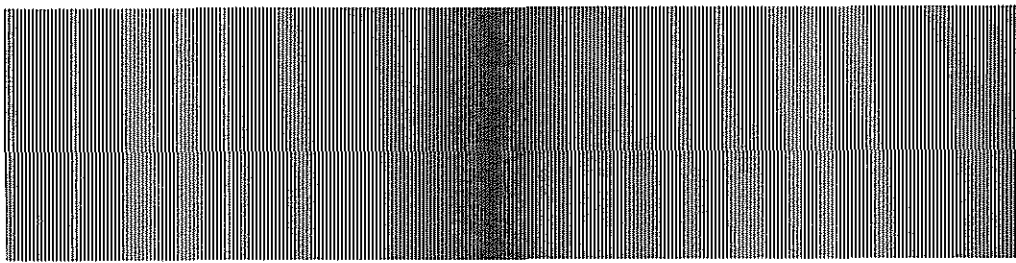


# MICRO WAVE NEWS



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A Report on Non-Ionizing Radiation

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## EPA RF/MW Guidelines: Compliance Costs Estimated

The cost to the U.S. broadcast industry of complying with a 100 uW/cm<sup>2</sup> radiofrequency and microwave (RF/MW) radiation exposure standard for the general public would be between \$19.1 and \$45.6 million, according to an economic analysis by the Lawrence Livermore National Laboratory. FM stations would bear the greatest burden of compliance with a 100 uW/cm<sup>2</sup> standard — 57-64 percent of the total industry costs.

Compliance with the American National Standards Institute (ANSI) standard would cost radio and television broadcasters \$8.4-16.2 million, of which FM stations would pay \$4.0-8.2 million.

In a report to the Environmental Protection Agency (EPA), Livermore's Charles Hall estimated the economic impact of 18 alternative exposure limits for radio and television stations: from 1 uW/cm<sup>2</sup> to 10 mW/cm<sup>2</sup> for FM and TV and from 10 V/m to 1,000 V/m for AM. Hall found that the average reduction in profit as a result of a 100 uW/cm<sup>2</sup> standard would be 1.8-5.4 percent for FM stations and 0.8-1.3 percent for TV stations, and 0.4-0.8 percent for AM stations meeting an 86.6 V/m standard.

The Livermore study also estimated the social cost of the EPA radiation guidelines — defined as the opportunity cost of allocating resources to RF/MW radiation control instead of to other projects. For 100 uW/cm<sup>2</sup> and 86.6 V/m, the social costs would be \$38.7-93.4 million; for 200 uW/cm<sup>2</sup> and 264.6 V/m, \$26.5-60.3; and for 1 mW/cm<sup>2</sup> and 446.7 V/m, \$15.9-31.2 million. (Calculations were run for "low" and "high" cost assumptions yielding the ranges cited above; the estimates are for the present value of the net after-tax costs.)

*(continued on p.8)*

## EPA To Disband Radiation Research Group

The Director of the Environmental Protection Agency's (EPA) Health Effects Research Laboratory is moving to disband the non-ionizing radiation research group and abolish the Experimental Biology Division (EBD) in which it works. Laboratory Director Dr. Gordon Heuter has asked the division to develop a phase-out and reorganization plan to submit to the EPA headquarters in Washington. Final approval could come before the end of the year.

According to EBD Director Dr. Richard Phillips, ongoing research which can be completed in the next few months will be allowed to continue, as will extramural projects that already have been fully funded.

*(continued on p.11)*

# HIGHLIGHTS

## Connecticut Dispute Prompts 10 uW/cm<sup>2</sup> Recommendation

A dispute over a proposed UHF-TV transmitting tower on Avon Mountain, CT, has led the town of Avon's leading health official to recommend that the community adopt a public, residential exposure safety standard of 10 uW/cm<sup>2</sup> for radiation from a single source or from multiple sources on a single tower. The standard would apply to levels measured at homes nearest the tower.

The 10 uW/cm<sup>2</sup> recommendation is equivalent to the 1984 exposure standard set by the Soviet Union (see *MWN*, June 1985) and is a hundred times stricter than the Connecticut state standard.

Avon's Director of Health, Hudson Birden, Jr., explained in a memorandum to the town's Planning and Zoning Commission that his recommendation "anticipates eventual standards at the state or federal level by being more conservative by a whole order of magnitude than any standard currently established or proposed in this country" and that the 10 uW/cm<sup>2</sup> standard can be "easily achieved" by the station planning to build the tower. The memorandum notes that knowledge of adverse health effects of non-ionizing radiation is "not definitive" but adds that the proposed tower presents "no cause for concern."

Astroline Communications, which owns WHCT-TV, Channel 18, wants to construct a 750-foot tower for a 3.26 megawatt broadcast antenna operating at 495.25 MHz. The tower would be sited near a small antenna farm on Avon Mountain in a sparsely populated area. The station is now broadcasting from a 279-foot tower in the antenna farm; it would be torn down if the new tower is approved.

Local residents opposing the tower argued at two planning commission hearings in October that the transmissions pose a potential health hazard and could reduce property values. In addition, the residents contend that the tower would be an eyesore and would detract from the beauty of a hiking trail that runs through the area.

### Both Sides Might Sue

The planning commission is expected to issue a decision on Astroline's application in mid-November. Marshall Berger, Jr., the residents' attorney, said in a telephone interview that his clients will sue to block construction of the tower if the planning commission approves the application. Berger is a partner in the Simsbury, CT, firm of Pease, Main & Berger. Mark Oland, Astroline's attorney, said that the company would consider going to court if the planning board rules against it.

At the board's October 1 meeting, Professor Abe Liboff of Oakland University in Rochester, MI, warned the commission to move "very cautiously" in light of uncertainty about low-level effects of non-ionizing radiation. Liboff previously had presented data to the board on behalf of the local residents which projected a 26.8 uW/cm<sup>2</sup> field from the new tower in the house nearest the proposed tower site, approximately 1,200 feet away. The field level at the house

from all sources, including those at the antenna farm, was estimated to be 41.3 uW/cm<sup>2</sup>.

By contrast, Micro Communications, Inc. of Manchester, NH, a consultant to the broadcaster, projected a field at the house of just 0.3 uW/cm<sup>2</sup> from the proposed tower, excluding an FM transmitter that would broadcast from the tower. The consultant also estimated ambient fields near the house to be 11.72 uW/cm<sup>2</sup>.

Another consultant to Astroline estimated a combined field level at the road, 750 feet from the tower site, of 81.9 uW/cm<sup>2</sup>, with 44 uW/cm<sup>2</sup> from the proposed transmitter alone.

Astroline was also represented by Dr. Herbert Pollack, a private consultant, who has done extensive work for the State Department, especially on the irradiation of the U.S. embassy in Moscow.

### Connecticut Standard

In 1984, Connecticut passed a law directing the state's Department of Environmental Protection to implement public safety rules based on the 1982 American National Standards Institute (ANSI) standard (see *MWN*, June 1984). The ANSI limit at the Channel 18 broadcast frequency is approximately 1.65 mW/cm<sup>2</sup>.

The law could make the Avon 10 uW/cm<sup>2</sup> recommendation moot if the state intends for the law to preempt local regulations, but Astroline attorney Oland, who works for the Hartford-based firm of Schatz & Schatz, Ribicoff & Kotkin, noted in a telephone interview that the Connecticut law is unclear on preemption. It is "no comfort for either side," he said.

Kevin McCarthy, director of the state's Radiation Control Unit, told *Microwave News* that his staff is in the process of drafting the legislatively mandated radiation rules. He said that the preemption issue is unresolved and, if necessary, will be addressed by state attorneys.

Other broadcasters transmitting from the antenna farm, which is across the street from the proposed Astroline site, have said they will increase power output if the WHCT

### Vernon & Cougar Mountain

In November, EPA officials will drive a van loaded with detection equipment to Vernon, NJ, from Las Vegas, NV, to measure RF/MW radiation levels in the town. The EPA is responding to citizen concerns over an increased incidence of Down's Syndrome among children in Vernon (see *MWN*, May 1985).

A report on the cluster of Down's cases is expected soon from the Centers for Disease Control in Atlanta, GA.

Meanwhile, an EPA report on measurements taken on Cougar Mountain, WA, by EPA's Richard Tell and FCC's Dr. Robert Cleveland has not yet been released (see *MWN*, May 1985).

tower is approved and radiofrequency interference results. Residents expressed concern that this would further increase field levels in the area. Plans to expand existing facilities could run into zoning obstacles, however, since all of the towers currently violate the town's zoning laws and operate under special exemptions. These exemptions would be nullified by expansion, according to Oland.

## **FCC Delays RF Rules; Rejects State and Local Preemption**

The Federal Communications Commission (FCC) has delayed implementation of its radiofrequency (RF) safety rules until January 1, 1986. The rules, which will require broadcasters seeking FCC permits to comply with public exposure standards set by the American National Standards Institute (ANSI), were scheduled to take effect October 1.

The delay came in response to petitions filed by the National Association of Broadcasters (NAB) and the TV Broadcasters All Industry Committee (TVBAIC), who asked the FCC to push back implementation of the rules as far as June 1, 1986 and to preempt state and local RF standards, most of which are stricter than ANSI's (see *MWN*, May 1985).

The Corporation for Public Broadcasting, GTE, KONG-TV and the Electromagnetic Energy Policy Alliance generally supported the NAB and TVBAIC positions.

In a notice published in the September 24 *Federal Register* (50 FR 38653), the commission granted a delay in the effective date of the rules but rejected a request to override state and local RF safety standards. As it stated when the RF rules were issued earlier this year, the FCC said that preemption is "beyond the scope" of the proceeding (see *MWN*, April 1985). The commission added that it was unsure of the legal basis for FCC preemption.

The FCC did say however that it intended "to consider on an ad hoc basis non-federal RF radiation standards adversely affecting a licensee's ability to engage in FCC-authorized activities."

Under the rules, the FCC will require applicants for construction permits, licenses and renewals to assess radiation levels. If the levels could cause public exposures in excess of the ANSI standard, applicants would be required to prepare an environmental impact statement (EIS) under the National Environmental Policy Act of 1969 (NEPA).

In its September 24 notice, the FCC also:

- rejected the NAB's recommendation that an individual transmitter at a multiple-transmitter site be treated as a single source without regard to signal levels from the other transmitters. The FCC explained that the overall RF radiation environment is the critical factor, not whether a single source is operating within the exposure limits.
- denied requests made by the NAB and others that more extensive public involvement be permitted in the development of the technical bulletin the FCC is preparing to help

### **Technical Bulletin**

The FCC's advisory bulletin on how applicants for broadcast facilities and satellite station permits can determine whether they comply with the ANSI standard is scheduled to be published in early November.

*Evaluating Compliance with FCC-Specified Guidelines for Human Exposure to RF Radiation*, Office of Science and Technology (OST) Bulletin No.65, will be available from: International Transcription Services, 2100 M St., NW, Washington, DC 20037. The cost has not yet been set.

The NAB is planning to reprint the bulletin independently and distribute it to its more than 5,000 radio and television station members.

broadcasters evaluate compliance (see box). The commission said that all interested parties had already been invited to participate and it saw no reason to make the proceeding more formal.

## **California FM Station Ordered To Cut Power**

The Federal Communications Commission (FCC) recently ordered a California FM radio station to severely reduce its power after state officials discovered that forest rangers using a nearby fire-lookout tower were exposed to radiofrequency (RF) levels two to three times higher than the American National Standards Institute (ANSI) limit.

The tower, which is used only from May to October when the risk of forest fires is greatest, sits just 66 feet from the station's transmitter and is at virtually the same height. Neil Smith, consulting engineer to station KERG-FM, said that the office atop the metal tower is in the station's main broadcast signal.

FCC and California officials are handling this highly unusual situation cautiously. The effective date of the FCC's RF public exposure rules is January 1, 1986, and the officials are concerned that the KERG problem could set a precedent with far-reaching consequences. Pat Healey, who owns the station along with her husband, Daniel, said that several other broadcasters have contacted KERG, and FCC officials told *Microwave News* that the National Association of Broadcasters (NAB) has expressed interest in the situation, although a NAB spokeswoman denied any involvement.

State officials refused to comment, but Smith explained that the state first expressed concern about the possibility of a hazard when the station began upgrading its transmitter from a Class A to a Class C license, increasing its power output from 40 watts to more than 50 kW. The FCC had approved the Class C license at 56 kW in May, but the station could produce just 51 kW and so received "special temporary authorization" from the FCC to operate at that level.

## HIGHLIGHTS

When a California Department of Telecommunications staffer measured power levels of approximately 2.5 mW/cm<sup>2</sup> in the rangers' office, or "cab," the FCC ordered KERG, which operates at 104.7 MHz, to reduce its output from 51 kW to 2 kW. ANSI's limit for the FM broadcast range is 1 mW/cm<sup>2</sup>. After KERG constructed a copper shield around part of the cab, the commission allowed the station to increase to 19 kW. But when new state measurements again found hot spots in excess of the ANSI limit, the FCC ordered KERG back down to 2 kW. At the conclusion of the fire season in early October, when the fire tower was no longer occupied, the station resumed broadcasting at 51 kW.

The FCC has instructed the station and the state to find a solution to the problem before May 1986, when the fire season begins again. Smith, representing KERG, said that he is confident that the conflict will be easily resolved.

### **Leukemia Risk Among Coal Miners Linked to EM Fields**

Researchers studying male, underground coal miners have found an apparent association between leukemia and prolonged exposure to electromagnetic fields (EMFs) from overhead transmission lines and transformers.

Dr. Priscilla Gilman of the School of Medicine at West Virginia University in Morgantown and Dr. Richard Ames and Michael McCawley of the National Institute for Occupational Safety and Health (NIOSH) office in Morgantown found that men who worked 25 or more years in coal mines had a statistically significant, two-and-a-half-fold increased risk of developing all types of leukemia, compared to men who worked underground for less than 25 years. (The investigators estimated EMF exposure on the basis of years worked in coal mines.)

In a case-control study comparing 40 coal workers who died from leukemia with 160 controls who died from causes other than cancer or accidents, the team calculated the odds ratio for all chronic leukemia to be 8.22 and the odds ratio for chronic lymphocytic leukemia (CLL) to be 6.33. For myelogenous leukemia the odds ratio was 4.74. All of these increased risk indices were statistically significant.

The researchers point out that the overall increased risk of leukemia was not related to cigarette smoking or to coal miners' pneumoconiosis and that while acute myelogenous leukemia (AML) previously has been linked to toxic chemical exposures, their study did not find a statistically significant relationship between AML and EMFs.

Strikingly, Gilman and coworkers note that CLL "has been reported not to be related to chemical, radiation or other environmental agents by most authors." They conclude that EMFs are a "prime suspect in the elevated risk for CLL."

Gilman and Ames recently left West Virginia: Gilman is now chief of pediatrics at Fort Gordon, GA, and Ames has returned to the California Department of Health Services in

Berkeley, CA. NIOSH's McCawley told *Microwave News* that he is not planning to do a follow-up study.

The study, "Leukemia Risk Among U.S. White Male Coal Miners," appeared in the September issue of the *Journal of Occupational Medicine*.

### **FCC Releases ISM Rules; RF Lighting Provisions Contested**

The Federal Communications Commission (FCC) has issued final rules simplifying its procedures for handling industrial, scientific and medical (ISM) equipment under Part 18 of the commission's regulations. The new rules, which took effect on September 27, streamline equipment authorization procedures, specify new measurement methods, reclassify ISM frequencies and set technical standards for radiofrequency (RF) lighting devices, pending the outcome of the commission's separate proceeding on RF lighting.

The RF lighting provisions already have been challenged. The National Association of Broadcasters (NAB) has filed a petition for partial reconsideration of the rules, repeating its earlier recommendation that the FCC include a limit for radiated emissions below 30 MHz. The NAB contends that emissions from RF lighting devices pose a serious RF interference (RFI) problem for AM radio broadcasters.

#### **Rules Consistent with Proposal**

The final rules are essentially the same as the FCC's November 1984 proposal (see *MWN*, December 1984). One major change is that, under the final rules, manufacturers of non-consumer equipment must "verify" compliance with the RFI standards by submitting test results — in last year's proposal, the commission only asked manufacturers to notify it of compliance. The change was made in response to widespread industry support for verification, according to the commission.

Verification procedures require manufacturers to show compliance with ISM standards where the equipment is installed or at a "suitable" measurement site if the tested equipment is "representative" of equipment produced later.

Consumer equipment, including microwave ovens, and RF lighting devices used for general purpose and consumer applications must be "certified" — other RF lighting devices will be subject only to verification. (For certification, measurement data must be submitted to the FCC; test data need not be submitted for verification.) The commission will permit operation of consumer equipment prior to approval to avoid marketing delays.

The FCC eliminated its three-year recertification requirement that had applied to some ISM equipment. Medical diagnostic ultrasound equipment is exempt from the rules.

In response to a comment from IBM concerning the applicability of Part 18 rules to its computer plasma dis-

plays, which use RF energy to excite gases in the display tube, the FCC explained that this type of display is governed by Part 15 rules for computing devices since its primary use of RF energy is not for ISM purposes. In another area, the FCC rejected a request submitted by the Aerospace and Flight Test Radio Coordinating Council that ISM equipment at aerospace manufacturing plants be exempted from testing procedures and emission limits.

### Measurement Methods

The final ISM rules consolidate emission measurement methods into Bulletin MP-5, *Methods of Measurements for Industrial, Scientific and Medical Equipment*, which supersedes FCC Bulletins OCE 39 (on medical diathermy equipment), OCE 20 (on microwave ovens) and Test Procedure No.2 (on ultrasonic equipment). The FCC emphasizes in its final rules that MP-5 "is not a mandatory test procedure, but is basically a guideline and a summary of the methods used at the FCC laboratory."

The FCC defines ISM equipment as machines that generate RF energy from 9 kHz to 3,000 GHz for non-telecommunication purposes. ISM uses of frequencies were approved for 6.78 MHz, 61.25 GHz, 122.5 GHz and 245 GHz.

The final rules, which appear in the September 5 *Federal Register* (50 FR 36061), emerged after a seven-year effort to overhaul the decades-old Part 18 regulations. The FCC simplified the ISM rules by condensing them from nine to three subparts.

### RF Lighting Dispute

The FCC rejected a NAB recommendation that RF lighting devices meet an emission limit of 25 uV/m at 10 meters below 30 MHz. Instead, RF lighting will continue to be subject to Part 15, subpart J standards for electromagnetic interference (EMI) from digital and computing devices at least until action is completed on a separate rulemaking on RF lighting. (In August 1983, the FCC issued a Notice of Inquiry on these devices, Docket 83-806, see *MWN*, September 1983).

According to the commission, no reports have been submitted on interference caused by RF lighting devices to radiocommunication services when the Part 15, subpart J rules were met, and there is "insufficient information" to determine whether a limit below 30 MHz is needed.

The NAB responded to the final ISM rules by repeating its request for a 25 uV/m limit in its petition for partial reconsideration filed on October 7. The petition contends that "the interim standards essentially provide no limitations on radiated emissions in the AM broadcast band whatsoever, and new evidence submitted herein indicates that such limitations are indeed warranted and necessary."

In a report submitted with the petition, the NAB argues that: "the risk does not appear to be the potential interference from a particular, individual lighting device; rather, the risk is the inevitable effect on the AM listening environment that would clearly arise from unchecked increases in the cumulative interference effect of multiple RF light-

ing devices" (emphasis in original). The report notes that RF lighting devices are expected to replace incandescent and fluorescent lighting in millions of homes and offices.

The report, *Electrical Interference to AM Radio Reception*, prepared by the NAB's AM Improvement Subcommittee, compares conducted and radiated interference from light dimmer switches to interference from RF lighting devices. It concludes that the RF lighting units tested "exhibited conducted levels of RFI that were approximately equal to the various dimmers. However, while the radiated RFI was slightly lower than that from the noisiest dimmers, it was considerably higher than the best 'RFI suppressed' dimmers."

The report concludes that, "Suppressing RFI is clearly possible in any RF lamp, and shouldn't be an overly burdensome task for RF lamp manufacturers."

## Workers File Suits Over Clear Radiation Accident

Workers involved in the 1983 radiation accident at the Clear Air Force Station in Alaska have gone to court alleging a range of injuries due to overexposure to radiofrequency (RF) radiation. In what is likely to be a long, drawn-out battle, suits were filed in Alaska and New York in September.

Richard Eldridge, one of six workers involved in the accident, and his family filed suit on September 12, charging that Felec Services, Inc., a subsidiary of ITT which operates Clear for the U.S. Air Force, "engaged in conduct which made injury to its workers from RF radiation substantially certain to occur." The complaint was filed in the Alaska State Superior Court in Fairbanks by Richard Friedman of Royce, Wollenberg & Friedman, based in Sitka, AK (Case No. 4FA-85-2077). Eldridge and his family are asking for both compensatory and punitive damages from Felec, but do not specify an amount. The case has been moved to federal court at Felec's request.

Friedman told *Microwave News* that he did not expect Eldridge's case to go to trial for another year.

Also on September 12, three other workers and their families filed complaints against Felec, Federal Electric Corp. and ITT Arctic Services, Inc., all ITT subsidiaries, in U.S. District Court in Anchorage (Nos. A85-517 and 518). Edgar Forsling, Ronald Foster and John Jessop also sued RCA Corp. in U.S. District Court in New York City. RCA manufactured some of the key components used at Clear. In total, the suits ask for more than \$100 million for negligence, fraud and malicious breach of contract. The three workers are represented by Jon Running and Noble Sokolosky of Running & Culver in Tulsa, OK.

Mary Hughes, an attorney with Hughes, Thorseness, Gantz, Powell & Brundin, who is representing Felec, refused to comment. Hughes works in the firm's Anchorage office. RCA is represented by the New York City firm of Quirk & Bakalor.

## Accident History

In September 1983, the six civilian welders and technicians were working on a high-power radar at Clear, near Fairbanks, when it was accidentally turned on (see *MWN*, November 1983 and January/February 1984). The intensity of the workers' exposure is disputed; according to an Occupational Safety and Health Administration (OSHA) reenactment of the accident, the levels could have been as high as 390 mW/cm<sup>2</sup> for approximately eight minutes (see *MWN*, December 1984).

In his complaint, Eldridge alleges that although there was supposed to be a foolproof system to prevent the radar from operating when a worker was in the radome, "Felec instituted a policy which called for this system to be routinely bypassed" and that, in order to save money, Felec "routinely had the radar understaffed and manned by undertrained personnel." Eldridge claims that Felec misled its employees as to the dangers of RF radiation, issuing the men useless radiation badges, and that Felec and the Air Force conspired to keep everyone ignorant of the severity of the workers' injuries.

In their 55-page Felec complaint, Foster, Forsling and Jessop catalog a series of safety violations and contract violations at Clear and allege that the company misled them as to the risks associated with radiation exposures. They present new details on working conditions at the Air Force installation. For instance, they state that the radiation measurement meters used at Clear routinely underestimated the actual levels of exposure and that as early as 1979 Felec was telling its workers that radiation badges could detect RF energy.

The three workers contend that RCA installed defective equipment at Clear, which led to the radiation accident.

## GAO Report

A report on the Clear accident by the U.S. General Accounting Office (GAO) is due to be released in November, according to a spokesman for Congressman Don Young, who requested the GAO study.

The *Anchorage Daily News*, which obtained a draft copy of the document, reported that the GAO concluded that Felec was responsible for the accident and that Air Force oversight of the contractor's performance was inadequate.

## Florida Panel Recommends 190-Foot ROW for 500 kV Line

The Florida Department of Environmental Regulation (DER) has recommended a uniform 190-foot right-of-way (ROW) as a condition for certifying a proposed 500 kV AC transmission line. The DER based its decision on uncertainties over the biological effects of magnetic fields.

The Florida Power Corporation, which wants to build the 42-44 mile Lake Tarpon-Kathleen transmission line,

had planned to use 190-foot ROWs in undeveloped areas but only 100-foot ROWs in certain residential areas.

In an August 22 report, the DER recommended a buffer greater than 50 feet between the line and residential areas until some of the outstanding questions about biological effects have been settled. The department noted that "some state action is appropriate," but was unwilling to establish a field restriction based on leukemia and cancer risks.

The DER decision follows a utility-funded study which concluded that it is "unlikely" that power lines pose a public health problem and 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" (see *MWN*, July/August 1985).

Karen Anthony, a DER spokeswoman, explained in a telephone interview that there is "still enough uncertainty about magnetic fields that we feel we have to include a margin of caution." She added that the DER generally agrees with the study panel's findings.

According to utility calculations cited in the DER report, the 500 kV line would create magnetic field levels of 242-246 milligauss (mG) at the edge of a 100-foot ROW under maximum load conditions. According to Anthony, the maximum magnetic field at the edge of the ROW would be 154 mG with a 190-foot ROW. With a normal load, the magnetic field would be 35-37 mG and 24 mG for 100 and 190-foot ROWs, respectively. The maximum electric field at the edge of a 100-foot ROW would be 3.73 kV/m, and 1.8 kV/m at the edge of a 190-foot ROW.

The DER also recommended an induced current limit of 4.5 mA to protect against shocks (and cardiac pacemaker interference) as a condition for certifying the line. To facilitate compliance, the department suggested a maximum electric field strength of 9 kV/m for non-roadway areas. In addition, the DER advised that television reception should not be significantly degraded by interference from the transmission line.

The hearing officer for the Lake Tarpon-Kathleen line is expected to make her recommendations by mid-January and the project application will then be sent to Governor Bob Graham.

The DER has no more copies of its August 22 report. For more information, contact Karen Anthony, DER, Twin Towers Office Building, 2600 Blair Stone Rd., Tallahassee, FL 32301, (904) 488-0130.

## Editor's Note

We apologize for the lateness of this issue. Our November/December issue will be published before the end of the year. We will resume our regular schedule starting with the January/February 1986 issue.

## BEMS Roundup

Outlined below are some of the highlights from the annual meeting of the Bioelectromagnetics Society (BEMS), held in San Francisco, CA, in June. (See also the reports in our July/August issue.)

• Dr. Ross Adey of the VA Hospital in Loma Linda, CA, is studying the connection between electromagnetic fields (EMFs) and cancer promotion. He presented a three-stage model to explain how EMFs couple with cells: energy is amplified on the surface of the cell membrane, then passed through the membrane into the cell interior. Adey described how weak, low frequency EMFs can influence three different enzyme systems: adenylate cyclase, protein kinases and ornithine decarboxylase. (Protein kinases and ornithine decarboxylase play important roles in cancer promotion.) He stressed that non-linear, non-equilibrium processes are at work, allowing relatively small amounts of energy to activate biochemical reactions. "It's an exciting time," he said, because EMFs are not only the object of our studies, but they provide us with a unique tool for unraveling what is going on.

• Female mice chronically exposed to continuous wave 2.45 GHz radiation at a power density of 10 mW/cm<sup>2</sup>, a specific absorption rate (SAR) of 6.8 W/Kg, showed an "appreciably shorter lifespan" compared to controls, according to Dr. Charles Liddle and coworkers at the Environmental Protection Agency's (EPA) Experimental Biology Division in Research Triangle Park in North Carolina. EPA's Dr. John Allis, who presented the paper in San Francisco, said that half the exposed mice died within 82 weeks, while it took 102 weeks for the controls to reach 50 percent mortality. The mice were exposed for one hour a day, five days a week for 26 months, beginning at five weeks of age. The experiment had not yet been completed, but Allis pointed out two interesting preliminary findings: First, most animals failed to show any gross lesions and there was no pattern among those that did. And second, the mice's rectal temperature went down a few hours after exposure.

• Dr. Reba Goodman of Columbia University and Dr. Ann Henderson of Hunter College, both in New York City, have found that sine waves can stimulate RNA transcription more than the pulsed electromagnetic fields (PEMFs) associated with bone-healing devices. In a continuation of their studies on RNA transcription in the salivary gland chromosome of a gnat (see *MWN*, July/August 1983), Goodman and Henderson compared the effects of seven types of single pulses, repeated at 15 and 72 Hz, and five types of pulse bursts, repeated at 1.5 to 15 Hz, with 72, 222, and 4400 Hz sine waves. Each of the three types of signals displayed a different pattern of stimulation: the sine waves had the greatest effect, and the pulse burst the least. The 72 Hz sine waves were the most effective of all. Not only can the signals increase preexisting RNA activity, they can induce new transcription. The researchers emphasized that the fields did not raise the temperature of

either the cells or their surrounding media. A paper describing their results will be published in *Bioelectromagnetics* next year.

• In our July/August 1984 issue, we reported on a paper by German scientists showing that magnetic fields like those associated with nuclear magnetic resonance (NMR) imaging can induce relatively large temperature changes in live mice. At BEMS, Dr. Tom Tenforde of the Lawrence Berkeley Lab at the University of California announced that an attempted replication had failed. Tenforde exposed female rats and mice to either a static magnetic field of 7.55 T (tesla) or a magnetic field gradient of up to 60 T/m. He concluded that the results of his studies "clearly indicate that strong magnetic fields and magnetic field gradients do not influence thermoregulation in rodents."

• Dr. Gregory Lotz and Jack Saxton of the Naval Aerospace Medical Research Lab in Pensacola, FL, have found, on the basis of studies on male rhesus monkeys, that the "heat produced in deeper tissues by the resonant RF frequency is not fully redistributed by the circulatory system, even during steady-state conditions." Lotz and Saxton based their conclusions on exposures of five monkeys at 225 MHz (their resonant frequency) and 1290 MHz at power densities of 7 to 42 mW/cm<sup>2</sup> — SARs of 0.102 (W/Kg)/(mW/cm<sup>2</sup>).

• In China, microwave heating is being used for reversible male contraception, as well as for the treatment of prostatitis and epididymitis caused by vasectomy. A group headed by Dr. Bill Guy at the University of Washington in Seattle and Dr. Han-Bao Jiang, who was visiting Guy's lab from Sichuan University, used fiberglass models filled with material dielectrically similar to muscle to estimate localized specific absorption rates (SARs) resulting from such clinical treatments. Using 915 and 2450 MHz radiation, they found that when the applied power for male contraception was about 60 watts, the maximum SAR in the testes was about 480 W/Kg — or more generally, 8 W/Kg per watt of input power. The highest SARs for both near and far field exposures were at the base of the penis, when the model was exposed with the penis parallel to the electric field.

## NBS To Set Up EMC LAP

The National Bureau of Standards (NBS) has decided to set up a laboratory accreditation program (LAP) for electromagnetic compatibility (EMC) and telecommunications equipment testing.

In a notice published in the September 25 *Federal Register* (50 FR 38874), the NBS announced that the scope of the LAP will include four test methods for conducted emissions, radiated emissions and terminal equipment compatibility, all using procedures devised by the Federal Communications Commission (FCC). Military and foreign test methods will be added to the LAP later, according to the NBS. (The fees for participating in the LAP are listed in the *Federal Register* notice.)



The NBS anticipates that the first group of labs will be accredited by April 1986.

The electromagnetics LAP is being set up under the National Voluntary Laboratory Accreditation Program (NVLAP) at the request of Walter Poggi, president of Retlif, Inc. in Ronkonkoma, NY (see *MWN*, March and June 1985).

On June 17, the NBS hosted a workshop to discuss the LAP; 15 industry and government experts attended. For a report on the meeting or for additional information, contact Harvey Berger, Laboratory Accreditation, NBS, Admin A531, Gaithersburg, MD 20899, (301) 921-3431. The NBS's Jeffrey Horlick is the project leader for the electromagnetics LAP.

## *Economic Impact of RF/MW Guidance* (continued from p.1)

The EPA guidance would apply to all sources of RF/MW radiation, but previous research by the agency has indicated that most public exposures to RF/MW radiation stem from broadcast transmissions. The Livermore study, released in late October, only estimated the economic impact on broadcast sources of the planned EPA guidelines.

There are approximately 4,400 FM and 4,600 AM radio stations and 1,100 broadcast TV stations in the U.S., according to the report. *Broadcasting* magazine's statistics are higher: 5,050 FM, 4,799 AM and 1,219 TV stations.

### **EPA Guidance Stalled**

The EPA was set to propose a 100 uW/cm<sup>2</sup> standard in the summer of 1984 but, at the last minute, the agency did not publish its proposal (see *MWN*, October 1984). EPA's guidance would directly affect only federal agencies, though once approved it would de facto become a national standard.

Earlier this year, EPA officials announced that they would issue a proposal on the guidance in 1985 and reach a decision by 1986 — though the agency would only list a number of options for the guidance rather than propose a specific number (see *MWN*, January/February 1985).

The EPA options have yet to be published. Sources told *Microwave News* that the proposal is still awaiting the approval of the Office of Management and Budget (OMB).

### **Compliance Strategies**

The Livermore report provides details on possible compliance strategies. Hall concluded that the available techniques to reduce RF radiation levels were limited to variations on three types of actions:

(1) Exclude or warn the public of areas exposed to RF over the standard;

(2) Use existing antenna models or design new ones that produce less unwanted downward grating, or side-lobe radiation; or

(3) Raise the antenna to reduce the RF energy at ground level.

Although all three strategies are applicable to FM stations, Hall noted that only limiting public access is appropriate for AM stations. TV radiation can be controlled through a combination of changing the designs of antennas and increasing their height.

The first volume of the Livermore study, *An Estimate of the Potential Costs of Guidelines Limiting Public Exposure to Radiofrequency Radiation from Broadcast Sources* (No. EPA 520/1-85-025, July 1985) describes the study results; the second volume in two parts, is a compilation of sample calculations. The study is available from the National Technical Information Service (NTIS), Springfield, VA 22161, (703) 487-4650 for \$40.95 (paper) or \$5.95 (microfiche); order No. PB86-108826.

### **Related EPA Reports**

The EPA has also released *An Engineering Assessment of the Potential Impact of Federal Radiation Protection Guidance on the AM, FM and TV Broadcast Services* (No. 520/6-85-011, April 1985) by Paul Gailey and Richard Tell of the EPA's Office of Radiation Programs' (ORP) Non-Ionizing Radiation Branch in Las Vegas, NV. Gailey and Tell have developed computer models to estimate the RF/MW radiation levels on the ground near broadcast stations and have investigated the impact of possible mitigation strategies.

The Gailey-Tell report is also available from NTIS for \$16.95 (paper) or \$5.95 (microfiche); order No. PB85-245868.

A third EPA report, *The Radiofrequency Radiation Environment; Environmental Exposure Levels and RF-Emitting Sources*, by ORP's Norbert Hankin, is a comprehensive summary of potential exposures from different types of equipment. Hankin told *Microwave News* that the report is a compilation of material that has already been published in other agency reports.

Hankin said that although his report is still in draft form, it is already publicly available at the EPA library in Washington, DC, and at each of the EPA regional offices. The final report should be printed by the beginning of the year. ●

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## Options for Addressing Potentially Adverse Health Effects from Public Exposure to RF/MW Radiation

In June 1984, the Office of Radiation Programs (ORP) at the Environmental Protection Agency (EPA) was set to propose a standard (or "guidance") for public exposures to radiofrequency and microwave (RF/MW) radiation. The proposal was never issued due to conflicts within the agency; opposition came primarily from EPA's Office of Policy Planning and Evaluation (OPPE).

In our July/August 1984 issue, we published the full text of an options paper written by Jack Campbell of OPPE. Reprinted below is a response to Campbell's memorandum, written in August 1984 by staffers at ORP and the Office of Air and Radiation (OAR), of which ORP is a part. Microwave News obtained the ORP-OAR memorandum under the Freedom of Information Act.

This memo is the first official confirmation that EPA was planning to propose an exposure standard ten times stricter than the 1982 American National Standards Institute guidelines — or 100  $\mu\text{W}/\text{cm}^2$  in the 30-300 MHz band.

Since early this year, EPA officials have maintained that they plan to publish a list of options for the guidance in the Federal Register (see MWN, January/February 1985). The list is still under review at the Office of Management and Budget (OMB), however; when (and if) it emerges, it is likely to be similar to the one published here.

### Background

Radiofrequency (RF) radiation exposure levels in the environment have been studied by the Office of Radiation Programs (ORP) since 1972 and range from very low general population levels of less than one microwatt per square centimeter ( $\mu\text{W}/\text{cm}^2$ ) for most people to levels of several thousands of  $\mu\text{W}/\text{cm}^2$ . EPA has also conducted research on the biological effects of RF radiation showing that exposures within this range of environmental levels can evoke numerous kinds and degrees of biological effects in laboratory animals.

In April 1979, EPA initiated a program to develop Federal Radiation Protection Guidance to protect the public from potentially adverse health effects from exposure to RF radiation. An Advance Notice of Proposed Recommendations (ANPR) was published in the *Federal Register* in December 1982. This action was prompted by:

- a growing knowledge of the biological effects of RF radiation with a concomitant rise in environmental exposure levels, and by
- requests for EPA to develop regulations from: (1) the National Telecommunications and Information Administration within the Department of Commerce, (2) the Federal Communications Commission and (3) industry.

Based on these findings the Office of Air and Radiation (OAR) has concluded that the establishment of federal guides which define maximum permissible exposure intensities is appropriate. Accordingly, an Interagency Workgroup was developed consisting of representatives from all involved federal agencies (sixteen agencies) to assist in the preparation of recommended exposure limits. ORP also conferred with an EPA workgroup in the actual drafting of a Notice of Proposed Recommendations (NPR). A decision package consisting of a background information document, a Science Advisory Board (SAB) reviewed and approved critical assessment of the biological effects literature developed by the Office of Research and Development titled *Biological Effects of Radiofrequency Radiation*, and an analysis of the poten-

tial economic impact of various alternative regulatory levels was assembled.

At a meeting of the Steering Committee on April 6, 1984, it was determined that all representatives of the Agency, except for the Office of Policy, Planning and Evaluation (OPPE), concurred with the issuance of the draft NPR for public comment. The NPR recommended maximum permissible exposure limits equal to one-tenth of the current American National Standards Institute (ANSI) voluntary standard (see Option 4). OPPE staff subsequently revealed that their opinion was that:

- because there is no statutory requirement that EPA regulate RF radiation exposures, and
- because ORP was unable to enumerate actual adverse health effects in the population,
- EPA should not recommend exposure limits (see Option 1).

OPPE later developed an options paper and circulated it for review, suggesting that it be used to resolve their concerns over policy issues raised by proposing federal guidance for RF radiation.

### Current Status

There exist significant differences of opinion between OPPE and ORP over this issue. Matters have not been resolved as of this date. With consideration of OPPE's options paper, OAR has developed this brief summary of various alternative options for dealing with RF radiation. The options range from no regulatory action to proposing environmental exposure limits comparable to those used in the Soviet Union, the most stringent standards in existence today.

### Related Matters

To help form a perspective on the difficult issue of selecting an appropriate option to follow, it may prove useful to be aware of several activities related to radiation protection in the RF area. ANSI, in 1982, revised its voluntary standard for RF radiation by making the permissible exposure limits dependent upon frequency, and in the frequency range of most stringent control of exposure intensities, set its radiation protection guide at 1,000  $\mu\text{W}/\text{cm}^2$ . The International Radiation Protection Association (IRPA) has recently published guidelines on limits of exposure to RF radiation which recommend intensities, at the most stringent frequencies, not to exceed 200  $\mu\text{W}/\text{cm}^2$ . The National Council on Radiation Protection and Measurements (NCRP) currently has under review a draft report recommending public exposure limits also equal to 200  $\mu\text{W}/\text{cm}^2$ . The NCRP scientific committee preparing its report had several members who also served on the SAB panel which reviewed the EPA biological effects document which was used as a basis for deriving acceptable exposure limits by OAR. The conclusions of these two prestigious radiation protection organizations are compatible with the adoption of similar limits in the state of Massachusetts, Multnomah County, Oregon and the City of Portland for public exposure. Recently the Johns Hopkins Applied Physics Laboratory adopted a similar yet somewhat more stringent standard (100  $\mu\text{W}/\text{cm}^2$ ) for use within its facilities. The National Institute for Occupational Safety and Health (NIOSH) has prepared a new recommended occupational exposure limit for RF radiation of 500  $\mu\text{W}/\text{cm}^2$ . In addition, the Food and Drug Administration's Center for Devices and Radiological Health is considering the promulgation of a performance standard for RF heat sealing machines.

A recent scientific report, in which laboratory animals were

## FROM THE FIELD

exposed over their entire life span to low-level RF radiation at an intensity equivalent to the present ANSI standard, has described a statistically significant increase in the incidence of malignant tumors in the exposed animals. This study is the first lifetime study and the first to link RF radiation exposure with cancer. This finding may play a significant role in public perception of possible public health implications for RF radiation exposures in the environment and consequently in public expectations of EPA's regulatory action in this area.

### Alternative Regulatory Options

#### Option 1— No Regulatory Action

*Pro:*

- Would reduce agency resource requirements in ORP.
- Would avoid inconsistency between ANSI standard and possible agency position.
- Avoids the need to make risk management decision.
- Could allow for continued research to better define threshold exposures resulting in adverse effects.
- Could allow for more time to identify and quantify adverse health effects in the population resulting in more refined risk estimates.

*Con:*

- Is unresponsive to state, federal agency and industry requests for guidance.
- Offers no public health protection.
- Will tend to promote even greater fear over possible health effects by public.
- Will do nothing to reduce proliferation of standards at the local level and associated resulting economic impact.
- Transfers responsibility for protection of public health to others unequipped technically and/or administratively to develop RF exposure limits.
- In view of the current context, i.e., high public concern and the issuance of an ANPR, no regulatory action could make the agency appear foolish.

#### Option 2— Adopt the ANSI Standard

*Pro:*

- Industry has stated that it would like the ANSI standard and is willing to comply with it.
- Would be consistent with ANSI and avoid controversy in some circles over reason for differences in EPA recommendations and ANSI.
- Total estimated cost of compliance to broadcast industry is approximately \$15 million spread over a ten-year period resulting in an average annual cash flow of \$1.6 million.

*Con:*

- Would result in rates of energy absorption in the body which are above the observed threshold for some biological effects, including recent observations of cancer.
- Could lead to heat stress for some individuals in high temperature and humidity environments.
- Would carry the negative connotation of applying a standard which industry itself largely developed.
- ANSI itself stated that the limits are to be used as upper limits of exposure, particularly for the public, suggesting that a greater margin of safety may be required for the general population.
- Would be unusual and precedent setting in that the general population exposure limit would exceed the probable recommended occupational exposure limits (NIOSH's draft standards are one-half of the ANSI values). This would create controversy and be inconsistent with traditional radiation protection practices.

- ANSI has been criticized on the basis of not including sufficient public participation in its radiation protection guide development process.

#### Option 3 — Base Guidance on Recommendations of IRPA and NCRP

*Pro:*

- Would result in rates of energy absorption in the body which are generally below the observed threshold for most biological effects.
- Would be responsive to the statements within the current ANSI standard that its limits should be used as upper limits of exposure, particularly for the public.
- Would help to reduce level of controversy brought about by adoption of less stringent limits such as the ANSI standard which were developed largely by industry.
- Would remove inconsistency with recent recommended occupational exposure limits from NIOSH which are one-half the ANSI values.
- Would appear conciliatory and responsive to concerns of some federal agencies expressed during interagency workgroup process in which more stringent limits were discussed.
- Would be consistent with general recommendations of two prestigious radiation protection organizations.
- Would be consistent with usual practice of generally providing more protective standards for the general public than those established for occupational exposures.

*Con:*

- Relatively higher cost of compliance to industry (\$28 million, spread over 6 years).
- Could be viewed by some as not conservative enough in view of certain biological effects research findings involving relatively low-level, non-thermal exposures.
- Although the population exposure standard would be lower than that expected to be proposed for occupational exposure by NIOSH, the difference would not be near the factor of 10 normally used.
- Could be viewed by some as too conservative in view of the controversial nature of some of the low-level effects findings and their implications for public health; the Agency has been criticized for placing too much emphasis on thermal effects only.
- Number of potentially impacted VHF broadcast stations would rise to 835 as compared to 202 stations for compliance with ANSI standard.
- Leaves no practical negotiating room for OMB review short of adopting ANSI standard with attendant negative connotations listed above.
- If recent cancer findings prove accurate and are used to define a no observed adverse effects level (NOAEL), guidance would only be a factor of 5 below this; this would be inconsistent with the normal use of a factor of 10 for interspecies comparisons.

#### Option 4 — Base Limits on 1/10 of ANSI Standard (OAR Proposal)

*Pro:*

- Strongly protective of public health in relation to Options 1-3 above.
- Would be viewed as a conservatively set public health standard by most all individuals, including consideration of nonthermal effects.
- Would increase cost of compliance by less than a factor of 3 over ANSI standard or only 39 percent over Option 3 to a value of \$41.5 million spread over a ten year period resulting in an average annual cash flow of \$4.7 million.

- Is in range (a factor of 2) of those limits recommended by IRPA and NCRP, thereby enhancing technical credibility.
- Other federal health protection agencies have indicated their agreement with approach in deriving such limits and the resulting numerical limits.
- Low likelihood of need to further tighten standard if later research shows low-level effects.

**Con:**

- Number of potentially impacted VHF broadcast stations would rise to 1,229.
- Could be viewed by some as too conservative in view of the controversial nature of some of the low-level effects findings and their implications for public health.
- Some federal agencies have suggested that such limits might impose some constraints on their operation of certain transmitting systems (these agencies have not provided supporting data for such claims despite EPA requests for same).

**Option 5 — Propose Limits Similar to Soviet RF Standard**

**Pro:**

- Would be equivalent to most conservatively set exposure standard in the world, removing virtually any doubt as to lack of health protection afforded.
- Would provide enough margin of safety to accommodate most conceivable future adverse findings in biological/ epidemiological research.

**Con:**

- Would require large expenditure for compliance costs by industry, increasing costs to at least \$333 million and affecting 86 percent of all broadcast VHF stations in the country.
- Could realistically add to overall impact by affecting military operations and possibly impacting on national security.
- Would be difficult to justify in terms of additional economic and operational impact relative to added degree of protection.
- Would be inconsistent with recommendations of other radiation protection organizations such as IRPA and NCRP.

Senator Albert Gore, Jr. (D-TN), has been trying to save the radiation research program — Senator Jake Garn (R-UT) has opposed restoring the funds. In response to Gore's efforts, on November 8, the House-Senate Conference Committee on HUD and Independent Agencies directed EPA to "make no final decision or take no action on terminating the non-ionizing radiation health effects research program before January 1, 1986."

The EBD was slated to stop work on non-ionizing radiation under the President's fiscal 1986 budget (see *MWN*, March 1985). Supporters of the program, including industry groups, waged a letter-writing campaign to try to reverse the administration's decision.

In 1983, when a similar effort to stop research on non-ionizing radiation at EPA failed, Congress instructed the agency to step up work on the extremely low frequency (ELF) fields associated with power lines. That work was just beginning when the research group was again cut out of the budget.

The 25 researchers in the division, who contribute a total of 16 person-years on non-ionizing radiation research, will be reassigned to other parts of the laboratory. None of them will lose their jobs as a result of the reorganization.

A number of well-publicized studies will be discontinued when the division is closed. Among those are a long-term, low-level exposure study that has been in preparation for years; Dr. Ezra Berman's experiments to try to replicate the teratological effects of very weak, low-frequency magnetic fields discovered by Dr. Jose Delgado and Dr. Jocelyne Leal in Spain; and Dr. Carl Blackman's studies on calcium efflux and the role played by the Earth's magnetic field in weak field interactions. ●

## CONFERENCES

December 4-5: **International Conference on Electric and Magnetic Fields in Medicine and Biology**, London, UK. Contact: Conference Services, Institution of Electrical Engineers, Savoy Place, London WC2R 0BL, UK, (01) 240-1871, ext. 222.

December 5-8: **2nd Annual Meeting of the American Society of Clinical Hyperthermic Oncology**, Gene Autry Hotel, Palm Springs, CA. Contact: Dr. Haim Bicher, Hyperthermic Oncology, Daniel Freeman Memorial Hospital, 301 N. Prairie Ave., Suite 311, Inglewood, CA 90301, (213) 673-8620.

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

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January 8-10: **Detection of Optical Radiation**, Americana Dutch Resort Hotel, Lake Buena Vista, FL. Contact: V. Amico, Professional Engineering Development, University of Central Florida, Orlando, FL 32816, (305) 275-2123.

January 13-14: **Satellite Communications: Applications, Technology & Competition**, Halloran House, New York, NY. Contact: Carol Every, Frost & Sullivan, 106 Fulton St., New York, NY 10038, (212) 233-1080.

January 13-16: **National Radio Science Meeting**, University of Colorado, Boulder, CO. Contact: Professor S.W. Maley, Dept. of Electrical Engineering, University of Colorado, Boulder, CO 80309.

January 21-23: **Electrical Overstress Exposition**, Anaheim Hilton and Towers, Anaheim, CA. Contact: Jim Russell, 2504 North Tamiami Trail, Nokomis, FL 33555, (813) 966-3631.

January 30-February 1: **RF Technology Expo**, Anaheim Hilton and Towers, Anaheim, CA. Contact: Kathy Kriner, *RF Design*, 6530 S. Yosemite St., Englewood, CO 80111, (303) 694-1522.

February 2-7: **Winter Meeting of the IEEE Power Engineering Society**, Penta Hotel, New York, NY. Contact: PES-IEEE, 345 East 47th St., New York, NY 10017.

March 5-7: **Workshop on Measurement of Electrical Quantities in Pulse Power Systems II**, National Bureau of Standards (NBS), Gaithersburg, MD. Contact: Ron McKnight, B344 Metrology Bldg., NBS, Gaithersburg, MD 20899, (301) 921-3121.

March 12-13: **IEEE 1986 National Radar Conference**, Los Angeles, CA. Contact: Radar Systems Group, Hughes Aircraft Co., R-1, D-428, PO Box 92426, Los Angeles, CA 90009.

March 25-27: **IEEE IMTC/86: Instrumentation/Measurement Technology Conference**, University of Colorado, Boulder, CO. Contact: Robert Myers, IMTC/86 Coordinator, 1700 Westwood Blvd., Suite 101, Los Angeles, CA 90024, (213) 475-4571.

April 2-3: **22nd Annual Meeting of the National Council on Radiation Protection and Measurements**, Washington, DC. Contact: NCRP, Suite 1016, 7910 Woodmont Ave., Bethesda, MD 20814, (301) 657-2652.

## BIOLOGICAL EFFECTS

**Light Literature...**In the fall of 1984, the New York Academy of Sciences (NYAS) hosted a conference on the *Medical and Biological Effects of Light* (see *MWN*, December 1984). The academy has now published the 44 papers presented at the meeting (*Annals of the NYAS*, Volume 453, September 20, 1985). Among the topics covered are the direct effects of light, the indirect effects of light, especially on biorhythms, and the health effects of interior lighting. Contact: NYAS, 2 East 63rd St., New York, NY 10021, (212) 838-0230....Dr. Norman Rosenthal and coworkers at the NIMH's Clinical Psychobiology Branch in Bethesda, MD, authored one of the papers presented at the NYAS meeting. In addition, they have published results on the "Antidepressant Effects of Light in Seasonal Affective Disorder" in the February 1985 issue of the *American Journal of Psychiatry*....In the popular press, Jack Fincher reviews the field of photobiology in "Notice: Sunlight May Be Necessary to Your Health" in the June 1985 issue of the *Smithsonian*. See also Bruce Fellman's article on the pineal gland, "A Clockwork Gland," in the May issue of *Science* 85....A team headed by Dr. Penny Glass of the Children's Hospital National Medical Center in Washington, DC, has found evidence that bright lights in hospital nurseries may be a contributing factor in the development of eye ailments among premature infants. They recommend that lighting standards be reassessed. See the August 15 issue of the *New England Journal of Medicine*....In our March issue, we described a case of phytophotodermatitis among supermarket employees who were exposed to psoralens from vegetables and then to UV or bright sunlight. Now the Centers for Disease Control reports a similar outbreak among children using limes in an art class at a day camp in Maryland. The skins of limes and other citrus fruits contain furocoumarins, which are chemically similar to psoralens. Details of the outbreak appear in the August 2 issue of *Morbidity and Mortality Weekly Report*.

**EPRI Reports...**The Electric Power Research Institute (EPRI) has released four new reports: (1) T.J. Reed of Westinghouse Electric Corp. in Pittsburgh, PA, and G.W. McKee of the Pennsylvania State University in State College, PA, have found that five types of plants suffered no significant adverse effects on germination, growth and survival when exposed to 60 Hz electric fields ranging from 10 kV/m to more than 40 kV/m. Sharply-pointed leaves on some plants showed "very limited" damage at levels above 30 kV/m. *Effects of 60 Hz Electric Fields on Living Plants Exposed for Extended Periods* (EA-4159), July 1985, \$25.00....(2) R.J. Weigel and W.T. Kaune of Battelle Pacific Northwest Labs in Richland, WA, have designed and built a facility for exposing small animals to air ions and static electric fields like those associated with high voltage DC power lines. *Design, Construction and Testing of a DC Bioeffects Enclosure for Small Animals* (EA-4189), July 1985, \$25.00....(3) Researchers at Westinghouse Electric Corp. and Pennsylvania State University in State College found "no direct effect on the growth,

development and overall health and well-being" of chick embryos exposed to 60 Hz electric fields. The results are based on the exposure of 20,000 eggs to field strengths ranging from 0.1 to 100 kV/m over three years. *Effects of 60 Hz Electric Fields on Embryo and Chick Development, Growth and Behavior* (EA-4161), July 1985, \$25.00....(4) B. Greenberg and V. Bindokas of Bioconcern and J. Gauger of IITRI, both in Chicago, IL, have issued the final report on their study of bees living in hives located under high voltage power lines (see *MWN*, July/August 1985). *Extra-High Voltage Transmission Lines: Mechanisms of Biological Effects on Honeybees* (EA-4218), August 1985, \$20.00. All four reports can be ordered from Research Reports Center, PO Box 50490, Palo Alto, CA 94303, (415) 965-4081.

**Guy Study...**The Air Force has published the ninth and final volume on the long-term, low-level exposure study done at the University of Washington in Seattle under the direction of Dr. Bill Guy (see *MWN*, July/August 1984, March and June 1985). In this summary report, Guy and coworkers conclude: "In summary, no defensible trends in altered longevity, cause of death or spontaneous aging lesions and neoplasia can be identified in the rats exposed to this long-term, low-level radiofrequency radiation exposure." *Effects of Long-Term Low-Level Radiofrequency Radiation Exposure on Rats, Volume 9: Summary*, August 1985, USAFSAM-TR-85-64, and the previous eight volumes are available from Dr. Jerome Krupp, USAF School of Aerospace Medicine, Brooks AFB, TX 78235.

## COMPATIBILITY & INTERFERENCE

**RFI to Cochlear Implants...**Inner-ear cochlear implants that electrically stimulate auditory nerves are highly sensitive to RFI from a wide variety of sources, such as light dimmers, computer terminals, police radar and UHF mobile radios. Sharon Hepfner and Dr. Michael Skelly of the University of Cincinnati Medical Center (UCMC) report in the August 8 *New England Journal of Medicine* that, "Patients with implanted nerve stimulators should be warned of the possibility of such interference and should be alert to the presence of radio transmitters, library and airport metal detectors and electrical sources capable of emitting appreciable radiofrequency energy..." All seven deaf patients who have received the House/3M Cochlear Implant System at the UCMC have reported interference problems, according to the authors, who offer tips for implant users to reduce the risk of RFI.

**Assorted Notes...**In October 1982, the FCC fined Sonic Cable TV in California \$6,000 for violating the commission's signal leakage limits (see *MWN*, November 1982). Sonic appealed the ruling, but lost (see *MWN*, January/February 1984). Sonic appealed again and, in a decision handed down in September, lost again....In its August 19 issue, *Aviation Week & Space Technology* reports a case of unidentified UHF interference at about 401.9 MHz to the

U.S. geostationary weather satellite, GOES-4. Ground controllers have been unable to locate the source of the RFI...Three British researchers have published "Measurements of the Field Strengths on Offshore Oil Platforms for Assessing Radiofrequency Hazards with Electroexplosive Devices" in the August *IEEE Transactions on Electromagnetic Compatibility*...Concern over EMI to electronic devices in automobiles is growing. See articles in the October *IEEE Spectrum* and the June 13 *New Scientist*.

### INTERNATIONAL

**IRPA on UV and Lasers...**The International Non-Ionizing Radiation Committee of the International Radiation Protection Association (IRPA) has released guidelines for exposure to non-coherent ultraviolet (UV) radiation between 180 nm and 400 nm and for exposure to laser radiation of wavelengths between 180 nm and 1 mm. Both sets of guidelines appear in the August 1985 issue of *Health Physics*.

**Spy Dust...**Recent U.S. allegations that the Soviet KGB used a toxic chemical to track the movements of American diplomats in Moscow resurrected memories of the Moscow microwaves affair. U.S. officials admitted to knowing about the chemical, nitrophenyl pentadienal (NPPD), which is a mutagen and is visible under ultraviolet light, since 1976. A 1979 Senate report on microwaves in Moscow chastised the State Department for withholding information for 23 years about the irradiation of the embassy.

### MEASUREMENT

**VOR Calibration...**The NBS is now offering calibration services for very high frequency omnidirectional range (VOR) air navigation systems — though direct generation or measurement of VOR RF signals is not part of the service. A new NBS publication provides details on the service: *VOR Calibration Services*, NBS Technical Note 1069, by Neil Larsen, Dominic Vecchia and George Sugar. The report includes overviews of VOR systems and the new NBS VOR audio generator and phasemeter. The report is available from the Government Printing Office, Washington, DC 20402 for \$6.50. Order No. 003-003-02652-2. For more information, contact: Neil Larsen, Mail Code 723.01, NBS, Boulder, CO 80303, (303) 497-3711.

**Resources...**Early next year, the *Proceedings of the IEEE* will feature a special issue on "Radio Measurement Methods and Standards," edited by Bruno Weinschel and Stephen Adam...Amplifier Research is marketing a new 14"x5.5" transmission-line cell to test the effectiveness of RF shielding materials which the company claims produces more reliable and repeatable results than those obtained by shielded-room testing. The portable unit, SET-19, is manufactured by Elgal in Israel and costs \$6,600. For more information, contact Amplifier Research, 160 School House Rd., Souderton, PA 18964, (215) 723-8181...Three

recent papers: M. Martinelli, P.A. Rolla and E. Tombari of the Dept. of Physics at the University of Pisa in Italy, "A Method for Dynamic Dielectric Measurements at Microwave Frequencies: Applications to Polymerization Process Studies," *IEEE Transactions on Instrumentation and Measurement*, September 1985; M. Mostafavi, J.C. Bolomey and D. Picard of the Ecole Supérieure d'Electricité in Gif Sur Yvette, France, "Far-Field Accuracy Investigation Using Modulated Scattering Technique for Fast Near-Field Measurements," *IEEE Transactions on Antennas and Propagation*, March 1985; and S. Burkhart of Lawrence Livermore National Lab in Livermore, CA, "Coaxial E-Field Probe for High-Power Microwave Measurement," *IEEE Transactions on Microwave Theory and Techniques*, March 1985.

### MEETINGS

**60 Hz Measurements...**Last February 12-13, DOE and EPRI sponsored a *Workshop on Measurement of Non-Uniform and Fluctuating 60 Hz Electric and Magnetic Fields* at the EPA's Las Vegas, NV, facilities. Aerospace Corp., DOE's contractor for support on its electric field effects program, has now published a report on the workshop, including brief synopses of the 15 presentations made by the 12 invited speakers, together with reproductions of their slides. A copy of the report is available from Dr. William Wisecup or Lee Rosen, c/o W/L Associates, Suite 401, 600 S. Frederick Ave., Gaithersburg, MD 20877, (301) 948-0642.

### MILITARY APPLICATIONS

**ELF Monitoring Program...**The IIT Research Institute (IITRI) has published the third annual report of the Navy's ongoing ecological monitoring program on the possible effects of the electric and magnetic fields from the Navy's Project ELF communications system. The report covers 1984. In addition, IITRI has released a two-volume compilation of status reports from the 11 contractors who are participating in the ecological studies. The monitoring program is funded by the Navy's Space and Naval Warfare Systems Command and is administered by IITRI; R.D. Carlson is IITRI's program manager. The 53-page summary report, *Extremely Low Frequency (ELF) Communications System Ecological Monitoring Program: Summary of 1984 Progress*, by J.E. Zapotosky, July 1985 (Technical Report E06549-18), and the two-volume, 1148-page *Compilation of 1984 Annual Reports of the Navy ELF Communications System Ecological Monitoring Program* (Technical Report E06549-17, June 1985) are available from the National Technical Information Service (NTIS), Springfield, VA 22161.

### PEOPLE

**William Mumford**, a pioneer in the field of microwave radiation bioeffects as well as in many areas of microwave technology, died on June 19 at the age of 80. Among his many accomplishments, he was a member of the Elec-

## UPDATES

tromagnetic Radiation Management Advisory Council (ERMAC) from the time it was formed in 1968 until it was disbanded in 1982....**Dr. Robert Powers** resigned as chief scientist of the FCC on September 12 to join the MCI Telecommunications Corp. **Dr. Thomas Stanley** has taken over as acting chief scientist....Over at NTIA, **David Markey** has resigned as administrator and has been replaced by **Rodney Joyce**, the former minority counsel of the House telecommunications subcommittee....**William Lambdin** has retired as the general manager of Electro-Metrics, based in Amsterdam, NY....**Dr. Mays Swicord**, chief of the molecular biology branch of the Office of Science and Technology at FDA's Center for Devices and Radiological Health, is on a year's assignment at the World Health Organization's Division of Diagnostic, Therapeutic and Rehabilitative Technology in Geneva. **Dr. Larry Bockstahler** is taking over as acting branch chief....**Dr. Tom Rozzell** is back as manager of ONR's bioelectromagnetics program after a two-year stint at ONR's London office. **Dr. Michael Marron**, who took over during Rozzell's absence, has moved to ONR's molecular biology branch.

### POWER LINES

**EPRI Takes Over Test Facility...**In September, the Electric Power Research Institute (EPRI) took over the ownership of the High Voltage Transmission Research Facility (HVTRF) from General Electric. The facility, located in western Massachusetts, is used for both AC and DC research and testing; among the many projects carried out there are studies on electric and magnetic fields and corona phenomena. For more information, contact HVTRF Manager Luciano Zaffanella at (413) 494-4356 or EPRI Project Manager John Dunlap at (415) 855-2305.

### STANDARDS

**EIA on TV and VCR Immunity...**The Electronic Industries Association (EIA) has published *Immunity of Television Receivers and Video Cassette Recorders (VCRs) to Direct Radiation from Radio Transmissions, 0.5 to 30 MHz*, Interim Standard No.16. The standard was developed by an EIA committee under the chairmanship of Howard Lester of GE. (See also *MWN*, January/February 1985). Copies are available for \$7.00 from EIA's Standards Sales Office, 2001 Eye Street, NW, Washington, DC 20006, (202) 457-4966.

**IEC and CISPR...**The following publications are now, or will soon be, available from ANSI's International Sales Dept., 1430 Broadway, New York, NY 10018; note prices do not include postage and handling. (1) *Effects of Current Passing Through the Human Body* (Publication 479-1), prepared by IEC Technical Committee 64, on electrical installations in buildings, details human shock threshold limits for direct currents and for 15-100 Hz currents (Cost: \$31.00). (2) *Limits and Methods of Measurement of Radio Interference Characteristics of Fluorescent Lamps and*

*Luminaires* (CISPR Publication 15) recommends methods to control RFI to radio reception at frequencies from 150-1605 kHz. It was prepared by Subcommittee F, on RFI from motors, household appliances, lighting apparatus and the like, of the International Special Committee on Radio Interference (CISPR) (Cost: \$41.00). (3) *Measurement of the Immunity of Sound and Television Broadcast Receivers and Associated Equipment in the Frequency Range 1.5 MHz to 30 MHz by the Current-Injection Method/ Guidance on Immunity Requirements for the Reduction of Interference Caused by Radio Transmitters in the Frequency Range 26 MHz to 30 MHz* (CISPR Publication 20) is an interim document for use while CISPR Subcommittee E, on EMI characteristics of radio receivers, prepares a more extensive document (Cost: \$33.00). (4) *Interference to Mobile Radiocommunications in the Presence of Impulsive Noise; Methods of Judging Degradation and Measures to Improve Performance* (CISPR Publication 21) was prepared by Subcommittee D, on EMI relating to motor vehicles and internal combustion engines (Cost: \$13.00). (5) Subcommittee D also prepared a report on *Limits and Methods of Measurement of Radio Interference Characteristics of Vehicles, Motor Boats and Spark-ignited Engine-driven Devices* (CISPR Publication 12) (Cost: \$31.00)....The IEC also has released three amendments for review under the *Six Months' Rule*; copies can be ordered from ANSI: (1) *CISPR/A (Central Office) 32 Amendment No. 1* to CISPR Publication 7B adds data processing equipment, information technology equipment, home computers and video games and other sources of potential EMI to a chart included in CISPR 7B (Cost: \$9.00). (2) *CISPR/A (Central Office) 33 Amendment No. 3* to CISPR Publication 16 pertains to the use of an absorbing clamp to measure interference (Cost: \$9.00). (3) *CISPR/A (Central Office) 34 Amendment No. 3* to CISPR Publication 16 adds information regarding quasi-peak and average detector response (Cost: \$9.00).

### TECHNOLOGY

**A Change in Direction...**Old ideas have a way of popping up again, often in a slightly different form. A recent example is a new project on the drawing boards at NASA and DOE: the perpetual plane — or at least one that can stay aloft for a year. NASA is looking into the feasibility of using such an unmanned aircraft to monitor atmospheric concentrations of carbon dioxide. How do you keep a plane up for so long? By beaming up microwave power from a ground station. A leading proponent of the plan within DOE's carbon dioxide research program is Fred Koomanoff, who used to be the director of DOE's Solar Power Satellite (SPS) project before the idea lost its appeal in the early 1980s. Under the SPS program, satellites in Earth orbit would have collected solar energy and beamed it down to elliptical receiving antennas (called "rectennas") on the ground. According to an analysis by Rice University researchers in 1978, finding the land for the rectennas, each with 13-by-9 kilometer axes, in the



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continental U.S. would not be easy. Beaming up microwaves should be a lot simpler, but it is still far from certain whether NASA and DOE will go ahead with the perpetual plane.

**Microwave Sintering...**EPRI has awarded a \$94,600 contract to Northwestern University in Chicago, IL, to study methods of "Microwave Sintering of Ceramics" (No. RP2730-1). Researchers at Northwestern will develop a new cylindrical cavity to test rapid heating and rapid sintering using microwaves and compare the results with those from conventional techniques. Microwave sintering offers the promise of improved efficiency over electrically heated ovens. The project is scheduled to take 11 months. For more information, contact EPRI's A. Karp at 3412 Hillview Ave., PO Box 10412, Palo Alto, CA 94303, (415) 855-2000.

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#### VDTs

**UV Hypothesis...**Near-ultraviolet radiation (UV-A) could be responsible for headaches, irritability, skin rashes, visual problems, reproductive abnormalities and a host of other ailments reported by VDT users, according to Dr. Anthony R. Mawson of the Louisiana State University Medical Center (LSUMC) in New Orleans. Mawson suggests that "chronic exposure to subliminal amounts of UV-A radiation produces the VDT-associated ill-effects by catabolizing vitamin A in skin and plasma into highly active metabolites, the gradual accumulation of which results in an endogenous form of vitamin A intoxication." He adds that these metabolites can cross the placenta and cause pregnancy abnormalities. Mawson does not dispute that UV-A emissions from VDTs are much lower than current standards, but contends that such safety standards are of "dubious validity" and that ill-effects could result from chronic exposure. Mawson emphasizes the speculative nature of his theory, but argues that it lends itself to further research. "Speculations on the Origin of the Ill-Effects Associated With the Use of VDTs" appeared in the *Journal of Theoretical Biology*, 114, 223-241, 1985. A reprint is available from Mawson at the Section of Rheumatology and Rehabilitation, Department of Medicine, LSUMC, 1542 Tulane Ave., New Orleans, LA 70112.

**Terminal Shock...**A Canadian labor official has published *Terminal Shock*, a full-length book on VDTs. Bob DeMatteo of the Ontario Public Service Employees Union (OPSEU) in Toronto focuses mainly on VDT radiation emissions, providing the most detailed discussion yet published in the popular press. The book is a greatly expanded version of a 1981 OPSEU pamphlet (see *MWN*, November 1981). To order, send \$9.95 to Independent Publishers' Group, One Pleasant Ave., Port Washington, NY 11050, (516) 944-9325.

**Resources...**A year-long study by a congressional subcommittee has ended in a staff recommendation that further radiation research is needed. The subcommittee on health and safety of the House of Representative's Com-

mittee on Education and Labor argues in a recently released staff report that this research "could eliminate, and definitely reduce, any lingering doubts" about radiation hazards. The staff recommends against legislation setting VDT standards for equipment design, lighting and other environmental factors. For a copy of the "Staff Report on the Oversight of OSHA with Respect to VDTs in the Workplace" (Serial 99-A), contact the subcommittee at Room B345A, Rayburn Bldg., U.S. House of Representatives, Washington, D.C. 20515....Dr. Karel Marha and David Charron, among the first researchers to suggest that very low frequency (VLF) pulsed radiation might cause biological effects among operators, have published "The Distribution of a Pulsed Very Low Frequency Electric Field Around Video Display Terminals" in *Health Physics*, 49, 517-521, 1985. The paper details measurements taken around four identical, unshielded VDTs with an EFS-1 electric field sensor made by Instruments for Industry of Farmingdale, NY. They found that VLF electric fields exceeded 300 V/m measured as far as 20 cm from the right side of the set. Beyond 20 cm, the fields decreased rapidly and "were mostly negligible at 50 cm from the surface of the VDT." Marha and Charron, who work for the Canadian Center for Occupational Health and Safety (CCOHS), previously published reports on VDT emissions (see *MWN*, December 1983)....Dr. Arthur Frank of the University of Kentucky has uncovered no evidence that VDT work can cause injury to the human eye. The study, sponsored by The Newspaper Guild (TNG), is the second part of a two-phase effort involving members of six TNG locals in the U.S. and Canada (see *MWN*, November 1983). For a copy of the Part II report, contact TNG at 1125 15th St., NW, Washington, DC 20005.

**NIOSH Radiation Testing...**Dr. Bill Guy of the University of Washington in Seattle will measure electric and magnetic fields, induced body currents and static charges from as many as 25 VDTs under a contract with NIOSH (Order No. 85-35744). The measurements will be made at AT&T's offices in Washington, DC, as part of a Health Hazard Evaluation. Guy will complete his work by December 1 and his results will be incorporated in a report due by December 31. Previously, Guy studied VDT emissions for IBM (see *MWN*, April 1985).

**Legislation...**The Governor of Rhode Island has signed the first VDT bill to become law in 1985. On May 29, Governor Edward DiPrete approved Bill No. 85 H6097, sponsored by Representative Edward Dambruch, requiring the state's Department of Labor to produce a brochure on the proper use of VDTs in the workplace and to develop a training program for VDT workers. In Oregon on July 12, Governor Victor Atiyeh vetoed Senate Bill 57, sponsored by the Senate Interim Committee on Labor, chaired by Senator Margie Hendriksen. The bill, which had passed both houses of the state legislature, would have directed the state Workers' Compensation Board to develop guidelines for the purchase and use of VDTs in public and private offices.



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