MICRO WAVE NEWS

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INSIDE...

Microwave News invites contributions to *From the Field,* our monthly column featuring news and opinions from the non-ionizing radiation community. Letters from readers are also welcome.

RF Hazards in Honolulu

The Environmental Protection Agency (EPA) will measure radiofrequency (RF) radiation levels in Honolulu, HI, where public exposures are estimated to fall in the 1-10 mW/cm^2 range in certain locations. If confirmed, these levels would be well above the safety limits EPA plans to propose this June and the highest ever documented in an urban area in the United States. The potential hazards in Hawaii will force the federal government to establish a precedent for the enforcement of EPA's "guidance," the nation's first general population standard for RF radiation.

Although EPA has been aware of the exposure conditions in Honolulu since 1975, it had been unwilling to take measurements until last month. Now, in response to a February 14 request from the Federal Communications Commission (FCC), EPA has agreed to a field survey, which EPA Administrator William Ruckelshaus believes will provide an "opportunity for both our agencies to work together on the problems of [RF guidance] implementation."

Interviews with officials at both agencies indicate that these problems could be considerable. The issue of public safety may be sidelined as the agencies work out their respective responsibilities for enforcing RF exposure limits.

EPA staffers maintain that exposure conditions similar to those in Honolulu are possible elsewhere, although the number and magnitude of potential problems in the city are probably unmatched. Since Honolulu's zoning laws bar transmitters from the surrounding hills, broadcasters have nestled antennas in the midst of the high-rise city. A number of antennas are at eye level with apartments in adjacent buildings, and, in some cases, recreation areas share rooftops with multiple antennas.

An EPA official has estimated that the survey will cost less than $5,000.

Exposure Guidance

EPA's exposure guidance is rumored to set a 100 uW/cm^2 limit for the 30 MHz to 1 GHz band, which includes most broadcast frequencies. This limit is approximately fifty times lower than the estimated exposures in Honolulu and a factor of ten lower than the 1982 American National Standards Institute (ANSI) 1 mW/cm^2 guideline, which EPA is using as a benchmark until the guidance is proposed.

The guidance will be enforced independently by all federal agencies. Once it is signed by the President, each agency will be responsible for assuring compliance by RF and microwave sources under its jurisdiction. In his letter to FCC Chairman Mark Fowler, Ruckelshaus wrote that once the RF survey is completed, "I believe the commission should then act to correct any detected problems."

The FCC has yet to announce how it will interpret its responsibility to enforce the standard among its licensees, or more specifically, how it will respond if measurements show that exposures in Honolulu fall between the forthcoming guidance and the ANSI limit. Nor is it clear who will pay for the costs of any regulatory actions.

(continued on p.7)

HIGHLIGHTS

NCRP Study on RF Measurements

The National Council on Radiation Protection and Measurements (NCRP) has initiated a study tentatively titled "A Practical Guide to the Determination of Human Exposure to RF Radiation."

NCRP's newly established Scientific Committee (SC) 78 will develop easy-to-use guidelines for making measurements in the 10 kHz to 100 GHz frequency range and for interpreting them in light of present knowledge of biological effects. The committee, which is chaired by Richard Tell of the Environmental Protection Agency (EPA), will also investigate how to handle variations in polarization, work in the near field and allow for time averaging of signals.

In addition to Tell, the members of SC 78 are: Howard Bassen of the Food and Drug Administration's National Center for Devices and Radiological Health, Jules Cohen of Cohen and Associates, Dr. David Conover of the National Institute for Occupational Safety and Health, Dr. Carl Durney of the University of Utah (presently visiting MIT) and Ronald Petersen of AT&T Bell Labs.

NCRP Executive Director Roger Ney said that the new committee will continue the work described in NCRP Report No. 67, *Radiofrequency Electromagnetic Fields: Properties, Quantities and Units, Biophysical Interaction and Measurements* (see *MWN*, October 1981).

In a telephone interview from his office in Las Vegas, NV, Tell said that the committee plans to finish a draft report in about a year. "If we are successful," he added, "a user of a given standard will have a practical methodology to apply it."

Progress Report on New York Power Lines Studies

The Scientific Advisory Panel of the New York State Power Lines Project met in Albany, March 25-26, to review the status of 16 ongoing studies on the biological effects of 60 Hz fields. None of the studies are complete, but the preliminary findings of two investigators are causing some excitement.

The most surprising results were those of Dr. Wendell Winters, who found that exposures to electromagnetic fields at levels comparable to those under some power lines significantly enhanced the growth of cultured human tumor cells. The panel plans to ask other researchers already under contract to the project to replicate Winters's experiments.

Winters's team at the University of Texas Health Sciences Center in San Antonio exposed tumor cells grown in culture to 60 Hz electric and magnetic fields, singly and in combination, for periods of up to 24 hours. The current densities ranged from 0 to 300 mA/m^2 (a density approximately associated with an electric field of 30 kV/m) and magnetic fields from 0 to 1 gauss. Examination of cells 10-14 days after exposure indicated that the growth of tumor cells was enhanced by magnetic fields alone and by a combination of electric and magnetic fields, but not by electric fields alone.

According to project Administrator Michael Rampolla, assistance in replicating the work will be sought from Drs. Maimon Cohen of the University of Maryland School of Medicine in Baltimore and Arland Carsten of Brookhaven National Lab in Upton, NY.

In a telephone interview, Winters said that he has repeatedly achieved the same enhancement effect, which he called "quite unexpected." Winters will present his findings at the Bioelectromagnetics Society (BEMS) meeting in July.

The second set of results that sparked the panel's interest were those of Dr. Klaus-Peter Ossenkopp on low intensity ELF magnetic fields and epilepsy. Ossenkopp found that exposure for one hour to a 60 Hz alternating magnetic field of 1 gauss had a beneficial effect: it reduced the severity, duration and number of seizures in epileptic rodents treated with a seizure-inducing drug. The panel asked Ossenkopp, who is at the University of Western Ontario in London, Canada, to expand his dose-response data.

A semiannual progress report on all the studies was released before the March meeting. Though the majority of the studies are still in the preparatory stage, preliminary findings were also reported by Dr. Charles Graham of the Midwest Research Institute in Kansas City, MO, and Dr. Gordon Livingston of the University of Utah Medical Center in Salt Lake City, UT.

Graham has completed the first part of his $465,000 study on the "Influence of 60 Hz Fields on Human Behavior, Physiology and Biochemistry." According to the status report, "The results of the electric and magnetic field perception study have indicated the feasibility of conducting a valid, double blind investigation of field effects."

Livingston has failed to find an effect in his $162,000 study of "Reproductive Integrity of Mammalian Cells Exposed to 60 Hz Electromagnetic Fields." Livingston is studying human and rodent cells to see whether exposure could cause damage to cellular DNA or disturb cell growth. Human lymphocytes were exposed to a current density of 0.003-3 mA/cm^2 and a magnetic field of 2 gauss. The project summary states that Livingston found a consistent "absence of treatment effect as measured by sister chromatid exchange frequency or replication index in the human lymphocytes."

The project's two epidemiolgical studies on the possible relationship between certain types of cancer and electromagnetic fields were not far enough along to appear in the current report but will be included in the next report, due in August.

To obtain copies of the status report and the minutes of the March 25-26 meeting, contact Rampolla at the Center for Laboratories and Research, New York State Department of Health, Albany, NY 12201, (518) 474-7888.

Aircraft RFI Tests

The Federal Aviation Administration (FAA), computer manufacturers, aircraft companies and airlines are running a large number of tests to determine whether electronic devices, especially portable computers, can cause harmful

radiofrequency interference (RFI) to aircraft navigation and communication systems.

The preliminary results do not permit firm conclusions, but the magnitude of the investigation is impressive. Outlined below are some of the findings presented at the second meeting of the Radio Technical Commission for Aeronautics' (RTCA) Special Committee 156 on "Potential Interference to Aircraft Electronics Equipment from Devices Carried Aboard" held in Washington, DC, on February 28-29.

The FAA has collected path loss data aboard a Boeing 727 and concluded that an interfering signal is more likely to originate from outside the plane than from inside. In the tests run inside the plane, the signal source was placed in the aisle, however, and not next to the windows. More tests may be needed to determine if the location of the source inside the aircraft affects the likelihood of interference.

Eastern Airlines presented the results of its tests aboard Lockheed 1011, Airbus 300, McDonnell Douglas DC-9 and Boeing 727 planes in a hangar and of much more limited tests in flight. Some RFI was reported on the ground under very controlled conditions — with the interfering source outside the plane and near the target antennas. No interference was found when the plane was in flight.

Boeing and McDonnell Douglas have also completed tests, but the results were not ready in time and will be on the committee's agenda for its next meeting on June 12-13. Air Canada, United, Western and Delta Airlines also have testing programs in progress.

Representatives from Radio Shack, Apple Computer and Hewlett Packard all presented data from their respective emission tests. The findings indicate that computer peripheral equipment, such as disk drives, printers and displays, are the worst emitters and that cabling between devices is usually not shielded and could therefore amplify such emissions.

Another part of the RTCA's investigation is the search for known incidents of RFI caused by electronic equipment brought aboard the aircraft. Statistics from NASA's Aviation Safety Reporting System (ASRS), presented at the February meeting, show that there has only been one aircraft RFI incident in 30,000 safety reports. (It should be noted that ASRS is a voluntary program and there are no penalties for failing to report an unusual event.)

The incident occurred on a December 10, 1982 Eastern flight. The minutes of the RTCA meeting describe what happened: "The crew of the DC-9 had reported that all three of their navigation receivers were unreliable. Maintenance personnel had checked these receivers out and had reported no apparent problems with the navigation equipment. During the flight, flight attendants had checked the cabin area to see if any passengers were using electronic devices and had not found anyone using such devices. It was suspected that two large cases in the cargo area may have contained some sort of electronic devices or that a passenger's luggage may have contained some devices which were turned on. In any case, no positive conclusion could be reached on the cause of this interference...."

It was this incident, not previously reported in any detail, which played a role in initiating the RTCA study (see *MWN*, October 1983). For a number of months, Eastern banned the use of computers on its flights, but the airline lifted the restriction in late January (see *MWN*, March 1984).

A newly reported RFI incident was also reported at the meeting by Mr. E. Hoare of British Airways: on November 8, 1983, there were strong indications that a Sony Walkman affected the performance of an Omega system aboard a Brittania Airways Boeing 737. (Omega is a worldwide radionavigation system.)

Frank White, chairman of the RTCA committee, cautioned that these two incidents do not provide positive proof that passenger-operated devices were the sources of RFI. But, he added, they do indicate the need for more testing.

More work is planned before the June meeting. Among the assignments are additional tests with a Sony Walkman and collection of emission data from computer watches and other types of computing devices.

In general, all air carriers have been asked to test a variety of devices on aircraft to see if they cause interference. Also, one of the committee members will investigate the possibility of studying airplanes leased by the press to see if they have experienced RFI from the devices used by reporters on the road.

NJ Adopts and CT Proposes ANSI Standard

The state of New Jersey has adopted the American National Standards Institute (ANSI) guidelines for general population exposure to radiofrequency and microwave (RF/MW) radiation, a move which Connecticut may follow later this spring. The standard, which at its strictest level limits exposures to 1 mW/cm^2, will not affect commercial broadcasters, the primary source of environmental nonionizing radiation.

New Jersey

New Jersey's Commission on Radiation Protection adopted the ANSI standard at a March 28 meeting. The measure sets limits for public exposures to 300 kHz to 100 GHz radiation and establishes emission limits for microwave ovens. (Emissions are limited to 5 mW/cm^2 measured at a distance of 5 cm for units manufactured after 1971 and to 10 mW/cm^2 for units made before then.) The commission exempted emergency mobile communication services, such as police radios, from compliance. In public hearings held before the final commission vote, a representative from the state police warned that these services could be affected by a 1 mW/cm^2 limit.

Now that an RF/MW standard has been adopted, RCA's Dr. Fred Sterzer, chairman of the commission's nonionizing radiation subcommittee, told *Microwave News* that his group will address 60 Hz power line radiation. He noted that New Jersey has a voluntary field strength limit of 3 kV/m at the edge of power line right-of-ways (ROW), but that this two-year-old committee resolution is unenforce-

able. The guideline does not specify the width for ROWs.

A report of a playground located under a high power transmission line where electric fields are significantly higher than the voluntary limit aroused interest in reevaluating power line radiation safety. According to commission member Eugene Fisher of the State Bureau of Radiation Protection, only a preliminary report has been prepared and no details on the situation are available for release.

The commission, composed of representatives from state agencies, industry and the research community, is chaired by Max Weiss of AT&T Bell Labs.

Connecticut

Connecticut lawmakers will vote on adopting the ANSI standard before the legislative session ends May 6. Assembly Bill 5675, sponsored by Rep. Moira Lyons, originally called for establishing exposure limits at least as restrictive as ANSI's, but the qualifying language was dropped before the measure was reported out of the joint Environment Committee late last month (see *MWN*, March 1984).

The bill would empower the Commissioner of Environmental Protection to establish a non-ionizing radiation program for implementing and enforcing the standard. The commissioner's office would have the authority to exempt specific sources from compliance.

If the bill becomes law, Connecticut would become the third state to set its own RF/MW standard. Last year Massachusetts was the first, choosing exposure limits five times stricter than ANSI's (see *MWN*, September 1983).

Conferences: Busy Summer and Fall

The conference line-up for late summer and fall offers something for just about everyone interested in non-ionizing radiation, from ELF to visible light. And this is the year to go to Italy or Japan, if your travel budget will allow it.

In October, the Engineering Foundation will sponsor a small gathering on regulations governing the use of electromagnetic radiation. Those planning to site facilities but concerned about the uncertain and changing regulatory climate will want to consider attending the Hershey, PA, conference. You must apply, however, and attendance is limited to approximately 120 people. According to Dr. Sam Koslov, co-chairman of the conference organizing committee, the meeting is modeled on the Gordon Conferences, with all dissussions off-the-record to allow the free exchange of ideas and opinions.

Dr. Arthur Pilla of Mount Sinai Medical Center is arranging a Gordon Conference on bioelectrochemistry, especially the bioeffects and medical uses of electromagnetic energy. Pilla reports that there has already been a great deal of interest in the July 30-August 3 meeting, and he is scheduling a poster session every day. Those planning to go should consider bringing a paper along. Application forms are in the March 2 issue of *Science*, which also lists speakers and discussion leaders. Here again, a maximum of 120 attendees will be allowed.

Those working on the bioeffects of ELF and static electromagnetic fields will want to attend the Hanford Life Sciences Symposium in early October in Washington state. A preliminary program will be released by August 1. Those interested in the other end of non-ionizing spectrum will want to consider attending a meeting on the medical and biological effects of visible light to be held at the New York Academy of Sciences at the end of October.

If you can afford to go further afield there are two meetings in Italy this summer and two in Japan in the fall. The 21st General Assembly of the International Union of Radio Science (URSI) will be held in Florence at the end of August through early September. At that time there will be an open symposium on the interaction of electromagnetic fields with biological systems. Two weeks after URSI, a NATO workshop on electromagnetic field effects on cells will be held in Erice, on the island of Sicily. Attendance at the workshop is by invitation only.

There will be an international symposium on electromagnetic compatibility (EMC) in Tokyo in mid-October and the annual meeting of the Bioelectrical Repair and Growth Society (BRAGS) will be in Kyoto at the beginning of November. Special travel arrangements are being made for those wishing to attend both these meetings. For information on travelling to the EMC meeting, contact Donick Travel & Tours, 12425 Rancho Bernardo Rd., San Diego, CA 92128, (619) 451-2330; for the BRAGS meeting, contact the International Professional Meeting Coordinators, 711 Third Avenue, New York, NY 10017, (800) 221-2216, or (212) 757-5710 in New York. Details for all these conferences are provided below.

- July 30-August 3: *Bioelectrochemisty*, Tilton School, NH. Contact: Dr. Alexander Cruickshank, Gordon Research Center, University of Rhode Island, Kingston, RI, 02881, (401) 783-4011, or Dr. Arthur Pilla, Bioelectrochemistry Lab, Mount Sinai Medical Center, New York, NY 10029, (212) 650-7741.

- August 27-30: *Open Symposium on Interaction of Electromagnetic Fields with Biological Systems*, Florence, Italy. Contact: Dr. Elliot Postow, Naval Medical R&D Command, National Naval Medical Center, Bethesda, MD 20814, (202) 295-1140 or Ms. Alma Paoluzi, Physics Lab, Istituto Superiore di Sanita, Viale Regina Elena, 299, 00161 Rome, Italy. For information on the URSI General Assembly, to be held August 28-September 5 in Florence, contact: Professor A.M. Scheggi, IROE-CNR, Via Panciatichi, 64, 50127 Florence, Italy, (55) 4378512.

- September 17-21: *NATO Advanced Research Workshop on Interactions Between Electromagnetic Fields and Cells*, Erice, Italy. Contact Prof. A. Chiabrera, Biophysical and Electronic Engineering Department, Via all'Opera Pia, 11A, 16145 Genoa, Italy, (10) 311811

- October 2-4: *Interaction of Biological Systems with Static and ELF Electric and Magnetic Fields*, Holiday Inn, Richland, WA. Contact: Patricia Bresina, Biology and Chemistry Dept., Battelle Pacific NW Labs, PO Box 999, Richland, WA 99352, (509) 376-0100.

• October 16-18: *1984 International Symposium on Electromagnetic Compatibility,* Hotel Pacific, Tokyo, Japan. Contact: Professor T. Takagi, Dept. of Communications, Tohoku University, Sendai, 980, Japan, (0222) 22-1800, ext. 4266.

• October 21-26: *Managing the Electromagnetic Environment,* Pocono Hershey Resort, White Haven, PA. Contact: Harold Comerer, Engineering Foundation, 345 East 47th St., New York, NY 10017, (212) 705-7835.

• October 31-November 2: *Medical and Biological Effects of Light,* Barbizon-Plaza Hotel, New York, NY. Contact: New York Academy of Sciences, 2 East 63rd St., New York, NY 10021, (212) 838-0230.

• November 5-8: *4th International Meeting of the Bioelectrical Repair and Growth Society,* Holiday Inn, Kyoto, Japan. Contact: BRAGS, 425 Medical Education Bldg., 36th & Hamilton Walk, Philadelphia, PA 19104, (214) 898-8653.

Oven Sales Rebound in 1983

Microwave oven sales rebounded last year, with factory shipments running 64 percent over 1982's disappointing levels. Year-end figures from the Association of Home Appliance Manufacturers (AHAM) show that over six million units were shipped in 1983, two million more than the year before and a new annual record.

Shipments reached an all time high for one month when 737,800 units were sent out from factories in January 1984, supporting recent predictions that this will be another record year. In estimates released before the exceptionally strong December and January showings, AHAM predicted 1984 sales would fall a little short of 1983.

According to industry surveys, approximately 30 percent of American households already have microwave ovens.

Though sales are up, highly competitive marketing has left many retailers scrambling for profits. The February 13 *Home Furnishing Daily* (now a weekly) reports that some ovens are selling for as little as $139. As profit margins slip on many ovens, retailers push different models and hard sell accessories. *HFD* cites one store owner who explains, "If you merchandise microwave ovens today the same way as you did one year ago, you'll lose money."

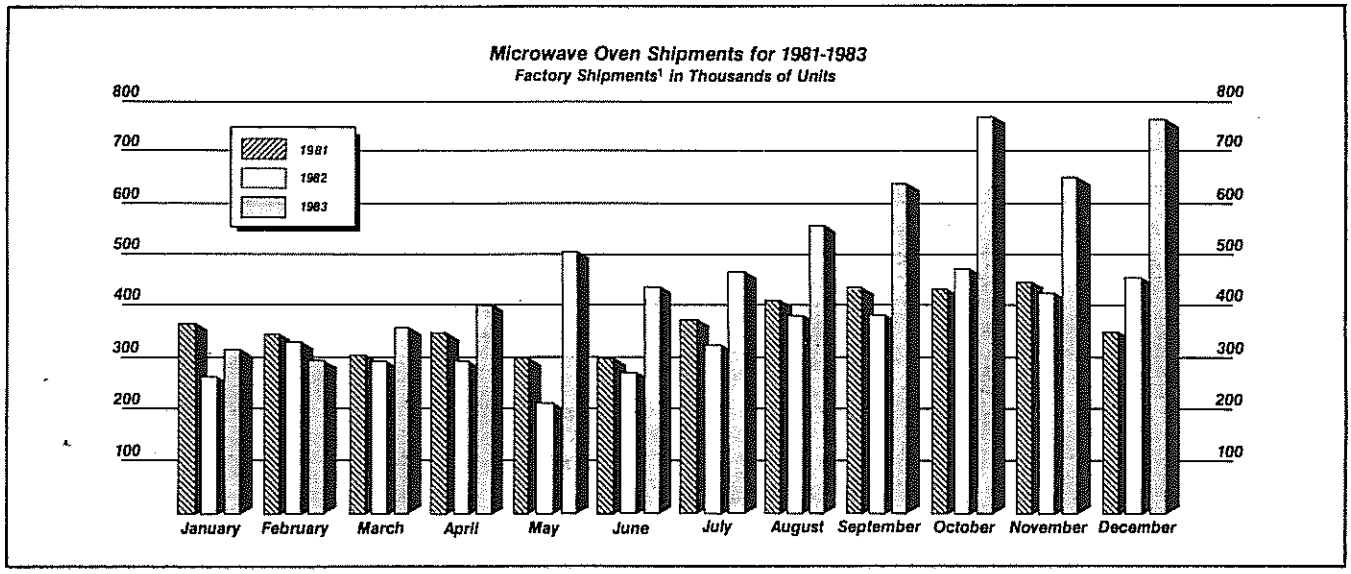
It appears that compact ovens will be a strong growth area in 1984. Sanyo's national sales manager predicted in the March 26 *HFD* that compacts will make up more than 30 percent of the seven million ovens he expects will be sold in 1984. He noted that, although market saturation is relatively high in urban areas where small ovens sell best, the premium on space in city apartments sustains the demand for compacts.

Selling compacts does not preclude offering consumers a stunning array of models and options. For example, one of the new Litton-Aire Generation II over-the-range ovens automatically determines cooking time and power setting and Magic Chef's Big-Little ovens can now be built into a wall with a special kit.

The upswing in microwave oven demand is clearly demonstrated in the table and chart below, which is based on AHAM statistics for ovens shipped in 1981-83.

Microwave Oven Shipments[1] (in Thousands)

		% Change Over				% Change Over	
	1983	1982	1981		1983	1982	1981
Jan.	312.0	16.7	-13.8	July	461.4	42.6	25.7
Feb.	291.0	-10.2	-12.8	Aug.	544.4	45.9	35.5
Mar.	356.5	20.4	18.9	Sept.	635.7	66.2	48.4
Apr.	398.2	39.4	17.0	Oct.	770.7	63.8	76.8
May	492.4	132.2	66.4	Nov.	648.1	52.9	46.0
June	431.3	55.3	29.1	Dec.	771.6	77.6	113.1
				Annual Total:	6113.3	50.2%	38.8%



[1]Includes US produced and imported microwave ovens and combination microwave ovens/ranges.
Source: the Association of Home Appliance Manufacturers (AHAM)

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SHORT COURSES

May 1-3: Mutual Design of Natural Gas Pipelines and Electric Power Lines, Palo Alto, CA. Fee: $75 (EPRI members), $275 (non-members). *Contact: John Dunlap,* Electric Power Research Institute (EPRI), PO Box 10412, Palo Alto, CA 94303, (415) 855-2305.

May 2-4: Health Safety and Other Human Factor Issues in Computer Graphics, Washington, DC. Fee: $695. Contact: George Harrison, Continuing Engineering Education, George Washington University (GWU), Washington, DC 20052, (800) 424-9773, or (202) 676-6106 in DC.

May 7-11: Electromagnetic Interference and Control, Washington, DC. Fee: $875. Contact: GWU, see May 2 above.

May 7-11: Microwave Circuits Design: Linear Circuits, Palo Alto, CA. Fee: $895. Contact: Continuing Education Institute (CEI), 5410 Leaf Treader Way, Columbia, MD 21044, (301) 596-0111 or (213) 824-9545. Repeated ***June 4-8:*** Boston, MA.

May 8-11: Grounding & Shielding, Honolulu, HI. Fee: $815. Optional fourth day for $235. Contact: Don White Consultants Inc. (DWCI), Star Route 625, PO Box D, Gainesville, VA 22065, (703) 347-0030. Repeated ***June 19-22:*** Chicago, IL.

May 14-18: Fundamentals of Communication Satellite Systems, Washington, DC. Fee: $875. Contact: GWU, see May 2 above.

May 15-17: Seminar on Mutual Design of Overhead Transmission Lines and Railroad Communications and Signal Systems, Chicago, IL. Fee: $100 (approx.). Contact: EPRI, see May 1 above. Repeated ***June 19-21:*** Washington, DC; ***September 11-13:*** Atlanta, GA.

May 15-17: Design Methods for Emission and Susceptibility Control, Boston, MA. Fee: $695. Contact: EMXX Corp., 6766 Deland Dr., Springfield, VA 22152, (703) 451-4619. Repeated ***June 25-27:*** Sunnyvale, CA.

May 15-17: An Introduction to EMI/RFI/EMC, Los Angeles, CA. Fee: $815. Contact: DWCI, see May 8 above.

May 18: Electrostatic Discharge Control, Boston, MA. Fee: $275. Contact: EMXX, see May 15 above.

May 21-23: Hazardous RF Electromagnetic Radiation, Washington, DC. Fee: $695. Contact: GWU, see May 2 above.

May 21-25: Microwave Circuit Design I: Linear Circuits, Los Angeles, CA. Fee: $895. Contact: UCLA Extension Short Course Program, PO Box 24901, 6266 Boelter Hall, Los Angeles, CA 90024, (213) 825-1295.

May 21-25: Radar Systems & Technology, Washington, DC. Fee: $875. Contact: GWU, see May 2 above.

May 21-25: Radiation Safety Officer's Course, San Antonio, TX. Fee: $650. Contact: Medical School Continuing Education Services, University of Texas Health Science Center, 7703 Floyd Curl Dr., San Antonio, TX 78284, (512) 691-6295.

May 22-25: MIL-STD-461/462 & System-Level EMI Testing & Procedures, Washington, DC. Fee: $995. Contact: DWCI, see May 8 above.

May 22-25: Modern Antennas, Washington, DC. Fee: $675. Contact: Linda Billard, Technology Service Corp (TSC), 8555 16th St., Suite 300, Silver Spring, MD 20910, (800) 638-2628, or (301) 565-2970 in MD.

May 24-26: European Workshop on Nuclear Resonance in Medicine, Wiesbaden, West Germany. Fee: $260. Contact: Dr. Peter Rinck, PO Box 2149, D6200 Wiesbaden 1, West Germany.

May 31-June 1: MIL-STD-461/462 Test Workshop, Suburban Philadelphia, PA. Fee: $575. Contact: R&B Enterprises, 20 Clipper Rd., W. Conshohocken, PA 19428, (215) 825-1960.

June 4-5: Lightning Protection, Washington, DC. Fee: $625. Contact: GWU, see May 2 above.

June 5-8: Radar Cross-Section Measurement Techniques, Atlanta, GA. Fee: $675. Contact: TSC, see May 22 above.

Different Views at FCC and EPA

EPA's willingness to take measurements in Honolulu is a recent change in policy. Correspondence obtained through the Freedom of Information Act by *Microwave News* reveals that as late as last fall officials at EPA's Office of Radiation Programs (ORP) were reluctant to start a field study, although they acknowledged that exposures created by commercial FM broadcast sources probably exceeded 1 mW/cm^2. (For excerpts of the letters and memoranda on the Hawaii radiation situation, see pp.8-9.)

In a November 28, 1983 letter to a concerned resident, which was later forwarded to Honolulu Councilwoman Marilyn Bornhorst and Hawaii Senator Daniel Inouye, ORP's David Janes stated there was sufficient evidence of a hazard without EPA measurements for residents to seek "corrective action." Janes cited measurements taken by Robert Hall, a Honolulu resident, and calculations made by Richard Tell, an EPA physicist in Las Vegas, NV.

Janes noted that it is "highly unlikely" that the agency will select limits higher than ANSI's 1 mW/cm^2 guideline and that, "Therefore, as an interim position, the agency considers exposures above the ANSI limit to be excessive."

The letter advised that EPA had no enforcement authority and recommended that concerned parties approach the broadcasters involved, the FCC, state health officials or local zoning officials.

The FCC strongly disagreed with EPA's conclusion. Having learned of the potentially hazardous situation in Honolulu from Councilwoman Bornhorst, FCC's Fowler wrote to EPA's Ruckelshaus on February 14 to argue that no "adequate measurement data are available on which to base any decision on corrective action," and that only EPA has the expertise to take these measurements.

Just what the commission will do if EPA provides evidence of unacceptably high exposures is unclear. Since commercial broadcasters are the primary source of environmental non-ionizing radiation exposures for the general public, the FCC could play a key role in implementing the guidance. The commission has announced its intention to enforce the guidance among new or modified broadcast facilities under the National Environmental Policy Act, but has said nothing about how it will handle existing sources.

The FCC's lack of a non-ionizing radiation program, as well as its lack of a radiation safety policy, worries EPA officials who believe the commission must develop its own resources for ensuring that commercial broadcasters comply with the guidance. The agency's March 12 response to the FCC pointed out that the field survey should give FCC field personnel "some valuable experience and training on how to measure potentially hazardous levels of radiofrequency radiation." Although the FCC has offered to help with the survey, it has not made a commitment to send its field personnel, who specialize in measuring sources of RF interference.

The FCC maintains that it is only reasonable for the commission to take a wait and see attitude, given the years EPA has already spent developing RF guidelines. As for the immediate problem in Honolulu, the commission's Robert Cleveland would only say that "we have never been faced with a situation like this before, and our general counsel's office is currently exploring our possible options." Another staffer, who asked to remain anonymous, explained that "the ball is in EPA's court until they provide hard evidence of exposures they consider to be hazardous."

EPA Action in 1975

Conditions in Honolulu were first reviewed by EPA in 1975, in response to a request from the Hawaii Department of Health after the state legislature ordered an RF hazard study. The calculations subsequently prepared by Tell revealed that exposures in several locations near broadcast sources could exceed 1 mW/cm^2 and go as high as 6 mW/cm^2 on the rooftop of one hotel. Requests for actual measurements to confirm these estimates have been made periodically by residents and state officials since the publication of Tell's report, *An Analysis of Broadcast Radiation Levels in Hawaii,* (Technical Note No. ORP/EAD-75-1) in August 1975.

The agency initially argued that actual measurements were not needed because the calculated levels were below the Occupational Safety and Health Administration's (OSHA) 10 mW/cm^2 voluntary standard for worker exposures, which was based on the then current ANSI guidelines. ANSI revised its standard downward from 10 to 1 mW/cm^2 for the 30-300 MHz band in 1982.

In 1975, EPA's Acting Deputy Assistant Administrator for Radiation Programs William Mills summed up the agency's position, stating that even if the estimates were confirmed by field measurements, "there would be no further guidance we could give at this time. Therefore, field studies [in Honolulu] are not required at this time."

Although the agency was planning to measure environmental levels to help develop its guidance, Mills explained that: "It is our determination that these efforts can most efficiently be carried out on a generic basis by a prescribed set of metropolitan area surveys. The choice of metropolitan areas will be based on their ease of access, representative characteristics and potentially unique contributions. These criteria do not appear to be met by the Hawaii situation."

No readings in subsequent field surveys in 15 cities approached the levels calculated for Honolulu. In its advanced notice for proposing the guidance (47 *FR* 57338, December 23, 1982), the agency reported that the maximum levels found near FM antennas were 350 uW/cm^2 in a residential neighborhood and 97 uW/cm^2 in an office building. The agency estimated that more than 99 percent of the population is exposed to less than 1 uW/cm^2 (see *MWN*, January/

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February 1983).

The only measurements on a par with calculated levels for Honolulu were taken at an isolated antenna farm on Mt. Wilson in California, where EPA found maximum readings in the 1 to 7 mW/cm^2 range. The agency's April 1977 report on these readings (ORP/EAD-77-2) states that Mt. Wilson is "probably unique to the entire nation in terms of source density and total number of stations."

Current Status

In describing developments in Honolulu since 1975, EPA's Tell reported in an October 25, 1983 memo to ORP's Janes that "the principal change has been an increase in the number of roof-mounted broadcast antennas." He wrote that measurements taken without professional assistance by Robert Hall were as high as 8.2 mW/cm^2 on the rooftop of the Villa at Eaton Square condominium. Noting that the readings "are in the range of my calculations," Tell concluded that "the time has come to conduct a careful field study in Honolulu."

In a telephone interview, Hall told *Microwave News* that he believes his measurements "were fairly accurate," though he stressed the need for "independent verification."

The scope of the EPA field survey in Honolulu has not been determined. The letters between the FCC and EPA only mention the Villa condominium, though Tell's 1975 report and subsequent correspondence between Tell and Hall indicate there are a number of similar trouble spots in the city. The FCC's Cleveland told *Microwave News* that the commission expects EPA to take measurements at a number of sites.

Tell suggested in the October 25 memo that the Hawaii survey be expanded to include the Lualualei Naval Communications Area Master Station and the US Coast Guard Omega low frequency navigational station elsewhere on the island. Tell noted that these sites would "fit directly into our interest of conducting federal guidance impact investigations at US government facilities that have been suggested as possibly exceeding our proposed guidance exposure limits." ●

EXCERPTS

Correspondence and Memoranda on RF Radiation in Honolulu, 1975-1984

Excerpted below are letters and memoranda to and from the Environmental Protection Agency (EPA) and the Federal Communications Commission (FCC) regarding radiofrequency radiation exposures in Honolulu, HI. The material was obtained by Microwave News *through the Freedom of Information Act.*

The following abbreviations are used for state and federal offices: EPA/ORP — EPA Office of Radiation Programs, Washington, DC; EPA/SF — EPA Regional Office for Region IX, San Francisco, CA; EPA/LV — EPA Electromagnetic Radiation Analysis Branch, Las Vegas, NV; EPA/HI — EPA State Office, Honolulu, HI; HDH — Hawaii Department of Health, Honolulu, HI.

May 22, 1975: Letter from George Yuen, HDH, to James Channell, EPA/SF. The Hawaii State Legislature has adopted a resolution...requesting the State Department of Health to study the possible effects of radiation emission from broadcast towers and the advisability of their relocation or redesign....[We] call on you for assistance in conducting investigations of radiation emission from broadcast towers located in Honolulu....

July 3, 1975: Memorandum from W.D. Rowe, EPA/ORP, to Frank Covington, EPA/SF. At this time it is premature to discuss field verification studies, since the need for such studies strongly depends upon the bounds placed on potential and possible exposure by the analytical study [of Honolulu exposures] now underway....

August 21, 1975: Memorandum from William Mills, EPA/ORP, to Frank Covington, EPA/SF. Enclosed is a report prepared by Mr. Richard Tell of our Environmental Analysis Division, which examines the potential for exposure to radiation from broadcast stations in Hawaii....There is a potential for a small number of people to be exposed in the range from 1 to 10 mW/cm^2. We term this a significant exposure range, because it lies within a factor of 10 of the occupational exposure standard, and it is of interest to document such potential exposures should research indicate that a limiting criteria should be established somewhere in this range....We would not recommend that any present action be taken by the Hawaiian State Health Department....Because none of the calculated values exceeds 10 mW/cm^2, verification that actual values are as high as calculated values would not alter our recommendation....The choice of metropolitan areas [for field studies] will be based on their ease of access, representative characteristics and potentially unique contributions. These criteria do not appear to be met by the Hawaii situation....

September 3, 1975: Memorandum from Richard Tell, EPA/LV, to James Channell, EPA/SF. In actuality the only exact method of determining the exposure level [in Honolulu] would be careful field measurements....

April 12, 1977: Letter from Robert Hall, Director, Yacht Harbor Towers Condominium Association, Honolulu, to EPA/HI. As a direct result of the new television antenna atop the Ala Moana Hotel, we have [seven] questions that reflect our concern....

April 15, 1977: Letter from Richard Tell, EPA/LV, to Robert Hall. ...a value of 0.9 mW/cm^2 might occur at a distance of 350 feet from the [Ala Moana Hotel] antenna complex, the distance you say your building is from the Ala Moana....I am most interested in keeping in touch about this situation....

April 27, 1977: Letter from Robert Hall to Richard Tell, EPA/LV. According to information that I have developed and information that you have sent to me, we apparently have a theoretical possibility of 450 uW/cm^2 in my apartment and 540 uW/cm^2 in an apartment on the 40th floor....I request that your agency take on-site readings in Honolulu....

May 6, 1977: Memorandum from Richard Tell, EPA/LV, to David Janes, EPA/ORP. ...the Yacht Harbor Towers in Honolulu may well represent an ideal site for [a detailed, single building] study in that the situation has already uncovered itself, and the maximum exposures are predicted to be very intense relative to our other metropolitan area survey measurements....

November 16, 1977: Letter from Edward Kuramoto, HDH, to James Channell, EPA/SF. I have enclosed a copy of "Electronic Smog in Honolulu" by Robert W. Hall and a copy of a survey report done for KITV Channel 4 by John Mullaney, Consulting Radio Engineer, "Engineering Statement in Support of Response to Comments of Robert W. Hall Regarding Electronic Smog in Honolulu." Would you please determine if Mr. Mullaney's report appears to be valid....

December 2, 1977: Letter from Richard Tell, EPA/SF, to John Mullaney, Consulting Radio Engineers Inc., Potomac, MD. I was happy to see that you have recently conducted [field] measurements to determine the actual exposure levels....From our own estimates of population exposure I have determined that your measured values of electric field strength by Mr. Hall's apartment mean that the exposure is more than an order of magnitude greater than our estimate of the median exposure in the cities we have looked at and represents a value to which only five percent of these cities' populations are more intensely exposed....

October 26, 1979: Letter from Richard Tell, EPA/LV, to John O'Connor, FCC, Washington, DC. In accordance with our recent telephone conversation...regarding a new proposed UHF TV installation in Honolulu, Hawaii...I am writing to you concerning my analysis of this situation. My analysis was prompted by the close proximity of the proposed installation to nearby high rise buildings and a concern over the possibility of a radiofrequency radiation hazard should the station be constructed....I feel that it would be wise to obtain and very carefully evaluate detailed information pertaining to this installation before it is concluded that it will be perfectly safe....

October 8, 1983: Letter from Robert Hall, Hawaii Institute for Biosocial Research, Honolulu, to Richard Tell, EPA/LV. Since your original study, *An Analysis of Broadcast Radiation Levels in Hawaii* in August of 1975, the situation in Honolulu has changed considerably with regard to several new stations and generally more power....I have personally talked with a supervisor for the painting contractor for the [Villa on Eaton Square] where he reported that his men had difficulty handling metal objects while painting the side of the building facing the [KPOI-FM] tower....

October 25, 1983: Letter from Richard Tell, EPA/LV, to Robert Hall. We have performed a cursory look at the authorized broadcast stations in Honolulu following your inquiry and have noted a significant increase in the number of roof-mounted transmitting antennas....A major factor in interpreting the situation in Honolulu is the extremely complicated environment of many tall buildings with high power broadcasting facilities located on rooftops and adjacent tall towers....The only way to accurately determine these exposure levels is via careful field measurements which take into account the polarization of the incident fields, the frequency of the many signals simultaneously illuminating a given area and the complex reflection patterns which occur in such situations....

October 25, 1983: Memorandum from Richard Tell, EPA/LV, to David Janes, EPA/ORP. Mr. Hall's most recent letter provides some rooftop measurement data taken on the Villa on Eaton Square that show exposures as high as 8.2 mW/cm^2. In all honesty I don't know if the instrument he used was properly functioning but his data are in the range of my calculations. I believe that the time has come to conduct a careful field study in Honolulu....

November 1, 1983: Letter from Robert Werner, President, Villa on Eaton Square Board of Directors, Honolulu, to Richard Tell, EPA/LV. If you feel we are excessively concerned about this [RF exposure] situation please explain to us the reasons why we should be less concerned. On the other hand, if our situation is potentially dangerous, corrective action must be initiated now and a field study by your agency could provide us with the foundation necessary to launch such a program....

November 28, 1983: Letter from David Janes, EPA/ORP, to Robert Werner. Both model calculations by our Non-Ionizing Radiation Branch and measurements by the Hawaii Institute for Biosocial Research [Robert Hall] indicate that fields on the roof of the Villa exceed the recommendations of the American National Standards Institute (ANSI). This should be enough information for you to seek relief....In developing [RF] guidelines it is highly unlikely that EPA would choose levels in excess of the present ANSI voluntary standard and we may select lower levels. Therefore, as an interim position, the agency considers exposures above the ANSI limit to be excessive....We do not believe that additional measurements are needed for you to begin to explore avenues of corrective action....

December 8, 1983: Letter from Honolulu Councilwoman Marilyn Bornhorst to EPA/DC. [Honolulu] is a city with many high rises and very many radio and television transmitting stations. If there is a health problem to my consituents, I would like to know and I would like to have your best advice as to how this danger can be corrected....

December 21, 1983: Letter from David Janes, EPA/ORP, to Councilwoman Marilyn Bornhorst. We have received correspondence on [high RF levels in Honolulu] from Mr. Robert Werner and Senator Daniel K. Inouye and I have enclosed copies together with copies of our replies....If levels exceed those specified in the American National Standards Institute's (ANSI) standard, 1 mW/cm^2 for most of the broadcast frequencies, relief should be sought from the operator of the source, the Federal Communications Commission or state or local health or zoning authorities.

February 14, 1984: Letter from Chairman Mark Fowler, FCC, Washington, DC, to Administrator William Ruckelshaus, EPA, Washington, DC. We do not feel that adequate measurement data are available on which to base any decision on corrective action....Furthermore, the FCC lacks the resources and expertise to conduct the very specialized type of survey that would be required in this type of situation....We, therefore, ask that you commit the resources necessary to obtain the data needed on the RF environment in Honolulu. We will be happy to cooperate and assist in this endeavor to the full extent of our capabilities, but we must emphasize that although the commission may have certain jurisdictional authority over the broadcast transmitters in question, we are heavily dependent on EPA to provide us with the technical assistance necessary to determine the near-field RF environment in and around the area in question....

February 17, 1984: Letter to Councilwoman Bornhorst from Robert Powers, FCC. It is difficult at the present time to answer all of your questions satisfactorily since we feel that a comprehensive survey must be performed before we or any other government organization can determine whether a potential health hazard may exist at the location in question....We would also suggest that you consider contacting your local broadcasters and the Hawaiian Association of Broadcasters for assistance in resolving this matter....

March 12, 1984: Letter from Administrator William Ruckelshaus, EPA, to Chairman Mark Fowler, FCC. The field study you propose could provide an opportunity for both our agencies to work together on the problems of [guidance] implementation. The study should also give your field personnel some valuable experience and training on how to measure potentially hazardous levels of radiofrequency radiation. Once the study is completed, I believe the commission should then act to correct any detected problem....

UPDATES

BIOLOGICAL EFFECTS

News from Poland... Recent experiments carried out by Dr. Stanislaw Szmigielski in Warsaw indicate that microwave radiation can act as co-teratogen. In a letter to *Microwave News*, Szmigielski writes that he and his co-workers have found that microwaves enhance the teratogenicity of an anti-neoplastic drug, cytosine arabinoside (ara-C), in pregnant mice. Ara-C is itself a potent teratogen and when administered alone caused defects in 30 percent of the offspring. Microwave radiation alone did not result in an increase of resorption or malformations until hyperthermia was evoked at 40 mW/cm^2. When the mice were given the drug and simultaneously exposed to "non-thermal power levels" of 2450 MHz radiation (10 mW/cm^2), approximately 70 percent of the fetuses were deformed. Szmigielski concludes that "microwave radiation, not being teratogenic per se, enhances the teratogenic potency of other compounds and thus acts as co-teratogen." Szmigielski, who is at the Department of Biological Effects of Non-Ionizing Radiation at the Center for Radiobiology and Radioprotection in Warsaw, has submitted a paper detailing these results to *Teratology*.

Teratology at 6 GHz... Dr. Ronald Jensh of Jefferson Medical College in Philadephia, PA, has also been studying the teratologic potential of microwaves, but at higher frequencies. In two papers published in the February 1984 issue of *Radiation Research*, he describes the first experiments on the effects of 6 GHz microwaves on the developing organism. (Satellite communications as well as terrestrial telephone and television transmitters operate at this and nearby frequencies.) Jensh exposed pregnant mice to 35 mW/cm^2 microwaves (SAR = 7.28 W/Kg) throughout pregnancy; a level that did not cause a significant increase in maternal body temperature. At birth, he found that the 6 GHz radiation was "not overtly teratogenic," although the fetuses showed "slight but statistically significant growth retardation." Jensh suggests that this effect "may be a manifestation of a generalized heat-stress reaction." Among the mothers, there was a significant lowering of monocytes (a type of white blood cell). Jensh then followed the post-natal development of the offspring. He found that "the sexes appeared differentially affected." Irradiated females exhibited decreased and males increased activity levels in open field tests. Jensh concludes that the exposures "may result in subtle long-term neurophysiologic alteration not detectable at term using conventional morphologic teratologic procedures."

COMPATIBILITY & INTERFERENCE

FMAC on RFI...NTIA's Frequency Management Advisory Council (FMAC) has released a report on the cooperative effort between government and industry to reduce the susceptibility of consumer electronic devices to RFI. Because consumers must generally accept interference caused by authorized radio services, NTIA, on request, has been helping manufacturers design new products with a greater degree of electromagnetic compatibility by providing them with information about these services. FMAC has concluded that this effort should be continued and expanded. For information on *Coordination to Enhance Interference Rejection of Consumer Electronic Devices*, FMAC 36A-83, contact NTIA's Charles Hutchison, (202) 377-0805.

Radio Marti Snags... Radio Marti will not be beaming broadcasts to Cuba this month, and it now looks as though startup could be six months away. The Voice of America has leased office space for Marti headquarters, but not one of the 48-member staff is on board. The main reason, according to USIA Director Charles Wick, quoted in the March 29 *Broadcasting*, is time consuming security checks on potential candidates. He explained: "I'm sure you can imagine that Castro would just love to infiltrate this operation." Meanwhile, the March 14 *Washington Post* reported that Cuba's vice president has called Radio Marti an act of aggression, warning that Cuba will retaliate by jamming US broadcasters. All this has prompted the FCC to adopt final rules for compensating AM broadcasters for the cost of mitigating this RFI, as mandated by last year's Radio Broadcasting to Cuba Act (see *MWN*, November 1983). The new regulations, adopted March 15, allow compensation of up to $250,000 per case and go into effect August 1. In order to qualify, a station must experience interference "for at least 30 out of 60 consecutive days." How will the US react on a diplomatic level? Wick told Congress that he did not know what to recommend.

Power Systems EMC... There will be a one-day tutorial on "Electromagnetic Compatibility in Power Systems" on June 18 at the *1984 Power Electronics Specialists Conference* at NBS in Gaithersburg, MD (see Conference Calendar for details). Organized by Professor Ralph Showers of the University of Pennsylvania, the tutorial will review, among many other topics, the "techniques of measurement and control and the role of various standards, both voluntary and non-voluntary, in influencing the design of power systems." The following evening, a "rap session" on "EMI, RFI and Noise" will be moderated by R. Massey of AT&T's Bell Labs. The cost of the tutorial is $60 for IEEE members, $80 for non-members.

Changing Times...EMC engineers must adapt to changes in technology or they will become an endangered species. So says Dr. Heinz Schlicke, who spent 25 years at Allen-Bradley Co. and is now a freelance consulting engineer based in Milwaukee, WI. In a guest editorial appearing in the February issue of *IEEE Transactions on Electromagnetic Compatibility*, Schlicke warns: "Relearn or face obsolescence, that is the technical reality." Schlicke believes that the introduction of fiber optics will radically change the work of the EMC engineer, because it will make many systems immune to RFI. Instead of troubleshooting when faced with an interference problem, the EMC expert will have to participate in designing the *whole* system. In the course of a telephone interview with *Microwave News*, Schlicke cited a case of RFI at an automated shoe factory, located next to a railroad with steam engine locomotives. When the railroad was electrified, the factory started pro-

ducing only shoes for left feet. Schlicke emphasized that as factories become more and more automated, the costs of RFI are measured in thousands of dollars a minute when production lines are halted. EMC must be guaranteed in the factory design; it cannot wait until the factory is operational.

GOVERNMENT

Regulations and Standards... In the first part of a special report, "The Drive to Regulate Electromagnetic Fields" published in the March issue of *IEEE Spectrum,* Eric Lerner contrasts concerns over occupational and general population exposures to RF/MW radiation and illustrates the trend towards convergence among Eastern and Western standards. On the first point, he writes: "Paradoxically, while there is growing support for a standard to protect the public, which is rarely exposed to even moderate levels of EM fields, there is little pressure for a similar compulsory standard to protect employees at their work places, where the highest exposures occur....Thus, in some cases, regulators deem exposure levels as low as a few [hundredths of a uW/cm^2] sufficient to prevent a radio antenna from being built, as occurred in both the states of Washington and New Jersey, while at the same time state and federal agencies are permitting the exposure of some workers to radiation at 100 mW/cm^2, several million times more intense." Lerner notes for example that as many as 250,000 workers, "mostly women in a dozen industries, use [RF heaters and sealers] to make raincoats, handbags, furniture and a hundred other products" and that they are exposed to levels in excess of the new ANSI standard and often greater than even the old ANSI 10 mW/cm^2 standard. On another front, Lerner points to an emerging dichotomy among national standards: although the differences between, for instance, the Soviet and the ANSI standards are narrowing, Eastern and Western standards are being based on different quantitites. "For the Soviet, Chinese and Eastern European standards, total absorbed energy per unit mass...is key, while for the US standards, it is the rate of energy absorption per unit mass...Thus, for exposures of half an hour a day or less, there is in fact little difference among various national standards, but for a full working day there is still a factor of 40 separating Soviet and US standards." Lerner will be publishing a second article on EM fields in the May issue of *IEEE Spectrum,* focusing on recent research in biological effects, especially on the impact of weak fields. The May article, like the March one, is based on a round table discussion among a number of RF/MW experts who attended last summer's Bioelectromagnetics Society annual meeting.

MEDICAL APPLICATIONS

Hyperthermia Assessment... The Office of Health Technology Assessment (OHTA) in the Public Health Service is assessing what is known about the safety, clinical effectiveness and use of hyperthermia to treat superficial and subcutaneous tumors. OHTA will investigate: (1) hyperthermia used alone; (2) hyperthermia used with chemotherapy and (3) hyperthermia used with radiation therapy. OHTA wants to know if hyperthermia has significant advantages or disadvantages when compared to other modes of treatment. The assessment will be used by the Health Care Financing Administration in setting Medicare coverage policy. OHTA is encouraging public comments. For more information see the agency's notice in the March 13 *Federal Register* (49 *FR* 9476) or call Bette Lemperle at (301) 443-4990. Comments are due by May 14.

MILITARY SYSTEMS

Clear Accident... Alaska Congressman Don Young has asked the General Accounting Office (GAO) for a "detailed" investigation of the September 14 radar accident at Clear Air Force Station near Fairbanks, Alaska (see *MWN,* November 1983 and January/February 1984). In a March 8 letter, Young wrote that his purpose is "to insure that the affected employees have been afforded the best available medical evaluation, treatment and follow-up entitled to under law." To that end, Young asked for a review of Air Force actions and for a check that FELEC Services Inc., an ITT subsidiary, has complied with its AF contract. Young's request has been referred to GAO's National Security and International Affairs Division. Meanwhile, three of the six men who were exposed to microwaves have gone to Boston, MA, for further medical examinations.

Electromagnetic Envelopes... On March 30, the Associated Press' Barton Reppert reported that the "super-secret National Security Agency plans to shroud its main operations building at Fort Meade in an 'electromagnetic envelope' to prevent leakage of electronic signals that might be detected by spies." In congressional testimony, NSA Assistant Director Dale Seaberg said that the agency plans to include a $12.7 million "TEMPEST and energy retrofit package" for one of the operations buildings at its Maryland headquarters. Little is disclosed about the NSA budget and how much is spent to prevent the leakage of spurious signals that could be decoded by outsiders, but Seaberg did tell Congress: "We estimate that we now spend $4.5 million each year to build TEMPEST features into the individual pieces of equipment we buy. Provision of an electromagnetic envelope around the building will obviate the need for these expenditures." NSA's TEMPEST standard is classified — indeed the meaning of the term TEMPEST is itself secret — so the cost of meeting the specified leakage level is not commonly known. An item in the January 1984 *Defense Electronics* estimates that the costs of securing electronic equipment is "usually two or three times the price of commercial counterparts."

OVENS

A New Hazard...A medical doctor has reported a case in which radiation leaking from a microwave oven caused burns by heating up the metallic adhesive attached to a transdermal delivery patch. Such patches are a relatively new and increasingly popular way to deliver a drug over time — in this case, the patch dispensed nitroglycerine to a patient with a heart condition. Writing in the March 15 issue of the *New England Journal of Medicine,* Dr. Kent Murray of the University of Kansas School of Medicine in Wichita

describes how a 51-year old man received a second-degree burn from a Transderm Nitro-10 patch while sitting next to a microwave oven. The oven was later found to be leaking, although the emission level was not reported. Murray deduced that the patch's adhesive strip of aluminized plastic was heated by the microwave radiation, causing the burn. He warns that "other dermal delivery systems with metallic elements would present a similar hazard."

STANDARDS

C63 Meeting...ANSI's Committee C63 on Radio-Electrical Coordination will meet in San Antonio, TX, on April 27, immediately following the *IEEE 1984 Symposium on Electromagnetic Compatibility*. Among the agenda items are the results of numerous votes on C63 standards as well as a ballot to change the committee's name and scope.

VDTs

Reproductive Risks...NIOSH is investigating a cluster of miscarriages at Southern Bell's data processing center in Atlanta, GA. This is the tenth cluster of pregnancy problems to be made public (see *MWN*, March 1984). Workers at Southern Bell cited six miscarriages among 15 pregnancies in a complaint filed with OSHA in the spring of 1983. NIOSH, which agreed to investigate at OSHA's request, sent a team to the data processing center in September. A preliminary report based on that site visit was sent to Southern Bell on November 7. Neither NIOSH nor the company would release the report. John Morawetz, the principal investigator for NIOSH, said in a telephone interview that the report "suggested" that the cluster of miscarriages was a "random occurrence." He would not estimate when a final report on the investigation will be completed.

Radiation Tests... Four Australian researchers measured electric and magnetic fields from VDTs and found no evidence of health hazards for operators. Testing between 15 kHz and 100 MHz, the investigators found E-fields of 2.2-36 V/m at 5 cm from the screen and 0.22-2.7 V/m at 30 cm. The magnetic field was measured only at 30 cm, yielding levels of 0.26-76 mA/m. Near the cabinet surface, the maximum E-field was 65 V/m at 5 cm and 5.5 V/m at 30 cm; the maximum H-field was 0.18 A/m at 30 cm. Colin Roy and co-workers at the Australian Radiation Laboratory compared the readings to eastern bloc exposure limits below 300 kHz (50 V/m and 5 A/m) and calculated that maximum emissions levels at 30 cm were 5.4 percent and 1.5 percent of the E- and H-field limits, respectively. They also tested ultraviolet and visible light and, like the EM fields, found them well below applicable limits. Their report, "Measurement of Electromagnetic Radiation Emitted From VDTs," is published in the January 1984 *Radiation Protection in Australia: The Bulletin of the Australian Radiation Protection Society*, a quarterly journal....S.M. Harvey, of Ontario Hydro's Research Division in Toronto, has published "Electric Field Exposure of Persons Using Video Display Units," which presents data gathered as part of Ontario Hydro's ongoing study of VDT health and safety (see *MWN*, January/February 1984). The article, which appears in *Bioelectromagnetics* (Vol.5, No.1, 1984), includes details of the measurement method used for the "complex time variations and spatial distribution" of the E-fields from VDTs. Harvey concludes that "the partial body electric field exposures received by operators of the VDTs in our sample would be typically two or three orders of magnitude," below standards set for 1 MHz or less by the American Conference of Governmental Industrial Hygienists (600 V/m above 10 kHz and 60 V/m above 300 kHz), and that the VDTs tested "present no hazard to human health within the context of existing guidelines."

CONFERENCES

***May 2-5:** Dresden Symposium on Bone Healing with Electrical and Electromagnetical Stimulation*, Dresden, West Germany. Contact: Medical Academy "Carl Gustav Carus," Orthopaedic Clinic, Fetscherstrasse 74, 8019 Dresden, West Germany.

***May 6-12:** 6th International Congress of the International Radiation Protection Association (IRPA)*, Berlin, West Germany. Contact: Dr. R. Neider, Bundesanstalt fur Materialprurfung, Unter den Eichen 87, D-1000 Berlin 45, West Germany.

***May 7-9:** 1984 Microwave Power Tube Conference*, Naval Postgraduate School, Monterey, CA. Contact: John Skowron, Raytheon Co., Foundry Ave., Waltham, MA 02254, (617) 899-8400, ext. 4311.

***May 7-11:** Nuclear Magnetic Resonance 1984: National Symposium*, Hyatt Regency Grand Cypress Resort, Orlando, FL. Contact: Ms. Norine Karwel, Educational Symposia, PO Box 17241, Tampa, FL 33682, (813) 879-8765.

***May 20-24:** 16th Annual Meeting of the Conference of Radiation Control Program Directors*, Des Moines, IA. Contact: CRCPD, 71 Fountain Pl., Frankfort, KY 40601, (502) 227-4543.

***May 30:** Workshop on Payload Susceptibility to Space Shuttle Ku-Band Radiated Fields*, Johnson Space Center, Houston, TX. Contact: Ralph Lawton, McDonnell Douglas Technical Services Co., 16441 Space Center Blvd., Houston, TX 77058, (713) 488-5660, ext. 468.

***May 30-June 1:** IEEE MTT-S International Microwave Symposium*, San Francisco, CA. Contact: Dr. Ferdo Ivanek, Harris Corp., Farinon Division, 1691 Bayport Ave., San Carlos, CA 94070, (415) 594-3529. The *1984 IEEE Microwave and Millimeter Wave Monolithic Circuits Symposium* will be held in San Francisco May 29-30 in conjunction with the MTT-S meeting.

***June 3-8:** 29th Annual Meeting of the Health Physics Society*, Hyatt Regency, New Orleans, LA. Contact: Richard Burk, Jr., HPS, 4720 Montgomery Lane, Suite 506, Bethesda, MD 20814, (301) 654-3080.

***June 18-21:** 1984 Power Electronics Specialists Conference*, Gaithersburg, MD. Contact: Frank Oettinger, NBS, Room B344, Technology Bldg., Washington, DC 20234, (301) 921-3541.

***June 25-28:** 1984 International IEEE/AP-S Symposium and National Radio Science Meeting*, Westin Hotel, Boston, MA. Contact: Professor Harold Raemer, Dept. of Electrical Engineering, Northeastern University, Huntington Ave., Boston, MA 02115.

***June 26-28:** 7th International Symposium and Exhibition on Electromagnetic Compatibility*, Wroclaw, Poland. Contact: W. Moron, EMC Symposium, Box 2141, 51-645 Wroclaw 12, Poland.

***June 26-28:** 1984 International Conference on Lightning and Static Electricity*, Orlando, FL. Contact: J.J. Fisher, US Naval Air Systems Command, PO Box 15036, Arlington, VA 22215, (202) 692-7822.