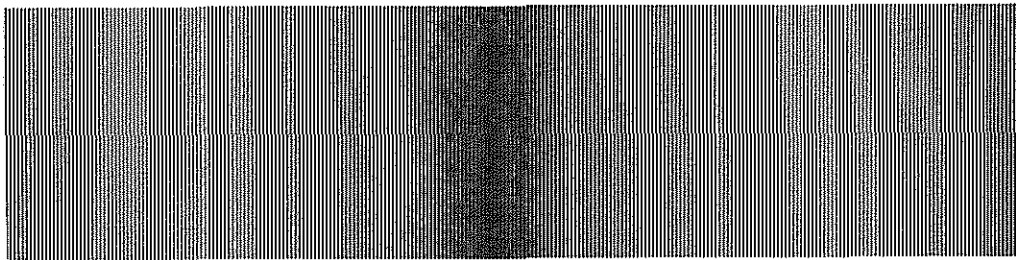


MICRO WAVE NEWS



Vol.V No.6

A Report on Non-Ionizing Radiation

July/August 1985

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RF and VLF Radiation Hazards Reappraised

The health risks associated with exposure to 30-70 MHz radiofrequency (RF) radiation are greater than previously believed, according to Professor Om Gandhi of the University of Utah. This new finding, together with previous research on shocks and burns from very low frequency (VLF) fields (300 kHz-3 MHz), could force a reappraisal of the adequacy of current safety standards, possibly leading to changes in the operation of broadcast transmitters and of industrial machinery such as RF sealers and heaters.

Gandhi has found that a 1 mW/cm² 40 MHz field induces a maximum current of 780 milliamps (mA) through the ankles in a free standing adult. Gandhi estimates that the resulting local specific absorption rate (SAR) in the ankles is 243 watts per kilogram (W/Kg). Such "hot spots" may present a risk of burns and other internal injuries.

Present exposure standards seek to limit *whole-body* SARs — for instance, the 1982 American National Standards Institute (ANSI) guidelines are keyed to a maximum SAR of 0.4 W/Kg. The ANSI standard also has a clause that specifies a maximum partial-body exposure of 8 W/Kg. The National Institute for Occupational Safety and Health (NIOSH) has recently proposed a similar partial-body limit of 5 W/Kg (see story on p.2). Gandhi has thus measured levels that are nearly 50 times greater than NIOSH's proposed local SAR limit.

Gandhi has also calculated the SARs for children in a radiation field. For a 10-year-old child standing in a 1 mW/cm² field, the maximum local SAR is 371 W/Kg at 50.7 MHz. A 5-year-old child experiences a maximum local SAR of 534 W/Kg at 62.5 MHz.

In a telephone interview, Gandhi said that the fields cause "very large currents" to pass through the human body: "What we thought were very low fields can nevertheless induce currents with very large local SARs." Gandhi, who is with the Department of Electrical Engineering at the University of Utah in Salt Lake City, told *Microwave News* that, "We must understand the role such high currents play in the human body."

According to Gandhi, up to 85 percent of the current passing through the ankles is also flowing through the abdominal region. To put the numbers into perspective, he explained that, *without* cooling by blood flow, an SAR of 70 W/Kg can cause a 1 degree Centigrade rise in body temperature per minute.

Of course, increased blood flow does cool off heated tissue, but whether it can do so before any damage occurs and whether the body's thermoregulatory system can handle the increased heat load are still unresolved questions and in need of study.

Some of Gandhi's data appear in the June issue of the *Proceedings of the IEEE*, 73, 1145-1147. The paper was submitted more than a year ago, and some of the results have now been revised with higher SARs than were originally reported.

(continued on p.9)

NIOSH Proposes RF/MW Occupational Standard — Stricter Than ANSI's

The National Institute for Occupational Safety and Health (NIOSH) has proposed worker exposure standards that are, for many frequencies, twice as strict as those set by the American National Standards Institute (ANSI) in 1982. The NIOSH proposal is part of a 293-page draft criteria document on occupational exposures to radiofrequency and microwave (RF/MW) radiation, released at the Bioelectromagnetics Society (BEMS) meeting held in San Francisco, CA, in mid-June.

In the external review draft of the criteria document, NIOSH proposes to limit worker exposures to a maximum of 0.5 mW/cm² for the 30-300 MHz frequency range. For 300 kHz-3 MHz, the maximum exposure would be 50 mW/cm². Like the ANSI standard, NIOSH proposes adopting a "ramp" type, frequency-dependent standard. Above 3 GHz, the NIOSH proposal would be 5 mW/cm², identical to ANSI's. (Excerpts from the NIOSH recommended exposure standard appear on pp.8-9.)

NIOSH is now in the process of soliciting comments on the draft criteria document from experts inside and outside the federal government. A revised draft will then be reviewed by Dr. Donald Millar, director of NIOSH. If approved, the final document should be issued next year.

The completed NIOSH document will be forwarded to the Occupational Safety and Health Administration (OSHA), which could set a standard for workplace exposures — though at present OSHA has no plans to do so (see *MWN*, November 1983 and March 1984).

Such a standard could affect a large number of workers. According to a report prepared for OSHA in 1982 by Centaur Associates, nearly nine million Americans are exposed to non-ionizing radiation on the job.

Basis for the Standard

The NIOSH standard is based on a threshold for adverse bioeffects at a specific absorption rate (SAR) of approximately 2 W/Kg. Using a safety factor of 10, NIOSH recommends that average whole-body SARs be limited to 0.2 W/Kg. In comparison, the ANSI standard is keyed to an average SAR of 0.4 W/Kg.

According to NIOSH, "No measurable core temperature increases are expected to occur in man or animals at SARs of 0.2 W/Kg or less. Few substantiated biological changes of any type have been reported in animals at SARs lower than 0.2 W/Kg, and the changes that occurred were not judged by NIOSH to have any significant effect on the health of the animal. SARs below 0.2 W/Kg are thus not expected to have any significant effect on man....The 0.2 W/Kg limit should prevent any additional increase in body temperature due to RF exposure, regardless of the ambient conditions."

In a paper presented at the BEMS meeting, "Assessment of the Biological Effects of RF Radiation," NIOSH's

Dr. Joseph Lary, Dr. David Conover and William Murray summarized the basis for the NIOSH recommendations:

Several adverse effects have been reported at SARs between 1.8 and 4.5 W/Kg including death (rats and rabbits); rectal temperature increases exceeding 3 degrees C (monkeys, dogs); hemorrhagic lesions, other tissue lesions, and tubular nephrosis (rabbits); staggering, muscular flaccidity and collapse, and spasms of the legs and wings (chicks); and extreme agitation, impaired locomotion, and exhaustion (dogs). At SARs exceeding 4.5 W/Kg, prolonged exposure generally produced severe hyperthermia in most animals and caused a variety of adverse health effects. At SARs below 1.8 W/Kg, no biological effects were reported which were considered by the authors to be clearly adverse to the animals' health. However, in the SAR range of 0.17-1.8 W/Kg, measurable increases in body temperature were reported as well as several distinctive physiological and behavioral changes. At SARs below 0.17 W/Kg, no temperature increases were reported and most of the biological effects involved increases in calcium efflux from the brain or increased permeability of the blood-brain barrier.

With respect to the calcium efflux effect, the NIOSH staffers argued that it "has no known significance to the health of the animal." As to the possibility of microwave-induced leakage through the blood-brain barrier, they concluded that this effect "has been difficult to replicate at low exposure levels and may be an experimental artifact."

The 0.2 W/Kg exposure limit should protect against any "significant interactions between RF radiation and drugs or chemical substances to which the worker might be exposed," according to the draft document. Of special concern, NIOSH cited the finding that RF/MW radiation can enhance the carcinogenicity of benzopyrene in mice at SARs as low as 2.0 W/Kg.

In the criteria document, NIOSH explains the need for the safety factor of ten partly because of uncertainty over heating effects in humans and rhesus monkeys — the agency notes that no significant temperature rise occurs in animals at SARs below 0.17 W/Kg — and partly because theoretical models indicate that the human thermoregulatory system is not affected at levels below 0.2 W/Kg. In addition, NIOSH cites the fact that "little is known about the long-term effects of chronic exposure of workers to RF radiation" and that, "The epidemiology literature presently does not provide an adequate basis to determine the long-term human health effects, if any, from exposure to RF radiation."

Under the NIOSH proposal, average whole-body exposures can exceed 0.2 W/Kg if partial-body exposures are not over 5 W/Kg — averaged over any one gram of tissue. The 1982 ANSI standard has a similar exclusion clause but with a maximum peak SAR of 8 W/Kg.

NIOSH explains: "It thus appears that continuous lo-

calized exposure of even poorly perfused tissues at an SAR of 5 W/Kg will not result in a localized temperature increase of more than a few tenths of a degree Centigrade and will not damage the exposed tissue." This 5 W/Kg limit should protect the lens and the pituitary gland from localized RF power deposition, according to NIOSH.

RF Shocks and Burns

NIOSH is seeking to protect workers against shocks and burns, irrespective of the ambient field:

Exposure conditions which will cause an involuntary response (startle reaction) due to an RF shock or current flow are not permitted from 300 kHz to 300 GHz. In addition, exposure conditions which will cause an RF burn are not permitted from 300 kHz to 300 GHz. These restrictions apply even if the exposure limits of this standard are not exceeded.

For frequencies below 3 MHz, NIOSH concludes that the 50 mW/cm² exposure limit will protect workers against shocks, burns or excessive SARs if there is no contact with a conducting object. When such a contact is made, however, the risks are much greater.

For instance, the NIOSH staffers cite estimates that a worker in a 3 MHz electric field at 50 mW/cm² who touches a grounded conductive object with his hand could experience an SAR of 16,625 W/Kg, a level which "would obviously cause an RF burn or a possible accident-causing

startle reaction."

NIOSH does not propose controlling RF shock and burn risks by limiting ambient field strengths, however. Instead, the agency advocates that such hazards "are best prevented by implementing appropriate safety features on a source-by-source basis rather than by limiting the incident field." The use of insulated gloves, shoes and other protective clothing is suggested as a possible control strategy.

NIOSH's Consultants

In preparing the document, NIOSH staffers consulted the following experts: Dr. Ernest Albert, George Washington University Medical Center, on central nervous system effects; Drs. Virginia Bruce-Wolff and Don Justesen, VA Hospital, Kansas City, on behavioral effects; Dr. Russell Carpenter, Food and Drug Administration, on ocular effects; Dr. Om Gandhi, University of Utah, on dosimetry; Dr. Ronald Jensch, Thomas Jefferson Medical College, on reproductive effects; Dr. Robert Lebovitz, University of Texas Health Science Center, on auditory effects; Dr. Robert Liburdy, U.S. Air Force School of Aerospace Medicine, on hematologic/immunologic effects; Dr. Shin-Tsu Lu, University of Rochester, on cardiovascular effects; Dr. Sol Michaelson, University of Rochester, on pathophysiological effects; and Dr. Vernon Riley, Pacific Northwest Research Foundation, on neuroendocrine effects.

Editor's Note

Microwave News Goes Bimonthly

With this issue, *Microwave News* begins a new publication schedule in a new, expanded format. Each issue will now be 16 pages long, and we will now publish bimonthly, rather than 10 times a year. These two changes, taken together, will result in essentially the same amount of news coverage over the year, while allowing us to cut costs.

We are making these changes to forestall an increase in subscription price. We have not raised our prices for three years and are reluctant to do so now, even though our expenses have gone up substantially.

Microwave News enjoys a very high renewal rate and we thank you for your loyalty. We trust that the changes we are making now will not affect your reliance on the newsletter as the premier source of information in the field. We encourage subscribers who are adversely affected by this change to contact us.

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If you count on us for all the news from the non-ionizing radiation community, we urge you to tell your associates how valuable the newsletter is. If we expand our subscription base, we will be able to hold off future price increases.

If you are reading someone else's copy, please get your own. If the newsletter takes a long time to circulate around your office, consider taking out additional subscriptions. If you are reading a photocopy, you are *breaking the law* and you should definitely subscribe.

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The September/October issue of *Microwave News* will be published about three weeks late. We will resume our regular publishing schedule with the November/December issue.

ELF and Cancer: An Update

The number of papers and letters on the suspected link between extremely low frequency (ELF) radiation and cancer continues to grow. Reported below are the latest developments. (See also *MWN*, October 1984 and May 1985.)

Neuroblastoma Risks

Drs. Margaret Spitz and Christine Johnson have found that the children of fathers exposed to electromagnetic fields on the job had a significantly increased risk of developing neuroblastoma, a malignant tumor of the central nervous system (a twofold elevated risk: odds ratio of 2.13). Males who reported themselves to be electronics workers had an even greater risk of fathering children with neuroblastoma — though the number of such cases was small, the odds ratio was 11.75.

The researchers conclude that, while there are "inherent problems" associated with the use of indirect measures of exposure and of occupational groupings, as well as the possible confounding problem of chemicals and heavy metals, "Even a suggestive association [between electromagnetic fields and] childhood cancer is disconcerting, and replication studies in other populations are warranted."

Spitz is at the M.D. Anderson Hospital and Tumor Institute at the University of Texas, and Johnson is at the University of Texas School of Public Health, both in Houston. Their paper, "Neuroblastoma and Paternal Occupation: A

Case-Control Analysis," appears in the June 1985 issue of the *American Journal of Epidemiology*, 121, 924-929.

Leukemia in Canada

High voltage power line workers have a threefold increased risk of dying of leukemia, according to Dr. Geoffrey Howe of the National Cancer Institute of Canada in Toronto. This finding emerged from a broader study of cancer mortality in Canada by Howe and Dr. Joan Lindsay, an epidemiologist with Statistics Canada, also in Toronto (see their paper in the *Journal of the National Cancer Institute*, 70, 37-44).

In a telephone interview, Howe told *Microwave News* that while the increased risk to power line workers is statistically significant, the number of cases studied is small. He explained that his research is designed to generate hypotheses rather than to yield conclusions about specific types of occupational risks. He said that, given the observed increased risk to power linemen, "the time has come to do some definitive studies." Howe plans to submit a letter to *Lancet*, the British medical journal, on the power line-leukemia link.

Brain Tumors

In our October 1984 issue, we reported on results obtained by Dr. Ruey Lin and colleagues at the Maryland Department of Health and Mental Hygiene which suggest a link between exposure to electromagnetic fields and the development of brain tumors. Their paper has now been

Symposium on Electropollution and Brain Tumors

Nobel laureate Dr. Marshall Nirenberg will head the list of participants at a symposium on the *Biological Effects of Electropollution: Brain Tumors and Experimental Models* to be held September 9 at Howard University in Washington, DC.

Dr. Sisir Dutta of the university's Departments of Botany and Oncology and Dr. Richard Millis of the Departments of Neurology and Zoology are organizing the university-sponsored meeting.

Other participants include: Dr. Carl Blackman of the Environmental Protection Agency (EPA), Dr. Om Gandhi of the University of Utah, Dr. Eugene Goodman of the University of Wisconsin-Parkside, Dr. B.E. Hackley of the U.S. Army's Institute of Chemical Defense at Edgewood Arsenal in Maryland, Dr. Bruce Kleinstein of Information Ventures, Dr. Ruey Lin of the Maryland Department of Health and Mental Hygiene and Dr. Margaret Spitz of the M.D. Anderson Hospital and Tumor Institute at the University of Texas in Houston.

Dutta and Millis are inviting researchers in the field of radiofrequency and microwave radiation biology who want to participate in the afternoon ses-

sion to submit a letter of inquiry or an abstract. According to Millis, there are still five open slots for speakers; those selected will receive funds for travel and accommodations.

Nirenberg, the chief of the Biochemical Genetics Laboratory at the National Heart, Lung and Blood Institute in Bethesda, MD, has developed an experimental model for the study of neuroblastoma and will discuss potential applications at the meeting.

Dr. Joe Elder of the EPA will be the luncheon speaker, addressing the public policy issues associated with electropollution.

The symposium is open to the public, but attendance is limited to about 60. Pre-registration is required, but there is no fee. The proceedings of the meeting will be published. The symposium will be held at the Howard University Inn, adjacent to the campus.

For more information, contact Dutta or Millis at Electropollution Symposium, PO Box 83, Howard University Administration Bldg., Washington, DC 20059, (202) 636-6933.

published: "Occupational Exposure to Electromagnetic Fields and the Occurrence of Brain Tumors" appears in the June issue of the *Journal of Occupational Medicine*, 27, 413-419.

In addition to their earlier findings, Lin and coworkers report that "the mean age at death was found to be significantly younger among cases in the presumed high [electromagnetic] exposure group."

Responses to Milham

Dr. Samuel Milham's April 6 letter to *Lancet* claiming support for the hypothesis that electromagnetic fields are carcinogenic (see *MWN*, May 1985) has generated a number of replies, which in turn have prompted comments.

Two letters, published in the May 11 issue of the journal, contend that the "Silent Keys" column in the American Radio Relay League's (ARRL) *QST* magazine, used by Milham as an index of recent deaths, is incomplete and that Milham had failed to control for the hazards of dust and fumes from soldering electronic components.

Harsher criticism came from ARRL's Committee on the Biological Effects of RF Energy, chaired by Raymond Wrangler, in a letter in the June 29 *Lancet*. The committee members argue that Milham's "hypothesis that electromagnetic fields are carcinogenic remains purely speculative" and that, "On the basis of the data we have seen, it cannot be assumed that participation in amateur radio activities increases the risk of leukemia." They are also critical of Milham's use of proportional mortality ratios (PMRs).

Then, in the July 13 issue, Dr. Michael Coleman of the ICRF Cancer Epidemiology and Clinical Trials Unit in Oxford, England, took the ARRL committee to task for its "inaccurate commentary" on Milham's original letter, including the discussion of PMRs. Coleman also explained that, even if the "Silent Keys" column omitted some cases, the impact on Milham's analysis would be minimal: "Milham's result could be wrong — but it is unlikely to be far wrong. Any bias toward preferential reporting of leukemia deaths...would have to be severe; Milham would need to have missed over 1,500 deaths, not one of them due to leukemia, for his result to be entirely due to such a bias."

In 1983, Coleman reported that he and coworker Janine Bell had found a statistically suggestive link between ELF and leukemia in a population of electrical workers in southeast England (see *MWN*, June 1983).

Epidemiology Handbook

Drs. Tim Aldrich and Clay Easterly of Oak Ridge National Laboratory have assembled a *Handbook of Epidemiologic Methods with Special Emphasis on ELF Fields*, a guide to the literature on ELF effects, focusing primarily on the possible link to cancer. Copies will be available soon at no cost. Write to the authors at the Health and Safety Research Division, Oak Ridge National Lab, Oak Ridge, TN 37831. Include a self-addressed mailing label.

Portland, Oregon Proposes 100 uW/cm² Standard — Again

The City of Portland's Bureau of Planning has reaffirmed its support for a general population exposure standard of 100 uW/cm² for 30-300 MHz radiation. A new proposal by the bureau calls for regulation of the siting and operation of all television and radio stations in Portland, the largest city in Oregon.

The new initiative, issued in July, is intended to clarify the existing regulatory framework, which the city planners found to be inconsistent and, sometimes, inequitable. If approved by the City Planning Commission and the City Council, the plan will require operators of all existing radio and television broadcasting facilities in the frequency band between 100 kHz and 300 GHz to register with the city. Those seeking to build new broadcasting stations will have to apply to the city and conduct radiation measurements around the proposed sites.

The Planning Commission held hearings on the bureau's proposal on July 23 and is expected to reach a decision by September. The City Council will not take final action before December.

Over the 100 kHz to 300 GHz range, the proposed Portland standard is ten times stricter than the 1982 American National Standards Institute (ANSI) standard. The planning bureau concluded that the ANSI limit "does not allow a sufficient margin of safety from known adverse impacts on living tissues."

Portland adopted a 100 uW/cm² interim standard in 1980 — the first public exposure standard in the United States. Although the rules were approved by the Planning Commission, they were never incorporated into the city's zoning rules by the City Council.

In September 1984, the City Council passed an ordinance placing a moratorium on new permits for radio and television facilities until July 1, 1985. In June, the council extended the moratorium until completion of its regulatory review or until January 1, 1986, whichever comes first. According to Steven Gerber, the principal author of the proposed regulations, the moratorium only applies to "major" sources — those with an effective radiated power of 500 or more watts. Thus point-to-point and mobile communications systems are exempt.

The planning bureau contends that its new recommendations "are intended to provide a consistent and knowable set of criteria for the operation and siting of RF broadcast facilities, while providing protection to the general population from RF emissions and the aesthetic impacts of significant broadcast facilities."

The situation in Portland is complicated by the fact that Multnomah County, in which Portland is situated, has its own radiofrequency and microwave radiation standard — 200 uW/cm² in the 30-300 MHz band. Originally, the county had proposed a 50 uW/cm² standard, but backed off in the face of opposition from local broadcasters (see *MWN*, July/August 1982). The city's new proposal is very similar to the county rules, but the exposure levels are

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twice as strict. According to the bureau's report, the Portland measure "has been written specifically to be compatible with the Multnomah County regulations."

The Portland planners argue that their proposal will not have any adverse economic impacts. They state that "There is no evidence that the admittedly conservative 100 $\mu\text{W}/\text{cm}^2$ standard will cause any significant hardship on the broadcast industry here in Portland." In addition, they have found no firm evidence "to suggest a negative impact on property values from proximity to broadcast facilities."

The Bureau of Planning has issued a three-volume report, *Radiofrequency (RF) Regulatory Review Project*, consisting of a "Report and Recommendations to the Planning Commission," a "Background Document" and a "Technical Appendix."

In the process of preparing the report, the bureau set up an RF Task Force, consisting of citizens, industry representatives and medical and technical experts.

For more information, contact Steven Gerber, Bureau of Planning, City of Portland, Room 1058, 1120 SW Fifth Ave., Portland, OR 97204, (503) 796-7706.

Hawaii Broadcasts Blamed for Burns and Extensive EMI

Radiation from broadcast antennas in Honolulu, Hawaii, is being blamed for shocks, burns and numerous instances of electromagnetic interference (EMI) with electronic equipment in high-rise condominiums neighboring the radio tower.

A study commissioned by Honolulu Councilmember Marilyn Bornhorst and released in June found that AM radio (550 kHz-1.6 MHz) broadcasts are a potential source of injury and are disrupting telephone answering machines and radio and television reception.

Richard Melton, a consultant who surveyed the residents of three condominiums for Bornhorst, concluded that metal objects in the apartments pose a danger of shocks and burns, ranging from "mild to capable of causing injury." He warned that "The severity of some of these problems is alarming and indicates a continuing danger of injury."

In the report, Melton characterized the interference as a "significant nuisance to many residents" at the two buildings closest to the transmitters — 100-250 feet from Ala Wai tower, from which 3 AM stations broadcast. At the third building, which is about 350 feet from the tower, reports of EMI-type disturbances were less common. The survey also included a fourth building more than a mile from the tower to serve as a control.

Other types of interference included buzzing in the ears and music emanating from interior walls, air conditioners and gold teeth. Also, radio broadcasts were recorded onto tape and video recorders and telephone answering machines.

The May 27 *Honolulu Advertiser* reported that one resident of the Villa on Eaton Square, one of the buildings surveyed, had gone through four answering machines in

the hope of finding one that does not pick up spurious radio signals. On occasion, she returned home to find that, instead of her phone messages, she had a one-hour tape of rock music. She also experienced EMI problems with her stereo, television and electronic organ.

Zoning Changes Recommended

Melton argued that "The survey results leave little doubt that the phenomena being reported are caused by radiofrequency radiation and give sufficient information to initiate changes in land use policies regarding broadcast towers."

Melton recommended that federal standards be set for siting radio and television transmitters to reduce both potential health risks and EMI and called for a retrospective health study of "as many persons as possible who have lived and/or worked for significant periods of time near sources of radiofrequency radiation." He also urged local, state and federal officials to form a task force "to work out a consensus solution to the existing radiofrequency radiation problems."

In releasing the survey results in early June, Bornhorst supported the report's recommendations. She said that the data provide "sufficient evidence" that Honolulu's zoning code should be changed to distance broadcast towers from areas where people live and work. Zoning rules currently prohibit siting transmitter towers on the hills surrounding the city, forcing broadcasters to place them in the city.

EPA-FCC Survey

In May 1984, Richard Tell of the Environmental Protection Agency (EPA) and Dr. Robert Cleveland of the Federal Communications Commission (FCC) measured levels as high as 306 mW/cm^2 next to the access-limiting fence at the Ala Wai tower. In a recreational area on the roof of the Villa on Eaton Square, they found AM levels greater than 24 mW/cm^2 (see *MWN*, January/February 1985).

In a press release accompanying Melton's report, Councilmember Bornhorst expressed alarm that the EPA-FCC measurements contrasted sharply with the agencies' press statements that residents near the tower are in no immediate danger. "How can they say that when they knew about the danger of burns, they know that there is an epidemic of birth defects in Vernon Township (another 'hot spot'), and they know of long-term studies that show it causes cancer in laboratory animals," she said.

For a copy of the report, *Survey of Phenomena Experienced by Residents Living Close to the Ala Wai Broadcasting Tower, Honolulu, Hawaii* (June 1985), contact: Councilmember Marilyn Bornhorst, City Council, Honolulu, HI 96813, (808) 523-4000.

Florida Panel Discounts Power Line Bioeffects

The Florida Electric and Magnetic Fields Science Advisory Commission (SAC) has concluded that "It is unlikely that human exposure to 60 Hz electric and magnetic fields can lead to public health problems." The one-year,

\$200,000 study was funded by the Florida Electric Power Coordinating Group (FCG), a consortium of state electric utilities, for the Florida Department of Environmental Regulation (DER).

The only adverse environmental effects associated with 230-or-greater kV transmission lines are the potential for pacemaker interference and shocks to honeybees living in hives under the lines, according to the SAC report.

The panel noted that "Adverse public health effects of such fields have not yet been established," but that "Because of certain ambiguities in the currently available scientific information, further developments in the area should be monitored." However, the panel added: "Once an initial decision has been made in Florida that public health problems are unlikely, reopening the area for further consideration would not be justified unless a significant new body of experimental evidence becomes available."

The SAC also concluded that "there is not currently sufficient evidence to allow the scientifically based choice of a measure of exposure to electric and magnetic fields that could be used as the basis for a program of exposure control."

The 266-page report, *Biological Effects of 60-Hz Power Transmission Lines*, recommends that "Concerned parties ...should urge the Food and Drug Administration to revise pacemaker testing and performance criteria so as to include circumstances representative of transmission line induced currents and appliance leakage currents."

The panel called on state agencies and the electric utilities to inform beekeepers of potential risks to their bees and of ways to eliminate these risks — grounded chicken

wire surrounding the hives is sufficient in most cases.

The SAC was formed by the FCG as an independent source of scientific expertise to the DER. The department had been charged with responsibility for assessing potential health hazards of transmission lines and, if necessary, for promulgating safety regulations, as a result of legislation passed in 1983 following siting disputes (see *MWN*, July/August 1983 and July/August 1984). Despite its apparent link to the utilities, the commission's report explains that the panel operated at "arm's length" from the utilities and that the DER is not bound by the SAC's recommendations.

The commission was chaired by Professor H.B. Graves of the Pennsylvania State University in University Park, who also chaired a study on the Navy's Project ELF, which similarly concluded that the ELF fields would be "unlikely" to pose a health or environmental problem (see *MWN*, May 1985).

Other SAC members were: Dr. T. Dan Bracken of Scientific Research and Consulting Services in Portland, OR; Dr. Jerry Griffin of the University of California in San Francisco, CA; Dr. John de Lorge of the Naval Aerospace Medical Research Lab in Pensacola, FL; Dr. M. Granger Morgan of Carnegie-Mellon University in Pittsburgh, PA; and Dr. Tom Tenforde of the Lawrence Berkeley Laboratory in Berkeley, CA.

For more information, contact the FCG's Ron Spika, 402 Reo St., Suite 214, Tampa, FL 33609, (813) 877-5301. The report is available from the National Technical Information Service (NTIS), Springfield, VA 22161, (703) 487-4650.

CONFERENCES

September 9: **Biological Effects of Electropollution: Brain Tumors and Experimental Models**, Howard University Inn, Washington, DC. Contact: Electropollution Symposium, PO Box 83, Howard University Administration Bldg., Washington, DC 20059, (202) 636-6933.

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

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

September 12-14: **1st Annual Clinical Hyperthermia Symposium and Workshop**, St. Louis, MO. Contact: Dr. B. Emami, Division of Radiation Oncology, Mallinckrodt Institute of Radiology, 4511 Forest Park Blvd., Suite 311, St. Louis, MO 63108, (314) 362-3470.

September 23-26: **4th International Conference on AC & DC Power Transmission**, London, UK. Contact: Institution of Electrical Engineers (IEE), Savoy Place, London WC2R 0BL, UK, (01) 240-1871.

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

October 3-5: **2nd Congress of the European Society of Magnetic Re-**

sonance in Medicine and Biology, Montreux, Switzerland. Contact: Dr. M.A. Hopf, 1 route de Florissant, CH-1206 Geneva, Switzerland, (41)(22) 472547.

October 7-9: **1985 International Geoscience and Remote Sensing Symposium**, University of Massachusetts, Amherst. Contact: Professor Calvin Swift, Dept. of Electrical and Computer Engineering, University of Massachusetts, Amherst, MA 01003.

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.

October 15-18: **Phased Arrays 85**, Bedford, MA. Contact: Dr. Hans Steyskal, RADC/EEA, Hanscom AFB, MA 01731, (617) 861-2052.

October 21-24: **1985 Conference on Electrical Insulation and Dielectric Phenomena**, Marriott Hotel, Amherst, NY. Contact: Steven Boggs, Ontario Hydro, 800 Kipling Ave., Toronto, Ontario M8Z 5S4, Canada, (416) 231-4111, ext. 6735.

November 5-6: **1985 Producibility of Microwave and Millimeter Integrated Circuits Conference**, Redstone Arsenal, AL. Contact: Joe Derie, U.S. Army Missile Command, Attn.: AMSMI-EE, Redstone Arsenal, AL 35898, (205) 876-8421.

November 5-7: **Review of Contractors Research on the Biological Effects of Electric and Magnetic Fields Associated with High Voltage Transmission Lines**, Radisson Mark Plaza Hotel, Alexandria, VA. Contact: Dr. William Wisecup, Aerospace Corp., Suite 4000, 955 L'Enfant Plaza, SW, Washington, DC 20024, (202) 488-6328.

EXCERPTS

NIOSH Draft Occupational RF/MW Exposure Standard

Reprinted below are excerpts from the occupational radiofrequency and microwave (RF/MW) radiation exposure standard proposed by the National Institute for Occupational Safety and Health (NIOSH) in the external review draft of its criteria document. The draft document was released at the annual meeting of the Bioelectromagnetics Society in San Francisco, CA, in June. See story on pp.2-3.

Explanations and Limitations of REL Usage

The explanations and limitations of recommended exposure limit (REL) usage are an integral part of the recommended Occupational Exposure Standard. It is essential to understand these explanations and limitations prior to determining compliance with this standard.

1. The RELs apply to both partial and whole-body exposures unless the provisions given in the section on "Exclusions from REL Usage" can be met.
2. All mean squared electric field strength (E^2), mean squared magnetic field strength (H^2) and equivalent plane-wave power density values shall be determined by free-space measurements (i.e., under exposure conditions in which *no part of the worker* is in contact with an electrically conductive surface whether or not the surface is grounded).
3. From 300 kHz to 300 MHz, measurement of both mean squared electric field strength (E^2) and mean squared magnetic field strength (H^2) is required for compliance. Measurement of equivalent plane-wave power density is not permitted for compliance at frequencies from 300 kHz to 300 MHz.
4. Above 300 MHz, measurement of either mean squared electric field strength (E^2), mean squared magnetic field strength (H^2), or equivalent plane-wave power density is sufficient for compliance.
5. RELs apply to both pulsed wave (PW) and continuous wave (CW) RF radiation exposures. For pulsed RF radiation sources, the average of the mean squared electric field strength, mean squared magnetic field strength or equivalent plane-wave power density is calculated by multiplying the peak pulse value of the mean squared field strength or power density by the duty cycle. The duty cycle is equal to the pulse duration in seconds multiplied by the pulse repetition rate in cycles per second.
6. All mean squared field strength and equivalent plane-wave power density measurements can be time averaged over any 6-minute period for comparison with RELs. This provision applies to CW exposures and to the average of the mean squared field strength and power density values for PW exposures.
7. For mixed or broadband fields consisting of several frequencies for which there are different REL values, the fraction of the REL incurred within each frequency range shall be determined, and the sum of all such fractions shall not exceed unity.
8. Measurements to determine compliance with the standard shall be made at distances of 5 cm or greater from any object.
9. This standard is not intended to apply to the purposeful exposure of patients by or under the direction of practitioners of the healing arts.
10. Exposure conditions which will cause an involuntary response (startle reaction) due to an RF shock or current flow are not permitted from 300 kHz to 300 GHz. In addition, exposure conditions which will cause an RF burn are not permitted from 300 kHz to 300 GHz. These restrictions apply even if the exposure limits of this standard are not exceeded. Shock and burn hazards can be controlled through the use of insulated gloves, shoes and other protective clothing; by insulating the RF source and conducting objects within the RF field; by using proper grounding techniques; or by eliminating the possibility of worker contact with the source or with conducting objects in the field. Extra precautions should be taken around long conductive objects such as wires, cables and cranes and around large ungrounded objects such as cars, trucks and buses when these objects are in close

NIOSH Draft RF/MW Exposure Limits

Frequency Range	Equivalent Plane-Wave Power Density (mW/cm ²)	Mean Squared Electric Field Strength (V ² /m ²)	Mean Squared Magnetic Field Strength (A ² /m ²)
0.3-3 MHz	50	188,500	1.33
3-30 MHz	450/f ²	3,770(450/f ²)	0.027(450/f ²)
30-300 MHz	0.5	1,885	0.013
300 MHz-3GHz	f/600	3,770(f/600)	0.027(f/600)
3 GHz-300 GHz	5	18,850	0.133

Note: f = frequency in MHz.

proximity to high power RF sources such as AM and FM broadcast antennas. The proper control measures for a particular exposure condition vary. Each case must be carefully analyzed to determine the optimum method of preventing RF shocks or burns.

11. These RELs and associated explanations, limitations and exclusions apply under all environmental conditions regardless of ambient air temperature, relative humidity, air velocity or the radiant energy input at frequencies higher than the frequency range of this recommended standard.

Exclusions from REL Usage

These exclusions from REL usage are an integral part of the recommended standard. It is essential to understand and correctly apply this information when claiming exclusions from REL usage

during compliance determinations.

1. For frequencies from 300 kHz to 30 MHz, the RELs may be exceeded if it can be demonstrated that the average whole-body SAR does not exceed 0.2 W/Kg, that the spatial peak SAR does not exceed 5 W/Kg as averaged over any one gram of tissue and that RF burns and startle reactions do not occur. However, exposures greater than 50 mW/cm² (188,500 V²/m², 1.33 A²/m²) will not be permitted for continuous exposures longer than 6 minutes, even if the above conditions are met.

2. For frequencies above 30 MHz, the RELs may be exceeded if it can be demonstrated that the average whole-body SAR does not exceed 0.2 W/Kg, that the spatial peak SAR does not exceed 5 W/Kg as averaged over any one gram of tissue and that RF burns and startle reactions do not occur.

VLF and RF Radiation Risks (continued from p.1)

Burns and Shocks

In a paper presented at the 7th Annual Meeting of the Bioelectromagnetics Society (BEMS) held in San Francisco, CA, June 16-20, Gandhi reported that "the currents flowing through the hand of a human in conductive contact with the handle of an ungrounded van can be as high as 879 mA and produce a local SAR in the wrist of about 1045 W/Kg." This experiment was run at 3 MHz at 100 mW/cm².

With respect to ways of protecting workers in such electrical environments, Gandhi reported that "electrical safety shoes and gloves provide adequate protection from induced currents up to about 1 MHz."

The Utah research is an extension of ongoing work on VLF radiation hazards funded by the U.S. Air Force School of Aerospace Medicine at Brooks Air Force Base in San Antonio (see *MWN*, May and September 1983). In an earlier paper, Gandhi reported that the electric fields associated with 100 mW/cm² 300 kHz-3 MHz fields — exposure levels allowed under the 1982 ANSI guidelines — could cause RF burns (see *Proceedings of the IEEE*, 70, 1462-1464, December 1982).

Gandhi's VLF results have been generally confirmed by Professor Bill Guy at the University of Washington in Seattle, whose work was also funded by the Air Force. Both Gandhi and Guy have found that VLF radiation can cause hot spots in the wrist.

According to William Hurt, the Air Force project officer for both studies, final reports on the studies should be available soon.

ANSI Standard Will Need Revision

In his talk at the BEMS meeting, Gandhi said that the 1982 ANSI guidelines are "clearly too high for the general population."

Similarly, in reviewing his VLF findings, Guy told the audience that the new results will require a change in the ANSI standard.

The new hot spot and body current data are likely to add

fuel to the ongoing debate on the safety of human exposure to radiation from radio, television and high frequency transmitters (see *MWN*, May 1985). In Honolulu, HI, for example, measurements by the Environmental Protection Agency and the Federal Communications Commission found AM radiation (550 kHz-1.6 MHz) levels as high as 3,054 mW/cm² (see story p.6). Gandhi's data could also have an impact in the 54-88 MHz band, used for television broadcasting.

The findings could also increase awareness of the health risks to those who use RF energy in industry. Of special concern are workers who use RF heaters and sealers, which operate in the 3-100 MHz frequency band.

While many of the BEMS attendees agreed with the Gandhi and Guy opinions that the ANSI standard needs immediate review in light of the new data, Subcommittee IV on "Safety Levels and/or Tolerances with Respect to Personnel" of the Accredited Standards Committee C95 will not begin considering any changes until next June.

Although the C95.1 standard will continue to be an official ANSI standard, the committee will no longer be an ANSI committee; instead it will be called the Accredited Standards Committee C95. The committee will continue to be sponsored by the IEEE and the U.S. Navy.

At a meeting on June 20 immediately following the BEMS conference, Dr. Kristian Storm of the UCLA School of Medicine, chairman of the C95.IV subcommittee, said that he was aware of the new Gandhi and Guy data and that they are being studied. According to Storm, budgetary and time constraints prevent a meeting before next year, when he plans to hold a two-day session to frame a proposed revision to the 1982 standard. That meeting is tentatively scheduled to coincide with the 1986 BEMS meeting, which will be held June 1-6 at the University of Wisconsin in Madison.

The C95.IV subcommittee meeting was held in the late afternoon after the close of the BEMS meeting, when many of the participants were making their way home. Neither Gandhi nor Guy was able to attend. ●

BIOLOGICAL EFFECTS

Immunology in the U.S.S.R....A group of researchers at the Kiev Institute for General and Communal Hygiene report that low-level exposure to 2375 MHz microwaves first stimulates and then depresses the immune system. Rats exposed to power densities of 10-50 $\mu\text{W}/\text{cm}^2$ experience a "strain on the energy metabolism processes occurring in neutrophils over the course of three weeks of irradiation." (Neutrophils are leukocytes.) A translation of "Immunological and Hematological Effects of Low Intensity SHF-Band Electromagnetic Fields" by G.I. Vinogradov and coworkers appears in *Biological Effects of Non-Ionizing Electromagnetic Radiation* (Vol.8, No.3, June 1984). See below.

Bibliographies...The Office of Naval Research has released three new volumes in its series, *Biological Effects of Non-Ionizing Electromagnetic Radiation*: Vol.8, No.3 (June 1984), Vol.8, No.4 (September 1984) and Vol.9, No.1 (December 1984). The last volume contains a complete translation of the abstracts of the papers presented at the *All-Union Symposium on the Biological Effects of Electromagnetic Fields*, held in Pushchino, U.S.S.R. in 1982. A limited number of copies of each volume are available from the Office of Naval Research, Code 441, Arlington, VA 22217 (include a mailing label)....The U.S. Air Force has released the fifth volume in its continuing collection of the RF/MW literature, *USAFSAM Review and Analysis of Radiofrequency Radiation Bioeffects Literature* (USAFSAM-TR-85-7). This edition contains a critical look at 40 papers and a cumulative index of the 200 papers reviewed in the 5 volumes issued to date. The reviews were written by Louis Heynick and Dr. Peter Polson of SRI International in Menlo Park, CA. Copies are available from the National Technical Information Service (NTIS), Springfield, VA 22161.

Honeybees and Power Lines...Honeybee colonies near power lines can suffer adverse effects, according to an EPRI study conducted by Bernard Greenberg and Vytas Bindokas, of Bioconcern and the University of Illinois at Chicago, and James R. Gauger, of the IIT Research Institute, also in Chicago. Hives were placed at varying distances from a 765-kV line so that they were exposed to electric fields ranging from 0.65 to 7 kV/m; half of the hives were shielded to provide controls. At 4.1 kV/m, the researchers found reduced hive weight and lower propolization (deposit of resinous material collected from tree buds), and at 5.5 kV/m, they noted loss of queens and impaired foraging, indications of serious damage to a colony. At 7 kV/m, fields inside the hive reached 100 kV/m, and shock currents were as high as 500 nA. At the DOE-EPRI-NY State contractors' meeting held in St. Louis on November 7, 1984, the researchers indicated that their data "suggest that colony disturbance under a 765-kV transmission line is not a direct E-field effect, but rather the result of shocks from induced-hive or bee-body currents." A forthcoming report will describe the results of a full-scale study that exposed hives and matched controls to field or

shock currents independently. The report, "The Effects of High-Voltage Transmission Lines on Honeybees" (EPRI EA-3898, Interim Report), was published in May 1985 and is available for \$11.50 (prepaid) from Research Reports Center, PO Box 50490, Palo Alto, CA 94303, (415) 965-4081. (See also their earlier report, EPRI EA-1809, with the same title, dated April 1981 and pp.6-7.)

Manipulating Genes with Electricity...High voltage electrical pulses can induce the introduction of foreign DNA into plant cells — a finding that could play an important role in the genetic engineering of plants. William Langridge, of the Boyce Thompson Institute for Plant Research in Ithaca, New York, and Bao-Jian Li, of the Cunshang University in China, applied short pulses of 40-volt DC to a mixture of bacterial plasmid (extrachromosomal DNA rings) and enzyme-treated carrot cells. About 2 percent of the carrot cells took up and expressed the bacteria DNA, a number 20,000 times greater than would occur without using the technique, called electroporation. The pulses open up the carrot cell membrane, allowing the entry of the foreign DNA. Current methods for introducing foreign DNA into plant cells are difficult and limited. Electroporation may one day allow any gene to be directly introduced into plant cells. See "Zapping DNA Into Plant Cells" in the July 13 *Science News*.

COMMUNICATIONS

An Alternative to Satellites...Soviet researchers are experimenting with powerful electromagnetic pulses to create plasma clouds of charged particles in the ionosphere to reflect TV and radio signals. This technique could possibly lead to an alternative to satellites, according to a December 20, 1984 report from TASS, picked up by the *Review of International Broadcasting* (Issue No. 100, released in June). With careful aiming, the reflected signals can be directed to specific spots on the Earth's surface. The U.S. is also involved in research of this type, though much of it is classified because of its potential application to military communications. For a review of some of the ongoing research, see the collection of papers on "Ionospheric Effects on Radio Systems" in the May-June 1985 issue of *Radio Science*, Vol.20, No.3.

Cellular Phones: Promise v. Reality...Over the last few years, the public has been promised a revolution in mobile communications with the introduction of cellular telephones — already available in 60 U.S. cities, with more to come. It turns out that the promise was greater than the reality. A series of press reports at the end of June noted that the demand for cellular phones is softer than expected and the cost of providing service is more than \$2,500 per subscriber. In addition to the marketing problems, the technology may not be working up to expectations. The system was originally hailed as an ingenious way of maximizing the efficient use of the frequency spectrum by dividing a region into hexagonal cells so that the same frequency could be re-used in non-adjointing cells, with a computer automatically transferring a call from one fre-

quency to another as a driver moved around the city. Before the introduction of cellular systems, a city had a maximum of 44 channels; New York City, a prime market, could only handle 12 mobile telephones at once. When the FCC authorized cellular service, they increased the number of channels to 666, allowing many more simultaneous calls. But the promise of adding capacity by splitting cells to accommodate demand is proving to be illusory. Indeed the present capacity is due only to the new FCC allocation, not to the new technology, and the cellular phone companies are in the process of going back to the FCC to ask for more spectrum space. As Andrew Pollack reported in the June 20 *New York Times*, "As the cells get smaller and closer together, coordination among different cells becomes more complex and interference more troublesome.... What was pictured in theory as a nice honeycomb pattern of hexagonal cells is turning out to be more of a haphazard jumble of amoeba-shaped cells. As the pattern deviates from the optimal, overall system capacity and quality of service degrade as well." One problem is the resistance of local residents to the siting of antennas in urban areas.

COMPATIBILITY & INTERFERENCE

Woodpecker Watch... Shortwave listeners in North America have organized "The Woodpecker Project" in an effort to force the Soviet Union to control interference caused by its over-the-horizon (OTH) radar system. Coordinated by the Association of North American Radio Clubs' (ANARC) OTH Committee, the Woodpecker Project plans to ask representatives at the 1987 World Administrative Radio Conference (WARC) for High-Frequency Broadcasting to object formally to the Soviet OTH interference, which produces a "pecking" sound. To support this position, organizers of the project are recruiting volunteers to help monitor shortwave frequencies from 5-23 MHz for Woodpecker interference 24 hours a day for a total of 5 days in October; each volunteer will be asked to monitor a 3 MHz band for 3 hours. The Soviet OTH radar uses a 3 to 4 millisecond square-wave pulse with a repetition rate of 10 pulses per second, according to the project, which recently noted that the radar has been operating around 10.7 MHz. For more information, contact Robert Horvitz c/o Woodpecker Project, 1634 15th St., NW, Washington, DC 20009.

Aircraft Generated EMI... NASA is about to undertake a research program to understand and control EMI aboard aircraft. The agency is soliciting bids for the collection of data on conducted and radiated interference to digital circuits — with special attention to fast rise-time transients. One of the goals of this effort is to update existing FAA rules for the safe and compatible use of modern electronic technology. NASA had been negotiating with Chris Kendall Consultants of Mariposa, CA, on a sole-source basis, but opened up the bidding when other parties expressed an interest in the project. The closing date for responses to Solicitation No. RFP2-31865(JAC) is August 8. For more information, contact NASA's Joanne Comstock, NASA

Ames Research Center, Moffett Field, CA 94035, (415) 694-5786.

EMI Survey... Frost & Sullivan, an international market research firm, is preparing a study for fall release on the U.S. market for EMI and RFI test equipment. As part of the project, the company has distributed a four-page survey questionnaire to specialists in the field. For more information, contact Raymond Cappiello, Project Director, 73 Hudson Rd., Bellerose Village, NY 11001, (516) 437-4335.

GOVERNMENT

Radiation Research Proposals... Bills have been introduced in both houses of Congress that would shift the responsibility for research on *ionizing* radiation bioeffects from the Department of Energy (DOE) to the Department of Health and Human Services (HHS). The "Radiation Research Reorganization Act" (H.R.1287), introduced by Representative Tim Wirth (D-CO) on February 26, and the "Radiation Reorganization Act" (S.525), introduced by Senator John Glenn (D-OH) on February 27, are virtually identical. Because the DOE is presently charged with the potentially conflicting roles of studying the health effects of radiation and producing and using nuclear materials, some members of Congress have raised questions about the objectivity of its bioeffects research efforts. Although the two bills apply specifically to ionizing radiation, they could open the door to a similar change for ELF (power line) radiation research, presently administered by the DOE's Electric Energy Systems Division. H.R.1287 was referred to both the House Energy and Commerce Committee's subcommittee on health and environment and the House Science and Technology Committee's subcommittee on science research and technology. Glenn's S.525 was referred to the Senate Committee on Government Affairs' subcommittee on nuclear proliferation and government processes. Glenn introduced a similar bill in 1982, S.2284, which would have set up two interagency panels to coordinate research and regulations for ionizing and non-ionizing radiation (see *MWN*, May and June 1982). That bill died in committee.

Cable Leakage Rules Reaffirmed... The FCC has reaffirmed, with minor modifications, its revised Part 76 rules for protecting aeronautical navigation and communications radio services from cable TV leakage interference. The commission argued that "reduced signal leakage is the

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UPDATES

only long-term solution to the problem of interference." In a June 21 "Memorandum Opinion and Order" (50 *Federal Register* 29394, July 19), the FCC denied seven petitions for reconsideration of its rules, which were issued last November (see *MWN*, December 1984), but approved a request to delay for 5 years the mandatory use of a signal-leakage criteria test (the "Cumulative Leakage Index") by cable operators. Other revisions include: (1) the adoption of a 100 microwatt "universal trigger level for FCC notification" for new aeronautical frequencies; and (2) the determination of this threshold level will now use *average* power across a 25 kHz bandwidth in any 160 usec period, rather than *peak* power, as originally required. This latter change was requested by the National Cable Television Association. For more information, contact the FCC's Freda Lippert Thyden at (202) 632-7792 for legal concerns and the FCC's Bernard Gorden at (202) 632-9660 for technical matters.

FCC Enforcement Actions...FCC officials interrupted the start of a corporate liquidation auction because computers that did not meet the commission's RF emissions rules were among the items up for grabs, according to *The Washington Post* (July 25). Seequa Computer Corp., based in Odenton, MD, sold inadequately shielded computers as long ago as last October, a commission spokesman told the newspaper. After some discussion between company and federal representatives, the auction began and the computers were sold — although the purchasers will have to wait at least 4-6 weeks for the FCC to complete lab tests on the units....The FCC has fined three cordless phone manufacturers \$2,000 each for selling cordless phones that exceed the commission's standards for radiated power emissions. Under a new sampling procedure that uses commercially available phones rather than prototypes (see *MWN*, November 1984), FCC staffers measured field strengths up to five times as high as the commission's maximum permissible limit of 10,000 uV/m at 3 meters. Matsushita Technology, Pacific Electronics Programs and Webcor Electronics were fined after failing to correct the violations despite warnings from the commission. The FCC fined three distributors of cordless phones for similar violations last January (see *MWN*, January/February 1985)....In another action, the commission has decided to require cordless phone manufacturers to label their products with warnings about the potential problems of RFI and inadequate security — including the use of one's phone by an outside party and inadvertent interaction with other nearby cordless phones. Beginning on November 1, manufacturers will have to describe their phones' security features to purchasers (50 *Federal Register* 24512, June 11). The FCC noted that the Association of Public-Safety Communications Officers (APCO) has been plagued with "drop off" calls to 911 emergency systems — no one is on the line when the call is answered. APCO has traced many of these calls to cordless phones. The FCC has taken no action on this interference problem but promises to reconsider the problem if it persists.

CDRH Reporting Review...The FDA's Center for Devices and Radiological Health (CDRH) has issued a public review draft of its "Report of the CDRH Task Force for Retrospective Review of the Recordkeeping and Reporting Requirements of 21 CFR 1002" (50 *Federal Register* 27024). The task force, set up in 1982 in response to a congressional directive requiring regulatory flexibility (see *MWN*, December 1982), recommends that manufacturers of radiation-emitting products be permitted to file less documentation than now required to prove that they are complying with CDRH regulations. In addition, the task force suggests, the types of reports required should be modified and streamlined. Comments on the recommendations are due by August 30. For more information, contact Melvyn Altman, CDRH (HFX-83), FDA, 5600 Fishers Lane, Rockville, MD 20857, (301) 443-3426.

LITIGATION

Yannon Hearing...Mrs. Antoinette Yannon's \$3.5 million product liability suit against RCA for the wrongful death of her husband, Samuel Yannon, due to long-term exposure to microwave radiation, is going back to court. A hearing will be held on September 10 in the state Supreme Court in Staten Island, NY. In July 1982, a Supreme Court judge dismissed the case, but the decision was reversed on appeal (see *MWN*, June 1984). Guy Lawrence of the New York City law firm of Bower & Gardner, which is representing RCA, refused to comment on any aspect of the case. A spokesman for RCA confirmed the September 10 hearing date. Yannon worked on microwave relay equipment at the Empire State Building for 15 years. He retired from New York Telephone in 1971 and died in 1974.

Loesch Dies...Andrew Loesch, a former FAA radar technician who filed a \$1.5 million suit against the FAA, claiming he developed a brain tumor from exposure to microwave radiation, died on July 23 (see *MWN*, May 1985). His attorney, Michael Allison of DeLayo and Olson in Albuquerque, NM, told *Microwave News* that the FAA denied the Loesch claim on July 19 and that a workers' compensation claim will be filed on behalf of Loesch's widow, Katherine. Allison said that he is still evaluating whether to file a suit against the manufacturers of the radiation-emitting equipment.

MEASUREMENT

NBS Report...Three members of NBS's Electromagnetic Fields Division have prepared a report, *Possible Estimation Methodologies for Electromagnetic Field Distributions in Complex Environments (Technical Note 1081)*, which outlines three ways of approximating field strengths when there are multiple sources operating at different frequencies. M. Kanda, J. Randa and N.S. Nahman outline the approaches: a statistical treatment, a numerical computation and the use of a directional probe. While the methods are still under development, the researchers expect them to help in the prediction of maximum field strengths inside buildings housing sensitive electronic and ordinance equipment and thereby prevent interference problems. The

report is available for \$2.00 from the Government Printing Office, Washington, DC 20402. Order No. 003-003-02638-7.

MEDICAL APPLICATIONS

Diathermy and Low Back Pain...A placebo treatment for low back pain proved to be as effective as short-wave diathermy (SWD) or osteopathy in a study by researchers at Guy's Hospital in London. T. Gibson and coworkers at the Department of Rheumatology randomly divided 109 patients who had suffered low back pain for 2-12 months into 3 groups: one was treated with SWD, a popular therapy for low back pain, another was treated by an osteopath (chiropractor) and the third was treated with an unplugged SWD unit that appeared to be functioning. 8 weeks after 4 weeks of treatment (3 times weekly with the active or inactive SWD, once weekly by the osteopath), 59 percent of those treated with SWD reported improvement, as did 62 percent of those treated with osteopathy and 67 percent of those treated with the detuned SWD; 12 percent of the patients who received SWD noted a worsening in their condition, as did 11 percent of those treated with osteopathy and 9 percent in the placebo group. Although the authors report that their study "does not indicate that SWD and osteopathy are equivalent to no treatment," they do conclude that "our results almost certainly attest to the magnitude of the placebo response which may be achieved when harmless treatments are applied with conviction." The study, "Controlled Comparison of Short-Wave Diathermy Treatment with Osteopathic Treatment in Non-Specific Low Back Pain," appeared in the June 1 issue of *Lancet*.

MEETINGS

Power Line Contractors...The date for the DOE-EPRI-NY State contractors' meeting, *Review of Contractors Research on the Biological Effects of Electric and Magnetic Fields Associated with High Voltage Transmission Lines*, has been officially set for November 5-7 at the Radisson Mark Plaza Hotel in Alexandria, VA, (703) 845-1010 or (800) 228-9822. There will also be two workshops, one on dosimetry on November 4 and one on mechanisms on November 8, but these sessions will be restricted. When making hotel reservations, mention "DOE Contractors Review" to get a reduced rate. For more information, contact Dr. William Wisecup, Aerospace Corp., Suite 4000, 955 L'Enfant Plaza, SW, Washington, DC 20024, (202) 488-6328.

1986 Gordon Conference...A Gordon Conference is being planned for the week of June 8-13, 1986 in New Hampshire to discuss the biophysical and biochemical effects of electromagnetic fields that can influence growth and excitation processes. The registration fee will be approximately \$250, including room and board. The conference follows the annual meeting of the Bioelectromagnetics Society, which will be held in Madison, WI, next year. For more information, contact Professor Howard Wachtel, University of Colorado, Boulder, CO 80309, (303) 492-7327, or Professor Betty Sisken, University of Kentucky,

Lexington, KY 40506, (606) 258-5796.

EMI for Non-EMIs...R&B Enterprises is introducing a new short course, *EMI for Non-EMI Personnel*, to provide an overview of the "basic hows and whys of EMI/EMC" for those "who want to feel more secure and confident when discussing EMI/EMC." The one-day course will be offered in Philadelphia, PA on October 10. The fee is \$345. Additional details from: Greg Gore, R&B Enterprises, 20 Clipper Road, West Conshohocken, PA 19428, (215) 825-1960.

MILITARY SYSTEMS

Effect of Standards...In April 1985, NATO's Advisory Group for Aerospace Research and Development (AGARD) hosted a series of two-day lectures in Lisbon, Paris and Rome on *The Impact of Proposed RF Radiation Standards on Military Operations* (AGARD Lecture Series No. 138). The invited speakers were John Mitchell, Col. Roger Graham and Dr. Jerome Krupp of the U.S. Air Force, Dr. Carl Durney of the University of Utah, Dr. Bill Guy of the University of Washington, Dr. Norbert Roberts of the University of Rochester and Dr. J. Bernhardt of the Institute for Radiation Hygiene in West Germany. Dr. Tom Rozzell of the Office of Naval Research attended the Lisbon lectures and summarized them for the June/July issue of the *Bioelectromagnetics Society Newsletter*. The following is based on Rozzell's report: Krupp reviewed the results of the long-term, low-level exposure study conducted by Guy for the Air Force: "The overall conclusion was that no cumulative ill effects could be attributed to the life-long exposure at absorption rates of 0.4 W/Kg or less." Krupp is the project officer for the study (see *MWN*, July/August 1984, March and June 1985). Krupp told the audience, "Rational review of the existing data provides no reason to predict adverse consequences from lifespan exposure to currently allowable levels of RF radiation." Graham discussed incidents of accidental overexposures to RF energy. He said, "In every case where the exposed person was an Air Force employee...they are kept under medical surveillance throughout their lives in order to detect any harmful effects that might develop." But, Graham added, medical examinations of those overexposed "have shown few, if any, consistent clinical patterns." Neurological and psychological exams have also failed to indicate any trends — except for anxiety in cases where the individuals have been concerned over their exposure. The full texts of the lectures are available from the National Technical Information Service (NTIS), Springfield, VA 22161.

National Communications Systems Expansion...The Defense Communications Agency (DCA) and the Air Force (AF) have announced plans to construct a Northeast Regional Communications Facility (NRCF) in western Massachusetts, but citizens and elected officials are resisting the proposal. The project was first described in a notice of intent to prepare a draft environmental impact statement (EIS) published in the *Federal Register* on March 28 (50

UPDATES

FR 12360). But most citizens in Hawley, MA, where as many as 40 transmitter towers and one microwave receiver would be sited, first learned of the project on May 15, when AF officials held a public meeting there; a second meeting was held the next day in nearby Granby, MA, near the Westover Air Force Base where the operations and receiver facilities are planned. Angered when the AF informed them that the formal comment period ended on June 1, citizens contacted their Congressman, Silvio Conte, who persuaded AF officials to extend the deadline to July 1. Conte, who, as the ranking Republican on the House of Representatives' Committee on Appropriations, wields considerable influence over the funding of the \$22.7 million project, subsequently vowed to block the project after he learned that no money has yet been appropriated for it. And officials of Franklin County, which contains Hawley, have hired the Boston law firm of McGregor, Shea & Doliner to represent them in their fight to block the system. An AF spokesman confirmed that the Pentagon will proceed with development of the project, including preparation of an EIS, but added that the scope of the EIS will be expanded to consider alternatives to the Hawley site. He admitted that this change was made "because of what Conte said." A two-page background paper and a four-page proposal summary, prepared by the AF before Conte became involved, explain that the Hawley-Westover AFB sites are clearly the best alternatives and that failure to construct the NRCF would "significantly increase the risk of potential damage and/or embarrassment to the U.S. government because of delays in communications which implement/effect actions and strategies as means of implementing U.S. government policies." According to the documents, the NRCF would operate between 3 and 30 MHz with an average power output of 10 kW and a maximum average of 20 kW. The 20-watt microwave link between the Hawley site and Westover AFB will operate in the 1800 MHz band. The draft EIS is due to be completed by the late summer or early fall and the final EIS is planned for early 1986; the AF's spokesman conceded that the expanded scope could delay completion. The AF hopes to begin construction on the project in 1986 and to start operating the facility in mid-1987. For more information, contact: Major Ken Small, USAF/LEEV, Bolling AFB, Washington, DC 20332, (202) 767-4156.

OVENS

Appliance Standards...The U.S. Court of Appeals for the District of Columbia has ruled that the DOE must reconsider its 1982 decision not to set efficiency standards for major appliances, including microwave ovens. The July 16 ruling is a legal victory for a coalition of consumer groups and state governments that has sought a federal efficiency standard since the DOE concluded that such standards could not be economically justified given the potential energy savings (see *MWN*, January/February 1983). Industry officials are concerned that the addition of federal standards to the existing patchwork of state rules will cause

havoc. Jack Langmead, vice-president of the Gas Appliance Manufacturers Association, told *The Washington Post* (July 17), "What we need is a single national standard to straighten out this massive confusion."

POWER LINES

Planning a Power Line...A new Oregon-to-California 330-mile transmission line is not scheduled to begin construction for another two years or to be turned on until 1990, but planning for the \$400 million project is well under way. 34 public meetings were held in May to identify public concerns in an effort to select a suitable corridor for the power line. The California-Oregon Transmission Project (COTP) is being managed by the Transmission Agency of Northern California, with the participation of the federal government, state agencies, and municipal and investor-owned utilities in California. The COTP plans to build a 500 kV AC transmission line and new substations and to upgrade an existing 230 kV line to 500 kV so that California and the Pacific Northwest can sell and exchange power. (The Transmission Agency, composed of 15 publicly-owned electric utilities, was set up by the state of California in 1984 to develop a power line "in an environmentally and economically sound manner.") Six public workshops were held in July to discuss the siting of the line. After further public review in November, an environmental impact statement will be prepared, due for completion by May 1986. Laura Edlin, public affairs director for the project, told *Microwave News* that public involvement is "critical" to the planning of the line. The project is publishing a newsletter to keep interested parties informed. Contact the COTP, PO Box 660970, Sacramento, California 95866....Meanwhile, a feud is brewing as Bonneville Power increases the price Californians must pay for electricity imported over the Pacific Intertie, an existing power line connecting Oregon and California. Much of the new cost stems from the ill-fated nuclear reactors of the Washington Public Power Supply System. For details, see the July 8 *Wall Street Journal*.

STANDARDS

In Finland...The Finnish government's occupational health bureau has issued a proposal to limit exposures to stray RF fields from plastic sealers. Over an eight-hour period, maximum worker exposures would be 60 V/m for electric fields and 0.2 A/m for magnetic fields. For shorter time periods, exposures could exceed these levels up to a one-minute maximum of 300 V/m and 0.8 A/m for electric and magnetic fields, respectively. The proposal, which is available in Swedish and Finnish and which is scheduled to be adopted at the beginning of 1986, is available from the Standards Information Center, NBS, Technology Bldg., Room B166, Washington, DC 20234, (301) 921-2092. Ask for TBT No. 85.73.

C63 Ballots...Subcommittee 1 on Techniques and Developments of the Accredited Standards Committee C63 on EMC has three draft proposals up for a vote: (1) An addition to C63.4 on EMC measurements to include the

"Methods of Measurement of Radio Noise Emissions from Medical Devices" and a proposed addition to either C63.4 or a planned immunity document on "Methods of Measurement of Electromagnetic Immunity of Medical Devices." These proposals are in their third drafts and are dated April 1985 (see *MWN*, June 1984). Ballots are due by July 31. (2) The extension of C63.2 on EMC instrumentation to 40 GHz. At present the C63.2 standard only covers frequencies up to 1 GHz. Ballots on the proposal, dated May 22, are due by August 9. (3) The June 24 revision of C63.12-1984, *Recommended Practice on Procedures for Control of System Electromagnetic Compatibility*. Votes are due by August 30. For more information, contact Fred Huber, Jr., IEEE Standards Office, 345 East 47th St., New York, NY 10017, (212) 705-7960. C63's Subcommittee 1 has scheduled a meeting for August 19, immediately preceding the *IEEE 1985 International Symposium on EMC*, to be held in Wakefield, MA, August 20-22.

Change at ACGIH...Herbert Jones has retired as chairman of the American Conference of Governmental Industrial Hygienists' (ACGIH) Physical Agents Threshold Limit Values (TLV) Committee and has been replaced by David Sliney of the U.S. Army Environmental Hygiene Agency at the Aberdeen Proving Ground in Maryland. Sliney is already a member of the TLV committee and Jones is expected to continue to work with the ACGIH group, which sets standards for exposures to non-ionizing radiation as well as to noise and to heat stress.

Other Developments...The National Electrical Manufacturers Association (NEMA) is seeking comments on its proposed procedure for *Evaluating Ground Fault Circuit Interrupters for Response to Conducted RF Energy*, (February 25, 1985). For more information, contact: Manager, Engineering Dept., NEMA, 2101 L St., NW, Washington, DC 20037....A new standard, *Electrical and Mechanical Characteristics for Terrestrial Microwave Relay System Antennas and Passive Reflectors* (ANSI/EIA) 195-C-1985, has been approved by ANSI's Board of Standards Review and should be available soon....The SAE's Committee AE-4 will meet on August 19 in Wakefield, MA, before the IEEE EMC meeting; see above.

ULTRASOUND

More on SCEs...In our April issue, we reported that a group from the University of Rochester had published a paper in *Science* (March 15) announcing that it had failed to replicate earlier findings that diagnostic ultrasound can increase the frequency of sister chromatid exchanges (SCEs), indicating a potential mutagenic and carcinogenic hazard. That paper has now generated two critical comments. Dr. Robert Bases of the Albert Einstein School of Medicine in the Bronx, NY, notes that the initial findings of an increased frequency of SCEs "has been confirmed and extended in publications from five laboratories in the United States and elsewhere." He posits that the mechanism of interaction may be the release of free radicals by pulsed ultrasound. The letter from Bases, who was one of

the coauthors of the original SCE paper, appeared in the May 10 issue of *Science*, as did a reply by Drs. Morton Miller and Victor Ciaravino of the University of Rochester. Dr. Alice Martin of the Northwestern University Medical School in Chicago, IL, also wrote to *Science* (July 19), charging that, in their reply to Bases, Miller and Ciaravino had "erroneously present[ed] our work as supporting the hypothesis that ultrasound has no effect on SCEs." Martin reiterated her opinion that "the question of possible bioeffects of ultrasound is still unresolved." (See A.O. Martin, *Journal of Clinical Ultrasound*, 12, 11, 1984.)

VDTs

Workers' Compensation Settlement...A San Francisco, CA, legal writer has received a \$15,000 settlement from her former employer's insurance company after filing a workers' compensation claim alleging that VDT use caused her debilitating eyestrain. Five ophthalmologists examined writer Jeanne Robinson and, though none clearly supported her claim, defense attorney Kevin Haney told *Microwave News* that his clients agreed to an out-of-court settlement to "get the thing disposed of." Judge Jane O'Neill of the California Workers' Compensation Appeals Board approved the settlement on March 5, specifically citing materials submitted by ophthalmologist Dr. William F. Hoyt, but Hoyt recently claimed in an interview that Robinson's claim is "fraudulent and has no merit whatsoever."

ETC...

Assorted Notes...*The Journal of Microwave Power* has a new look. Volume 20, Number 1, the first issue of 1985 and the first under the editorship of Dr. W.A. Geoffrey Voss, has an eight-and-a-half by eleven-inch format and features nine research papers and a section on patents and book reviews. Among the papers is a re-analysis by Dr. Allan Frey of Dr. Budd Appleton's data on cataract risks due to exposure to microwave radiation — first reported in the November 1984 issue of *Microwave News*. The *Journal* is available free with membership in the International Microwave Power Institute (IMPI). Dues are \$75.00 a year. Contact: IMPI, Tower Suite 520, 301 Maple Ave. West, Vienna, VA 22180, (703) 281-1515....Lightning strikes may not be random. According to an article in *The Washington Post* (June 27), Drs. Raul Lopez and Ronald Holle at NOAA's Environmental Research Labs in Boulder, CO, have found that local topography plays a major role in determining where a lightning bolt will strike. One study area was found to be hit by lightning more than 25 times each summer (see also the July 13 *Science News*)....Radio Marti, U.S. broadcasts to Cuba, went on the air on May 20, and all those fears of Cuban retaliation by jamming American radio stations have not materialized. But Radio Marti has brought about one major policy change: according to a dispatch by Reuters on June 18, Cuban radio has lifted its ban on Frank Sinatra, which has been in effect since the early 1960's. "Come Fly With Me" is once again on the Cuban airwaves.

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