to clear the air of all the disinformation which has been circulated over the years. It's time to acknowledge that EMFs do pose possible health risks and to find out how great those risks actually are.

BEMS Needs a New Compass

The Bioelectromagnetics Society (BEMS) is in danger of fading into oblivion.

The June annual meeting was a depressing affair. Attendance was down 25% from last year. The long rows of blank poster boards were an ever-present reminder of those who canceled their trips to St. Paul. Who can blame them? Walking the deserted streets near the hotel, one felt the entire local population had decided that they too would rather be somewhere else.

The few interesting papers were all from Europe. Not too surprising, given that there is no money for research in the U.S. Sessions were padded with tutorials and reviews of old controversies. All in all, it was a pretty stale affair.

If BEMS wants to survive it will have to reinvent itself. Hazard research must continue, but the society should also embrace those working on electromedicine. One reason BEMS has kept its distance from this promising field is that some fear that it would be a tacit recognition of more complex — read politically unacceptable — effects.

BEMS has money in the bank to see it through hard times. Those times are here now and the society must invest in its future.

And at the very least, given that annual meetings are big moneymakers, they should be held in places that people might actually want to visit.

Keeping an Eye on the Usual Suspects

• It's breathtaking to watch **George Carlo** rise like a phoenix. Just when we thought he would fade away like his soon-to-be-remaindered book, he's back with money in his pocket. Or almost. If the judge approves the proposed settlement in the *Busse* case, as appears likely (see p.6), Carlo will get a $250,000 bankroll to continue harassing the cell phone industry and a $150,000 insurance policy in case he should get into legal trouble again — call it a get-out-of-jail-free card. To be sure, we think that the industry needs more policing, but Carlo's tactics are so self-serving that they have come close to undoing the safety debate. One needs to look no further than the FDA–CTIA research project — known as the CRADA to some, and as an international laughingstock to others — to see how Carlo has managed to maneuver the FDA's only health effort into doing the wrong studies for the wrong reasons. Carlo's latest opening came when his insurance company decided that it had had enough and walked away leaving $1,400,000 on the table. It didn't take long for the *Busse* lawyers and Carlo to work out a 70-30 split and for the settlement papers to be signed. Unless the complaints get a lot louder, the checks will soon be in the mail.

• **Bob Park**'s most recent (July 13 & 27) ravings about EMFs in his weekly *What's New* e-mail letter sound as if they were dictated from the post-surgery recovery room. They may well have been. Last summer a tree fell on Park while he was jogging, necessitating a series of major operations. If the tree was a message from above to give his biases a rest, Park didn't get it. His columns are embarrassing to read: The facts are garbled, out-of-date and/or just plain wrong. When the errors are pointed out, he looks the other way. It's time for the leaders of the American Physical Society to take responsibility for Park, their chief lobbyist, and put him out to pasture, where he can froth at the mouth in private.

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California EMF Program To Issue Strongest Health Warning Yet

But Final Report Offers No Policy Advice

After spending more than $7 million over the last eight years, the California Department of Health Services (DHS) will soon issue the strongest warning to date on the potential health risks from exposure to power-frequency electromagnetic fields (EMFs).

Drs. Raymond Neutra, Vincent DelPizzo and Geraldine Lee, who wrote the report, conclude that they "are inclined to believe" that EMFs are a cause of childhood leukemia, adult brain cancer, amyotrophic lateral sclerosis (ALS) and miscarriages. (See p.4 for their general conclusions.)

The final report of the EMF Program, which runs more than 500 pages including appendices, has not yet been released, but *Microwave News* has obtained a copy. It "is slowly working its way through the bureaucracy," said Neutra of the DHS, who led the program. He expects to submit it to the California Public Utilities Commission (PUC) "at the end of the summer."

"We lowered a few of the risk estimates, but overall the conclusions in the final report are very similar to those in the draft," said DelPizzo, who served as research director of the EMF program before retiring recently to Reno, NV.

The report does not include recommendations on how to protect against any of the identified health risks.

(continued on p.3)

Germany Promotes Low-SAR Phones, Endorses Precautionary Approach

The German government is promoting low-radiation mobile phones. A phone with a specific absorption rate (SAR) of 0.6 W/Kg or less, averaged over 10 g, can now be labeled as an environmentally friendly product.

This new SAR guideline is the strictest in the world — more than three times tougher than the one recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP).

The introduction of a "Blue Angel" label (see illustration on p.8) is "a positive step for [the phone] industry and the consumer," the Federal Environment Ministry stated on June 14. The label is designed to help those who "have questions about possible health hazards from mobile phone radiation but do not want to do without such devices," the ministry explained.

The Federal Radiation Protection Office has also endorsed the new label. "Our goal is to minimize possible risks through precautionary policies," said Wolfram König, the head of the radiation office.

The new initiative will serve as an incentive for manufacturers to consider

(continued on p.8)

Conflicting EMF Breast Cancer Studies Resolved; Genetic Variability Is the Key, German Lab Reports

One of the most contentious — and nastiest — disputes over electromagnetic field (EMF) cancer risks may soon be resolved.

Members of Dr. Wolfgang Löscher's lab in Hannover, Germany, have shown that different substrains of the same strain of rats have very different responses to power-frequency EMFs.

In a presentation at the Bioelectromagnetics Society's (BEMS) annual meeting in Quebec City, Canada, on June 24, Dr. Maren Fedrowitz of the School of Veterinary Medicine in Hannover reported that two substrains of Sprague-Dawley rats had markedly different sensitivities to 50 Hz magnetic fields, as well as to DMBA, a known chemical carcinogen. One strain had significantly more DMBA-induced tumors than the other, which, for its part, had significantly enhanced growth of mammary tumors following EMF exposure.

Over the last decade, Löscher has conducted a large number of experiments showing that EMFs can promote the development of breast cancer in rats (see *MWN,* J/A93, J/F95 and S/O 99). But these findings have been challenged by some American scientists.

Dr. Gary Boorman of the National Institute of Environmental Health Sciences (NIEHS) in Research Triangle Park, NC, has been Löscher's leading critic. After Drs. Larry Anderson and James Morris of the Battelle labs in Richland, WA, were unable to repeat the German experiments, Boorman, who had arranged for their replication effort under the congressionally mandated research program known as EMF RAPID, made it clear that he had no confidence in Löscher's work (see *MWN,* M/A98).



DR. MAREN FEDROWITZ IS WORKING WITH PROF. WOLFGANG LÖSCHER

Relations between Löscher and the NIEHS deteriorated as the institute dismissed the German work in favor of Battelle's. Boorman and Dr. Jerry Williams of Johns Hopkins University in Baltimore publicly disparaged Löscher's studies as being fundamentally flawed. Löscher responded with accusations that Boorman was waging a dirty tricks campaign against him (see *MWN,* N/D98).

In its final report to the U.S. Congress, the NIEHS tried to put the issue to rest by concluding that there is "strong evidence" that EMFs do not promote breast cancer (see *MWN,* J/A99 and S/O99). This report was largely written by Dr. Christopher Portier. Portier was later promoted to associate director of the National Toxicology Program, which is administered by the NIEHS.

But, at the same time, Löscher and Anderson began working together to see if they could explain the divergent results. They later published a joint paper citing genetic variability as one of a number of possible hypotheses. "The data from the two labs suggest that the rats used in the Battelle study might be more sensitive to the carcinogenic effect of DMBA than the European rats, but possibly less sensitive to any influence of magnetic field exposure," they wrote in the September 2000 issue of *Environmental Health Perspectives* (see *MWN,* S/O00).

The new work "seems to go a long way to resolving the differences," Anderson said after Fedrowitz's presentation in Quebec. "It supports my and Wolfgang's suspicions about what was going on," he said in a later interview.

The lack of animal data to support the epidemiological evidence has cast doubt on the EMF–cancer link. "It would have been nice to have these results during the IARC deliberations," Anderson said, prompting Dr. Bernard Veyret of the University of Bordeaux to comment publicly, "This was a key element in the IARC decision."

Both Anderson and Veyret were members of the International Agency for Research on Cancer (IARC) panel that last summer unanimously concluded that EMFs are possible human carcinogens, largely based on epidemiological evidence (see *MWN,* J/A01). The panel might have classified EMFs as a "probable" or "known" human carcinogen with supporting animal data.



"This supports our suspicions"
— Dr. Larry Anderson

Löscher told *Microwave News* that he is now planning to repeat the DMBA breast cancer study using the same substrain of Sprague-Dawley rats used by Battelle.

More support for the significance of genetic makeup comes from a set of cellular experiments carried out by Dr. Anna Wobus's group at the Institute for Plant Genetics and Agricultural Research in Gatersleben, Germany.

Wobus's group found that 50 Hz fields caused changes in the expression of a number of different genes, Dr. Franz Adlkofer of the VERUM Foundation in Munich said at the BEMS meeting. "The genetic background may determine whether or not stem cells respond to ELF EMFs," he said. Wobus is part of the EC's REFLEX research group, which is coordinated by Adlkofer.

Adlkofer has previously reported that Wobus has found that RF/MW radiation at an SAR of 1.5 W/Kg could affect a number of different genes — but only in those cells that were p53 deficient (see *MWN,* N/D01). Wild type cells did not respond, however. He calls the p53 tumor suppressor gene "the guardian of the genome."

More generally, these two new sets of German findings may finally explain why so many biological experiments with electromagnetic radiation yield contradictory results. The inability of different labs to repeat studies has led many skeptics to dismiss the whole field of non-ionizing radiation health research. Some call them Cheshire cat effects, after the now-you-see-it-now-you-don't apparition in *Alice in Wonderland*.

Years ago, a multi-lab international effort called the Henhouse Project, sponsored by the U.S. Office of Naval Research, showed that pulsed magnetic fields could upset the development of eggs from some strains of chickens but not those from other strains (see *MWN,* M/A88).

Kaiser Miscarriage Study: A Chorus of Skeptics

Dr. De-Kun Li's critics are on the march. His epidemiological study linking miscarriage to EMF exposures above 16 mG has become the target of skeptical, even hostile, criticism.

Sir Richard Doll attacked Li's study in a March 25 posting on the Web site of the U.K.'s National Radiological Protection Board (NRPB). Li's findings do not provide "worthwhile evidence of an increased risk," wrote Doll, adding that they probably do not "even justify further investigation." Drs. David Coggon and Anthony Swerdlow, members of NRPB's Advisory Group on Non-Ionizing Radiation (AGNIR), which Doll chairs, and NRPB's Dr. Colin Muirhead also signed the commentary.

Li and colleagues at Kaiser Permanente in Oakland, CA, have reported that pregnant women exposed even briefly to magnetic fields over 16 mG face miscarriage risks up to six times greater than women with lower exposures (see *MWN,* M/J01 and J/F 02). In an accompanying commentary, Dr. David Savitz of the University of North Carolina, Chapel Hill, argued that Li's finding could be due to behavioral differences between women who are pregnant and women who are not.

Doll pointed to "severe limitations" in Li's study — specifically, possible selection bias and the absence of a dose-response trend — and cited Savitz's arguments with approval.

The U.K.'s Drs. Denis Henshaw and Mike O'Carroll immediately alerted Doll that Li had tested and refuted Savitz's hypothesis. Henshaw is a physics professor at the University of Bristol and Mike O'Carroll is an emeritus professor of applied mathematics who is now a leader of Revolt, a power line activist group.

Soon after, a more temperate version of the commentary appeared on the NRPB Web site — and this time, it was signed by Doll on behalf of the entire AGNIR. The group stated that the evidence for an increased risk was not "substantial" — rather than not "worthwhile" — and noted the response to Savitz from Li and Dr. Raymond Neutra of the California EMF project, which had sponsored the Kaiser study (see p.1).

In interviews with *Microwave News,* Li said that he felt the British commentary was "pretty hostile" and Neutra opined that, "Anything that is so controversial and contrary to people's assumptions triggers a critical response."

Though removed from the NRPB Web site, Doll's original comments have taken on a life of their own. Electric utilities in California circulated them and the BEMS newsletter published long excerpts in its March/April issue.

Even though Doll had toned down his comments, the NRPB continued to cast doubt on Li's results, echoing Savitz's original arguments. "Women who are more likely to have miscarriages... behave differently," NPRB spokesperson Dr. Michael Clark told BBC Radio's Alex Kirby on its *Costing the Earth* program aired on April 25.

On the same broadcast, Dr. John Swanson of the U.K.'s National Grid Co. was more cautious, however, arguing that Li's results deserve to be taken seriously and should be followed up. "As a responsible industry, we are prepared to test this result," he said.

In May, Savitz, Li and Neutra participated at an EPRI workshop. "My basic skepticism and uncertainty remain," Savitz told *Microwave News* after the workshop, which was described by Dr. Robert Kavet, EPRI's EMF manager, as an "internal business meeting" (see *MWN,* M/A02).

EPRI, which does research for the electric utility industry, states that it will "investigate whether sources of bias such as differential exposure misclassification and uncontrolled confounding have contributed to the associations" identified in the Kaiser miscarriage study. EPRI expects to have results ready for publication by the end of 2004, according to a project description posted on its Web site, <www.epri.com>.

In April, Neutra responded to Doll's criticisms in letters sent to the NRPB and to the editor of *Epidemiology,* where Li originally published his findings. The journal has declined to publish the response and the NRPB has not posted it on its Web site.

Neutra and Li sent a similar letter to the BEMS newsletter in May; Neutra displayed it on a poster board at the BEMS annual meeting. As of early August, the letter had not appeared in print.

California EMF Report *(continued from p.1)*

"At this stage, our role is to tell the PUC how certain we are that there is a problem and how serious we think the problem is," Neutra told *Microwave News*. "We are also laying out the pros and cons of different policy options, which the PUC can use if it holds regulatory hearings." Neutra said that PUC hearings have been requested.

DelPizzo sees no contradiction between the report's conclusions and its lack of policy advice. "People have a right to be warned," he said in an interview, "but whether a major effort to reduce EMFs is appropriate must still be decided."

Neutra, DelPizzo and Lee write that they see a greater probability of a health risk than do "the majority of the members of scientific committees convened to evaluate the scientific literature" by the U.S. NIEHS, the U.K. NRPB and IARC. Lab studies "might have failed to pick up a mechanism," the three researchers explain, and therefore they are unwilling to downplay the epidemiological evidence, which is central to their outlook.



DR. RAYMOND NEUTRA LEADS THE CALIFORNIA EMF PROGRAM

To those who argue that EMFs in the home or workplace are too weak to cause health effects, they respond that such arguments "depend on assumptions about biological systems that may or may not be sophisticated enough to reflect reality and rule out an effect."

For Alzheimer's disease, male and female breast cancer, adult leukemia, heart disease and suicide, they conclude that the evidence is weaker but that a link to EMFs cannot be ruled out.

A draft of the report, dated April 2001, was released for comment last summer, and elicited numerous reactions both favorable and critical (see *MWN,* J/A01 and J/F02). In May 2002, the

revised document won final approval from the program's 11-member Science Advisory Panel. Some panel members expressed reservations, however, arguing that the report's conclusions overstate the strength of the evidence pointing to health risks.

While the final version is very similar to last year's draft, the executive summary uses more general language to express the authors' degree of confidence. For example, the draft stated that:

> It is "*more than 50% possible*" that EMFs at home or at work could cause a very small increased lifetime risk...As this phrase implies, there is a chance that EMFs have no effect at all [emphasis in original].

The final version states:

> All three of the DHS scientists are inclined to believe that EMFs can cause some degree of increased risk...

It also lists the three authors' individual opinions on each type of health risk (see table below). The draft forced readers to guess who thinks what.

The final report is cautious about ways of reducing exposures, pointing to "uncertainty" over the "aspect of the 'EMF mixture,' if any," that should be mitigated (see box at right). It adds that individual decisions affecting exposures, such as choosing a home or jogging route, should balance the "uncertain" risks posed by EMFs against such "certain risks" as fire, flood or crime.

EMF mitigation measures are also discussed in the analysis of policy options accompanying the report. This appears to be generally unchanged from last year's draft. It concludes that "inexpensive" measures to reduce EMFs — such as restringing power lines and changing wiring in homes and schools — can be justified on a cost-benefit basis.

Lee has also left the California health department. She is now with AstraZeneca, a large pharmaceutical company.

The California program is the last major effort in the U.S. on the health effects of EMFs. No other research is under way or planned at this time. In July, the PUC advised Neutra that the program can continue up to another year until it has spent its remaining $100,000.

Putting Risks and Mitigation Strategies in Perspective

"There are ways to avoid...uncommon accumulated exposures by maintaining a distance from some appliances, changes in home wiring and plumbing and power lines. However, to put things in perspective, individual decisions about things like buying a house or choosing a jogging route should involve the consideration of certain risks, such as those from traffic, fire, flood and crime, as well as the uncertain comparable risks from EMFs."

"[E]pidemiological studies primarily implicate the magnetic fields or something closely correlated with them. Some researchers think that associated high- or low-frequency stray contact currents or charged air pollution particles are the true explanation rather than magnetic fields. The actions one would take to eliminate the field are not always the same as one would take to eliminate the currents or the charged particles....This additional uncertainty about what aspect of the mixture might need to be mitigated will thus provide a challenge for policymakers."

Excerpts from the Executive Summary of the California EMF Report

An Evaluation of the Possible Risks from Electric and Magnetic Fields (EMFs) from Power Lines, Internal Wiring, Electrical Occupations and Appliances will be placed on the EMF program's Web site, <www.dhs.cahwnet.gov/ehib/emf>, when it is released to the public.

California EMF Report's Conclusions

• To one degree or another, all three of the DHS scientists are inclined to believe that EMFs can cause some degree of increased risk of childhood leukemia, adult brain cancer, Lou Gehrig's disease [ALS] and miscarriage.

• They strongly believe that EMFs do *not* increase the risk of birth defects or low birth weight.

• They strongly believe that EMFs are *not* universal carcinogens, since there are a number of cancer types that are not associated with EMF exposure.

• To one degree or another they are inclined to believe that EMFs do *not* cause an increased risk of breast cancer, heart disease, Alzheimer's disease, depression or symptoms attributed by some to a sensitivity to EMFs.

However,

• All three scientists had judgments that were "close to the dividing line between believing and not believing" that EMFs cause some degree of increased risk of suicide,

Or

• For adult leukemia, two of the scientists are "close to the dividing line between believing and not believing" and one was "prone to believe" that EMFs cause some degree of increased risk.

The table below presents the individual estimates of the three EMF program scientists' "degree of certainty" (1-100) that EMFs increase the risk of each outcome. Several are lower than the estimates given in the draft report (see MWN, *J/A01).*

	childhood leukemia	adult leukemia	childhood brain cancer	adult brain cancer	female breast cancer	male breast cancer	miscarriage	ALS	Alzheimer's disease
Raymond Neutra	54	52	11	51	11	39	51	52	20
Vincent DelPizzo	95	85	45	80	49	45	56	55	40
Geraldine Lee	65	40	20	60	15	20	59	55	15

Federal Judge in Newman Brain Tumor Suit Will Decide if Phones Must Be Sold with Headsets, May Also Hear Other Cancer Cases

Catherine Blake, the federal judge presiding over the *Newman* mobile phone–brain cancer lawsuit, will also decide the class-action cases that would force phone manufacturers to provide consumers with hands-free kits.

Industry lawyers are now asking that other brain cancer lawsuits filed around the country be moved to her Baltimore courtroom — which would put Blake in charge of essentially all U.S. litigation on mobile phones and health.

Blake will decide by "the end of the summer" whether to allow Dr. Christopher Newman's case to be heard by a jury, a clerk working for Blake told *Microwave News* in early August. In February, Blake held a weeklong *Daubert* hearing on the scientific evidence linking mobile phone radiation to brain cancer (see p.7 and *MWN,* M/A02).

The headset suits were transferred to Blake last October 31 by the Judicial Panel on Multidistrict Litigation in Washington, which assigns cases in the federal court system. Motorola and the other defendants had requested that they be moved to federal court. On June 21, 2002, Blake denied motions filed by lawyers at the Peter Angelos firm in Baltimore, among others, to return the suits to the five state courts in which they were originally filed (see *MWN,* N/D00 and M/J01).

Demanding that manufacturers supply headsets with mobile phones is "a disguised attack on federal law in an area of national importance," Blake writes, referring to the Telecommunications Act of 1996, which gives the Federal Communications Commission (FCC) sole authority to set exposure limits for wireless technology (see *MWN,* M/A96). Therefore, she ruled, a federal court should have jurisdiction.

If lawsuits to require headsets were successful in some states but not in others, Blake noted, the result would be a patchwork of state and local RF/MW safety requirements, contrary to the 1996 law.

While Blake only ruled on a procedural question, her decision offers hints on how she might decide the substantive issues in the headset cases.

For instance, Blake contends that any court deciding these cases "necessarily must evaluate" whether the FCC rules "adequately protect the public's health." On this point, Blake emphasizes that a federal appeals court upheld the FCC's RF/MW guidelines two years ago after they were challenged by a coalition of activists (see *MWN,* M/A00). The similarities between that case and the headset lawsuits "cannot be ignored," she writes.

Reviewing the appeals court's decision, Blake endorses its finding that the FCC rules embody "carefully considered judgments" on the appropriate balance between health protection and the development of wireless technology.

Indeed, Blake argues that the plaintiffs chose to bring their lawsuits in state court because they recognized "the unlikelihood of success in federal court."

Blake also writes that the FCC had "considered and rejected a headset requirement." She refers to a statement on the joint FCC and Food and Drug Administration consumer information Web site: "Since there are no known risks" from mobile phone radiation, "there is no reason to believe that hands-free kits reduce risks" (see *MWN,* M/J02). The defense pointed this language out to Blake in a May 6 letter.

The multidistrict litigation panel will also decide whether to transfer to Blake the other personal injury lawsuits alleging that phone radiation causes brain cancer. In a July 3 filing with the panel, defense lawyers argued that the cases belong in Blake's court because they also turn on health issues.

In late July, the panel issued a conditional order to transfer the cases. The plaintiffs' lawyers can challenge this order, and several of them have told *Microwave News* that they will do so (see box below). The panel could hold a hearing on the matter at its next meeting, which is scheduled for September.

Jeffrey Morganroth of Morganroth & Morganroth in Detroit, who represents plaintiffs in six separate brain tumor lawsuits now before Judge Thomas Penfield Jackson of the federal district court in Washington, says that the defendants broke an agreement not to file any further motions until Jackson has decided whether to return these lawsuits to the District of Columbia court where they were originally filed (see *MWN,* N/D01 and M/A02). Defense attorneys counter that their request is not covered by the agreement, which Jackson had sanctioned.

Brain Tumor Lawsuits: New and Renewed

On May 30, lawyers for Brian Barrett revived his lawsuit against Nokia, BellSouth Mobility and the CTIA, which charges that his brain tumor was caused by mobile phone radiation. Barrett first sued early last year, but his attorneys at Weinstock & Scavo in Atlanta withdrew the suit "without prejudice" last December (see *MWN,* J/F01 and N/D01).

"We believe that recent developments in the science strengthen our case," explained Richard Capriola of Weinstock & Scavo. He pointed to Dr. Lennart Hardell's testimony in the *Newman* case and the fact that Hardell's epidemiological study linking phone use to brain cancer has been accepted for publication (see p.7 and *MWN,* M/A02 and M/J02).

Two weeks later, on June 14, Andrew Horn filed a complaint against Motorola, Verizon and others in Texas state court in San Antonio. Horn, a 24-year-old Houston resident, contends that his brain cancer is due to his use of his Motorola phone. He is represented by Patrick Haines of the Lanier law firm in Houston.

At the defendants' request, both cases have been moved to U.S. federal court. They might end up being heard by Judge Catherine Blake in Baltimore (see story above). Both Capriola and Haines told *Microwave News* that they will seek to return them to state courts.

«Eye on Europe»

Germany's research effort on mobile phone EMFs is getting under way. The **Federal Radiation Protection Office** (known as BfS) is "in the process of awarding grants," Dr. **Anne Dehos** of BfS' Institute for Radiation Hygiene told *Microwave News*. But she declined to say which proposals were selected until all the contracts have been finalized. Last summer, the government announced the four-year, €8.5 million ($8.5 million) effort (see *MWN,* J/A01, see also J/F02). Among those who have been funded is Dr. **Alexander Lerchl**, a professor of biology at the International University Bremen. Lerchl has received three grants, with a total budget of approximately €800,000. In two different experiments, leukemia-prone mice will receive lifetime exposures to 900 MHz GSM (0.4 W/Kg) or 50 Hz magnetic fields (10 mG, 1G, 10 G). The animals will be exposed 24 hours a day. In his third study, Lerchl will investigate the effects of 900 MHz signals on isolated hamster pineal glands.

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The **French** government report, *Mobile Telephones, Base Stations and Health: Current State of Knowledge and Recommendations,* is now available in English. Written by a panel chaired by Dr. Denis Zmirou (it is known as the **Zmirou Report**) and released last year, the 250-page report was translated by **MCL** in London for the **GSM Association**. Zmirou's committee recommended a precautionary approach to the use of mobile phones and asked manufacturers to reduce exposures "to the lowest possible level compatible with service quality" (see *MWN,* J/F01). It is available free on MCL's Web site, <www.mcluk.org>.

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BUWAL, the **Swiss** environment agency, has settled on a compromise, if somewhat complex, plan on how to apply its exposure limits to closely spaced base station antennas. The new scheme is more lenient than the one used in **Zurich**, but stricter than the approach favored by the wireless industry. Zurich has been treating telecom antennas within 100 meters of each other as a single source when applying the national precautionary limits of 4 V/m at 900 MHz (6 V/m at 1800 MHz). (In the past, we have incorrectly stated that BUWAL had issued a similar proposal, when it had only stated that antennas "in close proximity" — not within 100 m — should be treated as a single source; see *MWN,* S/O01 and M/A02.) BUWAL's new administrative guidelines, issued on June 28, advise local officials to treat antennas located on the same rooftop as a single source. In all other situations, both an antenna's distance from neighboring antennas *and* the transmitter power of nearby antennas should be taken into account. For example, for low-power antennas such as those commonly used in urban areas, antennas as close as a few meters from each other would be considered as separate sources, provided they are on different buildings. **SICTA**, the Swiss wireless industry lobby, had asked that antennas be considered as separate sources as long as they do not belong to the same network. "From now on," SICTA contends, "antennas in urban areas can only be operated at low power levels," requiring more antennas and imposing "high additional costs." Nevertheless, the trade group has accepted the rules because they will bring legal certainty and because BUWAL, at the same time, abandoned a proposal to include additional safety factors to compensate for measurement uncertainties. Zurich and other local governments are not bound by the new advice, but BUWAL warned that more or less stringent rules might be challenged in court as unreasonable. The guidelines are available, in German only, at <www.buwal.ch>; they will soon be translated into French and Italian.

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COST 281, the European group that encourages scientific cooperation on research on the potential health effects of mobile

Four Swedish Professors Assert Phones Are Safe

Once again, professors at the Karolinska Institute have written to a leading Swedish newspaper to try to convince the public that mobile phones are safe.

MOBILE PHONES ARE NOT DANGEROUS ran the headline in the July 18 *Dagens Nyheter* (*Today's News*). Phone radiation does not entail any cancer or genetic risks, wrote three researchers from the Karolinska and a fourth from Stockholm University.*

One of the four, Dr. Magnus Ingelman-Sundberg, also signed a letter last year that attacked Swedish scientists for making public statements about health risks associated with mobile phones (see *MWN,* S/O01). He is vice chair of the Karolinska's Institute of Environmental Medicine, where Drs. Anders Ahlbom and Maria Feychting are leading the Swedish component of IARC's mobile phone cancer study (see p.7 and *MWN,* J/F98 and M/A00).

The four researchers advised that occasional alarming reports about mobile phone cancer risks should be ignored.

On August 7, *Dagens Nyheter* ran a response from Jan Åberg, who lives in Trollhåttan and teaches classes on electrical safety. "We may be facing an environmental catastrophe, if we do not apply the precautionary principle" he wrote. Åberg also wonders how the four professors can be so certain that they are right given that they don't do research in the field.

* Drs. Björn Cedervall, Magnus Ingelman-Sundberg and Hans Wiksell, all of the Karolinska Institute in Stockholm, and Dr. Robert Nilsson of Stockholm University. Cedervall is associate professor of medical radiation physics in the department of oncology and pathology. Ingelman-Sundberg is professor of molecular toxicology at the Institute of Environmental Medicine. Wiksell is adjunct professor on the clinical applications of electromagnetic energy in the department of urology. Dr. Robert Nilsson is with the department of genetic and cellular toxicology at Stockholm University.

phones, will hold its next meeting at the Royal Society in **London**, November 12-13. It will host a seminar on ***Subtle Temperature Effects of RF EMFs***. Details are still being worked out; for more information contact Gerd Friedrich of the FGF, the German mobile phone industry group, at <info@fgf.de>.

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Germany has launched its own Internet database on **telecom antennas**, but access will be limited to authorized government officials. In contrast, similar sites in Switzerland and the U.K. are open to all (see *MWN,* M/J02). Only officials involved in planning, zoning or health care can use the German Web site. They can obtain a lot of detailed information, including locations, frequencies, output powers and antenna patterns. Even for these officials, however, access is limited to the specific areas for which they are responsible. The Regulatory Agency for Telecommunications and Post in Bonn maintains a database covering 51,000 sites, including those for mobile phones, radio and TV. Military and intelligence facilities are excluded. While the public cannot use the site, officials are allowed, at their discretion, to pass information along to others. In announcing the launch of the database on June 20, Matthias Kurth, the agency head, called it "a further step toward making the sometimes controversial discussion of antenna siting more substantive." More information is available, in German, at <www.regtp.de>.

NCRP Revives Committee on RF/MW Health Effects

The National Council on Radiation Protection and Measurements (NCRP) is reviving its committee on the biological effects of radiofrequency and microwave (RF/MW) radiation. The NCRP's board of directors disbanded the panel last year because its work was proceeding too slowly (see *MWN,* S/O01).

"I have been asked to chair a reconstituted committee," Dr. James Lin told *Microwave News*. Lin, of the University of Illinois in Chicago, was the original chair of the committee, which was first set up seven years ago to review the health effects literature and to recommend exposure guidelines (see *MWN,* S/O95).

"The board asked Jim to tell us what has been done and what needs to be done," said Ron Petersen, NCRP's vice president for non-ionizing radiation and a member of its board of directors. Petersen is a consultant based in Bedminster, NJ.

Lin said that he will recommend a slate of candidates for membership. The list will be presented to the NCRP's board of directors at its next meeting, which will be held September 11-12 at the council's offices in Bethesda, MD. Lin declined to reveal who he would like to invite to serve on his committee.

"The goal is to make a unique contribution," said Dr. Tom Tenforde, the newly installed president of the NCRP. The board suggested a number of important areas for the committee to focus on, he added, including a "critical analysis of other existing guidelines" and ways to communicate its findings to the public.

"We have some ideas on possible funding sources," Tenforde said.

« Wireless Notes »

Drs. **Lennart Hardell** and **Kjell Hansson Mild**'s paper on the incidence of brain tumors among users of cell phones is now scheduled for publication in the August issue of the ***European Journal of Cancer Prevention,*** Mild told *Microwave News*. The paper, which is at the heart of the Newman brain tumor lawsuit, had originally been expected to appear in the journal's June issue (see *MWN,* M/A02).

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ICNIRP's committee on **epidemiology**, chaired by Dr. **Anders Ahlbom** of the Karolinska Institute in Stockholm, has started working on a new review of the epidemiological literature on RF/MW health effects. "We are planning to focus on methodology," Ahlbom told *Microwave News,* explaining that this should help the interpretation of upcoming and future studies. He plans to complete the review by next summer. Dr. **Leeka Kheifets** of the WHO's EMF project and Dr. **Patricia Buffler** of the University of California, Berkeley, joined the committee in March.

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IEEE's Committee on Man and Radiation, known as **COMAR**, also is questioning the efficacy of devices that claim to protect users of mobile phones. "Independent tests on a number of such devices show them to be ineffective," according to a COMAR statement published in the May/June issue of the *IEEE Engineering in Medicine and Biology Magazine*. COMAR endorses the use of hands-free kits to move handsets away from the body for those who wish to reduce their exposures "for whatever reason." In addition, it advises that digital phones usually entail lower exposures than older analog models because the digital sets use less power. Earlier this year, the Federal Trade Commission took legal action against a number of companies that market **phone shields** for making false claims (see *MWN,* M/A02). The primary authors of the COMAR statement are Dr. **C.K. Chou** of Motorola, Dr. **Ken Foster** of the University of Pennsylvania and Prof. **Pere Riu** of the Technical University of Catalonia in Barcelona. The statement is also available on the Internet at <www.seas.upenn.edu/~kfoster/protective.htm>.

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Disney and **Motorola** are teaming up to tap the 6-to-12-year-old consumer electronics market. They will roll out the first products — a **two-way radio** and a 2.45 GHz **cordless phone** — in the fall, with others to follow next year. Motorola states that the walkie-talkies will have a range of up to two miles. And in late July, Disney announced that it is launching a service which will allow customers in Taiwan to download images of Mickey, Donald and Goofy onto their phone screens. In 2000, Disney pledged not to license its characters for use on cell phones "until there is reliable evidence establishing the absence of any [health] risk." Disney recently reaffirmed this commitment to *Microwave News* (see *MWN,* N/D00 and M/J02).

WHO's Brundtland Backs Repacholi's EMF Project

In recent months, Dr. Gro Harlem Brundtland, the director-general of the World Health Organization (WHO), has repeatedly spoken out in favor of a precautionary approach to the use of mobile phones, while the WHO's International EMF Project has demurred.

Brundtland is expressing "her personal views" and "she is not questioning the existing WHO position," Jon Liden, Brundtland's communications advisor, told *Microwave News*. Her remarks "do not constitute in any way a change in WHO's recommendations or position or amount to any conflict on this issue with the organization," he stated.

Drs. Michael Repacholi and Leeka Khefeits, who manage the EMF program in Geneva, have taken the position that more research is needed and that those who are concerned about possible radiation risks should limit their calls and use hands-free sets (see *MWN,* M/J02, also J/A00). But that is as far as they are willing to go. Repacholi argues against applying precautionary policies to mobile phones (Germany has just done so however; see p.1) and against limiting the use of phones by children.

At a July 1 press conference in Oslo held in connection with the conference of the International Union Against Cancer, Brundtland said: "I would be cautious about letting children use mobile phones for hours every day because we don't know enough about the damage." Her comments were picked up by newspapers and television networks all over the world.

She made similar remarks in an interview with the Norwegian press in March (*MWN,* M/A02). These were later picked up by Swedish but not by English language newspapers.

In July, when the story did spread further, the Mobile Manufacturers Forum (MMF), an industry trade group with close ties to the project, issued a statement endorsing the views of the project. "Brundtland's statements are her personal opinion and are certainly inconsistent with [the] official position of the WHO," the MMF stated.

With respect to power-frequency EMFs, the project last year shifted its opinion and endorsed a policy of prudent avoidance, while still rejecting the application of the precautionary principle (see *MWN,* S/O01).

Germany Promotes Low-SAR Phones *(continued from p.1)*

the precautionary principle when developing future generations of mobile phones, predicts Gerd Billen, who chairs the committee that oversees the ministry's label program. The panel has 13 members from government, industry and labor, consumer and environmental groups.

The environment ministry and the radiation protection office are urging manufacturers to apply for the label.

Phone makers, however, immediately dismissed the initiative as "inappropriate and nonsensical." BITKOM, a trade association whose members include Motorola, Nokia, Siemens and Sony Ericsson, stated that the initiative "lacks any scientific basis." The label implies that phone radiation is harmful and that there is a greater health risk from those phones that do not meet the new SAR requirement — but any mobile phone is safe if it meets ICNIRP's 2.0 W/Kg guideline, BITKOM stated.



"Environment label for low radiation"

Manufacturers have opposed labels for low-radiation phones since Jürgen Trittin, the German environment minister, first proposed them last year (see *MWN,* J/A01). Most phones sold in Europe include SAR information inside their packaging.

The Blue Angel Web site* states that the ICNIRP limit protects against established health hazards. But, it adds, in light of the precautionary principle, minimizing exposure is appropriate because of "indications of harmful health effects" at lower levels. According to the radiation protection office, 15% of the phone models marketed in Germany have SARs of 0.6 W/Kg or less.

The Blue Angel label is controlled by the environment ministry and is administered by the German Institute for Quality Assurance and Certification (known as RAL) in Saint Augustine, near Bonn. The oversight panel selects the product categories for which Blue Angel labels can be offered and approves the requirements for each category.

Labels may be displayed on scores of environmentally friendly products — for example, heaters that meet standards for energy efficiency and paper products with a high percentage of recycled fibers.

To be certified as environmentally friendly, phones must also meet requirements for recycling.

TCO'01 Mobile Phones, the certification standard launched last year by the Swedish white-collar union, TCO, specifies a maximum SAR of 0.8 W/Kg (see *MWN,* J/F01). TCO also requires that phones meet other criteria, including a standard for "telephone communication power." The German label requires only that a phone's performance be "adequate."

The federal radiation office's endorsement of this new SAR limit may portend major implications for the harmonization of radiation standards. The office has been closely associated with ICNIRP for many years. Dr. Jürgen Bernhardt, who retired in 2000 after a long career at the office's Institute for Radiation Hygiene, is a former chair of ICNIRP and is currently its vice chair. The office's Rüdiger Matthes is ICNIRP's scientific secretary, and Dr. Jutta Brix, a biologist there, is a consulting member of the commission.

*Go to <www.blauer-engel.de>. Portions of the site are in English.

IEEE RF/MW Exposure Limits: Revise or Stand Pat?

The Risk Assessment Working Group (RAWG) of the IEEE's International Committee on Electromagnetic Safety (ICES), better known as SCC-28, is still trying to reach consensus on how to revise its RF/MW radiation exposure standard (see MWN, *J/F02).*

The current standard, designated C95.1, has two sets of limits based on a maximum specific absorption rate (SAR) of 0.4 W/Kg for workers and 0.08 W/Kg for the general population. ICES applies these two tiers to what it calls "controlled" and "uncontrolled" environments, respectively.

These limits are based on the view that there is no "reliable evidence of hazardous effects" below a whole-body average SAR of 4 W/Kg. A safety factor of ten was then added for controlled environments, with an additional safety factor of five for uncontrolled exposures.

Reprinted below are excerpts from e-mails, obtained by Microwave News, *which have been exchanged within the RAWG.*

"I have no doubt that 0.4 W/Kg is entirely safe for everyone regardless of exposure duration, and that this value could well be chosen for a lower or only tier MPE."

— Dr. Marvin Ziskin
Temple University Medical School, Philadelphia

"I too believe that 0.4 W/Kg is safe for all, in all possible circumstances."

— Captain Greg Gorsuch,
Bureau of Medicine and Surgery, U.S. Navy, Washington

"There is a lot of talk about 4 W/Kg being a threshold for a nonhazardous effect, somehow tending to minimize the importance of the finding since we are presumably trying to set a standard to protect against adverse biological effects. Let me remind all of us that the 'threshold' discussed may be 'nonhazardous' in the context of the very short duration exposures used in determining it. But...most of the researchers who have developed these data agree that this threshold would turn into a really hazardous threshold *if* the exposure had been longer...So, sometimes, I sense that we are sort of talking like the 4 W/Kg figure is no big deal, but we know better."

— Richard Tell, Richard Tell Associates Inc.,
North Las Vegas, NV, and chair, RAWG

"Practically speaking, I think that you are going to be stuck with a two-tier approach with limits more or less similar to ICNIRP....If the level was 0.4 W/Kg for both public and occupational, the standard would instantly be dismissed in favor of ICNIRP. If the limit was 0.08 W/Kg for both occupational and public, people would applaud — but then you would soon be facing proposals for a new tier at 0.01 W/Kg for the general public."

— Dr. Kenneth Foster, University of Pennsylvania, Philadelphia

"I do not like the concept of stating a level (0.4, 0.08) and then trying to come up with a rationale for that number. This is crazy and logically backwards....If we cannot find a better rationale than the current one, which is weak, then let's not change the current standard. Don't grasp at straws. This is too important."

— Dr. Mays Swicord, Motorola, Plantation, FL

"Right now, the ICES approach to RF standards is not that different from the approach taken by ICNIRP....However, if ICES takes a significant departure from C95.1 and from ICNIRP, the struggle for international harmonization will be set back enormously....I believe that standards harmonization is good....My opinion is similar to that [of] Mays Swicord."

— Dr. Michael Murphy, U.S. Air Force
Research Lab, Brooks AFB, San Antonio

"We are obsessed by our own definition of 'science.' This standard is a lot more than science whether we like it or not. There have always been politics and sociology in the setting of MPE limits. Where do you think the lower public MPEs come from? Not quite the tooth fairy."

— James Hatfield, Hatfield & Dawson Consulting Engineers, Seattle

"When government does make a decision about risk for the public (e.g., pollution laws), I think they generally try to be more conservative than we in OSHA would be for healthy worker populations. That is why I still advocate at least two tiers if we want our standard to address all populations, including infants and the elderly."

— Robert Curtis, Occupational Safety and
Health Administration (OSHA), Salt Lake City

"A standard would be 'extremely conservative' if it protected to an extreme degree. In my judgment, a factor of 10...is not 'extreme.'"

— Dr. Asher Sheppard, Asher Sheppard Consulting, Redlands, CA

"I think the term 'extremely conservative' is actually a fair description for the 0.4 W/Kg whole-body-average SAR limit. I've come to this conclusion by comparing the 0.4 W/Kg heat load to other sources of heating that are routinely accepted by the community without any qualms, including for example: increasing the ambient air temperature by a few degrees; stepping out into the sunshine; hugging your children; and almost any form of physical exertion, including tapping out these words on my computer."

— Dr. Vitas Anderson, EME Australia Ltd., Melbourne

"I don't support the use of ALARA in RF standards. ALARA implies that lower levels are safer than higher, such as in the stochastic hazard of ionizing radiation [IR]. There is no analogy with RF, there are good reasons to believe that there are true thresholds with RF below which there is no effect at all even across a large population. Using ALARA in RF weakens its importance in IR. We have deliberately removed it from the Australian and NZ standards for that reason."

— Dr. David Black, Enviromedix IT Medicine,
Auckland, New Zealand

"C95 standards don't have to be perfect, but must be protective, enforceable and practical."

— Dr. Aviva Brecher, U.S. Department of
Transportation, Cambridge, MA

Abbreviations:

ALARA: as low as reasonably achievable

ICNIRP: International Commission on Non-Ionizing Radiation Protection

MPE: maximum permissible exposure

The Talk of BEMS: Divergent Mobile Phone Studies in the International Spotlight

It's not often that two papers presented at the BEMS annual meeting* command international media attention. But that's what happened this year with two studies that have very different implications for the safety of mobile phones.

CELL PHONES SAFE, U.S. STUDY FINDS was the headline in the June 26 *Globe and Mail*, a national Canadian newspaper. Two days later, the *Financial Times* warned ALARM BELLS RING FOR MOBILE PHONE MAKERS, echoing an item that had run a week earlier in the *Wall Street Journal,* as well as many other news outlets, both in the U.S. and Europe (see box, p.11, and p.13).

The *FT* and the *Journal* were referring to the work of Dr. Dariusz Leszczynski of the Finnish Radiation and Nuclear Safety Authority, known as STUK, in Helsinki. He has shown that mobile phone signals can change the way a large number of different genes are expressed. This may help resolve the ongoing controversies over microwave radiation links to cancer and leakage through the blood-brain barrier.

The *Globe and Mail* story was about a study carried out by Dr. Joseph Roti Roti in which rats were exposed for two years to two different types of mobile phone signals — analog and CDMA. He found that the rats showed no increase in spontaneous brain tumors or other types of cancer.

Iridium Signal: No Effect on Cancer Rates in Rats

A second, two-year animal exposure study, also reported at the BEMS meeting, showed that the 1.6 GHz radiation emitted by Motorola's Iridium phones did not increase brain cancer in rats.

"There is no evidence of increased tumors in the exposed animals," said Dr. Larry Anderson of the Battelle labs in Richland, WA. Indeed, he added, there is no suggestion of any toxic effect.

A group of 36 pregnant Fischer-344 rats was exposed in the far field for two hours a day, seven days a week at an SAR of 0.16 W/Kg. The exposures continued until the offspring were 23 days old. The Battelle team then selected three groups of 90 males and 90 females from the 720 offspring: These were exposed for two hours, five days a week in the near field over the next two years. The rats were placed in tubes in a carousel configuration, resulting in SARs in the brain of approximately 0.16 W/Kg and 1.6 W/Kg. The third group served as controls.

The Iridium satellite phone service went bankrupt in August 1999 after Motorola had invested more than $5 billion in the project. The Iridium system is still in limited operation; it is now being marketed to specialized users.

Anderson told *Microwave News* that he would soon submit his final report to Motorola and would then prepare a paper for publication. (See also p.2.)

Roti Roti, who is at Washington University in St. Louis, exposed rats to an average SAR of 1.25 W/Kg for four hours a day, except on weekends and holidays. "We tried to mimic a high level of exposure that humans might experience," he said.



"I have convinced myself that this is real"
— Dr. Dariusz Leszczynski

The fact that either of these two studies was headline news is a story in itself. STUK had not alerted the press and Leszczynski had already published his results weeks earlier in *Differentiation* (see *MWN,* M/J02). Indeed, Leszczynski had presented much of the data at last year's BEMS meeting (see *MWN,* J/A01).

Coverage of Leszczynski's work took off after a BBC reporter, on a hunt for the latest scoop on mobile phones and health, was directed to him.

There is no mystery about how the Roti Roti study got into the news. His media office issued a press release, as it turned out, on the same day that CNN ran a detailed story on Leszczynski's work. Roti Roti says that Motorola, which sponsored his study, did not ask him to send out a press release — nor did the company ask him to help counter the publicity generated by Leszczynski's findings. It came about, he explains, due to a series of serendipitous events.

In his press release, Roti Roti stated that, "As far as I can tell from the work so far, the greatest hazard with cell phones is driving a car while talking on one."



"I have no reason to believe that cell phones are not safe"
— Dr. Joseph Roti Roti

Leszczynski's work "should be followed up," Roti Roti told *Microwave News,* adding that he would be asking Motorola for the funds to do so himself. "It certainly raises an interest scientifically." Nevertheless, Roti Roti concluded, "I have no reason to believe that cell phones are not safe."

Leszczynski argues that his and Roti Roti's results are not necessarily contradictory. "I'm not saying mobile phone radiation can cause tumors; rather, that it might help damaged cells develop." But Leszczynski does question whether Roti Roti's rats were exposed to real-world conditions. They lived in a "very special protected environment," he said, pointing out that they did not encounter chemicals or other types of radiation.

Others at BEMS voiced similar concerns about the utility of

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* *24th Annual Meeting of the Bioelectromagnetics Society* (BEMS), June 23-27, 2002, Quebec City, Canada.

† *EMF Science Review Symposium: Breakout Group Reports for Clinical and* In Vivo *Laboratory Findings,* April 6-9, 1998, Phoenix, AZ, NIEHS Publication No.98-4400. It is available on the EMF RAPID Web site, <www.niehs.nih.gov/emfrapid>. (See also p.2.)

two-year bioassays, the type of brain cancer study Motorola commissioned from both Roti Roti and Battelle (see box on p.10). "Rats are not a particularly good model for brain cancer," said Dr. Gregory Lotz of the National Institute for Occupational Safety and Health in Cincinnati. He pointed to a report† from a symposium held under the EMF RAPID program, which concluded that the statistical power of animal studies may be limited by the rats' low incidence of spontaneous brain tumors.

Leszczynski's work has its critics too. For instance, it has been suggested that his exposure system may not adequately control the temperature of the exposed cells — that is, the effects he observes may be a thermal response rather than a result of the electromagnetic signal. To help resolve this possibility, Dr. Niels Kuster's group at IT'IS in Zurich built Leszczynski a new exposure system (see *MWN,* M/J02).

In Quebec City, Leszczynski told *Microwave News* that he had run the experiment three times with Kuster's new equipment and had gotten similar results. "It's reassuring," he said. "It's enough to give me some peace of mind that I'm going in the right direction."

"I have convinced myself that this is real," he added. "Mobile phone radiation triggers a stress response in the cell — it's nothing unusual."

At the BEMS meeting, Dr. Franz Adlkofer of the VERUM Foundation in Munich bemoaned the fact that nothing had yet been done to test the possible effects of 3G mobile phone technology. Adlkofer, who coordinates the REFLEX project in which Leszczynski participates, said that, "This is gross negligence" given the hundreds of billions of euros that have been spent on the launch of 3G.

BEMS Journal To Publish IEEE Literature Reviews

BEMS will publish the literature reviews generated by the IEEE's International Committee on Electromagnetic Safety (ICES), also known as SCC-28. They will appear in a supplement to *Bioelectromagnetics,* the society's journal.

The U.S. Air Force will pay for the cost of the supplement, approximately $15,000, according to Dr. Ben Greenebaum, the editor of *Bioelectromagnetics*.

"I am optimistic that the issue will appear in the first half of 2003," Greenebaum told *Microwave News*. "My feeling is that if the basic premises get out there in black and white, it will be a basis for public discussion."

Dr. Asher Sheppard, the immediate past president of BEMS, compared the move to ICNIRP's publishing the rationales for its standards in *Health Physics*. "The papers will be thoroughly reviewed. The society is not taking sides," said Sheppard, a consultant based in Redlands, CA, who is a member of the journal's editorial board.

More than a dozen "white papers" have been or are in the process of being drafted — most of them by Motorola and Air Force staffers. Copies can be downloaded from the subcommittee's Web site, <grouper.ieee.org/groups/scc28/sc4/main.html>.

Assessing the Leszczynski Study

"I don't think anyone can say whether there are or are not safety problems."

— Dr. Dariusz Leszczynski, Finnish Radiation and Nuclear Safety Authority, Helsinki, quoted by Gautam Naik, "Human Cells May Be Affected by Mobile Phone Radiation," *Wall Street Journal*, June 20, 2002

"If the blood-brain barrier is even temporarily affected by mobile phone radiation, it might have long-term health effects."

— Leszczynski, quoted by Duncan Graham-Rowe, "Phone Safety Debate Reignites," *New Scientist*, June 29, 2002

"At the moment, there is no scientific support for introducing any sort of limitation either on the use of mobile phones or setting new safety limits."

— Leszczynski, quoted in "Fresh Fears over Mobile Phones," *BBC News* (U.K.), June 19, 2002

"I advocate [a precautionary approach] even more strongly now than two years ago, because of the evidence that has been coming out since then....I don't care if it's nonthermal or thermal, what I'm worried about is whether there are effects."

— Sir William Stewart, chair, U.K. Independent Expert Group on Mobile Phones, *New Scientist*, June 29, 2002

"It's difficult for me to believe that nonthermal effects exist."

— Dr. Mays Swicord, Motorola, Plantation, FL, *New Scientist*, June 29, 2002

"This is good work, and another part of the jigsaw, but the Stewart group was well aware of the possibility of biological effects. You can't go straight from a biological effect to a health effect. It's a big leap."

— Dr. Michael Clark, NPRB, Chilton, U.K., in "Mobile Phone Radiation 'Harms Brain Barrier,'" *The Times* (U.K.), June 19, 2002

"If repeated in the intact body, it has horrific implications."

— Dr. Alan Preece, University of Bristol, U.K., quoted by J. Pickrell, "Cell Phone Buzz," *Science News*, June 29, 2002

"The implications here for health are zero."

— Dr. Michael Repacholi, World Health Organization, Geneva, *New Scientist*, June 29, 2002

"You cannot look at one study in isolation. You need to look at all studies in their totality."

— Jo-Anne Basile, CTIA, Washington, "Finnish Study Concludes Radiation Disrupts Cell Activity," *RCR Wireless News,* June 24, 2002

"Everyone has been working on this for years, but nothing has stood up."

— Dr. Garth Price, Telstra, Australia, quoted by Garry Barker, "Health Peril Played Down," *The Age* (Australia), June 21, 2002

FROM THE FIELD

Meeting Notes

• The health effects meeting in **Catania** in **Sicily**, originally scheduled for July, will now be held in September. Among those on the preliminary program are Drs. Carl Blackman, Martin Blank, Settimio Grimaldi, Lennart Hardell, Henry Lai, Wolfgang Löscher, Fiorenzo Marinelli, Kjell Hansson Mild, Paolo Perfetti, Elihu Richter, Stanislaw Szmigielski and Mikhail Zhadin, as well as members of the organizing committee — Drs. **Livio Giuliani**, **Michael Kundi** and **Wilhelm Mosgoeller**. The main goal of the meeting, which is being arranged by Italy's National Institute for Prevention and Work Safety, is to have "a critical discussion of the evidence in the different research fields and a discussion of the possibilities to include this evidence in a comprehensive risk assessment." The invitation notes criticisms of **ICNIRP** for its failure to include a variety of epidemiological and other health studies in its exposure guidelines.

• Even though the Electricity Supply Association of Australia's **(ESAA)** August 9 workshop is advertised as being about power-frequency EMFs, a preliminary program suggested that the results of the replication of the "Repacholi" mobile phone cancer study would be released (see *MWN*, M/J97 and S/O98). But this is not to be. The Australian government, which is funding the experiment, has barred Dr. **Tim Kuchel** of the Institute of Medical and Veterinary Science in Adelaide from discussing his findings prior to publication, the ESAA told us. Kuchel did not respond to a query as to when he will reveal the results, but sources told *Microwave News* that the paper has been submitted.

• The proceedings of the international symposium on ***Light, Endocrine Systems and Cancer: Facts and Research Perspectives,*** held last May 2-3 at the University of Cologne, have been published in *Neuroendocrinology Letters*. The journal is offering a discount price of $49.50, instead of the regular $64.00. Go to <www.nel.edu/Press/Light-Endocrine-Cancer.htm>. In addition to the papers presented at the meeting, there are also four evaluations — by Drs. **Charles Poole**, **Christopher Portier**, **Till Roenneberg** & **Robert Lucas** and **Vladimir Anisimov** & **Johnni Hansen**. Poole, an epidemiologist at the University of North Carolina, Chapel Hill, predicts that this research area will soon be transformed into one associated with "big-time, managed science" and that then, "Researchers on light at night and cancer will quickly find what they have been seeking: the darkness at the end of the tunnel." In his comments, NIEHS' Portier has only one footnote — to "I Got Rhythm," the Gershwin song from the 1930 Broadway show *Girl Crazy*. These evaluations, as well as the abstracts of the papers, can also be downloaded at no charge from the university's Web site, <www.uni-koeln.de/symposium 2002>.

New/Revised Listings

August 9: **Electricity Supply Association of Australia Scientific Workshop 2002: Standard Setting for Power-Frequency EMF,** Melbourne, Australia. Contact: Carmel Pannowitch, ESAA, PO Box 1823Q, Melbourne, VIC 3001, Australia, (61+39) 670-1014, Fax: (61+39) 670-1069, E-mail: <pannowitch@esaa.com.au>.

September 13-14: **EMF Scientific and Legal Issues: Theory and Evidence of EMF Biological and Health Effects,** Catania, Sicily, Italy. Contact: Dr. Livio Giuliani, E-mail: <l-giuliani@libero.it>, Dr. Michael Kundi, E-mail: <michael.kundi@univie.ac.at>, Dr. Wilhelm Mosgoeller, E-mail: <wilhelm.mosgoeller@univie.ac.at>; or Eva Marsalek, Tel./Fax: (43+02243) 87366, E-mail: <eva.marsalek@utanet.at>. Originally scheduled for July 5-6.

"MICROWAVE NEWS" FLASHBACK

Years 20 Ago

• The eighth unexplained cluster of adverse pregnancies among VDT operators is reported — at Surrey Memorial Hospital in Vancouver, Canada.

• In a letter to the *New England Journal of Medicine,* Dr. Samuel Milham publishes the first epidemiological link between leukemia and occupational exposure to EMFs.

• The ANSI RF/MW exposure standard is "pro-industry," says Dr. Nicholas Steneck of the University of Michigan in a paper presented at the annual meeting of the Bioelectromagnetics Society.

Years 10 Ago

• Dr. Keith Florig of Resources for the Future in Washington argues in *Science* that the U.S. could "justify" spending on the order of $10 billion a year on EMF mitigation and that the need for a federal research program is "particularly acute."

• ELF EMFs can block melatonin's ability to control the growth of breast cancer cells, Dr. Robert Liburdy reports at an international conference on EMFs in biology and medicine.

• In Disney's new film, *Honey, I Blew Up the Kid,* power line and RF/MW radiation stimulate the "kid" to grow and grow and grow.

Years 5 Ago

• The National Cancer Institute dismisses any association between childhood leukemia and living near power lines. An accompanying editorial advises against "wasting" any more money on EMF research.

• The NAS–NRC questions the validity of a Michigan Tech University report that ELF EMFs enhance tree growth. Later, committee members say they are not so sure about the basis of their criticism.

• Swiss Re warns that EMF litigation could threaten the entire insurance industry. Its electrosmog report notes that a shift in public attitudes on acceptable risks could cause juries to favor plaintiffs.

Across the Spectrum

"More studies that directly investigate the effects of mobile phone use in the human population are urgently needed....With an estimated 1.6 billion mobile phone users worldwide by the end of 2005, even a small association of mobile phone use with brain cancer could have massive implications, for mobile phone users and the industry alike."

— Editorial, "The Million Dollar Question,"
***Lancet Neurology,* p.201, August 2002**

"Certainly everyone is entitled to have their opinion, but what really matters is science. The independent, peer-reviewed science all indicates that there is no health risk."

— Marc Choma, director of communications, Canadian Wireless Telecommunications Association, Ottawa, referring to Dr. Gro Harlem Brundtland's concerns over mobile phone health risks, quoted by Heather Sokoloff, "WHO Chief Gives Warning Despite Lack of Proof of Health Risks," *National Post* (Canada), July 2, 2002 (see p.8)

Alice Stewart, who has died aged 95, achieved worldwide fame and changed medical practice through her tenacious investigations...Stewart showed a clear connection between leukemia before the age of 10 and the mother's exposure to x-rays during early pregnancy....But it was aggressively opposed by many physicists and radiobiologists, by the committees of the International Commission for Radiation Protection...

— Anthony Tucker, obituary for Dr. Alice Stewart,
***The Guardian* (U.K.), June 28, 2002**

"The cost will be huge and hard to imagine."

— Dr. C.K. Chou, Motorola, Plantation, FL, commenting on a Chinese proposal to adopt a 1 W/Kg SAR standard for mobile phones (see *MWN,* M/J02), quoted by Hou Mingjuan, "Phone Radiation Rule Under Fire," *China Online,* <www.chinaonline.com>, June 20, 2002; Mingjuan identifies Chou as a "science adviser" to the Mobile Manufacturers Forum (MMF), see <www.mmfai.org>

"So now there's kind of a passing of the baton."

— Jo-Anne Basile, vice president for external and industry relations, Cellular Telecommunications and Internet Association, Washington, commenting on the Leszczynski study and the "drying up" of RF/MW research in the U.S. as the effort has increased in Europe, interviewed by Steve Young, *Lou Dobbs Moneyline,* CNN, June 25, 2002 (see p.10)

Letters to the Editor

More Reasons Children May Be at Risk

June 25, 2002

To the Editor:

I read with great interest your report on the Rome meeting on the possible risks of mobile phones to children (*MWN,* M/J02). My institute at the University of Vienna and Physicians for a Healthy Environment (a nongovernmental organization) have produced an information booklet on *Mobile Phones and Children,* sponsored by the Austrian Green Party. It discourages the use of mobiles by children.

The arguments are similar to those that have been put forward by others. In addition, however, it relies on a fact that has not been previously stressed and, to my surprise, appears not to have been discussed in Rome. A child's skull is not only thinner and surely has different dielectric properties because it has more blood vessels — it also contains many more stem cells which can form blood cells.

Hence, if RF/MW radiation has an influence on the development of cancer, its effects will be greater in children for two reasons. First, the most vulnerable cells are only millimeters from the antenna. (To my knowledge, nobody has calculated the SAR within the bone marrow of the skull.) And second, the earlier in life a malign transformation occurs, the more likely it will result in a clinical malignancy.

Prof. Michael Kundi
Institute of Environmental Health, University of Vienna
Kinderspitalgasse 15, A-1095 Vienna, Austria
<michael.kundi@univie.ac.at>

Holding Firm Seven Years Later

June 14, 2002

To the Editor:

Dr. Robert Adair's ongoing dispute with Drs. Richard Albanese and Kurt Oughstun over the Air Force's PAVE PAWS radar [see *MWN,* M/A02 and M/J02] reminds me of another controversy over non-ionizing radiation.

In 1995, Adair and 13 other scientists including six Nobel laureates filed an amicus brief in the *Covalt* case. In *Covalt v. SDG&E,* the Covalt family sued the San Diego electric utility for lost property values and potential health effects due to elevated EMF levels from nearby power lines [see *MWN,* N/D95, also M/A95 and S/O96]. The brief swayed the court with false arguments that EMFs are not a risk factor for cancer.

Since then, several major changes have taken place. Most notably, in June 2001 the International Agency for Research on Cancer (IARC) unanimously voted to classify EMFs as a Category 2B carcinogen, that is, a possible human carcinogen. At about the same time, the California Department of Health Services (DHS) reached a similar conclusion in a draft report based on a five-year investigation of possible EMF health effects [see *MWN,* J/A01].

It is time for Adair and the others to retract this brief. Their ultimately incorrect scientific opinion about EMF health risks carried much weight before the California courts and in the court of public opinion. If Adair is indeed a good scientist, he will recognize that consensus has been reached, and that it differs from the view offered in the *Covalt* brief. If Adair will not revisit his opinion, I will never believe anything *he* says again.

Cindy Sage
Sage Associates
1396 Danielson Rd., Santa Barbara, CA 93108
<sage@silcom.com>

Dr. Robert Adair offered the following response:

June 19, 2002

To the Editor:

Ms. Sage vs. six Nobel laureates (two in medicine)? I judge it no-contest. And the conclusions expressed in their amicus curiae are not challenged by statements of "not impossible" by less eminent groups.

Robert Adair, PhD
Department of Physics, Yale University, New Haven, CT 06520
<adair@hepmail.physics.yale.edu>

Hot New Papers

Roger Santini et al., "Symptoms Experienced by Users of Digital Cellular Phones: A Study of a French Engineering School," ***Electromagnetic Biology and Medicine, 21,*** **pp.81-88, 2002.**

"A survey study, using a questionnaire, was conducted in 161 students and workers in a French engineering school on symptoms experienced during use of digital cellular phones. A significant increase in concentration difficulties ($p<0.05$) was reported by users of 1800 MHz (DCS) cellular phones compared to users of 900 MHz (GSM) cellular phones. In users of cellular phones, women significantly ($p<0.05$) complained more often of sleep disturbance than men. The use of both cellular phones and VDT significantly ($p<0.05$) increased concentration difficulties. Digital cellular phone users also significantly ($p<0.05$) more often complained of discomfort, warmth and pricking of the ear during phone conversations as a function of calling duration per day and number of calls per day."

Reprints: Dr. R. Santini, National Institute of Applied Sciences, Villeurbanne, France, E-mail: <**roger.santini@free.fr**>.

J. Van de Kamer and J. Lagendijk, "Computation of High-Resolution SAR Distributions in a Head Due to a Radiating Dipole Antenna Representing a Hand-Held Mobile Phone," ***Physics in Medicine and Biology, 47,*** **pp.1827-1835, May 21, 2002.**

"SAR distributions in a healthy female adult head as a result of a radiating vertical dipole antenna (frequency 915 MHz) representing a handheld mobile phone have been computed for three different resolutions: 2 mm, 1 mm and 0.4 mm....For an effectively transmitted power of 0.25 W, the maximum averaged SAR values in both cubic- and arbitrary-shaped volumes are, respectively, about 1.72 and 2.55 W/Kg for 1g and 0.98 and 1.73 W/Kg for 10 g of tissue. These numbers do not vary much (<8%) for the different resolutions, indicating that SAR computations at a resolution of 2 mm are sufficiently accurate to describe the large-scale distribution. However, considering the detailed SAR pattern in the head, large differences may occur if high-resolution computations are performed rather than low-resolution ones. These deviations are caused by both increased modeling accuracy and improved anatomical description in higher resolution simulations. For example, the SAR profile across a boundary between tissues with high dielectric contrast is much more accurately described at higher resolutions....Thus, for strongly inhomogeneous regions high-resolution SAR modeling is an absolute necessity."

Reprints: Dr. Jeroen Van de Kamer, University Medical Center Utrecht, The Netherlands, E-mail: <**jeroen@radth.med.uu.nl**>.

V.N. Binhi and A.V. Savin, "Molecular Gyroscopes and Biological Effects of Weak Extremely-Low-Frequency Magnetic Fields," ***Statistical, Nonlinear and Soft Matter Physics (Physical Review E), 65,*** **051912 (10 pp.), May 2002.**

"The molecular interfering gyroscope is a challenger for solving the *kT* problem as a probable mechanism of magnetobiological effects [MBEs]. ...The role of molecular gyroscopes could probably be played by short sections of polypeptides and nucleic acids built inside globular proteins or in cavities between associated globules. In this respect, it is interesting to look at the Watson-Crick pairs of nitrous bases (adenine-thymine and guanine-cytosine) that bind the DNA strands into a double helix as well as some other hydrogen-bound complexes of nitrous bases. ...Generally speaking, the fact that the molecular gyroscope model gives a physically consistent explanation of MBEs proves indirectly its real grounds. Further studies should verify whether this conclusion is correct. In any case, today, the interfering molecular gyroscope is a single available mechanism to give explanations that would be physically transparent and generally agreeable with experiments."

See also new books, *MWN,* M/J02, and <www.biomagneti.com>.
Reprints: Dr. V.N. Binhi, Russian Academy of Sciences, Moscow, E-mail: <**Binhi@biomagneti.com**>.

Vatican Radio Linked to Leukemia

Paola Michelozzi et al., "Adult and Childhood Leukemia near a High-Power Radio Station in Rome, Italy," ***American Journal of Epidemiology, 155,*** **pp.1096-1103, June 15, 2002.**

"Vatican Radio is a very powerful station located in a northern suburb of Rome, Italy. In the 10 km area around the station, with 49,656 residents (in 1991), leukemia mortality among adults (aged >14 years; 40 cases) in 1987-1998 and childhood leukemia incidence (eight cases) in 1987-1999 were evaluated. The risk of childhood leukemia was higher than expected for the distance up to 6 km from the radio station (standardized incidence rate=2.2, 95% confidence interval: 1.0, 4.1), and there was a significant decline in risk with increasing distance both for male mortality ($p=0.03$) and for childhood leukemia ($p=0.036$)....The results of the study show an excess within 2 km of the radio station and a decline in risk with distance from the site both for leukemia mortality among male adults and for leukemia incidence among children. However, the number of cases is small, and the excess mortality from leukemia was found only among men, whereas no significant increase was observed among women."

See *MWN,* M/A01, M/J01, S/O01 and M/J02.
Reprints: Dr. P. Michelozzi, Department of Epidemiology, Lazio, Italy, E-mail: <**salute@asplazio.it**>.

Allan Smith et al., "Arsenic Epidemiology and Drinking Water Standards," ***Science, 296,*** **pp.2145-2146, June 21, 2002.**

"In conclusion, when there is such direct human epidemiological evidence that a substance causes cancer, we should focus on margins of safety, avoiding extensive statistical manipulations of data and excessive debate about potential uncertainties. Prudent public health decisions should not wait until there is proof of serious cancer risks at low exposure."

Reprints: Dr. Allan Smith, University of California, Berkeley, School of Public Health, E-mail: <**ahsmith@uclink4.berkeley.edu**>.

Reba Goodman and Martin Blank, "Insights into Electromagnetic Interaction Mechanisms," ***Journal of Cellular Physiology, 192,*** **pp.16-22, July 2002.**

"Low-frequency (<300 Hz) EMFs induce biological changes that include effects ranging from increased enzyme reaction rates to increased transcript levels for specific genes. The induction of stress gene HSP70 expression by exposure to EMFs provides insight into how EMFs interact with cells and tissues....Biological studies with *in vitro* model systems have focused, in general, on the nature of the signal transduction pathways involved in response to EMFs. It is likely, however, that

EMFs also interact directly with electrons in DNA to stimulate biosynthesis. Identification of an EMF-sensitive DNA sequence in the HSP70 promoter, points to the application of EMFs in two biomedical applications: cytoprotection and gene therapy. EMF induction of the stress protein hsp70 may also provide a useful biomarker for establishing a science-based safety standard for the design of cell phones and their transmission towers....Our finding that weak EMFs can stimulate the synthesis of stress proteins indicates that cells view EMFs as potentially harmful, rather than benign. In that sense, cellular studies have provided important evidence to complement the epidemiological studies. The results of those cellular studies have also pointed to a molecular mechanism, thereby neutralizing a frequent argument in this controversy....The EMF-induced stress response offers a more reliable and realistic biological criterion for establishing cell phone safety standards than tissue heating."

See also: Goodman-Blank "hot paper," *MWN,* N/D99.
Reprints: Dr. Reba Goodman, Columbia University Health Sciences, New York, NY, E-mail: <**rmg5@columbia.edu**>. At press time, a pdf is available free from the journal's Web site: <www.interscience.wiley.com/jpages/0021-9541>.

Review of 18 Mobile Phone Cognitive and Sleep Studies

Denise Hamblin and Andrew Wood, "Effects of Mobile Phone Emissions on Human Brain Activity and Sleep Variables," ***International Journal of Radiation Biology, 78,*** **pp.659-669, August 1, 2002.**

"Direct comparison of the 18 studies of human brain responses to mobile phone emissions is difficult because of differing experimental protocols....Since most evidence is that RF energy at these levels does not lead to significant heating of tissue, many investigators have suggested more subtle alterations in calcium binding to membranes, permeability of the blood-brain barrier, nervous system information processing, neurotransmitters and learning processes. These effects have been suggested to originate from modified, and perhaps adapted, intercellular processes and communication due to EMFs interacting with the cell membrane surface of glycoproteins. On the other hand, some investigators believe that even a slight temperature increase in brain tissue may underlie a mechanism by which GSM-type signals may improve blood flow, hence exciting neural activity and synaptic transmission and affecting brain function. One area that may hold implications for the studies reviewed is combined exposure with other coexisting frequencies....As concomitant EMF exposures may hold implications for the results of studies under current review, it is of paramount importance that they are considered....It is difficult, if not impossible, to extrapolate to long-term effects of cumulative exposure. As many of the acute effects observed in the studies reviewed here appear transitory, restricted and reversible, the possibility of cumulative effects seems unlikely. Long-term studies are required to completely address the concerns of public health....The most consistent finding in this area has been the enhancement of alpha power as seen in EEG recordings and during cognitive tasks. These findings are confined to the experimental arrangements under which they were observed, but do demonstrate that mobile phone emissions could have an effect on human brain activity and sleep variables both during and after exposures at one extreme of normal phone use."

See also: C. Cook, A. Thomas and F. Prato, "Human Electrophysiological and Cognitive Effects of Exposure to ELF Magnetic and ELF Modulated RF and Microwave Fields: A Review of Recent Studies," *Bioelectromagnetics, 23,* pp.144-157, February 2002.
Reprints: Dr. A. Wood, Swinburne University of Technology, Melbourne, Australia, E-mail: <**awood@swin.edu.au**>.

Chung-Yi Li, Pei-Chun Chen, Fung-Chang Sung and Ruey-Shiung Lin, "Residential Exposure to Power-Frequency Magnetic Field and Sleep Disorders Among Women in an Urban Community of Northern Taiwan," ***Sleep, 25,*** **pp.422-426, June 15, 2002.**

"The [difficulty initiating sleep] prevalence was significantly associated with bedroom magnetic field exposure of ≥2 mG (odds ratio (OR): 1.20, 95% confidence interval (CI) =1.02-1.40). The [difficulty maintaining sleep] prevalence was significantly higher for women with background exposure of ≥2 mG (OR: 1.28, 95% CI=1.04-1.56)."

Reprints: Dr. Ruey Lin, National Taiwan University College of Public Health, Taipei, E-mail: <**linrs@episerv.cph.ntu.edu.tw**>.

Tongzhang Zheng et al., "Occupation and Risk of Non-Hodgkin's Lymphoma [NHL] and Chronic Lymphocytic Leukemia [CLL]," ***Journal of Occupational and Environmental Medicine, 44,*** **pp.469-474, May 2002.**

"We analyzed data from two population-based, case-control studies of NHL performed in Kansas and Nebraska. A total of 555 incident NHL cases, 56 CLL cases and 2,380 population-based controls were included in the analysis. Information on occupation and other confounding factors was collected through telephone interviews. Study pathologists reviewed slides of tumor tissues in all cases....A significantly increased risk of NHL was also observed among metalworking machinery and equipment workers, fabricators, assemblers, welders and solderers.... Our study also found an increased risk for male electrical and electronic equipment repairers who had worked at their job for 10 or more years (OR: 2.8, 95% CI=0.9-8.3) and also among women (OR: 5.6, 95% CI=0.9-34.7). An increased risk of NHL for all major histological types was also observed for telephone communication industry workers, with a significant association for small lymphocytic NHL and CLL. A potential association between exposure to electromagnetic fields and NHL risk has been proposed by several investigators, although the hypothesis continues to be widely debated..."

See also: Fabbro-Peray and Cano "Hot Papers," *MWN* J/A01 and S/O01, respectively.
Reprints: Dr. Tongzhang Zheng, Yale University School of Public Health, New Haven, CT, E-mail: <**tongzhang.zheng@yale.edu**>.

K. Vangelova, M. Israel and S.Mihaylov, "The Effect of Low-Level Radiofrequency Electromagnetic Radiation on the Excretion Rates of Stress Hormones in Operators During 24-Hour Shifts," ***Central European Journal of Public Health, 10,*** **pp.24-28, June 2002.**

"Twelve male operators at a satellite station for TV communications and space research were studied during 24-hour shifts....[O]ur data indicate considerable effect of 24-hour occupational exposure of RF EM radiation on stress hormones. The low-level exposure evoked pronounced stress reaction with changes in the circadian rhythm. The variability of catecholamines secretion increased under the RF exposure."

Reprints: Dr. Katia Vangelova, National Center of Hygiene, Medical Ecology and Nutrition, Sofia, Bulgaria, E-mail: <**KatiaVangelova@yahoo.com**>.

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The Cellular Telecommunications & Internet Association (CTIA) is soliciting proposals for research to be conducted under the Cooperative Research and Development Agreement (CRADA) with the U.S. Food and Drug Administration (FDA) for the second phase of research, specifically studies to improve exposure assessment that will both aid in the interpretation of existing studies and enhance the utility of any future epidemiological studies needed to assess the possible health effects of radio frequency energy (RF) from wireless phones.

A copy of the full Request for Proposal (RFP) is available on-line at www.wow-com.com/rfp or by calling the CTIA CRADA administrator at 202-785-0081.

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UPDATES

PAVE PAWS

NAS-NRC Measurement Advice... In a July 22 letter to the U.S. Air Force (USAF), Dr. Frank Barnes, chair of the National Academy of Sciences-National Research Council (NAS–NRC) panel that is charged with assessing potential health effects of RF radiation from the PAVE PAWS radar on Cape Cod, recommends the types of measurements to be carried out. For instance, Barnes wants to see "a comparison of waveforms from a radar utilizing a reflector antenna and waveforms similar to PAVE PAWS." Barnes is at the University of Colorado, Boulder. The letter is on the Web site of the National Academy Press, <www.nap.edu>. (For more on the PAVE PAWS controversy, see *MWN,* S/O00 and M/A02, and the items below.)

STANDARDS

Current Limits Questioned... Writing in *IEEE Spectrum,* a magazine that rarely runs criticisms of IEEE standards, Raymond Kasevich calls for RF/MW radiation exposure limits to be revised "using all of the available results and information—not just the data that fit previously held assumptions." He would like the work of Drs. Richard Albanese, Henry Lai and Dariusz Leszczynski to be taken into account (see item below and p.10). "The telecommunications industry, which is in deep denial, needs to face reality," he writes. Kasevich, chief scientist of CS Medical Technologies in Great Barrington, MA, offers his opinion in the magazine's August issue.

IEEE Says No to Brillouin Precursors... The subcommittee of ICES (SCC-28) revising the IEEE RF/MW exposure standard has moved not to include Brillouin precursors in its deliberations — thus dismissing the work of Drs. Richard Albanese and Kurt Oughstun, who have suggested that Brillouin precursors created by the PAVE PAWS radar could pose a health risk (see *MWN,* M/A02 and M/J02).The panel made the decision at a meeting on June 29 in Quebec City following the BEMS conference, in response to a motion from Raytheon's Arthur Varanelli, which was seconded by Dr. Eleanor Adair, who recently retired from the U.S. Air Force. The motion stated that there is no "evidence in the peer-reviewed scientific literature supporting Brillouin precursors as being biologically important at RF frequencies." Dr. John Osepchuk, formerly of Raytheon and past chair of SCC-28, said that the issue is "99% politics and 1% science."

PEOPLE

Professor **Shoogo Ueno** of the Biomedical Engineering Department at the University of Tokyo is the new president-elect of the Bioelectromagnetics Society (BEMS). He will take over from the current president, Dr. **Frank Prato** of the University of Western Ontario in London, Canada, at BEMS' next annual meeting, to be held in Maui, Hawaii, in June 2003. Ueno is also the chair of Japan's Committee to Promote Research on the Possible Biological Effects of EMF....Dr. **Ken Foster** has written a biographical paper about his mentor Dr. **Herman Schwan**, with special emphasis on his scientific work. Foster is in the bioengineering department at the University of Pennsylvania in Philadelphia, the department that Schwan was instrumental in establishing in

1973. "Herman P. Schwan: A Scientist and Pioneer in Biomedical Engineering" appears in the *Annual Review of Biomedical Engineering, 4,* pp.1-27, 2002. The article features a full-page picture of Schwan, but due to an editing error, he is identified as Foster....Dr. **Gunnhild Oftedal** has joined the faculty of technology at Sør-Trøndelag University College in Trondheim, Norway. Oftedal, who collaborated with Dr. **Kjell Hansson Mild** on the Scandinavian mobile phone–headache study (see *MWN,* M/J98), says that she plans to continue to work on EMF issues in cooperation with Prof. **Anders Johnsson** at the Norwegian University of Technology, also in Trondheim, where she used to work.

ANTENNAS & DIPLOMACY

Cyprus Shifts Stance... On July 3, Cyprus' foreign and environment ministers asked the British military not to proceed with plans for two new antennas to be used for intelligence-gathering at the U.K. military base there. They warned that the 320-foot towers — and a huge wire net connecting them — would "seriously harm the environment" on the Mediterranean island by damaging a marsh that is internationally recognized as a wildlife habitat. The British countered that its base is not in the protected area and rejected as "unrealistic" a Cyprus government proposal to relocate the towers, according to the July 3 *Cyprus Mail*. Previously, government officials had rebuffed public and parliamentary opposition to the project based on health concerns (see *MWN,* J/A01 and S/O01). Clashes between British military police and some of those protesting the towers have continued. The member of parliament who was arrested last year for scaling one of the existing towers, thereby sparking a riot, was arrested again. This time, he entered the construction site, climbed a bulldozer and refused to come down.

SOLAR POWER SATELLITES

Plants Growing in the Beam...NASA is once again investigating space solar power (SSP) — a plan to collect solar energy with satellites and beam it down to Earth with 2.45 GHz or 5.8 GHz microwaves (see *MWN,* S/O01). Dr. Jay Skiles of the NASA Ames Research Center near San Jose, CA, is investigating whether microwaves will interfere with plants growing near the 100 km^2 (39-square-mile) ground-based receiving antenna (known as a rectenna). The power density at the center of such a receiving array would reach 23 mW/cm^2, according to one estimate, dropping to 1 mW/cm^2 at the edge of the rectenna and 100 $\mu W/cm^2$ at the protective fence. In an experiment that ended in early June, Skiles exposed alfalfa plants to 2.45 GHz radiation at power densities of 0.1-4 mW/cm^2 and monitored the levels of chlorophyll, as well as of carbon dioxide and oxygen, in the air. Preliminary results will be reported later this summer, he told *Microwave News*. This was essentially a pilot study, Skiles said. "Now we are set to move ahead with plants growing in real-world conditions." He expects to begin these experiments at both 2.45 GHz and 5.8 GHz this summer....Earlier this year, NASA, the National Science Foundation and EPRI issued a request for proposals on "impacts of microwaves on living and nonliving systems," among other topics related to SSP (<www.nsf.gov/pubsys/ods/getpub.cfm?nsf02098>). The deadline for proposals was June 15.

Cell Towers

Wireless Convenience? or Environmental Hazard?

Edited by B. Blake Levitt with chapters contributed by:
Carl Blackman, EPA; Robert Cleveland, FCC; Albert Manville, F&WS; Henry Lai and Andrew Marino, among others



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MICROWAVE WEAPONS

Military Plans Unfolding... In recent weeks, David Fulghum of *Aviation Week* has been a font of information on high-power microwave (HPM) weapons — some of it a bit contradictory. On July 22, he quoted Mike Booen, head of Raytheon Electronic Systems' directed energy programs, predicting that HPMs would be operational within four to five years. But then in the August 5 issue, Fulghum reported that microwave weapons would probably be used in the much-talked-about war against Iraq. In between, on July 29, *Aviation Week* announced that the U.K.'s defense ministry has successfully tested a prototype HPM weapon and that Germany is considering developing one too.

ALTERNATIVE MARKETING

Magazine Plugs Shields... In its June issue, *Alternative Medicine* features an eight-page spread on EMF dangers which is followed by an "informal study" of devices "designed to neutralize" the "harmful effects" associated with EMF exposures. Tests of the Teslar watch and two pendants, the QLink and the BioElectric Shield, yielded "impressive" results: When wearing the devices, a volunteer had no change in heart rate during a mobile phone call, but without the gadgets her pulse sped up while using the phone, according to the tester, Larry Trivieri. "Who would have thought it," he concludes, "those darned things seem to work!" We should note that the articles are flanked by ads for the BioElectric Shield, the QLink and the Teslar watch. The BioElectric Shield received extensive free publicity in 1998 when several U.K. newspapers claimed that Cherie Blair, Prime Minister Tony Blair's wife, was wearing the device and that Hillary Clinton had recommended it to her (see *MWN,* S/O98).

Keeping Current: Follow-Up on the News

◆ The use of electric blankets did not lead to an increased risk of endometrial cancer, according to Jane McElroy and coworkers at the University of Wisconsin, Madison. Their paper is in the August 1 issue of the *American Journal of Epidemiology (156,* pp.262-267, 2002). Previously, she reported no electric blanket link to breast cancer (see *MWN,* N/D01).

◆ Germany's Federal Radiation Protection Office is dismissing a Japanese researcher's prediction that ICNIRP limits could be exceeded if many mobile phones are used in an enclosed space, such as a train car or elevator (see *MWN,* M/J02). Dr. Tsuyoshi Hondou's calculations are "based on unrealistic assumptions," the agency stated in July on its Web site, <www.bfs.de>.

◆ Dr. Nancy Wertheimer and Ed Leeper offer some ideas to explain the contradictory results obtained in two Canadian EMF studies on childhood leukemia. See: "Potential Motion-Related Bias in the Worn Dosimeter Measurements of Two Childhood Leukemia Studies," which appears in the July issue of *Bioelectromagnetics (23,* pp.390-397, 2002).

◆ In Lancashire and North Yorkshire, where police are testing the TETRA system before installing it throughout the U.K., officers are blaming the new digital radios for headache, nausea and other symptoms, according to a survey reported in the July 18 *Daily Telegraph*. The Police Federation, the employee group that did the survey, contends that its members are being used as "guinea pigs" (see *MWN,* S/O01 and N/D01).

◆ Radiation from nearby telecom transmitters was not responsible for a cancer cluster among children at an elementary school in Valladolid, Spain, according to an expert inquiry commissioned by the health council of Castile and León (see *MWN,* J/F 02). Nevertheless, the commission's report, released on May 23, recommends that the antennas be removed.

◆ Two Minneapolis suburbs have dropped their opposition to Xcel's planned upgrade of a power line from 115 kV to 230 kV. Sunfish Lake and Mendota Heights had cited health concerns in voting to block the project earlier this year, but they decided to settle with the utility after state courts ruled against them and Xcel threatened to sue (see *MWN,* M/A02 and M/J02). The Power Line Task Force is vowing to continue to fight the upgrade.

VIEWS ON THE NEWS

How To Do Science: Löscher Teaches Americans a Lesson

We should all thank Germany's Wolfgang Löscher for reminding us what science is really about: Testing ideas until you understand what is going on.

Ten years ago, Löscher and Meike Mevissen began publishing a series of papers that upset the prevailing paradigm by showing that relatively weak magnetic fields can promote breast cancer in laboratory animals.

This is important. Evidence of an EMF effect on animals is the missing link. With it, the epidemiological evidence pointing to a cancer risk would be much more credible.

NIEHS' Gary Boorman asked Battelle's Larry Anderson to repeat Löscher's work. His first two experiments went awry. A third attempt found no effect.

Boorman dismissed Löscher's work as flawed and went on to wage a campaign to discredit Löscher, even resorting to dirty tricks.

Instead of turning tail as so many others have done when confronted by an angry EMF establishment, Löscher went back to the lab and ran more experiments. He collaborated with Anderson and together they explored why their results disagreed.

Now, four years later, Löscher thinks he has the answer. As his postdoc Maren Fedrowitz explained at the June BEMS meeting: Animals with different genetic makeups respond differently to EMFs (see p.2).

EMF research is plagued with unreplicated results because there is never enough money, persistence and curiosity to resolve apparent contradictions. The significance of genetic variability emerged in the Henhouse Project 15 years ago, but it was ignored because it, too, challenged the orthodoxy.

Löscher has shown us that EMF enigmas can be explained — if one behaves like a scientist.

Dr. Li's Chorus of Critics

Last year when we first reported De-Kun Li's innovative study linking miscarriages to a new metric — maximum magnetic field exposure — we predicted that it would not soon be followed up (see *MWN,* M/J01). But we never dreamt that it would be attacked so fiercely.

Sir Richard Doll and his NRPB colleagues called the results essentially worthless and said that they do not warrant a second look (see p.3). The electric utility industry and BEMS wasted no time before circulating Doll's harsh opinion. At EPRI, Rob Kavet lip-synchs Li's critics when not prevaricating about his own activities.

Much too much protesting is going on, which suggests only one thing: Li is on to something after all.

Motorola's Junkyard Dog

It was an ugly scene. Motorola's Joe Morrissey came to the microphone after Dariusz Leszczynski's talk at the BEMS meeting and asked if he had read the epidemiological and animal studies showing that mobile phone radiation has no health effects. If so, he wondered, why was Leszczynski speculating about microwave-induced cancer risks and leakage through the blood-brain barrier (see p.10).

"Are *you* aware of these studies?" Morrissey demanded to know. There was a moment of stunned silence before Leszczynski responded that of course he was. "I should have answered, 'Yes, I can read,'" he later told us.

Motorola is the single most important force in bioelectromagnetics today. It is the largest sponsor of health research, both on its own and through the Mobile Manufacturers Forum, and it controls key positions on standard-setting committees and professional societies such as BEMS. Motorola has a big say about what papers are published, what standards are adopted and what meetings are held — it even decides what news is sent to BEMS members.

But as the Morrissey episode illustrates, there is more than science on Motorola's agenda. The company has never shied away from spinning research results. Remember how its PR people "war-gamed" the Lai-Singh results? (See *MWN,* J/F97.)

Too often, Motorola takes the position that experimental results from labs it sponsors are always right and that conflicting findings must be wrong. Henry Lai and N.P. Singh saw DNA breaks in rat brains following microwave exposure, but Joe Roti Roti did not. Motorola says you have to believe Roti Roti.

Whether discouraging China from adopting a tough new SAR standard or pushing for looser microwave exposure limits in the U.S. or arguing that putative nonthermal effects must be due to heating, Mays Swicord, C.K. Chou and Joe Elder want us to believe that their opinions are based on science and only on science.

It's a tough sell. Morrissey is their attack dog and his nasty performance at the BEMS meeting tells us a lot about Motorola's real agenda: to discredit any data that could hurt the market for mobile phones.

By the way, we wonder whether Morrissey is aware of Ross Adey's animal study showing that digital phone radiation can protect against cancer. He should be. Motorola sponsored it.

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MICRO WAVE NEWS

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With this issue, we begin a new column on medical applications in order to keep our readers up-to-date on developments on RF and microwave hyperthermia, bone healing, NMR imaging, microwave thermography and other topics.

ERMAC HEARS AGENCY UPDATES, OWN FUTURE IN DOUBT

The Electromagnetic Radiation Management Advisory Council (ERMAC) met July 15-16 under the new chairmanship of Donald Jansky, an associate administrator of the National Telecommunications and Information Administration (NTIA). Sixty people crowded into the Washington, DC meeting room for a review of the Environmental Protection Agency's (EPA) present and future programs and the US-USSR cooperation agreement.

News on an array of topics cropped up during the meeting, including:

- Funds for NTIA's side effects program, which includes ERMAC, have been deleted from the FY83 NTIA budget.
- EPA's forthcoming population exposure standard may be frequency independent. The criteria document for the standard will be submitted to the agency's Scientific Advisory Board in September.
- The NIOSH RF/MW criteria document will be seriously delayed if the Institute is moved to Atlanta and Cincinnati as proposed. (See related story below.)
- EPA's non-ionizing radiation programs in Las Vegas will move to Silver Spring, MD.
- The Soviet Union has raised its occupational exposure standard to 25 uW/cm² from 10 uW/cm².

(continued p. 2)

NIOSH RF/MW CRITERIA DOCUMENT IN TROUBLE AGAIN

The much delayed National Institute for Occupational Safety and Health (NIOSH) criteria document on radiofrequency and microwave (RF/MW) radiation is in trouble again. The new setback came as the Reagan administration proposed to move the institute out of the nation's capital to Atlanta and Cincinnati. A source within the criteria documents branch said, "Work has come to a virtual standstill as the staff tries to deal with the shock of the move." Many employees are known to be looking for other jobs, and none of the three staffers writing the documents has made a commitment to move with NIOSH. As of last May, the criteria document was scheduled for external review in December.

According to the administration's plan announced this June, most of NIOSH will move to Atlanta from Rockville, MD, and thus be in the firm control of its administrative parent, the Center for Disease Control (CDC). The approximately 50 members of the criteria documents branch would be transferred to Cincinnati. Dr. J. Donald Millar, director of CDC's Center for Environmental Health, has been selected to replace the past director, Dr. Tony Robbins, who was fired earlier this year.

The proposed move drew immediate criticism from a number of congressmen and labor leaders. Sheldon Samuels of the AFL-CIO's Industrial Union Department, a long-time follower of the progress on the RF/MW docu-

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- The World Health Organization criteria document on RF and microwave radiation health effects will soon be available.
- Soviet over-the-horizon radar is causing serious interference problems.
- An evaluation of prospective populations for future RF/MW epidemiologies will be released this September.

ERMAC Budget Cut

Confronted by the loss of program funds, Jansky pledged to "do whatever I can" to carry out ERMAC's responsibilities. He said he had appealed to restore the bioeffects research program in NTIA's FY83 budget, and will use discretionary funds, if necessary, to support the program. (Funding for FY82 will remain at the same level as this year's budget.) He cautioned, however, that the future was still too uncertain to allow guarantees. Underscoring his point, Jansky warned that the new administration will ask ERMAC "to justify its existence" and suggested the council do just that.

Lobbying efforts began almost immediately. ERMAC, responsible for tracking and evaluating work on the side effects and control of non-ionizing radiation, drafted a letter to the Secretary of Commerce stressing the importance of EPA's RF/MW public health standard and of the agency's research programs.

In a June 23 letter, Howard Johnson of RCA sent a related message to the secretary: ERMAC's work warrants greater support. ERMAC "has not been properly aided or utilized" since its move from the White House, Johnson wrote. He urged that the council be reconstituted with a new charter and that it receive a fair share of the FY82 budget.

EPA Program

EPA's Dr. Daniel Cahill, David Janes and their staffs from the Offices of Research and Development and of Radiation Programs briefed ERMAC on the agency's extra-and intramural projects during the first day and a half of the meeting. Cahill said that EPA's criteria document for an exposure standard will go to the Scientific Advisory Board for review this September. Later, on questioning, Janes announced that the federal guideline emerging from this document may be flat. Unlike the ANSI and NIOSH proposals, Janes explained that EPA is considering a single non-frequency dependent standard to simplify enforcement. Both officials noted that the budget cuts would not significantly hamper their programs (See *MWN* April 1981).

Completion of an EPA project identifying potential populations for future epidemiologies was reported by Doreen Hill. Hill, a graduate student working at EPA on a follow-up study of workers at the MIT Radiation Laboratory, said the evaluation will be out this September.

EPA's research activities drew general praise from ERMAC, except for repeated calls from Dr. Sam Koslov of the Johns Hopkins Applied Physics Lab for experiments at power densities closer to present environmental levels.

In administrative news, Janes has been made the permanent director of the surveillance and emergency preparedness division in EPA's Office of Radiation Programs, while Richard Tell remains the acting chief of the office's non-ionizing radiation surveillance branch. Plans are underway to bring Tell's operations east from Las Vegas sometime during the next fiscal year.

USSR Radar Interference

The update on the US-USSR Cooperation Agreement sparked a heated protest from Dr. Ross Adey. Adey, from the VA hospital in Loma Linda, CA, could not support the program as long as interference problems caused by Soviet over-the-horizon (OTH) radar continue. "I don't think anyone can be aware of what is going on in the microwave frequency spectrum from 6 to 30 MHz," Adey said, "and not know that the Russians deliberately, maliciously and willfully are destroying the ability of the western world to utilize that spectrum." He opposed all scientific exchange programs until this "grossly abusive misuse of the spectrum" stops.

(The US has its own plans for an OTH system. The Air Force has proposed Bangor, ME, for its defense radar. A July 1981 supplement to the project's 1975 Environmental Impact Statement details the effects of siting the system at Bangor International Airport and reviews the issue of biological effects of non-ionizing radiation.)

Dr. Clifford Mitchell, from the National Institute of Environmental Health Sciences, and several council members felt the benefits of exchange outweighed the shortcomings. Mitchell said Soviet scientific reporting has improved markedly since the program began and he supported renegotiation of the agreement, which expires May 1982. Jansky, acknowledging that the USSR has been "roundly criticized" for this radar interference, asked Adey for more information in writing but said the ERMAC was not the proper forum for his complaint.

USSR and WHO Standards

News of a rise in the Soviet occupational standard popped up on the heels of this exchange. Dr. Morris Shore of the Bureau of Radiological Health (BRH) said he learned of the shift to 25 uW/cm² from 10 uW/cm² during a workshop in Kiev earlier this year. No one else at the meeting had heard of the change, and Shore is still awaiting details on the standard from the Soviet Union.

Poland's Przemyslaw Czerski, presently visiting BRH, announced that the World Health Organization criteria document on non-ionizing radiation health effects will be available soon. The report (EHC No. 16, WHO 1981, Geneva) concludes that acceptable occupational exposures range between 0.1 and 1.0 mW/cm², depending on the exposure time.

A suggestion was made to reconvene ERMAC in this fiscal year, but several council members doubted that another meeting could be scheduled by late September and no date was set. The minutes of the meeting are now in draft form and will be out before long. Meanwhile, the minutes of the August 1980 meeting are still available.

* * * * *

ERMAC's statement on the risks to employees at the Moscow Embassy, not discussed at the meeting, is now out. See opposite page.

NIOSH

(continued from p. 1)
ment, said: "The degrading of the agency will slow down the possibility of a forthright report from NIOSH." But, he went on, "there is increasing resistance to the move and this is providing the impetus for an amendment to the Public Health Service Act, which would take NIOSH out of CDC."

Congressmen from at least three house subcommittees are examining the administration's plans for NIOSH. Representative Joseph Gaydos's (D-PA) health and safety subcommittee of the House Committee on Education and Labor held hearings on the proposal July 28. A number of witnesses argued that NIOSH should stay in Rockville because of the high costs of moving and of the importance of preserving the independence of the agency. Congressman Michael Barnes (D-MD), who urged Gaydos to call the hearings, made specific mention of the RF/MW document: "I myself know of one very important project that will likely go unfinished if NIOSH leaves this area. The long-awaited study of the impact of radiofrequency and microwave radiation will lose one and perhaps both of the scientists in charge of the project. Private industry and OSHA both want this study to appear. The study's suppression, whether intentional or unintentional, would be an unconscionable blow to thousands of American workers and consumers."

David Obey (D-WI) of the House Appropriation Committee's subcommittee on labor, health and human services and Toby Moffett (D-CT) of the House health and environment subcommittee of the Energy and Commerce Committee are also pursuing investigations.

While Congress is in summer recess, CDC is continuing with its reorganization of NIOSH. Whether any formal action will be taken to block the changes will not be known until Washington goes back to work after Labor Day. By then, a picture of who will be leaving NIOSH and of the resulting delay in the criteria document should emerge.

OSHA and ACGIH

Meanwhile, things have hardly been quiet at the Occupational Safety and Health Administration (OSHA). A move toward the development of a RF/MW standard was taken as officials were reported to be seriously considering setting up a standards committee—a step requested by labor representatives at last May's congressional hearings (see *MWN* June 1981). OSHA administrator Thorne Auchter, who has otherwise been busy withdrawing many occupational health standards,* is due to decide on the microwave issue soon.

Paralleling NIOSH's staff programs, the standard setting operation at OSHA has come to a virtual stop with the resignation of Dr. Bailus Walker and the firing of Dr. Peter Infante. Walker's departure leaves OSHA's health standards program without a permanent director. The upheaval caused by the dismissal of Infante over conflicting views on the carcinogenicity of formaldehyde has exacerbated the situation.

At its May meeting in Portland, OR, the American Congress of Governmental and Industrial Hygienists (ACGIH) approved a proposal for a new RF/MW standard. While similar to the NIOSH and ANSI proposals, the ACGIH standard, when formally accepted, would begin at 10 kHz—the first to apply to low frequency VDT radiation. A full text of the ACGIH standard will appear in *Microwave News* next month.

*See: R. Jeffrey Smith, "OSHA Shifts Direction on Health Standards," *Science, 212,* 1482, 26 June 1981.

MOSCOW EMBASSY

The National Telecommunications Information Administration (NTIA) has released its report for the State Department on the beaming of microwaves at the US embassy in Moscow with the final assessment of the biological risks to those exposed. As previously reported (see *MWN* January 1981), members of the Electromagnetic Radiation Management Advisory Council (ERMAC) anticipated no adverse consequences from the Moscow signal. The full text of the ERMAC statement is presented below.

The bulk of the report, *Microwave Radiation at the US Embassy in Moscow and Its Biological Implications: An Assessment* (NTIA-SP-81-12) is made up of the previously released State Department and Johns Hopkins University's Applied Physics Lab analyses of the exposure of embassy employees to microwaves.

FULL TEXT

ERMAC Assessment of the Potential for Biological Effects from Microwave Illumination of the U.S. Embassy in Moscow

The Electromagnetic Radiation Management Advisory Council (ERMAC) met on August 26, 1980, to assess the biological implications of the microwave environment within the U.S. Embassy in Moscow, based on a retrospective analysis of that environment. This assessment was undertaken in response to a recommendation in the 1978 "Foreign Service Health Status Study" by The Johns Hopkins University School of Hygiene and Public Health, which reads as follows:

> "There is a need for an authoritative biophysical analysis of the microwave field that has been illuminating the Moscow Embassy during the past 25 years with assessments based on theoretical considerations of the likelihood of any biological effects."

To implement this recommendation, the Department of State requested the assistance of the National Telecommunications and Information Administration (NTIA). The Johns Hopkins University Applied Physics Laboratory was requested to develop as complete a physical description of the U.S. Embassy microwave environment as possible using all available data. Models were developed describing the microwave power density distribution within the Embassy during the period January 1966 to February 1977. Based on these models, the Department of State estimated personnel exposure as a function of location in the Embassy. After reviewing this information, the ERMAC was asked to assess the likelihood of any biological effects from the microwave environment and estimated exposures described.

The Council agreed that the models presented tend to overstate rather than understate the probable microwave levels and that there is no indication of any significant variations from the models over time.

The Council discussed the current state of knowledge and on-going research on biological effects of microwave radiation. A considerable number of scientific investigations have been conducted and biological effects have been reported from exposures to power densities higher than those under assessment and to specific modulation frequencies not found in the Moscow signals. It was agreed that there is no scientific evidence, nor are there any theoretical grounds to suggest that biological effects would be expected to occur from the type and low levels of exposure as presented in the models.

Consequently, the ERMAC concluded that no deleterious biological effects to personnel would be anticipated from the microwave exposures at the U.S. Embassy in Moscow as described in this assessment.

GOVERNMENT UPDATE

NBS Measurement Report

The National Bureau of Standards has found that: "The need to develop and improve instrumentation, measurement standards, calibration services and standardized measurement techniques [for non-ionizing radiation] far outweighs the need to establish regional calibration laboratories."

This conclusion together with some 84 specific requirements to upgrade the capability to monitor levels of non-ionizing radiation are contained in *Requirements for an Effective National Non-Ionizing Radiation Measurement System* by NBS's Howard Clark with the cooperation of the Conference of Radiation Control Program Directors (Special Publication No. 613). The report grew out of a recommendation by the Senate Committee on Commerce, Science and Transportation (See *Report on Radiation Health and Safety,* December 1978).

About half of the 84 requirements were deemed to be high priority, but Clark found that those important tasks either were already being implemented or are now being developed.

Clark notes that the Conference of Radiation Control Program Directors believes that "the principal barriers to its own efforts in assuring non-ionizing radiation safety are the lack of (a) general population exposure standard which its members can enforce, (b) enabling legislation at the state level which would give them authority to act, (c) inexpensive, commercially available field-survey instruments, and (d) adequately trained people."

The report is available from the Government Printing Office for $2.75, stock no. 003-003-02335-3.

EMP News

The Defense Nuclear Agency's plans to deal with EMP radiation were reviewed in Lt. General Harry Griffith's testimony before a Senate defense appropriations subcommittee in early July.

Nuclear Regulatory Commission engineer Demetrios Basdekas believes that EMPs could cause a meltdown in nuclear reactors. His concerns are addressed in an Oak Ridge report, which concludes that a nuclear plant would shut down following EMP exposure. See Eric Lerner's "EMPs and Nuclear Power," *IEEE Spectrum,* June 1981; and *The Effects of Nuclear Electromagnetic Pulse on Nuclear Power Plants,* (ORNL-5029), available from the National Technical Information Service.

A number of technical papers on EMP were presented at the 18th annual conference on Nuclear and Space Radiation Effects, held at the University of Washington, Seattle, July 21–24.

William Broad's second and third articles on EMP, "Ensuring Delivery of the Doomsday Signal" and "Playing a Wild Card," appeared in the June 5 and 12 issues of *Science* respectively.

BRIEFS

The Federal Communications Commission (FCC) has proposed rules authorizing interim direct broadcast satellite (DBS) service in the 12 GHz band (46 *FR* 30124, June 5). If adopted, DBS priority will require frequency reassignment for terrestrial carriers currently operating in this band.... CBS, RCA and ten other companies have filed proposals for DBS service with the commission, which approved COMSAT's petition to enter the new field earlier this year....The Federal Aviation Administration (FAA) has recommended the threat-alert and collision avoidance system (TCAS) for US aircraft. FAA's J. Lynn Helms says the airborne system should be in operation by 1984....The Frequency Management Advisory Council (FMAC) met June 19 in Washington, DC, and continued work on its national long-range spectrum planning project. A joint FCC-NTIA contract will soon be negotiated to support this work. The next FMAC meeting is scheduled for September 11.

Litigation....Ronald Karras, a former radar repairman, has won a $200,000 mid-trial, out-of-court settlement of his suit against the General Electric Company and the Western Electric Company, according to a forthcoming article in the *National Law Journal* by Jill Jonnes. Karras, who worked on the Nike Hercules radar for 14 years, suffers from multiple injuries including deafness, bleeding eyes and systemic hemorrhaging. John Phillips, Karras's lawyer in Chicago, could not be reached for comment. The case number is CV-79-L-20237, Circuit Court, Cook County.

Around the Country....Electric field levels of up to 450 V/m but averaging 22–57 V/m at head height were recorded on the 102nd floor observatory of the Empire State Building in New York City. EPA's Richard Tell, who took the measurements in July 1980, found that field strengths increased with height. He guessed that reflective glass, installed elsewhere on the floor to reduce radiation levels, was not put in the transom window where the highest reading was found....The next meeting of the Scientific Advisory Panel for New York State's study on the health effects of power lines was scheduled for July 31 in Massena, NY. The panel hopes to finalize its selection of study research areas at the meeting....State Representative Joseph Lashinger, Jr., of Pennsylvania is preparing legislation to bring non-ionizing radiation under the authority of the state's Department of Environmental Resources (DER). Lashinger is also drafting action to require DER approval before utilities can begin new construction or operation of microwave devices....The zoning board hearing on COMSAT's proposed $50 million earth station in Cleveland Township, PA, is set for August 3. Among those scheduled to testify for COMSAT are Colonel Budd Appleton and Dr. Herbert Pollack....RCA Corp.'s plan to build a satellite communications earth station on Bainbridge Island, WA, has stirred community concern. RCA is now purchasing land for the station.

VDTs....Plastic cabinet VDTs at the Montreal *Gazette* will get metal shields and will be retested for radiation emissions. The Quebec Department of Environment will make the measurements. In department tests last January, high emission levels were recorded from several terminals at the paper.... The seven newspaper guild locals participating in the Mt. Sinai VDT study headed by Dr. Arthur Frank are listed in the June 12 *Guild Reporter.* Members will fill out questionnaires to de-

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termine if full medical examinations are warranted.... Action on a VDT safety bill requiring employers to inform workers about VDT-related hazards and the precautions to minimize them was indefinitely postponed by the Maine legislature this May. Representative Edith Beaulier, the bill's sponsor, said she will propose the bill again in the next session.... Next year the Illinois legislature will consider a VDT bill similar to Beaulier's.... The preliminary agenda and a list of participants are out for the *Symposium on the Impact of Video Viewing on Vision of Workers,* August 20–21 in Washington, DC. The NAS Committee on Vision is sponsoring the meeting. For information, contact Key Dismukes at the committee, (202) 389-6068.... An article by Eliot Marshall summarizing the May 12 congressional hearings on VDTs appeared in the June 5 *Science*.... The final NIOSH report on its Bay Area VDT study is now available. For a copy, send a self-addressed mailing label to: NIOSH, Publications Dissemination, DTS, 4676 Columbia Parkway, Cincinnati, OH 45226, Attn: VDT, DHHS Publication No. 81-129.... "Video Display Terminals, Are They Hazardous to Your Health?" an article by Eric Maloney, appears in the July *Microcomputing.*

Technology.... The market for cellular mobile radio equipment will reach into the billion-dollar range over the next decade, according to Frost & Sullivan of New York. In a 258-page report, the research firm anticipates significant market expansion in 1984 when the first commercial cellular systems are expected to be in operation. Carrier revenues are also expected to surge, reaching $42 million in 1984 from $3.5 million in 1981. "Cellular Systems and Alternatives for Mobile Radio Communications" is available from Frost & Sullivan, Inc., 106 Fulton Street, New York, NY 10038, (212) 233-1080, $900.... Lockheed will investigate the effects of very low frequency radio waves on the ionosphere. The June issue of *Microwaves* reports that scientists suspect VLF transmissions might lessen the mirror effect of the ionosphere and thereby disrupt long-range communications. The "simulated emission of energetic particles," or SEEP, experiment is being paid for by the Office of Naval Research.... Scientists from California Institute of Technology's Jet Propulsion Lab have reported on the first map of sea surface temperature in the June 19 *Science.* Measurements taken by Seasat scanning multichannel microwave radiometer (SMMR) in 1978 were used to produce the map.... Hughes Aircraft Co. is developing a special sensor, microwave imager (SSM/I) to monitor severe weather from space. *Aviation Week & Space Technology,* June 15, reports that the instrument detects a combination of reflected and emitted microwaves from a designated area. SSM/I is part of the Air Force defense meteorological satellite program.... NASA and Georgia Tech have built a prototype radar sensor for remote control of coal mining equipment. In the June issue, *Microwave Journal* reports that the device electronically measures the cutting machine's location in the shaft, enabling the operator to position and control the equipment far from the heavy coal dust produced at the shearing site.

Strasbourg Biomedical Symposium

The Symposium on Biomedical Thermology brought more than 250 participants from 20 countries to Strasbourg, France, June 30–July 4. In many ways, the meeting allowed French scientists to display their progress toward the diagnosis and treatment of cancer with electromagnetic energy.

Three years ago, the French government set up a special committee to encourage research on the medical applications of non-ionizing radiation, with special emphasis on hyperthermia, microwave imaging and bioeffects research. The panel was chaired by Dr. Michael Gautherie of the medical faculty at the University Louis Pasteur in Strasbourg, who also organized the symposium. With a budget of about five million francs, centers around the country bought equipment, recruited researchers and sponsored a host of projects.

Most of the French scientists reported preliminary results at Strasbourg, and it is still too early to predict how well the government's investment will pay off. Nevertheless, an array of techniques has been developed and many clinical studies are under way. Now, new money, some from commercial sponsors, will replace the public support, and this will no doubt select the most promising systems.

Among the presentations were news of RF and microwave hyperthermia units controlled by passive microwave thermography developed by a team from Lille, headed by Dr. Maurice Chive. The RF unit (13.56 MHz) is already being used in the treatment of 30 patients with neck and throat cancer, while the microwave unit (2450 MHz) will be operational soon. Professor Lucien Israel from Bobigny has been heating stomach, pancreatic and lung tumors with RF energy and has concluded that the length of the sessions is an important variable in determining optimal treatment regimes. He began with sessions of less than an hour, increasing them to three hours, while also increasing the number of sessions. Of the 55 deep, inoperable tumors, he scored 35 partial responses and two total regressions. Anticipating the widespread use of NMR imaging, Dr. A. Bellossi of the medical school in Rennes has started exposing female rats to constant magnetic fields of 6,000 gauss. His preliminary results indicate that the fields could enhance the induction of tumors by chemicals.

Reports from other countries included:

• Poland's Stanislaw Szmigielski presented experimental evidence for a biphasic reaction of the immune system to microwaves: stimulation of the system for up to a few days of exposure followed by suppression of cell-mediated immune reactions in animals exposed for several months. In an interview, he said that he would soon begin a new three-year study, funded by the US Bureau of Radiological Health, on the teratological and developmental effects of 2450 MHz on mice. He will also continue to study the co-carcinogenicity of microwaves with chemicals.

• Professor H. Frohlich of the University of Liverpool, England, speculated about a mechanism for frequency-dependent, low-intensity microwave bioeffects: "The energy of the microwave is then used simply as a trigger to initiate a pro-

(continued p. 8)

MEDICAL APPLICATIONS

NMR Imaging

Three studies on the diagnostic application of nuclear magnetic resonance have been recently published:

1) In what the *New England Journal of Medicine* called the "first clinical application of this powerful technique," a team from the University of Oxford reported an examination of McArdle's syndrome (a rare, inborn metabolic disease) with phosphorus-31 NMR. The non-invasive method can measure intercellular pH and phosphorus-containing metabolites of ATP. (See B.D. Ross *et al., NEJoM, 304,* 1338, and F.H. Epstein, *ibid, 304,* 1360, May 28, 1981.) The phosphorus NMR method is described in Jean L. Marx's "NMR Researchers Embark on New Enterprise," *Science, 213,* 425, July 24, 1981.

2) F.W. Smith and co-workers from Aberdeen, Scotland were able to differentiate malignant liver tumors from benign cystic lesions as well as derive useful data on cirrhosis and metastatic deposits using proton NMR. They concluded: "In demonstrating the presence of malignant tumors [NMR tomographic imaging] is as accurate as ultrasound and radionuclide liver scan and appears to be superior to them in the diagnosis of benign masses, obstructive jaundice, and inflammatory conditions such as cholecystitis." (See *Lancet,* p. 963, May 2, 1981.)

3) Two groups led by F.H. Doyle from Hammersmith Hospital, London and I.R. Young of Thorn-EMI Ltd. applied proton NMR to make images of the brain. Using an "inversion recovery technique," they were able to generate "unparalleled differentiation between gray and white matter in the brain." They went on to note that "in localization of lesions within the brain the white matter detail provided by the brain by NMR may allow a precision not possible with" X-ray computed tomography. The team concluded that "the technique will require clinical evaluation but appears to have considerable potential in the diagnosis of neurological disease." (See *Lancet,* p. 53, July 11, 1981.)

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Other new articles describing NMR imaging include: Jorge Llacer; "Nuclear Medical Imaging," *IEEE Spectrum,* July 1981; and Ellen R. Shell, "NMR: Beyond the X-Ray," *Technology Review,* July 1981.

Hyperthermia

Last March, Drs. Michael Douglas, Leon Parks and Jose Bebin of the University of Mississippi Medical Center reported three cases of acute myelopathy (disease of the spinal cord) in patients receiving hyperthermia cancer treatment within two months of spinal cord X-ray irradiation (*New England Journal of Medicine, 304,* 583, March 5, 1981).

Now, in a letter to the *Journal,* Drs. John Leith and Arvin Glicksman of Brown University write that, given the cellular processes at work, the potentiating effect of the two treatments was not surprising; they too favored caution when the two therapies are used in combination (*NEJoM, 304,* 1549, June 18, 1981).

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The July issue of *Microwaves* features a profile of Dr. Fred Sterzer, director of the Microwave Technology Center at RCA Labs in Princeton, NJ. The article describes the center's work with microwave hyperthermia and its joint cancer treatment program with Montefiore Hospital in Bronx, NY.

Controlling Paralyzed Muscle

A group led by P. Hunter Peckham at Case Western Reserve University in Cleveland has published a paper on a new implantable stimulator, controlled by RF power for exciting paralyzed muscle. (See *IEEE Transactions on Biomedical Engineering, BME-28,* 530, July 1981.)

New Journal

The IEEE will begin publishing a new quarterly journal, *IEEE Transactions on Medical Imaging,* early in 1982. For more information, contact: Dr. Glenn Knoll, Department of Nuclear Engineering, 119 Cooley Building, University of Michigan, Ann Arbor, MI 48109 (313) 764-4260.

* * * * *

EMBS Conference

Among the papers to be presented at the 3rd annual Engineering in Medicine and Biology Society Conference (see conference calendar on p. 8 for details) next September 19 are: "Microwave Radiometry Thermal Profiles of Breast and Drainage Lymph Node Areas," by J. Shaeffer *et al.* of Eastern Virginia Medical School; two papers on non-invasive blood flowmetry by groups from the Medical College of Wisconsin led by J.H. Battocletti (using NMR) and S. Salles-Cunha; "Endogenous Electricity in Bone," by S.R. Pollack, *et al.* from the University of Pennsylvania; "Electricity-Induced Bone Formation in Rats," by A.A. Marino *et al.* of Louisiana State University Medical Center; and "The Role of Pulsing Electromagnetic Fields in Orthopaedic Surgery," by J.S. Kort and A.L. Bassett of Columbia-Presbyterian Medical Center.

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For more news on medical applications, see the items on the L.H. Gray Conference and on the Biomedical Thermology Symposium on pp. 8 and 5.

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SOLAR POWER SATELLITES

Red Light for SPS

The National Academy of Sciences' panel on solar power satellites (SPS) offered a cool appraisal of the proposed DOE-NASA project to collect solar energy in space and beam it down to earth with microwaves. The principal conclusion of the National Research Council's Committee on Satellite Power Systems was:

"The concept of an SPS is presently faced with sufficiently serious difficulties—in technological readiness, cost, competing technologies for generating electricity, magnitude of the enterprise, and international concerns—that no funds should be committed during the next decade to pursue development of an SPS."

Among the areas "requiring vigorous research in order to clarify future decisions on SPS," the committee listed the biological effects of low-level microwave radiation. It went on to note that "public concerns about the potential effects of exposure to microwave radiation produced by an SPS will have to be resolved if an SPS is to be pursued," and concluded that: "There are also issues of political and social acceptability such as those related to the fear of possible hazards to health from exposure to microwaves." In addition, the allocation of orbital positions and microwave frequencies could require international cooperation.

With respect to non-ionizing radiation, the panel also found:

- The lifetime of existing klystron tubes for the conversion of energy to microwaves is "inadequate," and high-powered klystrons have not been tested in space.
- Although there are no demonstrated harmful effects of microwaves at power levels of 0.1–100 uW/cm², "no reliable theory exists on which to base an understanding of possible or alleged effects at these non-thermal power levels. Hence, while there is no evidence to suggest that such low power levels are not safe, neither is it possible now to prove that they are."
- Microwaves can heat the ionosphere in a way that might have an impact, either positive or negative, on radiocommunications.
- Satellite station-keeping tolerances, together with the intense microwave radiation, would make a portion of the orbital arc unusable to other electromagnetic systems, such as communication satellites.
- The costs associated with avoiding interference effects caused by electric fields in the vicinity of receiving antennas "could be substantial."

The SPS committee also found that the DOE-NASA *Program Assessment Report: Statement of Findings* on SPS, released last November (DOE/ER-0085), "tended to emphasize an optimistic rather than a pragmatic outlook" on the epidemiology of the effects of microwave exposure, among other factors.

Only the conclusions and recommendations of the committee's report, *Electric Power from Orbit: A Critique of a Satellite Power System,* have been released. The full report should be available soon from the National Academy Press, 2101 Constitution Avenue, NW, Washington, DC 20418.

* * * * *

LETTERS

To the Editor: In *MWN,* May 1981, there is an article concerning an Air Force contract with the University of Texas Health Science Center at San Antonio, Dr. David Ross, principal investigator. The article indicates that the study will be an attempt at a replication of the investigations of Adey and Blackman on amplitude-modulated radiofrequency radiation (RFR) on calcium efflux. Actually, this is not at all the case. In fact, this is an initial study in what will be a thorough Air Force-sponsored investigation of the effects of RFR on neuronal calcium function. Dr. Ross is specifically studying the effects of RFR on various calcium-dependent processes in mammalian synaptic tissue. Among the processes to be studied are affinity of calcium for receptor sites on the surfaces of myelin, synaptic membranes, and vesicles, potassium- and sodium-dependent calcium effluxes in synaptosomes, calcium transport protein, ATP-dependent calcium uptake in synaptic membrane fragments and calcium-dependent neurotransmitter release.

The reported alterations of calcium efflux from chick neuronal tissue in vitro has already been replicated. There have been intensive investigations over the past few years concerning the role of calcium in the functioning of the nervous system, and many advances have been made. The Air Force is taking advantage of this state-of-knowledge by extending the RFR-calcium studies beyond the simple efflux investigations to the underlying biochemical and physiologic mechanisms in an attempt to assess the biologic significance of the purported effect.

James H. Merritt
Radiation Sciences Division
USAF School of Aerospace Medicine
Brooks Air Force Base, TX 78235

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To the Editor: Maybe no one at the last C-95 meeting was sure where the six-minute averaging time came from (*MWN,* May 1981), but I know because I was there. It was developed by the original 95.IV subcommittee of which I was a member and represents, of course, human biological time constants.

Contrary to what you report from CU's Eckhaus, the standard *does* deal with pulsed sources, and the six-minute time is precisely how it does so.

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

A second report on the SPS, one by the congressional Office of Technology Assessment, is now at the printer and should be released soon.

* * * * *

In an article in the July issue of *IEEE Spectrum* ("Reflector Satellites for Solar Power"), Thomas Rogers proposes an alternative to the basic SPS concept: the collection of solar energy in widely separated arid regions around the world, the conversion of the energy into microwave energy, the distribution of the power by microwave mirrors in geostationary orbit and the collection of the energy by huge rectennas.

(continued from p. 5)

cess whose energy requirements is provided by the biological system."

• Dr. Nicholas Haimovici from Bremen, West Germany, described his successful treatment of 32 patients with broken bones in their feet with low frequency, pulsed magnetic fields, using a system like the one developed by Professor Andrew Bassett of Columbia University medical school.

• The US's Dr. James Schaeffer of the Eastern Virginia Medical School reported that he was able to identify breast tumors with microwave thermography (4.7 GHz) that could not be picked up with conventional X-ray mammography.

During one panel discussion, Canada's Professor Stanislaw Stuchly livened up the debate by asserting that he saw little long-term future for active microwave imaging: it cannot compete with X-rays and ultrasound. He felt that most of the results he had seen were artifacts.

Gray Conference

The tenth L.H. Gray Conference was billed as *Biological Action of Radiofrequency, Microwave and Ultrasonic Radiations,* but the emphasis was clearly on ultrasound, and to a lesser extent on RF and microwave hyperthermia. The 160 scientists, who came to Oxford, England, the week of July 13, heard a program of 60 papers on the therapeutic applications of non-ionizing radiation. The meeting began with overviews of hyperthermia by Professor Herman Schwan, presently visiting the Max Planck Institute in Frankfurt, Dr. E.H. Grant of the University of London and Dr. Norman Bleehen of Cambridge University. Grant reported on very recent results indicating the greatest differences in dielectric permitivity between tumor and normal tissues were below 100 MHz. As a possible explanation, Grant suggested that tumor tissues may be more membraneous.

Among the other papers, there was a report from Germany by W. Grundler and co-workers confirming previous findings of frequency-dependent effects of microwaves on the growth rate of yeast cells.

The proceedings of the meeting will be published as Supplement No. V to the *British Journal of Cancer,* due out at the end of 1981 or early 1982 at the latest. Copies are available from: H.K. Lewis & Co., 136 Gower Street, London WC1 E6BS.

Next Month

In our next issue, we will report on last June's International Microwave Power Institute's Symposium, held in Toronto, and the upcoming Bioelectromagnetics Society meeting to be held in Washington, DC.

CALENDAR

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

• August 10–19: 20th *General Assembly of the International Union of Radio Science (URSI),* Hyatt Regency Hotel, Washington, DC. Contact: Richard Y. Dow, Organizing Committee of URSI General Assembly, National Academy of Sciences, 2101 Constitution Avenue, NW, Washington, DC 20418.

• August 11–13: *Microwave Semiconductor Devices and Circuits,* Ithaca, NY. Contact: Joanne Davenport, Conference Office, 221 North Campus Union, Cornell University, Ithaca, NY 14853.

• August 19–21: 3rd Annual *Satellite Communications Users Conference,* Regency Hotel, Denver, CO. Contact: SCUC '81, Satellite Communications Magazine, 3900 S. Wadsworth Blvd., Denver, CO 80235.

• August 20–21: *Symposium on the Impact of Video Viewing on Vision of Workers,* National Academy of Sciences, Washington, DC. Contact: K. Dismukes, NAS, 2101 Constitution Ave., NW, Washington, DC 20418.

• September 7–11: 11th *European Microwave Conference,* Amsterdam, The Netherlands. Contact: Microwave Exhibitions & Publishers Ltd., Temple House, 36 High Street, Sevenoaks, Kent TN13 1JG, England.

• September 19–21: 3rd Annual *Conference on Engineering in Medicine and Biology,* Shamrock Hilton Hotel, Houston, TX. Contact: J.W. Clark, Department of Electrical Engineering, Rice University, PO Box 1892, Houston, TX 77001.

• October 26–27: *Microwaves and Thermoregulation: A Symposium,* hosted by the John B. Pierce Foundation, New Haven, CT. Contact: Office of Graduate and Continuing Education, Yale School of Medicine, 333 Cedar Street, New Haven, CT 06510

• November 9–11: 1st Annual Meeting of the *Bioelectrical Repair and Growth Society,* Philadelphia, PA. Contact: Executive Secretary of the Society, 425 Medical Education Building, 36th and Hamilton Walk, Philadelphia, PA 19104.

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

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

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

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

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

MICRO WAVE NEWS

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The new ANSI radiofrequency and microwave health standard has finally been approved. See p. 7; details next month.

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

Bioelectromagnetics Society Meeting

Budget Cuts Taking a Toll

The talk among the researchers at this year's Bioelectromagnetics Society (BEMS) conference was about money and where to get it. A cloud hung over the meeting as many of the participants wondered where they would find new grants to keep research projects alive. Some even questioned whether the society itself would survive. Although this seemed to be an exaggeration, the realities of the Reagan budget cuts were underscored by the absence of many familiar faces in the conference rooms of the Beverly Wilshire Hotel in Los Angeles.

The technical papers provided few exciting moments. Reports of new experimental findings did more to muddy than clarify the state of biological effects research. Negative findings where others had found positive ones, and vice versa, left many of the participants unable to explain their results. The search for mechanisms appeared as elusive as ever.

Interviews with government officials responsible for sponsoring bioeffects research indicated a period of austerity. The Office of Naval Research is the one exception, with some new money for work on biomedical applications, synergistic effects and complex field interactions. Otherwise, the programs at the Air Force School of Aerospace Medicine, the Bureau of Radiological Health and the National Institute of Environmental Health Sciences are staying at last year's levels. These are comparatively well off compared to those of the Environmental Protection Agency (EPA), the Department of Energy and the Naval Medical R&D Command, all of which are cutting back. EPA's Dr. Joe Elder said that the funding outlook was "very bleak."

(continued p. 8)

VDTs:

Eighth Cluster of Pregnancy Problems

A new cluster of pregnancy problems among Canadian video display terminal (VDT) operators has heightened concern over the safety of the terminals. Five out of six pregnancies among clerks in the accounting department of Surrey Memorial Hospital in Vancouver, British Columbia, have had adverse outcomes. This is the eighth unexplained cluster reported in the last two years. (See *MWN*, November 1981, January/February, April and May 1982.)

According to Jean Greatbatch of the Hospital Employees' Union, among the six pregnancies there were two miscarriages, one infant with a club foot and in need of eye surgery, one infant with bronchitis, one premature birth and one healthy baby. All the women worked in the same room and each had a VDT on her desk. Detailed information on the age and medical history of the affected women is not yet available.

The union maintains that the machines have not been proven safe and has

(continued p. 8)

HIGHLIGHTS

Leukemia Associated with Occupational Exposure to Electric and Magnetic Fields

A statistical survey of mortality among workers in Washington state has revealed an association between leukemia and exposure to electric and magnetic fields.

In a letter published in the July 22 issue of the *New England Journal of Medicine*, Dr. Samuel Milham, Jr., of the Washington State Department of Social and Health Services, reports that ten of eleven occupations with "presumed" exposure to these fields had a higher than expected death rate due to leukemia.

Electricians, power-station operators and aluminum workers all had statistically significant, elevated rates of leukemia mortality. (Aluminum workers are exposed to strong magnetic fields induced by direct currents used in the aluminum reduction process.) Among the seven other occupational classes were power and telephone linemen, television and radio repairmen and motion picture projectionists. (The last category of workers work near step-up transformers.) For these groups, the sample sizes were too small to detect a statistically significant relationship.

In a telephone interview, Milham said that, while he had not been able to document a cause and effect relationship, his analysis did indicate a "suspicious association." The next step, he went on, is to do an epidemiological study of one of these occupations. He said that his preferred population was electric power substation workers. Milham has already begun negotiations for such a study with the International Brotherhood of Electrical Workers.

Although Milham is the first to associate leukemia with occupational exposures to electrical and magnetic fields, Drs. Nancy Wertheimer and Ed Leeper published a paper showing a correlation between exposure to electric power lines and leukemia among children in the *American Journal of Epidemiology* in 1979. In that same paper, they reported a significant increase in cancer rates among occupational categories, which "seemed likely to include men frequently exposed to AC magnetic fields," when compared to the general population — based on data collected by the US Public Health Service.

In a telephone interview, Wertheimer said that "Milham's study adds more weight to the hypothesis that there is a connection between power line radiation and cancer." ●

Baltimore *Sun* Study: No Verdict on VDT-Cataract Connection

A study of Newspaper Guild employees at the Baltimore *Sun* has failed to resolve if video display terminals (VDTs) are inducing cataracts. In its preliminary report, the National Institute for Occupational Safety and Health (NIOSH) found no "significant association between VDT use...and the prevalence of eye abnormalities, including cataracts." The authors concluded, however, that "our survey may well have been inadequate in terms of the amount of exposure to VDTs .... Thus, the issue of VDT-associated cataracts is *not* resolved by our study." The survey did connect eye and muscle strain to workplace lighting and VDT design.

NIOSH's Dr. Alexander B. Smith, the chief investigator for the study, explained that the survey could not identify a VDT-cataract link, assuming one exists, because VDT users at the *Sun* averaged only 3.8 years on the sets. He said this period is "too brief to allow conclusions if one postulates that the incidence of cataracts increases with time spent on VDTs."

Another problem is that 16 percent of the study's current non-user population had worked on VDTs in the past, but the questionnaire failed to ask for a history of their VDT use.

The Newspaper Guild is not satisfied with the report. Mary Knudson, a union spokeswoman at the *Sun*, criticized the protocol for the eye examinations, which she said resulted in large differences in the number of cataracts found by the three ophthalmologists doing the testing. "We still need a good study to resolve this issue," she said. Her concerns were shared by the Guild's National Director of Research and Information David Eisen, who said that the question of cataracts remains open.

Among the guild participants, 56 of the 203 VDT users and 22 of the 79 non-users had some form of cataracts. Only three operators and two non-users, however, had "clinically significant" conditions that affected their vision.

The Guild was happier with the ergonomic portion of the survey and is planning discussions with management on improving workplace conditions linked to health problems. NIOSH found that changes in eye function and pains in the back, neck and shoulders were associated with office lighting and VDT screen characteristics.

The final report, which will be essentially the same as the preliminary version, should be available by September from Dr. Alexander Smith, NIOSH, 4676 Columbia Parkway, Cincinnati, OH 45226. ●

Yannon v. *RCA* Suit Dismissed; NY Telephone Appeal Denied

A New York state judge has dismissed Nettie Yannon's $3.5 million breach of warranty and negligence suit against RCA. Mrs. Yannon alleges her husband, Samuel, died from microwave radiation exposure received while tuning low-power transmitters built by RCA. As a New York Telephone Co. technician, Yannon worked on the equipment at an Empire State Building facility from 1957 to 1968.

After a week-long hearing on an RCA motion for dismissal, Judge Richard Goldberg of the New York Supreme Court, Richmond County, ruled on July 7 that Yannon was sane in 1968 and therefore capable of bringing suit within the three year statute of limitations. Mrs. Yannon filed her suit in 1976. Her lawyers maintain that her husband was unable to manage his own affairs and to make decisions by the time he was transferred from the Empire State Building and therefore could not protect his legal rights. Samuel Yannon was terminated by the phone company in 1971 because of ill health; he died three years later.

Mrs. Yannon intends to appeal. "I won't stop until justice is done," she said. Her lawyers, Jerome Ellis and David Paully of Staten Island, NY, must submit a notice of appeal to the State Supreme Court Appellate Division within 30 days of the lower court's judgment. As of July 30, they had not yet officially received Judge Goldberg's ruling.

RCA had no comment on the case.

In a separate action last month, the Appellate Division of the State Supreme Court denied New York Telephone's request to appeal a workers' compensation award to Mrs. Yannon. The court had affirmed an earlier ruling upholding the award on May 6. (See *MWN*, June 1982.) The company is now seeking permission for another appeal from the Court of Appeals, the state's highest court.

Excerpt of Decision

Upon the credible evidence adduced at this hearing, I find that plaintiff has not met her burden of proof concerning decedent's alleged insanity as defined in *McCarthy v. Volkswagen of America, Inc.*, supra. A careful review and analysis of all the evidence compellingly leads the court to conclude that Samuel A. Yannon was indeed functioning normally, or at least at a level sufficient to manage his own affairs and to protect his legal rights and interests in December, 1968, the date the causes of action accrued.

In sum the court finds that the decedent, Samuel Yannon, was not insane within the purview of CPLR §208, and that the statute of limitations was not tolled at the time the subject causes of action accrued. ●

US and USSR Agree to Run Identical Experiment at 2450 MHz and 10 mW/cm²

At a workshop held in Research Triangle Park, NC, on May 25-28, scientists representing the US and the USSR agreed to carry out an identical experiment in their respective laboratories. The experiment will involve the short-term exposure of male rats to 2450 MHz microwave radiation for seven hours at a power density of 10 mW/cm². The objective is to show that American and Soviet scientists will find the same effects on the animals' central nervous system and behavior.

The proposal to run the experiment at 10 mW/cm² came from the head of the Soviet delegation, Dr. Mikhael Shandala of the Institute of General and Communal Hygiene in Kiev. A number of American scientists were surprised by Shandala's initiative, given that the Russians have consistently reported behavioral effects at much lower power levels than American researchers. While US studies have focussed on exposures in the milliwatt range, the Russians have been more interested in looking for effects at microwatt levels, a factor of a thousand lower.

But as Dr. Donald McRee explained: Shandala wanted to pick an experiment that could test each country's experimental protocols quickly, and this could be best accomplished at a high exposure level. McRee, who is with the National Institute of Environmental Health Sciences (NIEHS) and who chaired the American delegation, said that the agreement "is really a step forward in the ability of both countries to validate each other's work."

McRee and Dr. Clifford Mitchell, also of NIEHS, will be the joint principal investigators for the US side of the study. The Bureau of Radiological Health is considering taking an active part in the experiment.

At the workshop, scientists from both countries presented papers describing their recent work. The Soviet papers are being translated and the proceedings of the workshop — nine American and seven Soviet papers—will be published in early 1983. Another workshop is scheduled for June 1983 to compare the results of the parallel experiments.

The papers presented by members of the Soviet delegation were:

- "Comparative Evaluation of Behavioral Methods of Research in Exposure to Microwave Radiation," by M.I. Rudnev.
- "Changes in Conditioned Reflex Activity in Albino Rats as a Criterion for Evaluating the Bioeffects of Ionized Air," by M.G. Shandala.
- "Behavioral Reactions of the Animal Organism During Exposure to Pulsed Electromagnetic Fields (2750 MHz)," by Y.D. Dumanskii, M.G. Shandala and V.N. Soldatchenkov.
- "The Effect of Electromagnetic Waves on the Organism as Judged by the Results of Works of Armenian Researchers," by U.G. Pogosyan.
- "The Importance of Considering the Reaction of Cerebral Bioelectric Activity in the Hygienic Evaluation of Microwave Radiation," by V.V. Varetskii.
- "Combined Changes of Neurophysiological and Heart Rate Processes During Long-Term Microwave Exposure," by N.N. Vasilevskii.
- "Behavior of White Rats in Stationary Electric Fields," by V.Y. Akimenko.

The members of the US delegation were: Drs. Ross Adey, Ernest Albert, Carl Blackman, Don Justesen, Richard Lovely, Donald McRee, Shin-Tsu Lu, Clifford Mitchell, Jack Monahan and Howard Wachtel. ●

Highway Project Raises Radiation Concerns in Hawaii

Plans to build a highway under a coast guard antenna in Oahu, HI, has focussed public attention on radiation hazards. The controversial proposal to complete a 10.3-mile gap in the island's highway system would route a four-lane road under the Omega antenna spanning the Haiku Valley near Honolulu and over a portion of its grounding system buried in the valley floor.

The dispute has also touched off fears among residents on the northern part of the island living near a navy communications station at Lualualei. According to a recently completed navy study, the nearby communities are not at risk from nonionizing radiation.

The 10-kW Omega antenna transmits time-sequenced signals at 10 to 14 kHz. It is one of eight Omega stations worldwide, which together form a radionavigational positioning system for shipping.

In response to an April 8 District Court ruling, the state's Department of Transportation (DOT) has circulated a draft supplement to its environmental impact statement for the H-3 highway, which contains studies and comments on the Omega antenna. According to engineering studies performed by Boynton Hagaman of Kershner & Wright, Springfield, VA, highway construction and use would be safe, though the road would require shielding to eliminate shock hazards. Hagaman estimates shielding would reduce average electric and magnetic fields above the highway to 300 V/m and 0.32 A/m.

The potential bioeffects of the very low frequency (VLF) signal were evaluated by Professor A.W. Guy of the University of Washington in Seattle. Noting that no standards cover exposures to 10 kHz radiation and that "there is very little information concerning biological effects at that frequency," Guy concluded that "existing scientific data and projected international safety standards" at other frequencies indicate that exposures would cause no harm.

Guy also evaluated the antenna's potential effect on pacemakers, which was a concern to DOT. After testing a widely used model from Medtronics Inc., he concluded exposure levels on the highway, once shielded, would not cause problems.

The analyses circulated in the draft supplement have come under sharp attack. Mark Hagmann, visiting professor at the University of Hawaii, has argued that there are not enough data to conclude projected exposures are safe. He also questioned the feasibility of safely constructing the proposed shield and cautioned that electric sparks could cause explosions during the refueling of equipment used for highway construction.

Paul Lane, a sales consultant for Medtronics Inc., said the sequential Omega signal could inhibit a pacemaker and cited a company statement warning that "a field intensity of 200 V/m is a danger to life and pacemakers may be affected before this intensity is reached."

An independent analysis of Hagaman's calculations has questioned the estimated exposure levels on which other evaluations are based. Dr. Jeremy Raines, a consulting electrical engineer in Rockville, MD, found that the electric fields near the highway have not been conclusively determined and could be higher than 300 V/m. Shock hazards also might be greater than reported.

Comments on the draft supplement were due July 26 and DOT hopes to have a final EIS by mid-August. If there are no delays, DOT would begin construction on the $480 million highway in 1985 and complete it in 1990–91. Given the ten-year old legal battle to stop the project, however, more delays are anticipated. The Stop H-3 Association plans to appeal the District Court's lifting of a construction ban to the US Ninth Circuit Court of Appeals.

The highway controversy has created concern near another military base. Maili and Nanakule residents, on the north side of the island, fear that low frequency radiation from the navy's Lualualei Radio Transmitting Facility could be increasing the incidence of cancer and hyperactivity in their children. Houses and an elementary school are within one half mile of the station's VLF antennas.

To reassure the public, the navy has performed a study of radiation levels within the station grounds. In a press conference last month, Captain C.W. Jauss, commander of the Naval Communications Area Master Station at Wahiawa, announced that levels at the facility are low and pose no health risks. At the same briefing, Guy, who verified the navy's measurements, supported Jauss's conclusion. The navy plans to release the study in mid-August.

Local residents are not happy with what they consider a limited and potentially biased study. Citizens Concerned for the Future of Our Children has decided to conduct its own survey to determine whether the community has unusual health problems. According to the group's Steward Meacham of Nanakuli, the University of Hawaii's Cancer Center is helping design the survey.

Bioeffects Bibliographies

The air force has issued the first two reports on its new effort to publish reviews of key papers on the biological effects of radiofrequency and microwave radiation. Together the reports assess 80 studies, with special emphasis on their validity and significance. The reviews, which include information on exposure conditions, the author's abstract and an appended critique, were prepared by Louis Heynick of SRI International in Menlo Park, CA, under contract from the Air Force School of Aerospace Medicine at Brooks Air Force Base.

The air force has just signed a new $522,700 contract with SRI to continue the service for the next three years. According to the AF's James Merritt, SRI will now hire consultants to help make judgments on which papers should be included in the survey. At the current level of effort they intend to review 80 papers a year.

Copies of the reports, *USAFSAM Review and Analysis of Radiofrequency Radiation Bioeffects Literature,* No. SAM-TR-81-24 and SAM-TR-82-16, are available free while supplies last. Contact: James Merritt, USAF School of Aerospace Medicine, Brooks AFB, TX 78235, (512) 536-3583. Afterwards they will be sold by the National Technical Information Service, Springfield, VA 22161. The air force is storing the reviews in a PDP 11/70 computer and is developing software to allow their retrieval by on-line users next year.

The latest issue of the National Telecommunications and Information Administration's (NTIA) *Biological Effects of Non-Ionizing Electromagnetic Radiation: A Digest of Current Literature,* October–December 1981, Volume VI, No. 2, (No. NTIA-CR-82-19), has been released. This is the last BENER report covered under a current contract, which has yet to be renewed. Given NTIA's stated desire to transfer its responsibility for non-ionizing radiation bioeffects coordination (see *MWN,* May 1982), the future of the digest is in question. The digest is available from NTIS.

The Bioelectromagnetics Society (BEMS) is in the process of putting the BENER data base onto a computer to allow on-line searches of the bibliographic entries. For more information on this new service contact: Dr. Tom Rozzell, Office of Naval Research, Code 4, 800 Quincy Street, Arlington, VA 22217, (202) 696-4053.

A new index of the bioeffects literature covering some 5,000 papers will be published in September. The literature was compiled by Dr. Zory Glaser and indexed by Julie Moore. The papers include those covered in the original report issued by the Naval Medical Research Institute in 1971 and the nine supplements released through 1978. In addition, the index will include those references published in the *BEMS Newsletter* during the last few years. The *Cumulative Index to the Bibliography of Reported Biological Effects and Clinical Symptoms Attributed to Microwave and Radiofrequency Radiation Exposure* will be available from Julie Moore & Associates, 3319 Avalon Street, Riverside, CA 92509, (714) 684-0441. Through August, the pre-publication price is $17.75, and $25.00 afterwards.

UPDATES

Biological Effects...The first issue of the *Journal of Bioelectricity* is out. Two of the papers, by Drs. John Lester and Dennis Moore of the University of Kansas medical school in Wichita, address the possible connection between microwaves and cancer. In a study of cancer incidence in Wichita, they find that "it appears related to the probability of exposure to radar," though they note that the results "cannot be interpreted to indicate that radar causes cancer." Rather, they argue that their findings justify more research. In a similar study, they look at radar from air force bases (AFB) and conclude that "counties with an AFB, when compared to population-matched counties without an AFB, have a significantly higher incidence of cancer mortality for the period 1950–1969." Here again their evidence is not strong enough to confirm a connection between radar and cancer, though they argue it is suggestive and urge more research. The journal is available from Marcel Dekker Inc., 270 Madison Avenue, New York, NY 10016, (212) 889-9595. Subscriptions are $75.00 for institutions and $37.50 for individuals; there will be three issues in Volume I....Professor Stanislaw Szmigielski's study on the co-carcinogenicity of 5–15 mW/cm^2, 2450 MHz microwaves and benzopyrene, first reported in these pages last year (see *MWN,* May 1981), has been published in the latest issue of *Bioelectromagnetics,* Volume 3, Number 2.

Communications...EPA's Richard Tell has reviewed the proposed shortwave installation to be built by the World Christian Broadcast Corp. (WCBC) near Anchor Point, AK. According to his "detailed analysis" of the TCI model 611 curtain antenna system operating in the locations WCBC proposed to the FCC August 28, 1981, "the electromagnetic fields will not exceed 15 percent of the proposed ANSI

standard" beyond the perimeter of WCBC property at any height within ten feet of the ground. While metallic fences may cause local enhancement of the fields, none of these will exceed the new ANSI guideline. Tell does indicate that fields inside the property boundaries are "likely" to exceed the OSHA 10 mW/cm² standard. He notes that there is a "possibility of inadvertent detonation of electroexplosive devices used close to the site (within probably 0.7 miles)," and that "interference to radio and television reception is a possibility, particularly within one mile of the proposed system."...Walden, NY, approved Highland Telephone Co.'s plans for a new transmitting tower at a July 7 hearing. Drs. Herbert Pollack and Sol Michaelson testified for the company and assured apprehensive residents that the facility would be safe....The FCC authorized five companies to build digital electronic message services on July 15....Air radionavigation and safety communications received additional spectrum space from the commission on June 7....In a June 23 notice of inquiry, the FCC solicited comments on using the spectrum between 17.7 and 40.0 GHz for fixed and mobile services. Comments are due September 7 and reply comments by October 7....National Public Radio and Mobile Communications Corp. of America are setting up a national paging system. Their new company, National Satellite Paging Inc., will use satellite links to NPR radio stations to send its customers' beeps.... The July 29 *Wall Street Journal* reports a similar joint venture planned by MCI, American Express, Metromedia and Communications Industries....Seiko has developed a wristwatch with a 1.2 inch black-and-white TV. According to the June 17 *Journal,* it will sell for about $400 in Japan....A California supermarket chain is using FM radio to send messages to its 92 stores. Messages travel on a sideband of station KBIG and are received, decoded and printed with equipment in each supermarket. Details appear in the June 16 *Management Information Systems Week*....The June *IEEE Spectrum* explains how low-power TV will work, how much it will cost and how it will support itself.

Compatibility & Interference...Will the government go ahead and build Radio Marti for broadcasting news to Cuba? If so, will it stick to the proposed 1040 kHz frequency, or will it use 1610 kHz at the top of the AM band, or pick shortwave frequencies? Will the FCC or NTIA be responsible for the allocation? Will the Cubans retaliate with a powerful interfering signal that could, as Congressman Timothy Wirth (D-CO) has warned, jam as many as 200 American AM stations? The saga goes on in the halls of Congress with no clear result in sight. At the end of July, debate had begun on the House floor, with the Senate Foreign Relations Committee still holding hearings ....The FCC has exempted certain types of medical electronic equipment from its RFI regulations. The Commission ruled that the costs of testing for compliance would be severe, especially since most medical equipment is not likely to cause interference. The action came in response to a petition from GE. (See 47 *FR* 31267, July 19.)... The FCC has extended the comment period for its proposal to remedy blanketed interference near FM transmitters. (See *MWN,* May 1982.) Comments are now due on September 29, and reply comments by October 29....Radio astronomers in England are worried that RFI from a proposed third airport outside London will disrupt their research. See Jane Wynn's item in the June 3 *Nature*....Tecknit will sponsor a free seminar on "Selecting and Applying EMC Shielding Materials," on September 7 just prior to the *International Symposium on Electromagnetic Compatibility* to be held in Santa Clara, CA. For more information, contact: Peter Grant, (201) 272-5500.

Government...The FCC has extended the deadline for filing comments on its proposal to consider RF/MW radiation hazards in its environmental rulemaking (see *MWN,* March 1982). The action came in response to a petition by the Association for Broadcast Engineering Standards. The Commission was also influenced by OSHA's decision to revoke all of its advisory standards, including the 10 mW/cm² RF/MW guideline, on which the FCC intended to rely. (The OSHA proposal was published in the May 28 *Federal Register,* see *MWN,* April 1982.) Comments are now due on August 16, and reply comments on October 18....Meanwhile the FCC has issued a bulletin, *Questions and Answers about Biological Effects and Potential Hazards of Radiofrequency Radiation.* Bulletin OST 56 is available from the FCC Consumer Assistance Office, Washington, DC 20554, (202) 632-7000....The FDA has announced its intention to merge the Bureau of Medical Devices (BMD) with the Bureau of Radiological Health (BRH). A decision on a name for the new unit has yet to be made, though the inside favorite is the National Center for Medical Devices and Radiological Health. BRH Director John Villforth has already been named the director of BMD and will take over the new center after an opportunity for public comment on the proposal and its formal approval by HHS....And EPA has decided to restructure its Office of Radiation Programs (ORP) to provide a "stronger focus on standard setting." The Surveillance and Emergency Preparedness Division, headed by David Janes, has become the Analysis and Support Division. Janes stays on as its director. How all the branches, including the non-ionizing radiation branch, will fit in the new scheme has not yet been worked out. Details are expected within a few weeks ....At the request of Congressman Richard White (D-TX), the General Accounting Office has issued a report (No. AFMD 82-74, May 24, 1982) critical of the way the Armed Forces Radiobiology Research Institute uses its computer systems. The institute is part of the Defense Nuclear Agency....The Army Armament R&D Command in Dover, NJ, has issued a guide to the security classification for railgun systems information. It recommends that data developed on electromagnetic propulsion technology be released to the public in 1995–2000....The International Trade Administration has determined that RF power amplifier assemblies and components, designed for uplinks in the C, X and KU bands from fixed satcom earth stations with power outputs of more than 1 kW, are likely to be sold in the US for less than fair value. A ruling from the International Trade Commission is expected soon.

Measurement...More than 40 people attended NBS' workshop on the development of a laboratory accreditation program (LAP) for electromagnetic services on July 1–2 in Boulder, CO. A summary of the meeting together with a list of the attendees is available from Robert Gladhill, Room B06, Technology Building, NBS, Washington, DC 20234, (301) 921-2427. Gladhill hopes to have the formal announcement for the establishment of the LAP by the end of the year....The proceedings of the 1982 *Conference on Precision Electromagnetic Measurements,* held in Boulder on June 28–July 1, will be published in the March 1983 issue of the *IEEE Transactions on Instrumentation and Measurement.* A digest containing summaries of the papers is available now for $32. Contact: Wallace Alspach, NBS, Mail Stop 723.00, 325 South Broadway, Boulder, CO 80303....BRH and NBS have initiated a calibration intercomparison program for microwave survey meters used in compliance testing of microwave oven and diathermy machines. From now on, NBS will supply the microwave standard to industry. BRH has also started similar comparison programs with the Japan Machinery and Metals Inspection Institute and the Canadian Radiation Protection Bureau in order to ensure that imported microwave products comply with domestic standards.... BRH has published a new report, *Performance Evaluation of RF Electric and Magnetic Field Measuring Instruments.* (No. FDA 82-8158) It is available from NTIS, Springfield, VA 22161. Accession No. PB 82-195009, $7.50 paper, $4.00 microfiche. Among the units tested are meters from Instruments for Industry and Narda....And NBS has just published the proceedings of the first national conference on electrical measurements of pulse power systems. The 420-page report, *Measurement of Electrical Quantities in Pulse Power Systems,* (SP 628), is available from the Superintendent of Documents, Government Printing Office, Washington, DC 20402. Stock No. 003-003-02403-1; $9.50.

Medical Applications...At the BEMS conference (see p. 1), Maria Stuchly of Canada's Radiation Protection Bureau reported on the measurement of RF fields near the Magnetrode hyperthermia system. The device operates at 13.56 MHz with an output power of up to 1000 watts. Based on tests with saline-filled phantoms and human subjects, she advised that the operator should be at least 1–2 meters from the unit, depending on the electrode used and the meter setting, to meet the Canadian and proposed ANSI exposure standards....And

BRH's Dr. Whit Athey discussed safety aspects of NMR medical imaging systems. He measured operators' exposure to magnetic fields from a Fonar unit, a low-field device, which uses a vertical, main magnetic field. The maximum exposure was 0.0059 tesla or 59 gauss. Athey recommended special care for patients with pacemakers or implanted electrodes and for stroke victims and pregnant women. In response to a question from the audience, he said that BRH had no intention of issuing a new guideline for exposures to time-varying magnetic fields from NMR units. BRH's current guideline is more stringent than other proposals. (See *MWN*, April 1982.)...Researchers at the University of Utah are working on systems to measure lung water content: active and passive microwave radiometers and NMR imagers. At BEMS, Dr. Magdy Iskander reported that the passive radiometer can detect changes of 3–4 percent in water concentrations. While the microwave units are cheap, portable and allow continuous monitoring, they can only register *changes* in water content. An NMR imager can detect absolute water levels; however these devices are larger, more expensive and not continuous. The Utah team published a paper on the NMR technique in the June 18 *Science*....In Britain, a clinical NMR research group has been set up in the Department of Biochemistry at the University of Oxford with a $500,000 grant from the British Heart Foundation.... And Picker International, a subsidiary of the General Electric Co. (UK), is planning to spend $15.6 million to develop, manufacture and market NMR imagers, according to an item in the July 5 *Electronic News*.... NMR is one of the topics to be discussed at the FDA's symposium, *Recent Advances in Analytical Methodology in the Life Sciences*, scheduled for August 16–18, in Bethesda, MD. Contact: Dr. Constantine Zervos, (301) 443-4490....A meeting on the use of electricity in regeneration was sponsored by the IEE (UK) in London; the June 10 *New Scientist* features an article on the conference....The Public Health Service's Office of Health Research, Statistics and Technology is assessing the safety and clinical efficacy of thermography for the diagnosis of breast lesions. For more information, contact: Dennis Cotter, Room 17A55, Parklawn Bldg., 5600 Fishers Lane, Rockville, MD 20857, (301) 443-4990....John Jenkins has been elected president and CEO of Clini-Therm Corp, a developer of hyperthermia equipment, Phillip Berry becomes chairman of the board of directors.

Military Systems...Last May 24, the navy tested its ELF transmitter on Clam Lake, WI, by sending a message to the USS Daniel Boone, which was submerged 400 feet off the Florida coast. The test was arranged to convince newspaper publisher John Lavine that the system did in fact work. Lavine, who owns four daily papers, was impressed with the demonstration and told an AP reporter: "There is no doubt that ELF works." He went on to endorse the project. The ELF transmitter is in routine operation 16 hours a day, sending messages to specially equipped navy submarines.... Meanwhile, the Naval Electronics Systems Command is negotiating with GTE Sylvania, in Needham Heights, MA, for the full-scale development of Project ELF. (See *MWN*, March 1982.)...Is the ELF communication system an integral part of Pentagon plans for a first strike capability? Thomas Murphy argues that it is—in the July/August issue of *Counterspy* magazine....The June 21 *Aviation Week* reports on the status of the blue-green laser system, which may be an alternative to the ELF transmitter...The air force has signed a $500,000 contract with SRI International to prepare environmental impact statements (EIS) for its two new PAVE PAWS radars. The air force is considering four sites near Goodfellow AFB in San Angelo, TX. A public meeting is scheduled for August 5 at Angelo State University. The AF hopes to have a draft EIS for the Goodfellow PAVE PAWS out by November, and a site selected by next March. An AF spokesman said that the EIS for the southeastern PAVE PAWS at Robins AFB, south of Atlanta, will be easier to prepare because it will be built on the base. SRI wrote the EIS's for the AF's two other PAVE PAWS installations in Massachusetts and California....The Cobra Judy radar, the world's largest moving phased array radar system aboard the USNS Observation Island, was officially transferred to the Eastern Space and Missile Center by the AF's Electronic Systems Division in June.... A few months after Thomas Amlie caused a stir contending that radar could help the enemy by transmitting information on position (see *MWN*, April 1982), the Israelis showed the power of that strategy in their invasion of Lebanon. As the detailed coverage in the July 5 *Aviation Week* explains, the Israelis used drones to insure that enemy radar was turned on, then they unleashed radiation-homing missiles on them....The legislation and national security subcommittee of the House Government Operations Committee held hearings on the development of navy and air force radar warning receivers on June 15. The two services will spend $1.7 billion buying the receivers from the Itek Corp. GAO's Walton Sheley, Jr., testified that though the navy's ALR-67 and the AF's ALR-74 are practically identical, the services have "essentially ignored" instructions from the Office of Secretary of Defense to use common hardware in their development. The DoD response is unknown at this time because it classified many aspects of the controversy. The hearing was closed soon after it began....Raytheon will test a new high frequency over-the-horizon radar from the AF....A new report by Frost & Sullivan indicates that the US military satellite communications market will be over $1.2 billion a year through FY87. For more information on report No. 1062, contact: F&S: 106 Fulton St., New York, NY 10038, (212) 233-1080....The July/August issue of *High Technology* describes the Navstar Global Positioning System program. When all its 18 satellites are in orbit at the end of the decade, users will be able to determine their location to within 16 meters.

Mobile Communications...As expected, the FCC received a cascade of cellular radio applications before its June 6 filing deadline. For a complete list, see the June 21 *Electronic News* or the June 14 *Broadcasting*. But not everyone thinks the idea deserves spectrum space. The National Association of Broadcasters has told the commission that available UHF frequencies should be allocated to TV. It recommends that the demand for mobile services be met by using existing technology more efficiently....Meanwhile, the Justice Department's antitrust division may investigate plans by AT&T, GTE and several other telephone companies to divide up cellular markets....The FCC has approved the release of 250 channels in the 800 MHz band for private land mobile radio services.

Ovens... Researchers at Battelle's laboratories in Columbus, OH, have developed a new microwave heating process that can regenerate absorbent materials used in extracting contaminants from gas streams. Battelle's Dr. Eugene Mezey headed the team, which now plans to apply the technique on an industrial scale. The patent office has awarded Battelle a patent for the process....The Justice Department has determined that DOE's proposal not to issue mandatory energy efficiency standards for home appliances, including microwave ovens (see *MWN*, May and June 1982), will not have "any adverse effects on competition in those markets." The ruling came in a May 5 letter to DOE Secretary James Edwards from Assistant Attorney General William Baxter, which is reprinted in the July 15 *Federal Register* (47 *FR* 30793).... Professors W.A.G. Voss and R. Turner of the University of Alberta in Edmonton, Canada, describe the development, performance and reliability of the Micro-Check microwave oven radiation detector in the March 1982 issue of the *Journal of Microwave Power*. The authors conclude that the device, which uses liquid crystals, is suitable for use by the general public.... Last year there were fears that cooking pork in a microwave oven might not kill all trichinae parasites. (See *MWN*, June 1981.) Now word comes from Purdue University's School of Consumer and Family Sciences in Lafayette, IN, that care should be taken in cooking turkeys with microwaves. Professor Bala Swaminathan inoculated turkeys with bacteria and cooked them in a microwave oven. Some of the bacteria survived the heating; he blamed cold spots.... 1,727,000 microwave ovens were shipped during the first half of 1982, down 13 percent from 1981, according to the Association of Home Appliance Manufacturers.

Satellite Communications...RCA has tabled its plan to build a satcom station on Bainbridge Island, WA, and is now seeking approval for an alternative site in the Indianola-Kingston area of northern Kitsap County, WA. At a July 22 hearing on the second site, RCA met a new set of opponents — residents who share Bainbridge Islanders'

worries over microwave radiation hazards. The final EIS's for both locations are out. Each contains the controversial RF/MW bioeffects review prepared by the Battelle Human Affairs Research Center in Seattle. Dr. Joe Elder of EPA's Experimental Biology Division critically evaluated the document when it was released in draft form last spring, and concluded: "The authors did a poor job of reviewing and citing the literature and reveal a lack of scientific insight into the complexities of the biological effects of microwave radiation." The regional EPA office in Seattle would only release Elder's evaluation through a Freedom of Information Act request....The New York City Planning Commission has approved Hughes Aircraft Company plans for a Galaxy Satellite Station in the Spring Creek area of Brooklyn...The EIS for Teleport, a huge satcom complex sponsored by the Port Authority of NY and NJ and Merrill Lynch, should be out for review in August. Andrews & Clark of New York City is preparing the statement, with the radiation aspects handled by Ammann Whitney, also of NYC....The FCC has approved Comsat's planned satcom facility in western Pennsylvania. The Roaring Creek Earth Station received local approval from the Cleveland Township Zoning Board last year....Direct broadcast satellite service (DBS) has finally won FCC approval. Interim rules for DBS appear in the July 21 *Federal Register* (47 *FR* 31555)....Home Box Office has chosen Scientific Atlanta of Atlanta, GA to supply four uplink stations for a new satcom center it will build in Hauppauge, Long Island, NY....Scientific Atlanta will also provide new equipment for RCA's Vernon Valley facility in New Jersey...The FCC approved the private sale of transponders for satellites launched by Hughes Communications, RCA and Western Union Telegraph. Will RCA try another auction?....An Office of Technology Assessment report, *US Civilian Space Policy and Applications,* (GPO No. 052-003-00878-5), supports development of 30/20 GHz satcom systems. Funding for NASA's 30/20 GHz research program has been repeatedly cut. Now both the House and Senate have earmarked money for a test run of the satellite.

Standards...On July 30, ANSI's Board of Standards Review approved the new RF/MW exposure standard (C95.1-1982). *Microwave News* will run the full text of the standard next month....At a meeting in early June, the physical agents threshold limit values (TLV) committee proposed several changes to the ACGIH's RF/MW radiation standard, first proposed last year. (See *MWN,* September 1981.) Among the revisions was the addition of the following language: The TLV's "may be exceeded if the exposure conditions can be demonstrated to produce a SAR of less than 0.4 W/Kg as averaged over the whole body and spatial peak SAR values less than 8.0 W/Kg as averaged over any 1 gram of tissue. For example for frequencies from 3 to 30 MHz, the equivalent power density can be increased by a factor of 10 up to a limit of 100 mW/cm^2, if it can be assured that exposed individuals are not in contact with the ground plane." And: "At frequencies below 30 MHz, ungrounded objects such as vehicles, fences etc., can strongly couple to RF fields. For field strengths near the TLV, shock and burn hazards can exist. Care should be taken to eliminate ungrounded objects, to ground such objects, or use insulated gloves when ungrounded objects must be handled." The TLV, which would apply to radiation in the 10 kHz-300 GHz frequency range, remains on the ACGIH's Notice of Intended Changes and interested parties have a year to submit comments on the new proposal....After extended debate, Multnomah County, OR, adopted a general population RF/MW standard on July 20. At its most stringent, in the 30-300 MHz band, the standard specifies a maximum exposure of 200 uW/cm^2. The County Board of Commissioners had initially supported a more severe 50 uW/cm^2 limit but backed off in the face of strong opposition from local broadcasters. The standard, as approved, closely resembles the one proposed by the county's planning commission this spring (see *MWN,* May 1982)....In comments submitted to the Massachusetts Department of Public Health on its proposed RF/MW standard (see *MWN,* March 1982), the National Association of Broadcasters (NAB) argues that the regulation would impose "unrealistically stringent limits" and "unnecessary paperwork burdens" on broadcasters—especially those whose radiation levels come nowhere near the proposed ANSI standards. The NAB is worried about the impact of the Massachusetts standard on broadcasters who use electronic news gathering equipment. The NAB recommends that the proposal be amended to exempt facilities that contain RF machines with input power to the radiating device of up to 25 watts (instead of 7 watts) and those using portable equipment. The comments were submitted by Erwin Krasnow and Barry Umansky....Writing in the March 1982 issue of the *Journal of Microwave Power,* Professor Herman Schwan finds himself in "essential agreement" with the proposed revision of the ANSI standard. In his analysis, Schwan considers only thermal effects.

Technology...NBS is working on ways of probing oil shale with RF energy to discover the ratio of rubble-to-void in underground caverns. A new report, *Modeling of Oil Shale Retorts for Electromagnetic Sensing Techniques* (No. NBSIR 81-1653), is available from NTIS, Springfield, VA, 22161 for $7.50. (Order No. PB82-153321.)...NBS scientists working at DOE's Energy Technology Center in Laramie, WY, have applied such RF techniques to accurately measure the dielectric properties of oil shale samples at 500°C over the 5-1000 MHz frequency range....On another energy front, researchers at the Southwest Research Institute (SwRI) in San Antonio, TX, have devised a way to automatically and continuously monitor the flow and quality of coal in boiler feed pipes using NMR and ESR technology. SwRI did the work under contract from a DOE technology center in Morgantown, WV....David Rust and Richard Doviak of NOAA's National Severe Storms Laboratory in Norman, OK, review the use of weather radar to study thunderstorms and lightning in the June 10 *Nature*....Tideland Energy, a company developing solar technology in New South Wales, Australia, have supplied solar power systems for 22 microwave repeater and terminal stations to the Department of Posts and Telecommunications in Papua, New Guinea.

VDTs...A VDT operator in San Francisco has received a workers' compensation award for job-related eye problems. This June, Sybil Barker won standard temporary disability benefits from her employer's insurance company two weeks before a scheduled Workers' Compensation Board hearing on her claim. Barker developed severe eye pains after three months at an architectural firm and was fired when her doctor told her not to return to the VDT....A booklet rating ten VDT models for health and safety features is now available from The National Association of Working Women. *The Human Factor: 9 to 5's Consumer Guide to the Health and Safety Features of Word Processors* includes an evaluation chart and recommendations to employers, manufacturers and public officials. Copies are $5 for institutions and $1.50 for individuals from the association, 1224 Huron Road, Cleveland, OH 44115....VDTs will be part of a NIOSH study of chronic stress in the office. The study design is currently being scaled down due to a 67 percent cut in funding. For more information, contact NIOSH's Barbara Cohen, Division of Biomedical and Behavioral Sciences, (513) 684-8386....The Ontario provincial legislature has defeated a VDT safety bill proposed by New Democrat Richard Johnson. (See *MWN,* December 1981.)...Concerns over possible ELF radiation hazards and the risks to pregnant women were the major subjects of discussion at the *International Forum on Low-Level EM Radiation and the Question of VDTs* held in Ottawa on June 4. The proceedings of the forum are being prepared and will be available from: The Planetary Association for Clean Energy, 100 Bronson Avenue, Ottawa, Ontario K1R 6G8, Canada, (613) 236-6265. Audio cassettes are also available....Delegates at the annual Newspaper Guild Convention in July called for immediate bioeffects research on the low frequency radiation emitted by VDTs—in both the ELF and VLF bands....Newspaper Guild President Charles Perlik, Jr., has written to NIOSH Director Dr. J. Donald Millar urging more research be done on 15 to 125 kHz radiation....VDTs are not the only source of low frequency radiation stirring up controversy. Hawaiians are worried about the Coast Guard's Omega navigational system, which radiates signals in the 10-14 kHz band—about the same frequency as that of a VDT flyback transformer. (See story on p. 3.)..The Labor Council of Metropolitan Toronto has launched a quarterly VDT newsletter. Subscriptions are $5 a year from the council's VDT Committee, Room 407, 15 Gervais Drive, Don Mills,

Ontario, Canada....Langley-St. Clair Instrumentation Systems Inc. of New York City is marketing a VDT screen X-ray shield. I-Protect, a leaded acrylic sheet fastening to the front of the terminal, comes in two sizes and sells for $50 to $60. For information, call (800) 221-7070. (*MWN* does not endorse commercial products.).... In a paper prepared for the BEMS meeting (see p. 1), Charles Wallach of Decisions and Designs Inc. in McLean, VA, suggests that ion imbalances in the air around operators and VDT screens could cause a number of health problems.... Norwegian researchers found PCB levels in offices with VDTs that were 50 to 80 times greater than levels outdoors. According to a report in the *International Archives of Occupational and Environmental Health,* Volume 49, p. 193, 1982, by Vemund Digernes and Erle Astrup of the University of Oslo, workplace air samples had PCB concentrations of 56–81 ng/m³. PCB's cause cancer in experimental animals. The authors hypothesize that VDT capacitors and transformers may be the source of PCB's and recommend further investigation of the terminals.... Are you a cyberphobe? The June 8 *Wall Street Journal* reports on Professor Sanford Weinberg's research indicating that up to 30 percent of US office workers suffer from cyberphobia, the fear of computers. Weinberg is at St. Joseph's University in Philadelphia, PA.

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Calcium efflux research emerged as a new growth industry. A number of researchers, following the lead from Drs. Ross Adey and Carl Blackman, are trying to extend and explain what is known about the frequency and power windows that govern the movement of calcium in the brain.

Blackman reported that he was taking the amplitude modulation to higher ELF frequencies — multiples of the 16 Hz window first identified by Adey and Dr. Suzanne Bawin. Blackman and his co-workers at EPA's lab in Research Triangle Park, NC, found no effect at 30 Hz, but they did measure a response at 45 Hz and 50 Hz. In the process, they uncovered one interesting new dimension to the window phenomenon: power windows appear to become narrower as the frequency increases. At 45 Hz they measured significant calcium changes at 35–50 V/m, but at 50 Hz the power window had shrunk to 45–50 V/m.

Before completing his presentation, Blackman preempted the obvious question: Is there a window at 60 Hz, the power line frequency? That experiment, he said, had not yet been run.

In the one non-technical paper on the program, Professor Nicholas Steneck, a historian at the University of Michigan in Ann Arbor, took aim at the new American National Standards Institute (ANSI) safety standard. He called the final product pro-industry and warned that it "will not attract more supporters than did the old 10 mW/cm² standard."

John Monahan of the Bureau of Radiological Health perplexed his audience with the preliminary results from his experiment involving both the permeability of the blood brain barrier (BBB) and microwave-drug synergy. He injected mice with scopolamine and then exposed them with 2450 MHz radiation at an average SAR of 10 W/Kg for 30 minutes. He saw no leakage through the BBB and, surprisingly, found that microwaves wiped out, instead of enhanced, the effect of the drug.

Describing a three generation study of rats exposed to 80 kV/m, 60 Hz electric fields, Dr. Debbie Majeau-Chargois of Tulane University in New Orleans said that her team had found significant changes in white blood cells (but not red cells) and in the paired organs such as kidneys and testes. In an interview, she said that the overall pattern was one of reaction to "mild stress."

Members of Dr. Bill Guy's group presented progress reports on their three-year, low-level exposure study at the University of Washington in Seattle. Nearly all the tests made after 21 months of exposure revealed no difference between the exposed animals and the controls. One variation was in a few of the screening tests—the significance of this finding will have to await further results. There was also an increase in malignant neoplasia among the exposed animals, but as Dr. L.L. Kunz warned, much more data must be collected before any inferences can be drawn.

The BEMS conference was held the week of June 28 in Los Angeles, CA. At the society's membership meeting, Guy was elected the next president of BEMS.

VDTs *(continued from p. 1)*

called for a moratorium on introducing more VDTs into provincial hospitals. This position puts it at odds with the provincial ministry of health, which is pressing for widespread automation in hospitals.

The cluster at Surrey Memorial has fueled the already intense controversy over VDT safety, though neither federal nor provincial health officials have indicated that potential VDT radiation hazards require investigation. A number of Canadian study groups are looking into the problem, however.

• The Task Force on Micro-Electronics and Employment was briefed on the Vancouver cluster at a hearing last month. Murray Hardie, executive director of the five member group, said the union's report "shows there are potential health problems that have to be addressed. The absence of sound scientific research in this area is a problem." The task force, established by Labor Canada this March with a $300,000 budget, is focusing on job displacement and health problems created by new office technology. It plans to publish its report and recommendations early this fall.

• A subcommittee of a $12 million federal project to develop prototypes for the office of the future will review existing VDT studies and could recommend that a new study be done. According to Phil Kinsman of the federal Department of Communications, which is coordinating the project, the group will review radiation issues because "at this point you just can't avoid them." Kinsman said VDTs will be designed to meet user specifications and will be tested for radiation as part of the project. In addition to government funds, two major participating business consortiums will spend over $50 million on research and development of office systems.

• The VDT task force set up last year by the Ontario Ministry of Labor's Advisory Council on Occupational Health and Safety (see *MWN,* December 1981) is now looking at potential reproductive hazards. According to task force chairman Dr. Gordon Stopps at the University of Toronto, this issue was added to the group's agenda because of "the upsurge in interest and the number of reported clusters." Stopps hopes the group's report will be ready in September.

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Time Windows in Bioeffects Research

Time is emerging as a key variable in the study of the biological effects of non-ionizing radiation. A number of important studies reported at conferences in June indicate that the duration of exposure and the time at which a response is measured can be crucial in detecting a biological effect. Researchers are beginning to talk of "time windows" to complement the already well documented frequency and power windows.

In the course of radiating a biological system, "there is a complex sequence of events at work, and if you don't time it right you might fail to observe an effect," Glen Rein explained during a break at the Bioelectromagnetics Society (BEMS) annual meeting in Boulder, CO, June 12-17. Rein, a researcher at St. Bartholomews Hospital in London, England, said that "the postulated time windows offer a good explanation for the inconsistency and absence of bioeffects in the literature."

Dr. Ross Adey of the VA Medical Center in Loma Linda, CA, spoke of "windows in time" at the *International Conference on Nonlinear Electrodynamics in Biological Systems* which he hosted the week before the BEMS meeting. "We are gradually learning about how membranes can achieve induced and persistent molecular states," he told *Microwave News*. The lifetime of such states could determine how a radiation-induced effect may be observed. Indeed, the effect may only show up at some later time or even in a later generation of cells, Adey said.

Dr. Przemyslaw Czerski of the Food and Drug Administration's National Center for Devices and Radiological Health commented that the importance of the time variable in studying living systems is not news for biologists. This trend, he said in an interview after the BEMS conference, represents "a move toward a biological rather than an engineering approach" within the electromagnetic research community.

Microwaves and the Cornea

Studies on the eye being carried out at Johns Hopkins University's Applied Physics Lab demonstrate the importance of time windows. A team led by Henry Kues has found that pulsed 2.45 GHz microwaves can affect the endothelial layer of the cornea in primates at average power levels of 10 mW/cm^2. But cellular abnormalities only occurred 24-72 hours *after* a four-hour exposure. Kues discovered that he would not see an effect until the latency period had elapsed.

Although there has been some discussion about this microwave effect on the eye during the last 18 months (see *MWN*, January/February and May 1982), Kues's paper at the BEMS meeting and a similar presentation at the Loma Linda conference by Dr. Sam Koslov, also of the Johns Hopkins Lab, mark the beginning of what promises to be a long public debate. The effect is occurring at a relatively low power level and there is already speculation that it will force a reassessment of health standards. For example, the new American Conference of Governmental Industrial

(continued on p. 2)

Time Windows *(continued from p.1)*

Hygienists standard, adopted in May, is 10 mW/cm² at 2450 MHz.

In the meantime, Kues and his colleagues will be busy explaining and extending their results. They plan to run experiments at lower power levels, down to 5 mW/cm², and at higher frequencies, probably at 9 GHz, in search of a threshold for the effect. They will also look into two notable observations. First, pulsed radiation is about four times more effective in damaging the cornea than continuous wave (CW) radiation. According to Kues, to achieve the same effect as that found for pulsed signals at 10 mW/cm² requires 40 mW/cm² of CW microwaves. Second, they are detecting a new, unexpected, regeneration phenomenon in the cornea.

PEMFs and Time

At the non-linear meeting, papers by Rein and by Dr. Richard Luben of the University of California, Riverside, also indicated the presence of time windows. Rein's experiments on the action of a 500 Hz pulsed magnetic field on the release of noradrenaline from cultured PC12 cells (see *MWN*, May 1982), and Luben's experiments with various pulsed electromagnetic fields (PEMFs) on the adenyl cyclase system show effects that are strongly dependent on when the field is turned on and when the response is measured.

Similarly, Dr. Jose Delgado, who has demonstrated that extremely weak PEMFs can have a pronounced effect on the development of chicken embryos (see *MWN*, March 1983), has added a new twist to his findings. In an interview at the BEMS meeting, he said that unpublished data from his lab in Madrid, Spain, indicated that all embryos at a particular stage of development will be affected by PEMFs. But, he added, if you expose the eggs in the same way, and then allow them to develop for four to five more days, half of the embryos return to normal.

Dr. Betty Sisken of the University of Kentucky in Lexington reported that chick embryos with amputated limbs developed abnormally if PEMFs were administered immediately after amputation. If exposure to the signal was delayed for 24 hours after amputation, however, the embryos were immune to the PEMFs.

In and Out of the Field

The course of electromagnetic interactions over time may be significantly different from the typical dose-response relationship for chemical and physical agents. Adey and Dr. Craig Byus of the University of California, Riverside, have found a decrease in protein kinase activity in human lymphocytes after 15 to 30 minutes of exposure to a 450 MHz, amplitude modulated field. (This system exhibits the well known 16 Hz frequency window.) But they found no difference between the exposed cultures and controls after a 60-minute exposure.

The cultures adapt to the field in an hour, but not during shorter periods —indicating the presence of a narrow time window for stimulating a response. Biological systems are quite adaptable, but only if there is enough time for homeostasis. Adey draws the inference that going in and out of a weak field may be more detrimental than staying in it and adjusting to it. One facet still to be explored is whether the effect returns with prolonged exposures.

Prospects for Funding

There was a strong consensus at both the BEMS and Loma Linda meetings that the level of science within the bioelectromagnetic research community is more rigorous than ever before. Many are excited by the papers and by the prospect of finally understanding the mechanisms of interaction. The question on everyone's mind is whether there will be enough funds to pursue the new avenues of investigation.

At the final session of the Loma Linda meeting, Adey said that he had watched the slow growth of "credible scientific results" on the biological effects of electromagnetic fields, and it is now time to turn the research effort from the sphere of hazard analysis to the pursuit of a whole new set of scientifically acceptable tools and techniques. Only in this way, he said, can the research community be assured stable funding.

The prognosis for more research moneys remains bleak, however. As Koslov put it: "The role of the federal government to date in this critical field can be most kindly described as ranging from pathetic to abysmal." One indication of the poor prospects is that the National Science Foundation failed to send an observer to the Loma Linda meeting. Some of the organizers of that meeting are considering setting up an ad hoc committee to make the case for more research funds in Washington.

Plenum Press will be publishing the proceedings of the Loma Linda conference. A major effort is being made to expedite the process: all manuscripts were due on July 31 with a commitment from Plenum to have the book ready within 100 days. The model for such speed was set by Springer-Verlag, which issued the proceedings of an international symposium held in West Germany in record time; the meeting was held November 29-December 1, 1982 and the printed volume was already making the rounds at Loma Linda in the first week of June. (*Coherent Excitations in Biological Systems*, edited by H. Frohlich and F. Kremer, New York: Springer-Verlag, 1983, $25.50)

There were many other interesting papers presented at the BEMS meeting. Next month, we will feature an overview of new research on extremely low frequency (ELF), radiofrequency, microwave and millimeter radiation reported in Boulder.

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HIGHLIGHTS

EPA Releases RF/MW Bioeffects Review

The Environmental Protection Agency (EPA) has released its draft review of the biological effects of radiofrequency and microwave (RF/MW) radiation in the 500 kHz-100 GHz frequency range. The document will serve as the basis for limits on population exposures to RF/MW radiation, which EPA is scheduled to propose later this year.

The three-volume, 500-page review draft does not indicate what the future standard might be. The closest EPA comes to a recommendation is the following summary sentence: "Despite the recognizably incomplete state of knowledge in this area, the currently available information suggests that the biologically effective SAR [specific absorption rate] for mammalian systems lies in the range 0.4 to 6.0 W/Kg."

EPA does not specify how these SAR values would translate into power density limits. For comparison, the new American National Standards Institute (ANSI) RF/MW safety level is 1 mW/cm^2 between 30 and 300 MHz, based on the consensus that whole-body SARs below 4 W/Kg are not "associated with effects that demonstrably constitute a hazard."

Although the literature review was written by the staff at EPA's Office of Research and Development, the RF/MW standard will be set by the agency's Office of Radiation Programs (ORP). In a telephone interview, ORP's Dave Janes said that the standard is "still a moving target." One of the key variables still to be decided is how the agency will handle frequency dependence. A flat, ramp and well approach are all still in the running, Janes said.

Although EPA officials would not disclose what levels are now under consideration, the speculation within the RF/MW community is that the standard will be in the 100-200 uW/cm^2 range. The EPA limits, once promulgated, will only apply to federal agencies, and are known as a "guidance."

The first public discussion of EPA's draft document will come at a meeting of a special panel of the Scientific Advisory Board (SAB), chaired by Professor Charles Susskind of the University of California, Berkeley (see *MWN*, March 1983). The SAB panel is tentatively scheduled to meet in Washington, DC, on September 22-23. Public comments on the draft are due by September 16.

A copy of the EPA report, *Biological Effects of Radiofrequency Radiation,* (No. EPA-600/8-83-026A, June 1983, External Review Draft) is available from: ORD Publications — CERI-FR, US EPA, Cincinnati, OH 45268, (513) 684-7562. (Be sure to include the document number with your request.)

Wisconsin Sues Over Project ELF

The state of Wisconsin has filed suit to block the navy's Project ELF communication system until a new environmental impact statement (EIS) is prepared. On July 20, Wisconsin Attorney General Bronson La Follette charged in federal court that the navy had failed to revise its 1977 EIS to take into account changes in the proposed submarine communications antenna and new studies on environmental and health effects of extremely low frequency radiation (ELF).

La Follette and Assistant Attorney General Shari Eggleson cited a number of changes in the navy's ELF proposal including a small, suspended antenna instead of the originally planned larger buried antenna. The mode of transmission has also gone from a unified to a joint, synchronized system. In addition, the attorneys cited the publication of "numerous" new studies on the bioeffects of ELF radiation that "raise serious concerns."

A spokesman for the navy would not comment on the suit except to say that the navy will contest it.

The navy's Wisonsin facility at Clam Lake was deactivated by President Carter in 1979; in 1981 President Reagan decided to reopen, upgrade and expand it —adding two antennas in Michigan operated by a control center at K.I. Sawyer air force base (see *MWN*, May 1981 and March 1982). According to current plans, the navy intends to have the ELF system in operation by 1986.

The Secretary of Defense, Caspar Weinberger, and the Secretary of the Navy, John Lehman, Jr., the defendants in the suit, have 60 days from July 20 to respond to the complaint (No. 83C672C) filed in US District Court for the Western District of Wisconsin.

Meanwhile, on July 15 in neighboring Michigan, the Natural Resources Commission voted 5-0 in favor of granting the navy an easement to build the ELF antenna. Michigan Governor James Blanchard opposes the navy project as a "terrible waste of taxpayers' money," and asked the commission to turn down the navy request. Wisconsin's Eggleson told *Microwave News* that Michigan has been invited to join the Wisconsin suit but has not yet responded.

Stop Project ELF, a citizen's group based in both states, is considering court action to reverse the Michigan decision. The group's John Stauber said that the commission does not have the authority to give the navy permission to build the antenna. "Only the state legislature has that power," Stauber claimed.

Power Line Action in Montana and Florida

Montana has set a standard to limit public exposure to power line radiation, and similar regluations are planned in Florida.

Montana's Board of Natural Resources and Conservation recently established a 1 kV/m limit for electric fields at the edge of the right-of-way (ROW) in residential and subdivided areas along a planned 500 kV power line. To comply with the rule, the Bonneville Power Administration (BPA) will have to widen the ROW along certain sections of its Garrison, ND-Spokane, WA, line from 125 feet to 160 feet. Property owners may waive the requirement.

The board based its decision on recommendations from Dr. Asher Sheppard, its consultant on the biological effects

of power line radiation. Sheppard, a research physicist at the VA Hospital in Loma Linda, CA, concluded that the electric fields produced by a 500 kV transmission line "are sufficiently intense that regulations intended to limit chronic exposure are a prudent requirement." BPA maintained that there is no evidence that higher field strengths are hazardous. Along with the 1 kV rule, the board imposed a 50 dBA transmission line noise limit in populated areas. This will require a 205 foot ROW.

Copies of Sheppard's report, *Biological Effects of High Voltage AC Transmission Lines*, February 1983, and the final report of the Department of Natural Resources and Conservation, Energy Division, *Preferred and Alternate Routes for the Bonneville Power Administration's 500 kV Transmission Line From Garrison West*, April 1983, are available from K. Heart, DNRC, 32 South Ewing, Helena, MT 59620, (406) 449-4600.

Florida will tackle radiation hazards under revisions in its Transmission Line Siting Act, which passed the state legislature in late May. Statutes 403.52 - 403.536 of the measure authorize the Department of Environmental Regulation to establish public safety requirements for siting applicants. Since no funds accompanied the order, the department must make a 1984 budget request before beginning its work. The regulations will not apply to lines built under the state's Power Plant Siting Act. These lines link new generating facilities to the state power grid.

The state action grew out of a local battle to block construction of a Florida Power and Light substation in Tamarac. After successfully leading community opposition to the project, town resident Herman Bender petitioned the governor and the legislature for state-wide regulations for power line radiation.

NAS Panel Finds VDTs Safe

The National Academy of Sciences (NAS) panel studying effects of video display terminals (VDTs) on workers' vision has concluded that VDTs are safe. The panel strongly discounted the possibility that radiation emissions from terminals could cause eye damage, including cataracts.

The Panel on the Impact of Video Viewing on Vision of Workers did not address radiation risks for fetuses in its report, *Video Displays, Work, and Vision*. Neither did the panel consider very low frequency (VLF) radiation emitted by flyback transformers which some researchers believe may be dangerous.

The panel concluded that radiation emissions from VDTs "are highly unlikely to be hazardous" to health. On the basis of its review of seven studies completed between 1977 and 1981, the panel found that "emissions of all types of electromagnetic radiation —X-rays, ultraviolet (UV), visible (light), infrared (IR), and radiofrequency (RF) radiation, including microwaves— are well below accepted occupational and environmental health and safety standard limits." The report states that the panel did not try to assess the adequacy of these standards.

The panel challenged the 10 cases of VDT-related cataracts reported by Dr. Milton Zaret, a Scarsdale, NY, ophthalmologist. Only four of those cases involved "significant lenticular opacities," according to the report, "and each of them had known preexisting disease or exposure to cataractogenic agents." The six other cases involved "inconsequential opacities that did not appreciably reduce visual acuity," the report says.

In a telephone interview with *Microwave News*, Zaret said that the panel never contacted him and that he had not seen its final report. But he contested the panel's conclusions on the basis of media coverage. He said he sees "more and more people who are being injured by radiation" from VDTs. "Not a week goes by that I don't see that the problem is worse than I originally thought," he said.

The panel found that visual problems commonly experienced by VDT workers varied with the quality of equipment, workstation design, and the nature of the task. The most common difficulties reported by the panel were blurred vision, tired eyes, muscular aches and stress. The report recommends that employers pay closer attention to designing jobs and workstation environments that improve worker comfort and reduce job-related stress.

A spokeswoman for 9 to 5, the National Association of Working Women, told *Microwave News* that a VDT telephone hotline run by that group is producing evidence in "complete contrast to the conclusions of the report." Janice Blood said that early results from the hotline indicate a need for further research.

She also said that the report's conclusions probably will delay additional research which she maintains is already overdue. Of the 3,012 calls received in the hotline's first month, 17 percent were related to eye and visual problems, 10 percent to pregnancy concerns, 8 percent to headaches, and 5 percent to muscle strain.

Spokesmen for The Newspaper Guild and the Communications Workers of America also were critical of the report.

The Panel on the Impact of Video Viewing on Vision of Workers was formed by NAS in the spring of 1981 in response to a request from the National Institute for Occupational Health and Safety (NIOSH) to evaluate available research on visual health problems associated with VDTs. The panel, chaired by Professor Edward J. Rinalducci, a psychologist at the Georgia Institute of Technology, held a public symposium in Washington, DC, in August 1981 as part of the study (see *MWN*, September 1981). A summary of those proceedings is published in *Behavior and Information Technology*, Vol.1, No.2, 1982.

VDTs Dropped from California Epidemiological Study

Contrary to statements made in June by the National Institute for Occupational Safety and Health (NIOSH), an epidemiological study of pregnancy outcomes among video display terminal (VDT) users is *not* underway. The agency's plan to collect information through a project headed by Kaiser-Permanente, one of California's major health care companies (see *MWN*, June 1983), fell through in July.

NIOSH staffers now say the agency is likely to launch its own study.

Dr. David Brown, assistant chief of NIOSH's Industry Wide Studies Branch, told *Microwave News* that "the California study is a moot point now, but the VDT-pregnancy issue is important enough for us to go ahead and do our own study." NIOSH hopes to identify a suitable study population by this fall. Both Brown and Dr. Jane Gordon, the VDT project supervisor, are optimistic that NIOSH will fund a full-scale investigation in fiscal year 1984, which begins in October.

Although NIOSH's Dr. Michael Rosenberg said he had reached an agreement with Kaiser early this summer, the company decided against adding the agency's proposed question on VDTs to its questionnaire. Rosenberg recently left NIOSH to work for Family Health International in Research Triangle Park, NC.

Kaiser is collecting data for California's Department of Health Services on the reproductive effects of malathion, the pesticide sprayed to combat medflies. According to the project's principal investigator, Dr. Diane Pititti, the study will also investigate a limited number of other topics, but not VDTs.

Standards and Litigation at IMPI

Professor Herman Schwan sought to clarify the history of the early development of radiofrequency and microwave (RF/MW) safety standards in his keynote address at the 18th Annual *Microwave Power Symposium*, in Philadelphia, July 19-21.

Looking back to the late 1950's and early 1960's, Schwan said that he wanted to deflate four myths: First, that there was no interest in non-thermal effects during the Tri-Service research period. Second, that there was no research on non-thermal effects at that time. Third, that there was no interest in Soviet research. And fourth, that there was a conspiracy to ignore RF/MW bioeffects.

"Some have accused us of neglecting non-thermal effects," Schwan said, "but nothing could be further from the truth." Schwan, who chaired the subcommittee that recommended the first American National Standards Institute (ANSI) safety limit (the 10 mW/cm^2 standard adopted in 1966), recalled that there was no pressure from industrial and military groups —only scientific considerations went into formulating the standard, he said. He went on to note that the new ANSI standard "is a logical extension of the early standard." Schwan recently became a professor emeritus at the University of Pennsylvania in Philadelphia, but he will continue to teach and do research there.

Professor Nicholas Steneck a historian at the University of Michigan in Ann Arbor, took a different position. "RF bioeffects research has over the years been adversely affected by its dependence on the development community, namely industry and the military," he told the same crowd that had just heard Schwan. Judging bioeffects research to be "biased in very pronounced ways," Steneck urged that "politics and social maneuvering" be avoided so that the field be allowed to develop on its own, free of the constraints that have proven to be so controversial.

Steneck was particularly critical of the RF/MW research community for not using accident reports to assess human health impacts. As an example he cited the lack of follow-up on the death of a Hughes Aircraft employee who died in 1953 most probably from exposure to microwaves. "The contention that no one is dying or even being injured is not a statement that has the weight of science behind it. It is a statement that reflects, basically, the faith of the RF/MW bioeffects research community," he said. Steneck is completing a book on the development of RF/MW standards.

Marc Moller, an attorney with Kreindler and Kreindler in New York City, told the conferees that with the proliferation of microwave technology in industry, medicine and the home, "an increase in personal injury claims and litigation is a virtual certainty." Moller was the lead attorney on behalf of Robert Engell, a TACAN repair mechanic who developed pancreatic cancer. The suit was settled last December but details on the settlement were not divulged (see *MWN*, January/February 1983).

While noting that the question of causation —relating injury to microwaves— varies from case to case, Moller said "some plaintiffs, in my judgment, will inevitably be able to meet the 'reasonable preponderance of the evidence test' required to obtain favorable litigation results."

ANSI C95 Goes Back to Work

At the first meeting of the American National Standards Institute (ANSI) C95 Committee on Radiofrequency Radiation Hazards since the approval of the new safety standard (C95.1-1982) last year, Dr. F. Kristian Storm presented an ambitious plan for revising the standard. According to ANSI rules, all of the institute's standards must be updated every five years, and as Storm noted "the clock is running."

Under Storm's plan, the C95.IV subcommittee would set up five new task groups: to scan the world literature for new reports, to evaluate their engineering, biological and statistical validity and to assess their implications for exposure risks. The data will flow through these groups to Storm and the members of his C95.IV subcommittee. The review process is already under way.

Among the other C95 subcommittees, there were the following developments:

- NBS' Dr. Ray Baird reported that his subcommittee (C95.I) on instrumentation had decided to combine two existing ANSI standards on far-field (C95.3-1979) and near-field (C95.5-1981) measurements into one document. A new task group, under the direction of FDA's Howard Bassen will decide the best way to consolidate and update them. One suggestion for the revision is to place a greater emphasis on the measurement of magnetic fields.
- Baird's subcommitee will study the possibility of addressing dosimetric techniques.
- Dr. John Osepchuk, the chairman of subcommittee II/III on terminology and units, reported that no one, including

the navy, had yet printed the new non-ionizing radiation warning signal (C95.2-1981, see *MWN*, October 1981). Although this subcommittee has no detailed plans for the immediate future, Osepchuk did suggest that C95 should revise its vocabulary to make it consistent with that of the ANSI C63 committee on electromagnetic compatibility.

• In the next few months a new standard covering electroexplosive devices, prepared by subcommittee V under the chairmanship of Ramie Thompson, will be ready for circulation to the full C95 committee.

• Dr. Paul Tyler's medical surveillance subcommittee (C95.VII) called for volunteers to assist him in determining the medical tests that should be administered to RF/MW workers, and to help him decide how to address the problem of defining who are RF/MW workers.

At the meeting, Storm presented a tentative roster of experts who will serve on the new C95.IV committees and task groups: *Committee for Literature Surveillance,* Chair: Louis Heynick. *Committee for Engineering Principles Validation,* Chair: Bill Guy; Working Groups: 3 kHz-3 MHz: C.K. Chou, 3 MHz-300 MHz: O.P. Gandhi, 300 MHz-100 GHz: R.A. Tell. *Committee for Biologic Principles Validation,* Chair: Don Justesen; Working Groups: Behavior: J. D'Andrea, Biorhythm: R. Smith, Cardiovascular: J. Lords, Nervous System: R. Lebovitz, Development & Teratology: M. O'Connor, Endocrine: S. Lu, Visual: R. Carpenter, Genetics: C. Blackman, Acoustic: K. Foster, Hematology & Immunology: R. Smialowicz, Metabolic & Thermoregulation: E. Adair, Physiology: R. Phillips, Oncology: J. Dickson, Compound Interactions: P. Czerski. *Committee for Statistical Validation,* Chair: Carol Newton. *Committee for Evaluation of Exposure Risk,* Chair: Dave Janes.

Storm, an associate professor of surgery in the Division of Oncology at the UCLA Medical Center, took over as chairman of the C95.IV subcommittee after Dr. A.W. Guy resigned when the new health standard was approved. Raytheon's Osepchuk will serve as the secretary of the subcommittee. Professor Saul Rosenthal of the Polytechnic Institute of New York continues to serve as the chairman of the parent C95 committee.

NBS Calibration Program

The National Bureau of Standards (NBS) has announced the formation of an accreditation program for laboratories that measure microwave power, attenuation and reflection coefficients. NBS expects to certify the first labs under the National Voluntary Laboratory Accreditation Program (NVLAP) by the spring of 1985.

Labs that are found to have the necessary expertise and competence will join the NVLAP for electromagnetic calibration services. In order to win accreditation in the LAP, labs must participate in at least one of three Measurement Assurance Programs (MAPs): power, attenuation and reflection coefficient, all in the frequency range 0.1-18 GHz.

The decision to formally set up the new LAP stems from a 1977 request by Bruno Weinschel of Weinschel Engineering in Gaithersburg, MD. In early 1982, NBS announced its decision that labs providing electromagnetic calibration services should be accredited. In July 1982, some 46 representatives from government agencies and the private sector attended an NBS workshop in Boulder, CO, to help develop the LAP.

For more information, contact Douglas Thomas, project leader for the EM NVLAP or John Locke, manager of laboratory accreditation, NBS, TECH B141, Washington, DC 20234, (301) 921-3431. NBS' announcement for the new EM LAP appears in the June 30 *Federal Register,* (48 *FR* 30174).

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UPDATES

BIOLOGICAL EFFECTS

Literature Surveys... The *Biological Effects of Non-Ionizing Electromagnetic Radiation: A Digest of Current Literature* is back in print. Volume VII, Number 1, covering the period from January to June 1982, was published in June and the next issue is due out soon. The quarterly BENER digests had stopped appearing after NTIA and ERMAC ran out of funds. The Office of Naval Research (ONR) came to the rescue with a three-year contract to allow Bruce Kleinstein's Information Ventures, Inc., based in Philadelphia, PA, to continue the service. A limited number of copies are available from Dr. Michael Marron, ONR, Code 441CB, 800 North Quincy St., Arlington, VA 22217. Please include a mailing label....Louis Heynick and Dr. Peter Polson of SRI International in Menlo Park, CA, have prepared *Bioeffects of Radiofrequency Radiation: A Review Pertinent to Air Force Operations,* Report No. USAFSAM-TR-83-1. The 181-page analysis of the current bioeffects literature, commissioned by the air force (AF), is designed as a background document for environmental impact statements and assessments for installations that involve emissions of RF/MW radiation —for example the AF's west coast over-the-horizon radar and southeast PAVE PAWS radar system. Those seeking a copy should contact James Merritt, USAF School of Aerospace Medicine, Brooks AFB, TX 78235. According to Polson, the report will be updated from time to time as a function of AF needs and available funding.

COMMUNICATIONS

FCC RF/MW Rules... At a meeting in mid-September, the FCC will decide how to proceed with its proposed rules (issued January 1982) on the evaluation of radiation hazards in its licensing procedures for RF/MW sources. The commission has completed its review of the 18 sets of comments from the broadcasting and communications industries and is now considering various policy options (see *MWN,* March and September 1982)....Meanwhile, the FCC's Office of Science and Technology has published a revised edition of its report, *Questions and Answers About Biological Effects and Potential Hazards of Radiofrequency Radiation,* OST Bulletin No. 56, second edition, June 1983. A copy is available from the commission's Consumer Assistance Office, Washington, DC 20554, (202) 632-7000.

COMPATIBILITY & INTERFERENCE

Immunity Task Group... The task group studying ways of enhancing the immunity of home electronic equipment met in Washington on July 26. Hector Davis of the FCC Labs has joined the group, which is chaired by Don Heirman of American Bell. Davis is preparing an internal FCC report on the immunity of TV sets. The Electronic Industries Association's (EIA) Consumer Electronics Group is going forward with immunity measurements of 18 TV sets and two VCRs from ten manufacturers. And the American Radio Relay League (ARRL) is completing a questionnaire that should pinpoint the most common RFI problems. At a meeting on June 23, the IEEE Standards Board welcomed the progress being made by the task group toward voluntary standards, avoiding the need for mandatory rules. The board set the following priority list: TV receivers, VCRs and related equipment, hi-fis, telephones, home computers, home security devices (detectors and alarms), home appliances and other electronic devices with microprocessors. The group's next meeting will be the week of the EMC annual symposium in late August. Heirman intends to continue the current schedule of meeting every four to six weeks.

EMC '83... Everything is set for the *1983 International Symposium on Electromagnetic Compatibility.* While the conference runs from August 23 to 25, workshops on EMP and shielding are scheduled for Monday the 22nd and a number of IEEE, ANSI, EIA and SAE meetings will also be held on Monday and on Friday the 26th. It will be a busy week, with six workshops and 23 paper and poster sessions. Attendance should be good: by the end of July, the Hyatt-Regency Crystal City Hotel was fully booked, forcing EMCers to neighboring hotels.

Reports, Products and Contracts... The FCC's Office of Science and Technology has issued two Technical Memorandums, "Teletext Related Interference Observed on WETA-TV, Washington, DC" (No. FCC/OST TM 83-2) and "Diurnal Variation in MF Skywave Propagation" (No. FCC/OST TM 83-4). The first describes the potential problems facing broadcasters when transmitting teletext information. The second details the ways in which daytime stations can expand their time on the air without causing interference to stations already authorized to broadcast during the sunset-sunrise hours. Both reports are available from the Downtown Copy Center, 1413 K St., NW, Washington, DC 20037, (202) 289-4140....A group from EPA, Southwest Research Institute and Electro-Metrics describes a new under-the-hood antenna system for measuring electric and magnetic fields from an automobile ignition system in the May *IEEE Transactions on Electromagnetic Compatibility.*...Dow Jones, the publisher of the *Wall Street Journal* has shielded its 11-meter satellite communications antenna in Highland, IL, from RFI with precast concrete panels made by the Fanwall Corp. of Arlington, VA. The 35-foot high, 72-foot long shield reduced the strength of an interfering terrestrial signal by 14 dB. The shielding wall can withstand winds of up to 100 mph....Keene Corp.'s Ray Proof Division in Norwalk, CT, has introduced a special shielding system to protect NMR imagers from RFI. The Series 84 enclosures can provide isolation from RF noise, reducing it 100 dB between 1 and 100 MHz....Comsearch Applied Technology has opened a field office in Annapolis, MD, to support EMC projects for the navy....The navy has awarded a one year, $893,044 contract to Bendix Field Engineering of Columbia, MD, for electromagnetic environmental effects and RF systems performance analysis. And Rome Air

Development Center at Griffiss AFB, NY, is negotiating with the Draper Lab in Cambridge, MA, for an analysis of the UHF and L-band interference threat for the late 1980's and 1990's.

GOVERNMENT

EPA's R&D Budget... In mid-July, the President signed HR 3133, which contains EPA's FY84 appropriations. The bill had emerged from a House-Senate conference committee with the House's $1 million line item for non-ionizing radiation health effects research deleted. Instead, the conferees agreed to add $4 million to the administration's original budget request —the one that planned to close EPA's RF/MW research program— for health effects research on air, drinking water, toxics and non-ionizing radiation (House Report No. 98-264, June 23, 1983). How the new money will be divided among these programs has been left up to EPA, though one House staffer was optimistic that agency officials would follow the recommendations of the House committees which called for more non-ionizing radiation research, especially at power line frequencies. It is not yet clear whether these funds are for extra-mural research or can be used to preserve the RF/MW group at EPA's Health Effects Research Lab in Research Triangle Park, NC. If the $4 million must be spent outside the agency, EPA could still save the lab by using some of the more than $24 million and 607 positions that Congress added to the EPA budget to be allocated at the agency's discretion. EPA Administrator William Ruckelshaus is scheduled to complete his EPA FY84 and FY85 budgets by mid-August. The fate of the RF/MW lab should be known then. Also, as we go to press, the *Washington Post* reports that Ruckelshaus has offered Professor Bernard Goldstein of Rutgers University the job of EPA Assistant Administrator for R&D. If Goldstein accepts he will replace Courtney Riordan who has been filling in on an acting basis.

FDA's Radiation Program Reorganized... The reorganization of FDA's National Center for Devices and Radiological Health is nearly complete: the plan has won the approval of FDA Commissioner Arthur Hayes, Jr., (who resigned on July 28) and the Assistant HHS Secretary for Health Edward Brandt. The center, with John Villforth as Director and James Benson as Deputy Director, is now operating under the new structure on an interim basis, with new appointees working in an "acting" capacity until HHS Secretary Margaret Heckler gives the final okay. As such, the Offices of Radiological Health and Medical Devices have been replaced by eight new offices. Four major ones: Compliance, Device Evaluation, Science & Technology and Training & Assistance; and four smaller ones: Health Affairs, Health Physics, Management & Systems and Standards & Regulations. The Office of Science & Technology, directed by Roger Schneider with Dr. Moris Shore as deputy director, has three new components: the Division of Physical Sciences (the same as BRH's old Division of Electronic Products) directed by William Herman; the Division of Life Sciences (the same as the old Division of Risk Assessment) directed by Dr. William Leach; and the Division of Biomedical Engineering (no director has yet been named). Howard Bassen will continue as chief of the electromagnetics branch in the new Division of Physical Sciences and Dr. Mays Swicord will serve as chief of the non-ionizing radiation branch in the Division of Life Sciences. Walter Gundaker is in charge of the new Office of Compliance, Robert Britain of the Office of Device Evaluation and Philip White of the Office of Standards & Regulations. When the plan is approved, a notice will appear in the *Federal Register.*

MEASUREMENT

New Narda Probe... Narda Microwave of Hauppauge, NY, has introduced a new electric field probe to simplify the measurement of radiation fields relative to the new ANSI RF/MW safety standard. The Model 8682 probe, when used in conjunction with the standard Narda 8611 or 8616 meter, will indicate exposure levels as a percentage of the ANSI guidelines —from 0.2 to 200 percent— by taking into account the frequency dependence in the ANSI limits. The probe costs $1250.

Dosimeter Expands... Dr. Wordie Parr, who resigned as chief of NIOSH's Physical Agents Effects Branch in Cincinnati, OH, at the end of last year has joined the Dosimeter Corp., also in Cincinnati, as products manager and consultant. While Dosimeter has been primarily involved with ionizing radiation, Parr plans to lead the company into the RF/MW instrumentation field.

MEDICAL APPLICATIONS

FDA Panel Smiles on BSD and NMR... Meeting in Rockville, MD, on July 6-7, the FDA's Radiologic Devices Panel recommended three NMR imagers and BSD Corp.'s hyperthermia unit be approved for marketing. The FDA must still accept the recommendation and give the final okay; the companies and the agency must agree on labelling language, which determines how the units may be used. The action on the BSD-1000 cancer treatment unit had been expected (see *MWN,* May 1983). NMR imagers made by Diasonics, Picker and Technicare are the first to receive clearance from the panel. The official FDA decision is not expected for about another three months, although action on the BSD unit could be a little quicker since the company has been negotiating with the agency for some time. The panel's action has put on hold a proposal by the National Electrical Manufacturers Association (NEMA) to reclassify NMR imagers from Class III to Class I or II (which do not require premarket approval)....NCI has awarded the Allegheny-Singer Research Corp. of Pittsburgh, PA, $1,654,712 for its hyperthermia quality assurance program, and the institute has issued a request for proposals (RFP 223-83-6032) for the development of educational guidelines and recommendations for hyperthermia operators.

Electric Fields Kill Pain and Affect RNA... Low frequency electrical fields are being used as anesthetics. Dr. William Bauer of the VA Medical Center in Cleveland, OH, has applied transcutaneous electrical nerve stimulation to treat severe head and neck pain among cancer patients. Writing in the June 1983 issue of *Archives of Otolaryngology,* Bauer reports that he achieved "extremely positive" results; the best frequency was between 0.5 and 8 Hz. Bauer used the Alpha-Stim 2000, developed by Dr. Daniel Kirsch and marketed by Electromedical Products Inc. of Hawthorne, CA. The unit costs $5,850; a smaller consumer (by prescription) model, the Alpha-Stim 350, is available for $995. (There are many other similar products on the market.) In a telephone interview, Bauer said that the use of electric fields is "opening up a whole new discipline in medicine." Bauer will soon be moving to Emory University in Atlanta, GA, where he will continue his work on pain as well as do research on the effects of electric fields on immunological and neurological diseases.... A team from Columbia University's medical school has found that two different pulsed electromagnetic fields (PEMFs) have different effects on RNA transcription. In a paper in the June 17 *Science,* Drs. Reba Goodman, Andrew Bassett and Ann Henderson describe their experiments with *Sciara Coprophila,* a fungus gnat, using single (72 Hz) and repetitive (15 Hz) pulses. While the single pulses increased the activity of messenger RNA after 15 and 45 minutes, the repetitive train of pulses increased activity only after 45 minutes. The authors conclude that their study "supports the hypothesis that PEMFs induce specific modifications in normal cell function."

OVENS

FTC-Amana Suit... The FTC has settled its 1982 suit charging Amana Refrigeration Inc. with falsely advertising its Radarange microwave oven (see *MWN,* November 1982). The commission maintained that company ads claimed an Amana oven was the only brand to pass an independent laboratory test, when in fact a Panasonic also passed. It also charged Amana with claiming a consumer survey rated its oven "best quality," even though many oven owners preferred other brands. Under a consent agreement, appearing in the July 18 *Federal Register,* (48 *FR* 32596), Amana, a Raytheon subsidiary, and its ad agency, Foote Cone & Belding, promise not to make these claims and to avoid misrepresenting any other surveys or tests. Amana officials say they entered the agreement, which carries no admission of guilt, to avoid lengthy and expensive legal action. Copies of the agreement and the original complaints are available from the FTC's Public Reference Branch, Room 130, 6th St. and Pennsylvania Ave., NW, Washington, DC 20580, (202) 523-3598. Comments on the agreement are due by Septmeber 16, after which the commission will decide whether to make the agreement final.

POWER LINES

Generally... Recent studies that link leukemia to low levels of ELF radiation from power lines (see *MWN,* March 1983) have caught the attention of Congress. According to Christopher Dodge of the Congressional Research Service (CRS) at the Library of Congress, CRS has received some two dozen inquiries about these studies from both Senate and House members. Dodge said he would not be surprised if hearings were held....DOE has released its *Draft Environmental Impact Statement, DOE/DEIS-0103, for the New England/Hydro-Quebec ±450 kV DC Electric Transmission Line.* Copies are available from Garet Bornstein, Office of Fuels Programs, Economic Regulatory Administration, Room GA-017, 1000 Independence Avenue, SW, Washington, DC 20585, (202) 252-5935....The Electric Power Research Institute (EPRI) has published *Measurement and Characterization of Substation Electromagnetic Transients,* final report (No. RP1359-2), March 1983, from the Texas A&M University. It is available from EPRI's Research Reports Center, PO Box 50490, Palo Alto, CA 94303, (415) 965-4081....CORRECTION: The title of another EPRI report, *Bipolar HVDC Transmission System Study Between ±600 kV and ±1200 kV: Corona Studies, Phase 2,* (No. RP430-2) was misreported in our June issue....A history of the ±400 kV DC transmission line cutting across Minnesota from North Dakota, a bitter siting controversy lasting nearly ten years, is featured in the July *IEEE Spectrum.* In his special report, Sheldon Mains of the Minnesota Environmental Quality Board maintains that the story holds important lessons for technical planners.

STANDARDS

RF Heaters in Canada... The Canadian government has proposed rules governing the design, construction and functioning of industrial RF heaters in order to limit radiation exposures to operators. The new amendment to the *Radiation Emitting Devices Regulations* specifies that stray fields measured 15 cm or more from the external surface of the heater shall not exceed: (i) a maximum electric field of 300 V/m; (ii) an effective electric field of 60 V/m; (iii) a maximum magnetic field of 0.8 A/m; and (iv) an effective magnetic field of 0.16 A/m. The rules also set limits for X-ray exposure. The regulations were proposed on March 30 and appear in the April 16 issue of the *Canada Gazette Part I.*

...Copies of the proposed new standard *Recommended Practice on Procedures for Control of System Electromagnetic Compatibility* No. BSR C63.12, are available for $6.00 from: Margaret Lynch, IEEE, 345 East 47th Street, New York, NY 10017....ANSI has approved a new set of definitions of radar terminology. Standard ANSI/IEEE 686-1982, *Radar Terms,* is available from ANSI, 1430 Broadway, New York, NY 10018. The price has not yet been set.

VDTs

Legislation and Regulation... Following legislative successes in Maine and Connecticut for supporters of VDT health and safety measures (see *MWN*, June 1983), state representatives in Oregon and New York plan to continue their efforts to enact VDT safety rules. Oregon State Senator Margie Hendriksen, whose VDT bill was not acted upon before the senate adjourned, told *Microwave News* that the Senate Labor Committee she chairs has recommended that a task force be established to study VDT health and safety issues. In a letter to the president of the Oregon Senate, the committee suggested the task force be directed to report to the senate when it reconvenes in 1985. New York State Assemblyman Frank Barbaro also announced his intention to reintroduce VDT safety legislation in the next assembly session. His legislation would require radiation shielding at the point of manufacture and guarantee pregnant women the right to non-VDT work. Barbaro appeared on the *Donahue* television show recently to discuss VDT health and safety concerns and state legislation. Also appearing were Karen Nussbaum of 9 to 5, Vico Henriques of CBEMA, Key Dismukes of the NAS Committee on Vision and Sue Waltz, a VDT worker. For a transcript of the show, send a check for $2.50 to Donahue Transcript, PO Box 2111, Cincinnati, OH 45201....Citing recent research findings of very low frequency radiation (VLF) health hazards from VDT flyback transformers (see *MWN*, November 1982, January/February and April 1983), the Newspaper Guild has called on the federal government to study possible VLF shielding. In its Officers' Report to the 1983 Newspaper Guild convention the guild urges "the appropriate government agencies" to develop specifications and cost estimates immediately for such shielding.

Studies in Progress... Researchers at the University of Texas, Austin, are at work on a study to establish an objective measure for visual fatigue among VDT workers. The project is scheduled to take four years to complete and is being led by Dr. A.J. Welch of the University's Departments of Electrical Engineering and Biomedical Engineering. Funding for the work comes from the IBM Corp., which has committed $382,000 to the study....The results of an epidemiological study of approximately 2,000 Newspaper Guild members (see *MWN*, March 1981) are expected soon. The study, coordinated by Dr. Arthur Frank at the Mount Sinai Medical Center in New York City, included eye examinations and a survey questionnaire involving seven locals of the guild. Frank recently left Mount Sinai to become Chairman of the Department of Preventive Medicine and Environmental Health at the University of Kentucky's College of Medicine in Lexington....Two University of Wisconsin, Madison, researchers are continuing their work on office automation problems. Dr. Robert Arndt is preparing a policy paper on office technology hazards due soon from the congressional Office of Technology Assessment (OTA). Arndt's presentation of differing views on potential health problems and available documentation will be released by OTA this fall and subsequently will be included in OTA's *Health and Safety Control Technologies in the Workplace*, a compilation of studies. Professor Steven Sauter, a colleague of Arndt's in the University's Department of Preventive Medicine, is studying the effect of automation on the nature of work in a project under contract to NIOSH. No date for the final report has been set....A new study looking at the impact of VDTs in the office will consider both ergonomic and radiation concerns. The *Project On the Workplace Impact of Video Terminals in the Office* began in April 1982 and is expected to cost between $250,000 and $300,000, according to its director, Professor Alan Westin of Columbia University. The research is being supported in part by IBM and Hewlett-Packard. The remainder of the funding comes from Westin's Educational Fund for Individual Rights....The Canadian Standards Association has set up a Technical Committee on Ergonomics to produce guidelines for workers and employers on office environment, workstation, equipment and furniture. Representatives from the Canadian Business Equipment Manufacturers Association and the Canadian Center for Occupational Health and Safety (CCOHS) will participate. Draft guidelines are scheduled for public review in early September and a final *Guidance on Ergonomics of the Office Environment* is due in December.

Resources...CCOHS has released a follow-up report to its recommendation early this year that radiation standards be extended to include the very low frequency radiation (VLF) emitted by some VDTs (see *MWN*, January/February 1983). *The Case for Concern About Very Low Frequency Fields from Visual Display Terminals: The Need for Further Research and Shielding of VDTs* is a 24-page document that argues the need for caution about VLF radiation at least until more is known. Also a pivotal Czechoslovakian study cited by CCOHS in making its recommendation has been translated into English and is available from the Center. Both the follow-up report and Czech researcher Dr. Hana Pafkova's finding of "an unfavorable effect" on embryonic development of pregnant mice exposed to a pulsed 300 Hz field with a peak value of 28,500 V/m and a pulse width of 10 microseconds can be obtained from CCOHS, 250 Main Street East, Hamilton, Ontario, L8N 1H6....The Canadian Department of National Health and Welfare recently released *Investigation of Radiation Emissions from Video Display Terminals* (see *MWN*, December 1982). The report concludes that, "There is no reason for any person, male or female, young or old, pregnant or not, to be concerned about radiation health effects from VDTs." Copies of the report, No.83-EHD-91, are available from: Public Affairs Directorate, Department of National Health and Welfare, 5th Floor, Brooke Claxton Building, Ottawa K1A 0K9....The highlights of the International Conference on Office Work and New Technology held in October 1982 (*MWN*, November 1982) are excerpted in *Office Automation: Jekyll or Hyde?* Copies cost $12.95 and can be ordered from Working Women Education Fund, 1224 Huron Road, Cleveland, Ohio 44115....The Canadian Advisory Council on the Status of Women has published, *Reproductive*

Hazards at Work: Men, Women and the Fertility Gamble, by Nancy Miller Chenier. In an early chapter this book-length study outlines reproductive hazards associated with VDTs. Other potential dangers discussed include chemicals, ionizing radiation, and psychosocial hazards. It is available free of charge from the Canadian Advisory Council on the Status of Women, Box 1541, Station B, Ottawa, Ontario, K1P 5R5.

ETC.

People...A number of changes are taking place among the leadership of the Bioelectromagnetics Society (BEMS). Dr. Bill Guy of the University of Washington, Seattle, took over as president of the society in June. The BEMS membership has elected Dr. Don Justesen vice-president, and he will take over as president when Guy steps down next year. Dr. Elliot Postow of the National Naval Medical Center in Bethesda, MD, will retire as editor of *Bioelectromagnetics* after completing the journal's fifth volume. Dr. R.D. Phillips of Battelle Pacific Northwest Labs in Richland, WA, will be the next editor of the BEMS journal; all manuscripts submitted for publication after January 1 should be sent to Phillips. And Dr. Michael Marron, who is replacing Dr. Tom Rozzell at the Office of Naval Research (ONR), will also assume editorship of the BEMS newsletter. Rozzell is off to ONR's office in London....At EPA's Health Research Lab in North Carolina, Dr. Claude Weil, who works on computer models of electromagnetic fields, is leaving the agency for Boeing in Seattle, WA....Dr. Eleanor Adair of the John Pierce Foundation at Yale University has been elected a fellow of the AAAS....And the Canadian Center for Occupational Health and Safety in Hamilton, Ontario, has formed a new section devoted to physical hazards. Dr. Karel Marha will serve as manager and Dr. Shelly Beauchamp as project scientist for the section, which will begin by focussing on the effects of non-ionizing radiation in general and low frequency magnetic fields in particular.

CONFERENCES

August 16-19: *2nd Annual Meeting of the Society of Magnetic Resonance in Medicine,* Fairmont Hotel, San Francisco, CA. Contact: SMRM, Radiology Postgraduate Education, Room C324, University of California, San Francisco, CA 94143.

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

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

September 4-6: *URSI Symposium on Techniques in Studies of Biological Effects of Low-Level Millimeter Waves,* Herrsching, West Germany (near Munich). Contact: Professor Saul Rosenthal, Polytechnic Institute of New York, Route 110, Farmingdale, NY 11735.

September 5-8: *13th European Microwave Conference,* Messezentrum, Nurnberg, West Germany. Contact: Microwave Conference, Convex House, 43 Dudley Road, Tunbridge Wells, Kent, TN1 1LE, England.

September 6-8: *2nd International Conference on Radio Spectrum Conservation Techniques,* University of Birmingham, England. Contact: Conference Services, IEE, Savoy Place, London WC2R 0BL, England.

September 12-14: *36th Annual Conference on Engineering in Medicine and Biology,* Hyatt Regency Hotel, Columbus, OH. Contact: Alliance for Engineering in Medicine and Biology, 4405 East-West Highway, Suite 210, Bethesda, MD 20814.

September 19-21: *16th Annual Electronics and Aerospace Conference and Exposition,* Shoreham Dunfey Hotel, Washington, DC. Contact: Susan Vekich, Honeywell Inc., Aerospace and Defense, Honeywell Plaza, Minneapolis, MN 55408.

October 2-5: *3rd International Meeting of the Bioelectrical Repair and Growth Society,* Holiday Inn Golden Gate, San Francisco, CA. Contact: Executive Secretary, BRAGS, 425 Medical Education Building, 36th and Hamilton Walk, Philadelphia, PA 19104.

October 4-6: *7th International Colloquium on Prevention of Occupational Risks due to Electricity: The Prevention of Electrical Accidents by Influencing Human Behavior,* Cologne, West Germany. Contact: Secretariat of ISSA-Section and Colloquium, Berufsgenossenshaft der Feinmechanik und Elektrotechnik, Gustav-Heinemann-Ufer 130, D-5000 Koln 51, West Germany.

October 16-20: *Conference on Electrical Insulation and Dielectric Phenomena,* Buck Hill Inn, Buck Hill Falls, PA. Contact: Dr. J.K. Nelson, Center for Electric Power Engineering, Rensselaer Polytechnic Institute, Troy, NY 12181.

October 27-28: *Studying Problems Associated with Video Display Systems,* Skyline Ottawa Hotel, Ottawa, Canada. Contact: Planetary Association for Clean Energy, 77 Metcalfe St., Suite 607A, Ottawa, Ontario, K1P 5L6, Canada.

November 7-9: *1983 Satellite Communications Symposium,* Hyatt Regency Hotel, Atlanta, GA. Contact: Betsy Crawley, Symposium Coordinator, 3845 Pleasantdale Rd., Atlanta, GA 30340.

November 14-17: *1983 Radio Technical Commission for Aeronautics Annual Assembly and Technical Symposium,* Marriott Crystal Gateway Hotel, Arlington, VA. Contact: RTCA Secretariat, One McPherson Square, 1425 K Street, NW, Suite 500, Washington, DC 20005.

November 16-17: *JINA 83,* (2emes Journees Internationale de Nice sur les Antennes), Nice, France. Contact: J.L. Guiraud, Centre National d'Etudes des Telecommunications, Centre de La Turbie, 06320 Cap D'Ail, France.

December 12-17: *8th Annual IEEE International Conference on Infrared and Millimeter Waves,* Carillon Hotel, Miami Beach, FL. Contact: Dr. K.J. Button, National Magnet Laboratory, Building NW-14, MIT, Cambridge, MA 02139.

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January 16-20: *Microwave Signatures in Remote Sensing,* URSI Commission F Specialist Meeting, Toulouse, France. Contact: Dr. Richard Moore, Remote Sensing Laboratory, University of Kansas Center for Research, 2291 Irving Hill Drive, Lawrence, KS 66045.

January 17-19: *Instrumentation & Measurement Society Technology Conference (IMTC) '84,* Aboard the Queen Mary, Long Beach, CA. Contact: Robert Myers, 1700 Westwood Blvd., Suite 101, Los Angeles, CA 90024.

February 20-22: *Office Automation & You,* Los Angeles Convention Center, CA. Contact: American Federation of Information Processing Societies,Inc., 1815 N. Lynn St., Arlington, VA 22209.

April 2-5: *3rd Annual Test & Measurement World Expo,* Brooks Hall, San Francisco, CA. Contact: Meg Bowen, 215 Brighton Avenue, Boston, MA 02134.

FROM THE FIELD

With this issue Microwave News *is introducing "From the Field," a monthly column featuring contributions of fact and opinion from our readers. We welcome short items of interest to the electromagnetic bioeffects and compatibility communities.*

"From the Field" offers you a quick way to communicate with your colleagues. There is no charge for this service, and we hope you will take advantage of it.

Of course, we continue to encourage our readers to submit letters to the editor on any relevant subject.

The opinions expressed in "From the Field" are those of the author(s) and do not necessarily represent the views of the editors of Microwave News.

Corrections From Battelle Pacific NW Labs

At last fall's Department of Energy contractors' review, Battelle's Dr. R.D. Phillips explained that a high-voltage transformer failed and was not correctly repaired: "The two high-voltage outputs, which are connected to adjacent electrodes in the mouse exposure system, were in phase rather than 180 degrees out of phase as specified." This resulted in lower field strengths than previously stated. The following two letters will be published in a forthcoming issue of Bioelectromagnetics. *We reproduce them here, at Battelle's request, to expedite the corrections in the papers cited.*

An erratum needs to be published in *Bioelectromagnetics* for the paper entitled, "Effects of 60 Hz Electric Fields on Specific Humoral and Cellular Components of the Immune System" 1982, *Bioelectromagnetics, 3,* 341-347 by J.E. Morris and R.D. Phillips.

A malfunction of the transformer used in this study was discovered after publication of this paper. The electric field strength in the mouse cages was 0.15-0.25 kV/m rather than 100 kV/m as reported in the publication. Experiments are planned to repeat this study at 100 kV/m.

James E. Morris, Ph.D.

An erratum needs to be published in *Bioelectromagnetics* for the paper by B.W. Wilson, et al. entitled "Chronic Exposure to 60 Hz Electric Fields: Effects in Pineal Function in the Rat" *Bioelectromagnetics, 2,* 371-380.

A malfunction of the transformers used for this study was detected subsequent to publication of this paper. The unperturbed field strength was 1.7-1.9 kV/m rather than 65 kV/m stated in the paper. A subsequent study at 60 kV/m produced essentially the same results as those observed at 1.7-1.9 kV/m.

Larry E. Anderson, Ph.D.

Biology and Chemistry Department, Battelle Pacific Northwest Laboratories, PO Box 999, Richland, WA 99352.

SHORT COURSES

August 26: ***The Understanding and Application of MIL-STD-461B,*** Arlington, VA. Fee: $295. Contact: R&B Enterprises, 20 Clipper Road, W. Conshohocken, PA 19428, (215) 825-1960.

August 29-30: ***Doppler Radar Meteorology,*** San Francisco, CA. Fee: $585. Contact: Technology Service Corp., 8555 16th St., Suite 300, Silver Spring, MD 20910, (301) 565-2970.

August 29-31: ***Engineering Techniques for Clinical Hyperthermia,*** Washington, DC. Fee: $685. Contact: Continuing Engineering Education, George Washington University (GWU), Washington, DC 20052, (800) 424-9773.

August 30-September 1: ***FCC & CISPR/VDE Compliance Design and Retrofit of Digital Devices,*** Newark, NJ. Fee: $760. Contact: Don White Consultants, Inc. (DWCI), State Route 625, PO Box D, Gainesville, VA 22065, (703) 347-0030.

September 12-16: ***Radar Systems Engineering,*** Washington, DC. Fee: NA. Contact: Continuing Education Institute (CEI) 10889 Wilshire Blvd., Los Angeles, CA 90024, (213) 824-9545 or (301) 596-0111. Repeated • September 19-23: Columbia, MD.

September 12-16: ***Spread Spectrum Communications Systems,*** Washington, DC. Fee: $855. Contact: GWU, see August 29 above.

September 13-15: ***EDP Equipment Design Seminar on Coping with the FCC/VDE Regulations on RFI,*** San Diego, CA. Fee: $695. Contact: EMXX Corp., 6706 Deland Drive, Springfield, VA 22152, (703) 451-4619. Repeated • October 11-13: Boston, MA; • November 8-10: San Francisco, CA.

September 18-24: ***Microwave Measurements,*** University of Kent, UK. Fee: 200-300 pounds, depending on IEE membership and housing needs. Contact: Institute of Electrical Engineering (IEE), Savoy Place, London WC2R 0BL, England, 01-240-1871, ext. 272 or 282.

September 19-21: ***Imaging Equipment Update,*** Chicago, IL. Fee: $150/$250/$300 for 1/2/3 days. (NMR and Nuclear Medicine on the 21st). Contact: Ms. Judy Gallegos, Dept. of Radiology, University of Utah School of Medicine, Salt Lake City, UT 84132.

September 20-23: ***Grounding and Shielding,*** San Diego, CA. Fee: $760. Contact: DWCI, see August 30 above.

September 26-29: ***Electromagnetic Compatibility Engineering,*** East Brunswick, NJ. Fee: $1160. Contact: Center for Professional Advancement, PO Box H, East Brunswick, NJ 08816, (201) 249-1400. Repeated • October 18-21: San Mateo, CA.

September 26-30: ***Electromagnetic Interference and Control,*** Ottawa, Canada. Fee: $855. Contact: GWU, see August 29 above. Repeated • December 12-16: Washington, DC.

September 27-29: ***Grounding, Bonding and Shielding,*** Nashua, NH. Fee: $695. Contact: R&B, see August 26 above. Repeated • October 3-5: Philadelphia, PA; • November 7-9: Atlanta, GA.

October 6-7: ***EMI and ESD Control in Electronic Systems,*** Philadelphia, PA. Fee: $495. Contact: R&B, see August 26 above. Repeated • October 24-25: Boston, MA; • November 10-11: Atlanta, GA.

October 10-11: ***International Requirements for EMI and Product Safety,*** Philadelphia, PA. Fee: $495. Contact: R&B, see August 26 above. Repeated • October 31-November 1: Boston, MA.

October 10-15: ***Advanced Microwave Circuit Design,*** Los Angeles, CA. Fee: $975. Contact: Short Course Program Office, UCLA Extension, PO Box 24901, Los Angeles, CA 90024, (213) 825-1295.

October 11-13: ***Current Issues and Trends in Controlling Occupational Exposures to RF/Microwave Radiation,*** Salt Lake City, UT. Fee: NA. Contact: K. Blosch, Rocky Mountain Center for Occupational and Environmental Health, University of Utah, Salt Lake City, UT 84112 (801) 581-5710.

October 17-18: ***EMI Workshop,*** Philadelphia, PA. Fee: $575. Contact: R&B, see August 26 above. Repeated • December 5-6.

October 17-21: ***Communications Satellite Engineering,*** Washington, DC. Fee: $855. Contact: GWU, see August 29 above.

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

Microwaves Promote Cancer

Microwaves can promote cancer, according to the first long-term study of microwave exposure ever carried out in the United States. The $4.5 million study revealed that exposures to low levels of pulsed 2450 MHz radiation caused a statistically significant increase in malignant tumors among rats.

The new cancer data come from a five-year study headed by Dr. Arthur W. Guy, the director of the Bioelectromagnetics Research Laboratory at the University of Washington School of Medicine in Seattle. The study was sponsored by the U.S. Air Force.

In addition to a general increase in cancer incidence, the experimental results suggest that microwave exposure is responsible for wide-ranging effects related to the adrenal glands and the entire endocrine system.

If confirmed, the new study would undermine the 1982 American National Standards Institute (ANSI) radiofrequency and microwave (RF/MW) radiation exposure standard. That standard asserts that the level of exposure used in the Guy study is safe.

The findings are far from definitive, but a number of experts found the preliminary and unpublished data highly suggestive of a link between microwave radiation and cancer, possibly through a stress reaction. In numerous interviews, researchers expressed rare unanimity in calling for a replication study because of the serious implications for public and occupational health.

"The bottom line is that the study must be repeated," said Dr. Barbara Chang, a hematologist and oncologist at the Medical College of Georgia in Augusta.

Chang explained that "there is increasing evidence that microwaves may be a tumor promoter," but cautioned that "there is no direct evidence that microwaves can induce cancer." Chang was a member of the ad hoc panel that recently evaluated the Environmental Protection Agency (EPA) literature review of RF/MW radiation bioeffects (see *MWN*, October 1983 and January/February 1984).

The new results lend support to an earlier Polish study which found that microwaves can promote cancer at higher exposure levels. Dr. Stanislaw Szmigielski showed that 2450 MHz radiation can enhance the carcinogenic action of benzopyrene (see accompanying story on past studies).

(Current theories hold that the development of cancer is a multi-step process. An important distinction is made between the induction and promotion of cancer. Induction refers to the initial transformation of the cells that leads to their uncontrolled growth, while promotion refers to the enhancement of that growth process or the survival of the transformed cells.)

Guy's Experiment

Guy and his collaborators exposed 100 male rats to 0.48 mW/cm^2 of 2450 MHz, 8 Hz amplitude modulated pulsed microwaves (10 microsecond pulses, 800 pulses per second) for 21 hours a day for up to 25

(continued on p.4)

Magnetic Fields Induce Temperature Changes

Magnetic fields like those associated with nuclear magnetic resonance (NMR) imagers can induce relatively large changes in the temperature of live mice, according to a recent paper by German scientists. This new, unexpected finding has surprised many leading researchers.

A team working under Professor Klaus Dransfeld of the Department of Physics at Konstanz University measured a detectable increase in rectal and surface temperature of mice placed in a static magnetic field of only 0.4 Tesla (T). The temperature effect begins to saturate in a field of 2 T, with little further heating as the magnetic field is increased to 8 T.

Interestingly, the temperature increase was only observed when the mice were in certain orientations in the magnetic field. In another orientation, there was a *decrease* in temperature as the strength of the magnetic field increased. (Reversing the direction of the magnetic field by reversing the coil current had no effect on the direction of the temperature change.)

The authors cannot explain what biological processes could cause the observed effect. They do note that there is a translational force (proportional to the susceptibility of biomolecules) in inhomogeneous magnetic fields which does change directions like the observed temperature.

In one experiment with a 3 T magnetic field, the rectal and dorsal temperatures of the mouse started to increase in about four minutes. The temperature continued to increase for three hours for a net change of 2.4 degrees Centigrade (C). After the magnetic field was turned off, it took two hours for the temperature of the mouse to return to normal.

Dr. Rudolf Oldenbourg, a co-author of the paper and presently a visiting post-doctoral researcher at Brandeis University's Martin Fisher School of Physics in Waltham, MA, said the group had run the experiment at different times and had always observed the same qualitative response. "Beyond any doubt there is a temperature change due to the magnetic field," he said in a telephone interview.

This study was motivated by a report of observed temperature increases as great as 5 degrees C in humans exposed to fields similar to those of NMR imagers. This observation has not been formally published, but is reported in a working paper cited in Dransfeld's paper. Oldenbourg believes that these temperature increases were measured for exposures to magnetic fields of up to 1.5 T.

In a series of interviews, experts in the field expressed surprise over Dransfeld's experiment. None could offer an explanation for his results and many were incredulous.

Dransfeld's findings could have an impact on the assessment of the risks of NMR imagers, which are using stronger and stronger magnetic fields. For instance, Technicare, a Johnson & Johnson subsidiary, has won government approval to market NMR units with magnetic fields of 0.6 T, and has four machines with 1.5 T fields undergoing trials at various clinics across the country. A spokesman for the company said that units with fields of up to 2.0 T are being tested in-house.

To date, there have been no reports of ill effects due to NMR imagers, from either their static magnetic fields or from their pulsed radiofrequency signals. Indeed, the Food and Drug Administration's Center for Devices and Radiological Health noted in its May *Radiological Health Bulletin* that, "The only significant adverse effect [of NMR imagers] observed was claustrophobia in about four percent of the subjects."

Dransfeld's paper appears in *Naturwissenschaften, 71*, 100, 1984, a prestigious German journal. The paper is written in English. Dransfeld was formerly with the Max Planck Institute for Solid State Physics in Stuttgart and the High Magnetic Field Lab in Grenoble, France.

Power Substations: EMI and Community Concerns

Computers and other electronic equipment in power substations can fail due to electromagnetic interference (EMI) from transients. This is the conclusion of a study headed by Dr. B. Don Russell of Texas A&M University in College Station and sponsored by the Electric Power Research Institute (EPRI). As engineers turn their attention to this problem, citizen groups are showing greater concern over the potential health effects of the EM fields associated with substations.

EMI From Transients

Russell and co-workers have characterized the transients which are caused by the operation of breakers and disconnect switches: the frequencies range from several hundred Hz to more than 200 MHz, with amplitudes of up to 70 kV/m and higher. Though the exception is the rule, a "typical" waveform lasts 10 microseconds, is in the 20 MHz range and has an amplitude of 5 kV/m (electric) and 3 A/m (magnetic). The "typical" transient generated by a 345 kV switch has a rise time of 180 nanoseconds (ns) (electric) and 60 ns (magnetic); for a 500 kV switch, the rise times are 700 ns (electric) and 100 ns (magnetic).

With respect to the EMI shielding that can be provided by a substation control building, Russell's group found an attenuation of about 15 dB in the 10-100 MHz range and up to 20-25 dB in the 1-10 MHz range, though they add that there are "significant holes" in this shielding.

Russell and co-workers warn that transients "represent a significant potential problem in terms of equipment interference...Failures will occur due to these transients; it is only a matter of time."

A brief summary of Russell's findings appears in two papers published in the July issue of the *IEEE Transaction on Power Apparatus and Systems*. The complete report, *Measurement and Characterization of Substation Electromagnetic Transients*, (No. EL-2982) is available from EPRI, Research Reports Center, Box 50490, Palo Alto, CA 94303, (415) 965-4081. Two related papers on a long-term transient monitoring system in a 138 kV and a 500 kV substation and transmission line, by a team headed by M.D. Perkins of Westinghouse Electric Corp. in Pittsburgh, PA, are in the August issue of the *IEEE Transaction on PAS*.

Public Concerns

Citizen concerns about the potential hazards of EM radiation associated with power systems are growing: disputes over substations have joined on-going controversies over transmission lines. The difficulties experienced by New York City's Con Edison and by Florida Power and Light (FP&L) may be an omen for other utilities.

Con Edison is building a substation near the United Nations and across the street from a housing development. A group calling itself HEED (Help End Environmental Danger) has succeeded in drawing attention to the plant, which is now half completed. In June, the City Council heard testimony on a motion to halt construction pending the writing of an environmental impact statement.

Dr. Abraham Liboff of Oakland University in Rochester, MI, testified for HEED arguing for a cautious approach in light of new research showing that magnetic fields are more biologically active than previously thought. A number of local politicians also spoke in favor of HEED's position.

Con Ed says there is no risk, citing measurements from a nearby substation that showed magnetic fields are on the order of a fraction of a milligauss, 80 feet from the station and 30 feet above the street. Con Ed's Dr. Peter Freudenthal told the council that there are 20 other substations in the city and "it would be ridiculous to stop this project." A decision from the City Council is expected soon.

In Coral Springs, FL, the community is trying to stop FP&L from building a substation that has already been shut out from a neighboring community. Citizens wanted to invoke a new state law, authorizing the state Department of Environmental Regulation (DER) to establish safety requirements for power lines (see *MWN*, July/August 1983). But, as DER's Karen Anthony told *Microwave News*, the law does not apply to substations.

Appeals Court Lifts Ban On Project ELF Construction...

A federal appeals court has lifted the construction ban on Project ELF in what may be the final blow to opponents of the Navy's massive land-to-submarine communications system. The June 13 order of the Seventh Circuit Court of Appeals in Chicago suspends a district court injuction against further construction pending completion of a supplemental environmental impact statement (EIS) on the project (see *MWN*, March 1984).

The appeals court is not expected to issue its decision on the project's future until this fall. Meanwhile, the Navy is proceeding with both the project and the mandated study.

The State of Wisconsin and Marquette County, Michigan, the plaintiffs in the original suit, believe that the study will be a pointless exercise if construction is allowed to continue. In an interview shortly after the appeals court ruling, Shari Eggleson, Assistant Attorney General for Wisconsin, explained that the Navy is under no obligation to act on the EIS findings should they show a health risk associated with ELF radiation and that it is extremely unlikely that the study, which is not expected for release until February 1985 at the earliest, will affect a project that is already largely completed.

In a last ditch effort to slow the project, the state and the county applied to the US Supreme Court on August 1 for a stay of the appeals court order — thus reinstating the construction ban — until the court of appeals issues its decision. The plaintiffs filed a similar motion with the appeals court on July 9. As we go to press, neither court has responded.

In the two paragraph order released on June 13, the three judges hearing the appeal stated that "we do not perceive any reason or justification for further delaying the implementation of this national defense project authorized by Congress and directed by the President."

The Navy has maintained throughout the court proceedings that national security will be jeopardized if the project is delayed.

Construction has now resumed at the Wisconsin Project ELF site at Clam Lake, and the Navy expects to award a contract for the transmitter in Michigan by August 31, with construction on the state's Upper Peninsula to begin in September. The Navy originally scheduled to complete the Clam Lake facility in September 1985 and finish all work by April 1986. According to a Navy spokeswoman, the Navy is "currently assessing the impact of the four-and-a-half month delay created by the court-ordered injunction."

...AIBS Gets Key Role in Project ELF EIS

The Navy has chosen the American Institute of Biological Sciences (AIBS) to coordinate the literature review and analysis for the Project ELF supplemental environmental impact statement (EIS). The review will cover the bioeffects literature for extremely low frequency (ELF) radiation published after the Navy's 1977 EIS.

Under a $319,000 Navy contract, AIBS has set up a nine-member panel chaired by Professor H.B. Graves of Pennsylvania State University. Both Graves and an AIBS spokesman told *Microwave News* that panel membership and the topic areas to be covered will not be finalized until mid-August and so they declined to discuss details —including who will serve on the panel.

The panel's report will incorporate material from two key sources. In addition to data provided through the Navy-contracted literature search underway at the IIT Research Institute (IITRI), in Chicago, IL, the panel will solicit research reports from experts in specific topic areas.

Although the AIBS report will include the panel's summary analysis, the EIS and its final conclusions will be written by the Navy. The Navy has set an October 31 due date for the report, but Graves indicated that this date may be hard to meet. Should the Navy's schedule hold, a draft EIS will be filed in mid-November and a final version completed sometime in the February-April period. The Navy is also planning to hold public hearings, probably in December.

AIBS is a 9,000 member not-for-profit scientific and educational organization based in Arlington, VA.

months. The rats, which were housed in a pathogen-free environment, had a maximum average specific absorption rate (SAR) of 0.4 W/Kg. One hundred rats were used as controls.

Guy's results were presented at the annual meeting of the Bioelectromagnetics Society (BEMS) in Atlanta in mid-July by Drs. C.K. Chou and Lawrence Kunz. In two separate papers, they delivered low-key assessments of their findings: a doubling of the weight of the adrenal glands and an excess of total malignancies among the exposed rats. Both effects were statistically significant. The speakers did not link the two effects, however, treating them as independent findings.

Kunz, the group's veterinary pathologist, noted that the incidence of each type of cancer in the rats was not in itself significant. The increase in cancer only became statistically reliable when the data were collapsed into a total cancer incidence index. In addition, he said that the cancer rate was not significant compared to historical controls rather than those actually used.

A Private Meeting

The presentations left much of the audience confused about what the results mean. But a clearer picture emerged later during an informal meeting with Kunz in Guy's hotel suite. Among those attending the briefing were researchers from EPA, the National Institute for Occupational Safety and Health (NIOSH), Dr. Chang, Dr. Don Justesen of the VA Hospital in Kansas City and Dr. Sam Milham of the Washington State Department of Social and Health Services.

Kunz reviewed the cancer data in some detail: There were 16 malignant tumors among the exposed rats, but only four among the controls. He went on to describe each type of tumor.

Based on this list, Chang and Milham immediately deduced a pattern of increased malignancies in the endocrine system. There were seven endocrine neoplasms among the exposed rats compared to only one among the controls: two thyroid, two pituitary and three cortical adrenal tumors. (The adrenal, thyroid and pituitary glands are part of the endocrine system.)

Kunz also revealed that there were six pheochromocytomas or pheos —benign adrenal tumors— among the exposed rats but none in the controls. Pheos secrete epinephrine, a neurotransmitter, and are associated with high blood pressure and headaches. They have also been connected with stress.

Putting the Data Together

The emerging pattern of experimental results differed from the isolated observations presented at the conference. The exposed rats experienced a doubling of their adrenal mass, an increase in the number of adrenal and other endocrine tumors, and an increase in the number of benign adrenal tumors, as well as a general increase in overall tumors.

Two theories were put forward by those assembled in Guy's suite. The observed effects could be caused directly by the microwave radiation, or they could be the manifestation of a general stress reaction brought on by the radiation.

Guy's results could provide an experimental basis for the widely reported complaints among workers chronically exposed to microwave radiation: headaches, dizziness, memory loss and fatigue. These symptoms have become known as "the microwave sickness."

Kunz resisted the notion that his results formed a coherent and consistent picture of adverse effects. He suspected that the increase in cancer was not a true finding. "I doubt that these data are reproducible," he said.

All those present wanted to see the experiment repeated, a desire that would take years to satisfy. "We might be seeing anything from an anomolous lowering of controls to a true difference indicative of non-specific stress," Justesen said.

Milham, an epidemiologist and physician, later summed up the general sentiment of those who had heard the Kunz-Guy briefing: "There appears to be a pattern in the data. It says at minimum that the experiment should be repeated."

One common observation was that Guy's group had not set out to test whether microwaves are carcinogenic — instead they studied a large number of health-related end points looking for any and all ill effects. A second study could be specifically designed to test for the microwave-cancer link.

A Provocative Finding

The results of Guy's experiment are still under review by Air Force officials. One Air Force researcher told *Microwave News* that he would prefer to withhold comment until the tumor analysis had been completed. The raw data, including computer tapes of all the individual data points as well as the pathology slides will be made available to all interested parties, he said.

The Air Force has sent the Guy results to Dr. E.H. Vernot of the Toxic Hazards Research Unit at the University of California at Irvine for an independent analysis. In a letter to the Air Force, Vernot wrote that the "finding of excess malignancies in the exposed animals is provocative."

Guy referred all questions about the biological aspects of his study to Kunz. Guy's chief assistant, Professor Chou said in an interview that, "We are all concerned about this, but we should realize that we had a small sample size." He concluded that "I cannot say that microwaves cause cancer at this time."

For the moment, everyone is anxiously awaiting the publication of Guy's results so that the many explanatory hypotheses already circulating through the research community can be tested.

A description of Guy's experiment and his findings will appear in nine volumes published by the Air Force; a number of these are already available. The findings discussed here are not ready for distribution but should be printed soon as "Volume 8." For more information regarding the availability of copies, contact the Air Force's contract monitor, Jerome Krupp at the USAF School of Aerospace Medicine, Brooks AFB, TX 78235.