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Bioelectromagnetics Society Meeting: A Report

The annual meeting of the Bioelectromagnetics Society (BEMS) is the event of the year for the biological wing of the microwave community. Experimental results are presented at BEMS long before they appear in print, giving researchers a chance to keep up and offering government and corporate officials a look at what might be driving tomorrow's regulations. There was something for everyone at this year's meeting in Washington, DC, but for many the big surprise was a paper about thermal mechanisms.

In the past, the so-called non-thermal effects have attracted the most attention. The proposition that low levels of non-ionizing radiation can alter biological systems, once considered a heresy, is now much more widely accepted. Of course, the possible mechanisms are still a matter of uncertainty and debate. While this year's papers at BEMS would generate few headlines, they confirmed the importance of power and frequency windows to explain bioeffects and added confusion to the drug-microwave synergy picture. The blood brain barrier seemed all but forgotten.

Environmental Protection Agency (EPA) researchers reported that miniscule internal electric fields can release calcium ions in the brain when excited by unmodulated ELF fields. Here again, power density windows were observed. Equally exciting was a report of a new frequency window: one which peaks at a modulation of 60 Hz and which is related to the immune system. Attempts to replicate the synergy between microwaves and tranquilizers have generally failed and many of those working on it have given up.

URSI Meeting

The BEMS meeting was scheduled to coincide with the 20th assembly of the
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Information and Litigation Center Set Up in Washington, DC

A new center has been established to help people alleging injuries from exposure to microwave radiation. The Microwave Radiation Information and Action Center, operating out of Washington, DC, will actively seek and disseminate government documents and will provide legal advice to those who have been exposed.

The center was set up by Stuart Lemle, the head of the Washington law firm Lemle and Associates, and Barton Reppert, a Washington based journalist. Lemle will serve as executive director.

The center has four main objectives: (1) to serve as a clearinghouse for information on the irradiation of the US embassy in Moscow and other cases involving human exposure to microwave radiation; (2) to promote the release of information on microwaves now in government files through requests under the Freedom of Information Act (FOIA), and when necessary through litigation; (3) to offer legal advice to persons who believe they have suffered health problems as a result of exposure to microwave radiation; and (4) to promote

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CONFERENCES: BEMS

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International Union of Radio Science (URSI), and the attendance of each profited. On August 13, immediately after BEMS, many of the participants moved over to the URSI meeting to hear a series of lectures on the *Interactions of Electromagnetic Waves with Biological Systems*. These general reviews of bioeffects, medical applications and standards will be collected, together with a critical analysis, into a special edition of *Radio Science*, but will probably not be published until the summer of 1983. (In preparation for the meeting, URSI published *Review of Radio Science, 1978-1980*, edited by S.A. Bowhill of the University of Illinois, Urbana-Champaign. The compendium has chapters on bioeffects, measurements and interference, among other subjects. A copy is available for \$20 from URSI, Avenue Albert Lancaster 32, B-1180 Brussels, Belgium.)

New Thermal Data

Certainly any vote on the most provocative paper of the meeting would have been won by Dr. Gregory Lotz of the Naval Aerospace Research Lab in Pensacola, FL. Lotz and two co-workers exposed male rhesus monkeys to 225 MHz RF fields at power densities ranging between 1 and 10 mW/cm² (SAR = 0.3-4.0 W/Kg). The frequency is near the monkey's theoretical whole-body resonance, but even so, Lotz found that at 5 mW/cm² (SAR = 1.5 W/Kg), the exposures caused "much greater heating than that which would be predicted based on dosimetric considerations and on comparisons to other frequencies." Lotz concluded by saying that there was "something unexplained" going on.

Whatever the explanation may turn out to be, the implications of his results were immediately apparent. The ANSI standard, now in the final stages of review, is based on the assumption that there are no demonstrable hazards associated with whole-body average SAR's of less than 4 W/Kg. Lotz's showing "dramatic" heating at an average SAR of 1.5 W/Kg could, as one agency official was quick to point out, have a profound impact on future standards. For the moment, everyone will have a chance to mull the paper over until the next gathering at October's *Microwaves and Thermoregulation* symposium at the Yale medical school.

Windows: Old and New

A new twist in calcium efflux research was reported by EPA's Dr. Carl Blackman: he exposed brain tissue to 16 Hz fields in the *absence* of a carrier frequency at ambient voltages of 1 to 70 V/m. In that range he identified two power windows, which caused statistically significant enhancement of calcium mobility. The internal electric fields were substantially lower than a thousandth of a V/m, making this, according to Blackman, "a solid case of a response that cannot be explained by a general heating mechanism."

Runs at 1 Hz and 30 Hz showed no effect, confirming the previously known activity of the 16 Hz field. The one quirk was that Drs. Ross Adey and Suzanne Bawin had done a similar experiment five years ago, and while they too had found power and frequency windows, the ELF fields had *reduced* calcium flow—not increased it (*Proceedings NAS*, 73, 1999, 1976). Blackman believes the different conditions in the two labs could explain this apparent inconsistency.

Dr. Rochelle Medici of Fairview State Hospital in Costa Mesa, CA, showed that the 16 Hz window has direct behav-

ioral implications. Although earlier behavioral tests carried out in 16 Hz amplitude modulated fields with neonatal chicks had proved negative, Medici tried again with ducklings on the grounds that water, used as a reinforcer in the experiment, is ineffective for chicks. Using a carrier frequency of 450 MHz and a power density of 1 mW/cm², Medici did find a significant difference in activity for the ducks in the 16 Hz field as compared to controls. Modulation at 3 Hz had no effect.

A completely new type of microwave window was reported by David Lyle, a graduate student working with Adey at the University of California, Riverside. Lyle was able to inhibit cell-mediated immune response with modulated 450 MHz radiation. He observed the greatest inhibition when the 1.5 mW/cm² field was modulated at 60 Hz. Lyle speculated that this mechanism of action may be related to the calcium efflux from brain tissue, given that cytolytic immune response is calcium dependent.

Drug Disorder

The sorting out of tranquilizer-microwave synergy seems as far off as ever. (See *MWN*, February 1981.) Both Dr. Rufus Sessions of Walter Reed Army Institute of Research, Washington, DC, and Dr. Richard Lovely of Battelle Northwest in Richland, WA, have been unable to produce the synergy reported by Dr. John Thomas. The exposure system was different in each experiment, leading to speculation that the possible discrepancy may turn on near and far field dosimetry. (Thomas used a near field exposure system, Lovely, the far field and Sessions circular waveguides.) Whatever the source, Thomas will have to find it himself, because neither Sessions nor Lovely intends to pursue the drug work.

Thomas may get some help, however, since Sessions will soon become the director of the Division of Behavioral Sciences at the Armed Forces Research Institute of the Defense Nuclear Agency. The move will put him near Thomas's lab at the Naval Medical Research Institute, and no doubt accessible for consultation.

The news from Guy lab in Seattle was equally contradictory. Robert Johnson was able to replicate the study reported at last year's meeting showing synergy between valium and 1 mW/cm² radiation with a different strain of rats and a different crew running the experiment. But in his new work, he failed to see any valium synergy in a shuttlebox behavioral test. Johnson will continue to work with valium and librium.

Blood Barriers

At last year's BEMS meeting in San Antonio, three research groups presented papers on their studies of microwave-induced permeability of the blood brain barrier (BBB). Surprisingly, no new work was reported this year.

Allan Frey did announce the results of a related study carried out by Elaine Coren and himself at their Randomline lab: the effect of microwaves on the blood-vitreous humor barrier in the eye, which they claim has a similar derivation and function as the BBB. In two experiments, they exposed rats to pulsed (7.5 pps, 10 usec), 1.2 GHz radiation with an average power of 75 uW/cm² for 25 minutes. In both cases, they detected significant leakage of the tracer dye through the barrier. Frey concluded that microwaves were definitely affecting the blood barrier in the eye, but he "didn't have enough information to say what was happening and why."

MW & ELF Chronic Studies

Reports of US studies of long-term, low-level exposures, presented at BEMS, indicate a failure to identify any significant bioeffects, though a Chinese study did turn up some microwave-induced changes:

- John D'Andrea reported that his team at the University of Utah had found no differences between 14 rats exposed to 500 $\mu\text{W}/\text{cm}^2$, 2450 MHz, CW microwaves for 650 hours over 92 days and controls (SAR = 0.12 W/Kg). Indicators of body weight, blood chemistry and open field behavior were all negative. D'Andrea did see a change in a shuttlebox behavioral test, but interpreted it as anomalous. The experiment was designed to extend the work of USSR's Michael Shandala and Battelle's Richard Lovely, both of whom did find some chronic effects. Professor D'Andrea speculated that the apparent inconsistency in results might be explained by differences in the exposure system and in the animals irradiated.
- Members of A.W. Guy's group at the University of Washington, Seattle, presented a progress report on their million dollar, three year study. At the end of the first year, 100 male rats, exposed to 480 $\mu\text{W}/\text{cm}^2$, 2450 MHz, 8 Hz modulated, pulsed (800 pps, 10 usec), microwaves had similar body weight, blood chemistry and open field behavior as the 100 controls (SAR equal to or less than 0.4 W/Kg).
- Kuo-Chiang Yee of the Microwave Institute of Chekiang Medical College, now visiting Guy's lab, reported finding some changes in EEG, EKG and leukocyte counts as well as fluctuations in blood pressure and errors in labyrinth tests among rats and rabbits following six-hour daily exposure for four and a half months to 2450 MHz, CW fields at power levels ranging from 0.1 to 10 mW/cm^2 . No changes in rectal temperature, body weight and whole blood cholinesterase were found. Yee warned that the results of the chronic experiment suffered from exposure conditions that allowed variations in SAR's among the exposed animals, and from the use of metal electrodes to measure EEGs and EKGs.
- James Grissett of the Naval Aerospace Research Lab in Pensacola, FL, described the replication of the long-term study of rhesus monkeys exposed to ELF fields of 0.2 mT and 20 V/m, which had showed a difference in growth rate of males, but not females, during the first year followed by no further changes. After completing its first year, the replication study has failed to show any differences in growth and development, leading Dr. Grissett to conclude that the ELF electric and magnetic fields "did not have a generalized metabolic effect on rhesus monkeys."

New Meters

Tadeusz Babij and Howard Bassen described a new RF meter developed at the Bureau of Radiological Health as a low cost alternative to today's \$2,000-3,000 instruments. The unit, operating in the 10-100 MHz range with a projected price of about \$1,000, should be attractive to local health officials for monitoring in occupational settings such as RF sealer operations. The bureau is demonstrating the meter to the private sector and is negotiating with a few companies that have expressed an interest in manufacturing it.

Scientists at the Lawrence Berkeley Lab are developing a portable magnetic field dosimeter. The second generation prototype, according to Dr. T.S. Tenforde, responds to steady-state and time-varying fields of up to 5,000 gauss. The unit has a memory capable of recording exposures over an 8-hour shift, as well as an alarm, triggered at preset levels of maximum magnetic fields and their rate of change. The unit weighs about a pound and would cost \$300-500 if 100 units were produced. Tenforde and his colleagues are now working on a third stage prototype. (Possible magnetic field exposure standards were discussed by Dr. C.E. Easterly of the Oak Ridge National Lab.)

Living Magnets

Professor Richard Frankel of MIT's National Magnetic Lab gave an impromptu talk on animal magnetism, a new field that promises to attract growing attention. With the discovery of magnetic bacteria, scientists have widened the search for living creatures that can manufacture their own magnetic material: so far, pigeons, honey bees, butterflies and sharks have all been found to contain small quantities of magnetite. (A report in the August 21 *Science* adds dolphins to this list.) Frankel left his audience with the intriguing suggestion that such living magnets may interact with radiant energy in as yet unpredictable ways.

Radiophone Radiation

With the promised growth of radiophones for mobile communications, many more cars will be sporting UHF antennas, raising interest about this new source of radiation exposure. Professors Guy and C.K. Chou have made some measurements with full scale human phantoms, standing and leaning on a 1971 Mazda. For an input power of 10 watts, they found a maximum SAR for a leaning woman of 0.6 W/Kg near the bridge of the nose. This was only a feasibility study using homogeneous models; now they plan to add detail to the models and take more measurements.

Project Migraine

Can a human "hear" signals of an impending earthquake or volcanic eruption? A woman from Salem, OR, seems to be able to. According to Christopher Dodge of the Congressional Research Service, she has a good record for predicting seismic activity, and she was found to be in sync with meters on Mt. St. Helens during last year's eruptions. The woman, who suffers from headaches and hence the name of the study she has spawned, Project Migraine, is currently undergoing tests at the University of Colorado. These hope to uncover any possible coupling between the woman and geophysical systems; while electromagnetic coupling has not been ruled out, an auditory effect is deemed more likely. Dodge guessed that there may be as many as 1,000 people across the country with the same condition. If anything comes of this, they may be in great demand.

At its annual business meeting, the election of Dr. Donald McRee of the National Institute of Environmental Health Sciences as president-elect of BEMS was announced. Next year's meeting will be held at the Beverly Wilshire Hotel in Los Angeles the week before the July 4th weekend.

STANDARDS

ACGIH

The American Conference of Governmental Industrial Hygienists (ACGIH) has proposed a new threshold limit value (TLV) for radio-frequency radiation and a revision of its microwave radiation TLV standard.

The ACGIH proposal has the same "well" shape as the NIOSH and ANSI proposals—the precise shape of the well is different for each—but is less stringent at the higher GHz frequencies. At the bottom of the well between 30 and 100 MHz, the proposed TLV is 1 mW/cm², rising at lower frequencies to 100 mW/cm² at 3 MHz and at higher frequencies to 10 mW/cm² at 1 GHz. (See opposite page for the full text of the ACGIH proposal.) The maximum high frequency power level suggested by either NIOSH or ANSI is 5 mW/cm².

The 100 mW/cm² limit would apply to frequencies as low as 10 kHz, making it the only US standard, either proposed or promulgated, to cover low frequency emissions from VDTs.

There is no current ACGIH TLV for radiation below 300 MHz, and the one for microwaves (300 MHz-300 GHz) is 10 mW/cm². According to the proposed change, the standard would become 3 mW/cm² at 300 MHz, increasing 1 mW/cm² for each 100 MHz rise in frequency up to 1 GHz. Above 1 GHz, the old and the new standards are the same.

The proposal offered by the Physical Agents TLV Committee was approved by the ACGIH board and membership at its annual meeting in Portland, OR, last May. It was recently published in the 1981 edition of the ACGIH TLV booklet in a "Notice of Intended Changes." According to ACGIH procedures, proposals are considered trial limits for at least a year, when they become eligible for formal adoption.

In an interview, Bill Kelly, executive secretary of ACGIH, stressed that the system allows all interested parties to comment on proposed changes. "We want as much input as we can get," he said. The review process is already under way: the TLV committee met in Toronto in mid-August, and some modifications to the low frequency portion of the standard were considered. Another meeting of the committee is scheduled for December.

The committee is also studying the possibility of setting TLVs for extremely low frequency (ELF) radiation (0-300 Hz) and for continuous and pulsed magnetic fields. At present the committee believes there is not enough information to propose standards.

Any comments on the RF/MW proposal should be sent to William Kelly, Executive Secretary, ACGIH, 6500 Glenway Avenue, Bldg. D-5, Cincinnati, OH 45211.

ANSI

A new draft of the American National Standards Institute's (ANSI) C95.1 standard for human exposures to radiofrequency and microwave radiation has been circulated to the C95 committee. Changes in the draft, worked out by Professor A.W. Guy, subcommittee IV chairman, are designed to resolve the objections that have delayed the standard. Committee members have until September 7 to submit comments on the draft. If no objections are raised, the standard will be submitted to ANSI for public review and comment. Otherwise C95 Chairman Professor Saul Rosenthal will call a full committee meeting to decide how to proceed.

The draft now being circulated, however, is essentially the same as the draft considered at the last C95 committee meeting in February. (Full text published in *MWN*, May 1981.)

One change is a rearrangement and rewording of the language on the standard's applicability to the general population:

"Because of the limitations of the biological effects data base, these guides are offered as upper limits of exposure, particularly for the population at large. Where exposure conditions are not precisely known or controlled, exposure reduction should be accomplished by reliable means to values as low as are reasonably achievable. Exposures slightly in excess of the radiofrequency protection guides are not neces-

sarily harmful; however, they are *not* desirable and should be prevented wherever possible."

The clause that specifies the guides "are not recommendations of levels for exposures of indefinite duration" has been deleted.

Other changes include the addition of a definition of "specific absorption rate" (SAR) and new language to describe the measurement of electromagnetic fields.

In the rationale document that accompanies the standard, a paragraph has been added to clarify how SAR's may be measured in order to qualify for the standard's exclusion clause:

"It was also recognized by the Subcommittee that to determine whether or not a particular RF source would meet these absorption criteria would be difficult and could be done only by a qualified laboratory or scientific body for a general class of equipment. In no case could a routine field survey determine conformance with the criteria of this part of the exclusion."

USSR

The Soviet Union has indeed raised its occupational standard to 25 uW/cm², according to Guy, who was in Kiev last June, although a senior Russian official attending the URSI meeting could not confirm the change.

Guy said that he had learned of the revision from Dr. B. Savin of Moscow's Institute of Industrial Hygiene and Occupational Diseases. Effective January 1982, the new occupational standard will be 25 uW/cm² for an 8-hour working day, 200 uW/cm² for a 2-hour exposure, and 1 mW/cm² for 20 minutes. The 20-minute standard is the same as the one now in effect, the 8-hour standard is now 10 uW/cm², and the new 2-hour limit is a doubling over the present 100 uW/cm² standard.

Meanwhile Professor Inal Akoev, deputy director of the Institute of Biological Physics in Pushchino, a scientific center south of Moscow, would only say that the standard was under discussion and that a decision on a possible revision may be reached by the end of the year.

Guy, who was visiting the Soviet Union from the University of Washington, Seattle, reported that the standard setting process in the USSR was similar to that in the US—marked by conflicts between regulators and users.

WHO & IRPA

Dr. Przemyslaw Czernski, presently visiting BRH from Poland, reviewed standards in Europe for the URSI conferees.

He announced that the World Health Organization (WHO) had adopted the "ALARA" principle for determining permissible exposures to non-ionizing radiation: "public exposures should be kept as low as readily achievable." Czernski noted that in applying the ALARA principle, WHO advised the consideration of social and economic factors, taking into account local conditions. He quoted from the new WHO report on non-ionizing radiation:

"Values within the range 0.1-1 mW/cm² include a high enough safety factor to allow continuous exposure to any part of the frequency range over the whole working day. Higher exposures may be permissible over part of the frequency range and for intermittent or occasional exposures."

Czernski reported that Italy and the EEC were also in the process of setting non-ionizing radiation standards. At the IMPI meeting (see p. 7) Amleto Ignesti said that the Istituto Superiore di Sanita in Rome would develop a standard by the fall.

Annette Duchene, secretary of the International Radiation Protection Association's (IRPA) non-ionizing radiation committee, said that the committee was also working on an exposure standard. A detailed report on IRPA's activities will appear in *Microwave News* next month.

ACGIH STANDARD—Full Text

ACGIH NOTICE OF INTENDED CHANGES (1981)

Radiofrequency/Microwave Radiation

These Threshold Limit Values (TLVs) refer to radiofrequency (RF) and microwave radiation in the frequency range from 0.01 MHz to 300 GHz, and represent conditions under which it is believed workers may be repeatedly exposed without adverse health effects. The TLVs shown in the Table are selected to limit the average whole body specific absorption rate (SAR) to 0.4 W/kg in any six minutes (0.1 hr) period for 3 MHz to 300 GHz, see the Figure below.

Since it is usually impractical to measure the SAR, the TLVs are expressed in units that are measurable, viz, squares of the electric and magnetic field strengths, averaged over any 0.1 hour period and this can be expressed in units of equivalent plane wave power density for convenience. The squared electric field (E), magnetic field (H) strength values, and power density (PD) are shown in the Table. For near field exposures PD cannot be measured directly, but equivalent plane wave power density can be calculated from the field strength measurement data as follows:

$$PD \text{ in mW/cm}^2 = \frac{E^2}{3700} \quad \text{where:}$$

E² is in volts squared (V²) per meter squared (m²).

$$PD \text{ in mW/cm}^2 = 37.7 H^2 \quad \text{where:}$$

H² is in amperes squared (A²) per meter squared (m²).

These values should be used as guides in the evaluation and control of exposure to radiofrequency/microwave radiation, and should not be regarded as a fine line between safe and dangerous levels.

Notes:

1. All Radiofrequency Radiation (RFR) exposures should be kept as low as reasonably possible given the current state of knowledge on human effects, particularly non-thermal effects.
2. For fields consisting of a number of frequencies, the fraction of the protection guide incurred within each frequency level should be determined and the sum of all fractions should not exceed unity.
3. For pulsed and continuous wave fields, the power density is averaged over the six minute period, and should not exceed the values in the Table, except as noted for partial body exposure.
4. For partial body exposures at frequencies between 0.01 MHz and 1.0 GHz, the protection guides in the Table may be exceeded if the output power of a radiating device is 7 watts or less. For example, if a hand held transmitter operating at 27 MHz has a maximum output of 5 watts, it would be excluded from any further field measurements.
5. No measurement should be made within 5 cm of any object.
6. All exposures should be limited to a maximum (peak) electric field intensity of 10 kV/m.

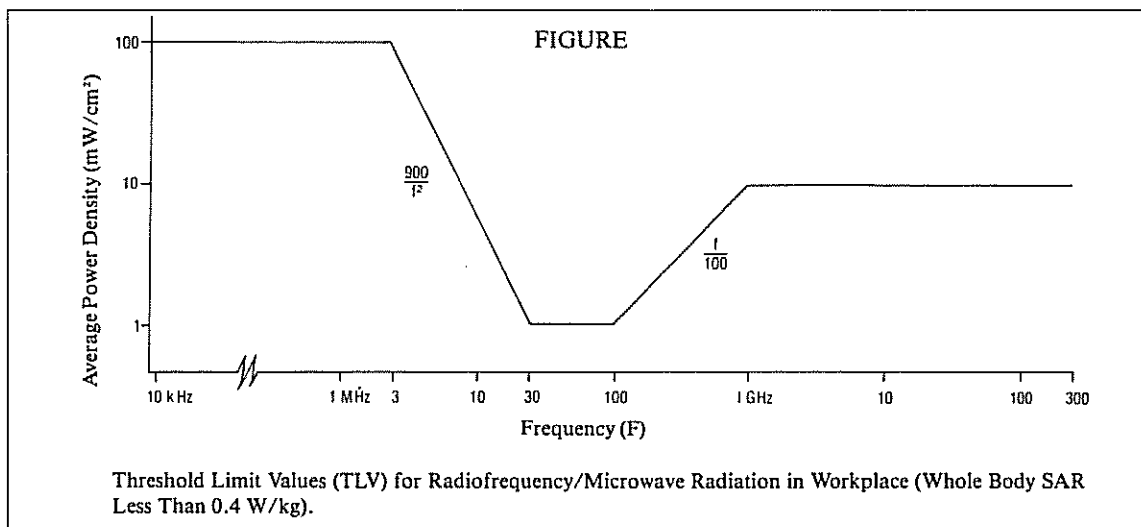


TABLE
RADIOFREQUENCY/MICROWAVE THRESHOLD LIMIT VALUES†

Frequency		Power Density (mW/cm ²)‡	Electric Field Strength Squared (V ² /m ²)	Magnetic Field Strength Squared (A ² /m ²)
0.01 MHz to	3 MHz	100	377,000	2.65
3 MHz to	30 MHz	900/f ² *	3770 x 900/f ² *	$\frac{900}{37.7 \times f^{2*}}$
30 MHz to	100 MHz	1	3770	0.027
100 MHz to	1 GHz	f [*] /100	3770 x f [*] /100	f [*] /37.7 x 100
1 GHz to	300 GHz	10	37,700	0.265

†mW/cm² = milliwatts per centimeter squared

*f = frequency in MHz

‡Note that the Table, as originally published in the ACGIH TLV booklet contains two typos, which have been corrected here.

NAS SYMPOSIUM

A symposium on Video Display Terminals and Vision of Workers sponsored by the National Academy of Sciences' Committee on Vision drew 250 people to Washington, DC, this August 20-21. Topics for the two day meeting ranged from the physiology of the eye to the design of VDTs.

The session on radiation exposure was the only discussion to end on a note of consensus. Symposium chairman Dr. Edward Rinalducci, of the Georgia Institute of Technology, concluded that the radiation risks "seem not to be considerable." Other potential hazards, however, were harder to define and require further study.

Radiation Surveys

Survey data on VDT radiation emissions were outlined by Bill Murray of the National Institute for Occupational Safety and Health (NIOSH). The very low levels of all emissions, Murray said, have convinced NIOSH that routine checks of VDTs are no longer necessary. Although requests for testing often cite possible malfunctions or variations in VDT models, Murray asserted that there is no reason to believe broken machines leak radiation. Further, NIOSH believes the variations among VDT models produced by some 150 manufacturers are minimal.

The key radiation issue for all concerned is the possible link between cataract development and chronic exposure to VDT radiation. Dr. Martin Mainster, of the Retina Foundation in Boston, said only large epidemiological studies could fully answer this concern, but "we can be reasonably confident from studies and surveys that any risk of specific ocular problems [caused by] VDTs is very unlikely." Professors William Ham, from the Medical College of Virginia, and Donald Pitts, from the University of Houston College of Optometry, agreed with Mainster. As a former member of the Electromagnetic Radiation Management Advisory Council, Ham said he has been concerned about radiofrequency and microwave bioeffects for a long time, "but no one who has studied in this field for the past ten years is the least bit concerned" about VDTs.

Cataracts and Epidemiologies

The focus on cataracts continued into the next panel on ocular pathology. Though not identified by name, the work of Dr. Milton Zaret, a well known New York ophthalmologist who maintains that low levels of non-ionizing radiation cause cataracts, was addressed. Alfred Sommer, of the Wilmer Ophthalmological Institute at Johns Hopkins University, said the ten anecdotal cases of cataracts—reported by Zaret—which are the primary evidence for a VDT-cataract link, are not convincing. Dr. Hugh Taylor, also from the institute, pointed out that cataracts are a general problem and that there was no evidence linking them to VDTs. Unless "something totally unexpected" comes up in the Mount Sinai or Baltimore *Sun* epidemiologies now underway, Taylor believed it is "not worthwhile to do more work with VDTs."

Dr. Arthur Frank, environmental health physician at Mount Sinai Hospital in New York City and director of its VDT epidemiology, and David Eisen, of the Newspaper Guild, were virtually alone in urging more work on long-term, low-level VDT radiation effects. Frank agreed that there is no evidence of damage, but stressed that little research has been done and that more data are needed. Eisen warned against "closing the book" on this issue before the *Sun* and Sinai studies are completed. NIOSH's Murray also called for more research on the effects of chronic radiation exposure on the eye, and for better field survey instruments. His concern, however, was not associated with VDT hazards.

Reporting on the Mount Sinai study, Frank said that participating members from five of the seven Newspaper Guild locals involved in the project will receive ophthalmological examinations.

Rashes Explained?

Two Scandinavian studies linking facial rashes to static electricity generated by terminals were reported by Olov Ostberg, from the Cen-

tral Organization of Salaried Employees of Sweden. In Norway, work completed by Walter Cato Olsen, of the Christian Michelsen Institute in Bergen, indicates that "rash-prone operators are commonly exposed to extreme electrostatic fields . . . caused partly by high voltages associated with the display screens and partly by electric charges accumulated by the bodies of the operators." The number of airborne microscopic particles increases in the presence of these fields. Olsen suggested that field-enhanced exposure to these irritants causes the rash, and possibly other health problems such as eye discomfort. Ostberg noted that Norway's proposed VDT regulations advise that static electricity be reduced to the lowest possible level. The Swedish equivalent of NIOSH is also concerned with static electricity and plans an epidemiology on the possible effects of airborne ions on the skin and eyes. Seven hundred operators and 350 controls will participate in the yearlong study.

Visual Fatigue

Visual fatigue proved more difficult to assess than radiation risks. Evidence of VDT-induced strain included a review of studies documenting changes in the eye's "resting focal point" after prolonged VDT work and of a survey showing more eye complaints from operators as their VDT work hours increased. It is still too early to say whether or not these effects signal permanent ocular change.

Investigations into the causes of eye stress have identified several key factors, including display screen characteristics, ambient lighting and VDT design. Work organization and pacing were also cited.

Surprisingly, not all of the symposium's experts thought VDTs entail a unique set of visual demands. Sommer was not convinced that reading from a display screen, for example, required a different effort than some traditional office work. Drs. Tony Adams, from the School of Optometry at the University of California at Berkeley, and Julian Hochberg, from the psychology department at Columbia University, however, strongly disagreed and cited image reflection on the display face, which is known to produce ocular stress, and the special acuity required by stroke-by-stroke reading.

As research and debate continue, national standards for VDT use have emerged to protect workers. Dr. Martin Helander, of the Canyon Research Group in California, provided a concise review and comparison of these ergonomic standards.

Although participants at the symposium agreed that more research is necessary to guarantee optimal VDT working conditions, current knowledge apparently is not fully utilized. For example, Dr. Harry Snyder, from the Department of Industrial Engineering and Operations Research at Virginia Polytechnic Institute, maintained that some good display screens already exist. Most unit designs, however, are based on home TV screens, which Snyder said are not entirely suitable for VDT work. Unfortunately, no one has compiled either an evaluation of available models or a criteria list for selecting terminals.

A summary of the symposium proceedings may appear this fall, but the final publication decision has not been made. For information, contact Key Dismukes at the Committee on Vision, (202) 389-6068.

BRIEFS

- Recognizing the need for greater information exchange, NIOSH has created the Clearing House on Office Worker Health Issues. Its current focus will be on VDTs, but NIOSH's Michael Smith says a range of issues affecting the office environment will eventually be covered. For information, contact Ted Schoenborn, Division of Technical Services, NIOSH, 4676 Columbia Parkway, Cincinnati, OH 45226.
- The August 13 issue of *New Scientist* reports on Norway's proposed safety guidelines for VDTs. The rules address static electricity produced by terminals, which a study by Norway's Christian Michelsen Institute has linked to facial rashes. (See above.)
- Government regulations for VDT radiation were recommended by this year's Newspaper Guild Convention. The July 31 *Guild Reporter* also notes that the guild is completing a handbook on VDT health measures for its locals.

IMPI

The International Microwave Power Institute (IMPI) held its annual symposium in Toronto, June 9-11.

The highlight of the meeting was the participation of Zhi-Yuan Shen, of the department of radio electronics engineering at Zhejiang University, Hangzhou, in the People's Republic of China. Shen is now visiting the Microwave Research Institute at the Polytechnic Institute of New York. He outlined the use of microwaves in the production of chocolate, dry milk cake, wine, spirits, timber, paper, medicines and magnetic tape. With respect to medical applications, Shen discussed hyperthermia research, but most interesting was the application of microwaves to acupuncture treatments: "Through a needle-type antenna, the microwave power (frequency about 1000 MHz) was transmitted into some acupoints on the body of the animals and human beings. The experiment indicated that the acupuncture curative effects of some illnesses were improved by this method."

Shen also said that there was some work on male birth control being carried out. Experiments on exposing wheat, soybeans and rice to CW and pulsed microwaves indicated that microwave exposure can stimulate variation in the plants, producing beneficial variations, which are inheritable.

In the opening plenary session, Dr. Geoffrey Voss, of the Surgical Medical Research Institute at the University of Alberta, described the biological effects research field as "most exciting," but decried its "remarkably low level of funding." According to Voss's calculations, the field is only getting one millicent per hertz of band width per year. He felt three millicents would be a more appropriate level—though he did not believe that all frequencies should be allocated equal shares of research moneys.

Maria Stuchly, of the Radiation Protection Bureau, Health and Welfare, Canada, presented an overview of a Canada-wide survey on types, number and use of radiofrequency and microwave diathermy devices. She found that the short wave (RF) treatment is used ten times more frequently than microwave diathermy. Stuchly concluded that the data clearly indicated a danger of overexposure to the operator and recommended voluntary guidelines to limit the risk. The survey found operator exposures as high as 315 V/m and 0.5 A/m for air-spaced electrodes used in knee treatments. Stuchly was particularly concerned with the high intensity fields around the cable connecting the applicator to the diathermy console. Electric fields of above 300 V/m may extend up to half a meter from the cables.

Amleto Ignesti, of the Italian National Research Council in Florence, said that while Italy did not have any microwave standards, the council preferred the USSR exposure limit without committing itself to the Soviet regulatory philosophy. On the subject of worker attitudes toward RF sealers, he observed: "In all cases we have come across, the workers of the industry felt very uneasy because of the suspicion of the presence of this possibly harmful polluting agent which cannot be sensed in any way and that can in principle be anywhere."

Ignesti described a new RF hazard meter with a green-yellow-red output display. The patented instrument responds to fields from below 1 MHz to above 100 MHz, with an accuracy of ± 3 dB. Its cost is about \$150 in Italy.

IMPI has been having financial difficulties and is in the process of restructuring its membership dues. Next year's meeting is scheduled for July 25-30 in San Diego.

Risk Meeting

Professor Nicholas Steneck, a historian at the University of Michigan, is organizing a conference on *Cost/Benefit Analysis and the Microwave Bioeffects Field* to be held next November 12-13 in Ann Arbor.

Supported by the National Science Foundation, Steneck has invited a dozen experts to prepare papers for the meeting: the papers will be circulated in advance, leaving most of the conference open for discussion.

Among those now scheduled to prepare papers are: Zory Glaser, Chris Dodge and Mays Swicord (government); Allan Frey, Don Justesen and Rochelle Medici (research scientists); Howard Johnson and John Osepchuk (industry); Richard Alabanese, Sam Koslov and Paul Tyler (military); Scott Denman and Edward Groth (consumer groups). A.W. Guy, Przemyslaw Czerski and representatives from EPA are also expected to attend.

A limited number of seats for the meeting are still available. For more information contact Steneck at the Department of History, 4638 Haven Hall, University of Michigan, Ann Arbor, MI 48109, (313) 763-2230.

Pre-Proposals Due in NY ELF Study

The scientific advisory panel for New York State's Overhead Power Lines Project, investigating the possible health effects of exposure to 60 Hz radiation from high power transmission lines, has selected research areas for funding and is now soliciting pre-proposals. Research areas include:

- Genetic, cytogenetic, teratogenic and reproductive studies.
- Cell and organ culture studies.
- *In vivo* animal physiology and pathophysiology.
- Animal and human neurobiology.
- Animal and human behavior.
- Multidisciplinary human studies with controlled exposure conditions.
- Epidemiology of human populations.
- Other studies relevant to health hazards.

A total of \$5 million in contracts is available.

All pre-proposals are due by October 15, 1981. For more information contact Dr. David Carpenter, New York Department of Health, Albany, NY 12201, (518) 474-4170.

Project ELF Rally

Stop Project ELF, a citizens group opposing the Navy's development of a giant underground antenna for communicating with submerged submarines, scheduled a September 4-7 rally at the Clam Lake, WI, ELF test facility. (See *MWN*, May 1981.) Possible biological effects from the extremely low frequency radiation emitted by the antenna are among the group's concerns.

Two of the directors of the project, John Stauber and Jennifer Speicher, were in Washington, DC, in August filing Freedom of Information Act requests with the Navy. They report that the Navy awarded a \$5 million contract to GTE Sylvania to test a mobile ELF system.

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UPDATE

Medical Applications.... *Physical Aspects of Hyperthermia*, the American Association of Physicists in Medicine summer school course held at Dartmouth College August 3-7, attracted 187 professionals from 11 countries. The 29 lectures will be reproduced in an AAPM monograph due out at the end of the year. For more information contact Anke Junge, executive secretary, AAPM, 335 East 45 Street, New York, NY 10017.... Funding for MIT Professors Philip Myers and Alan Barrett's microwave thermography system for detecting breast cancer has not been renewed, according to Dr. Thomas Rozzell of the Office of Naval Research.... Richard Borgens of the Jackson Lab in Bar Harbor, ME, and Ernesto Roederer and Melvin Cohen of Yale University describe the regeneration of the spinal cord in lampreys with applied electric fields in the August 7 *Science*.... The program for the first annual meeting of the Bioelectrical Repair and Growth Society scheduled for November 9-11 in Philadelphia is out. You can get a copy from the society at 425 Medical Education Building, 36th and Hamilton Walk, Philadelphia, PA 19104.... NMR imaging promises to be a major new medical tool, according to an expert poll published in *Forecast of Emerging Technologies*, a new FDA report to be released soon and mentioned in the July 30 *Nature*.

Technology.... Even though Xerox has abandoned its Xten digital communications network, other companies think they can make the service pay off. Satellite Business Systems, Tymnet Corp. and ISA Communications Services are seeking FCC approval to develop their own digital termination systems (DTS). The intra-city networks will operate in the 10.55-10.68 GHz band.... The thirteen companies now bidding to enter the direct broadcast satellite (DBS) service market are listed in the August 10 *Aviation Week & Space Technology*.... An article in the August issue of *IEEE Spectrum* outlines different technical approaches to DBS systems.... The US Army Medical Research and Development Command is seeking a contractor to develop a high peak power pulsed transmitter system for millimeter wave bioeffects studies (*Commerce Business Daily*, July 30, 1981).... OmniChuck, a new microwave heating system for processing silicon chips, has been developed by Machine Technology of Whippany, NJ. According to the August issue of *Microwaves*, OmniChuck, using pulsed 2.45 GHz radiation, is faster than infrared systems and does not require moving the wafers for baking.... Dayton T. Brown, Inc., of Long Island, NY, will receive \$208,860 from the Bureau of Mines to study an electromagnetic transmitter for locating trapped miners.... The Bureau of Mines has awarded a \$287,926 contract to the Xader Corp. of Springfield, VA, to investigate synthetic radar use in detecting coal mine hazards.

Government.... The Veteran's Administration Surgical Service's Ophthalmology Consulting Committee held its first meeting since November 1977 in Washington on August 10. Members of the committee are: Drs. Raymond Pilkerton (chairman), VA Medical Center, Washington, DC; James McDonald, VA Medical Center, Hines, IL; Arthur Chandler, VA Medical Center, Durham, NC; Ralph Stanifer, VA Medical Center, Houston, TX; Paul Whitmore, Walter Reed Army Medical Center, Washington, DC; and Budd Appleton, St. Paul Ramsey Hospital, St. Paul, MN.... The Bureau of Radiological Health has extended the comment period for its proposed rule on the measurement of leaks from microwave ovens. (See *MWN*, May 1981.) The Association of Home Appliance Manufacturers had requested the extension. The comment period will now run through October 23 (46 *Federal Register* 41102, August 14).

Military Systems.... The Air Force is proceeding with its plans for two additional PAVE PAWS installations (see *MWN*, May 1981). A contractor is being sought for a third-phased array radar facility at Robins Air Force Base, GA. The contract will include options on a fourth site in the Southwest (*Commerce Business Daily*, July 9).... Cobra Judy, a ship-mounted phased array radar for monitoring Soviet missile tests, should be operational late this year. According to the August 10 *Aviation Week & Space Technology*, the Air Force is currently testing the system. Cobra Judy, installed on the USNS

Observation Island, includes a 22.5-ft. wide phased-array antenna housed on the ship's stern and two 32-ft. diameter radomes on its top.

Moscow Embassy.... The State Department has assembled nine volumes of documents relating to the irradiation of the US embassy in Moscow and is making them available through the Freedom of Information Act. The 2000-page set, covering events between 1964 and 1977, includes a volume on Project Pandora. The cost of the documents will be 10 cents a page at most; a full set would probably be considerably cheaper. For more information contact: Frank M. Machak, Information and Privacy Coordinator, Department of State, Washington, DC 20520.

Bioeffects.... There were some angry letters generated by last December's review article on RF/MW bioeffects by Eric Lerner. These together with Lerner's response are published in the August *IEEE Spectrum*.

Information and Litigation Center Set Up in Washington, DC

(continued from p. 1)

greater public awareness of the risks and benefits of microwave radiation.

According to present plans, the center will be a membership organization, with its own newsletter. While the center will help members obtain information relating to their microwave problem, it will not represent them in court. Instead, Lemle will refer potential complaints and lawsuits to participating attorneys. Information collected from members will be handled on a confidential basis. Membership fees will be set on a sliding scale.

Reppert and Lemle have been working together on FOIA appeals to release materials on the government's handling of the Moscow embassy affair. In 1976, Reppert broke many of the early stories on the Moscow irradiation and Project Pandora, a secret investigation into the biological effects of low-level microwave radiation; between 1977 and 1980 Reppert was a Moscow correspondent for the Associated Press. To date, Reppert and Lemle have collected more than 4,000 pages of documents from a host of federal agencies, including the State Department, the US Public Health Service, the National Telecommunications and Information Administration, the Defense Intelligence Agency, and other branches of the Department of Defense. (In a related development, the State Department has prepared nine volumes of documents on the history of the Moscow irradiation for public release: see above.) They currently have a FOIA suit pending against the CIA in federal district court in Washington, DC.

With respect to ongoing legal activity arising out of the Moscow microwaves, Lemle would only say that he knows of a number of administrative claims now pending.

The center is in the process of getting tax-exempt, non-profit status. For more information contact: Stuart Lemle, Microwave Radiation Information and Action Center, 1320 19th Street, NW, Suite 200, Washington, DC 20036; (202) 775-0044.