MICRO WAVE NEWS

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

# *1982 RF/MW Litigation Survey*

Litigation over siting new radiofrequency and microwave (RF/MW) installations is on the rise, according to our 1982 case survey. Companies and local residents have turned to the courts to resolve disputes in four states. With many other siting applications now meeting local opposition, these cases may well mark the beginning of an important new trend.

The survey also reveals that most product liability claims are still being settled out of court, following the pattern reported in last year's survey (see *MWN*, April 1981). Several plaintiffs have dropped suits in exchange for settlements which stipulate that the terms remain confidential. The Delsesto and Spinella microwave oven case, for example, was dismissed with the consent of both parties after one day of trial last March: neither side would discuss the details. And news of the Karras $200,000 settlement for various severe injuries he claims resulted from working on radar leaked out months after the suit was quietly dropped last year.

The announced pre-trial settlements of the Kerch case for $30,000 this spring and the Foley case for $25,000 last year were exceptions to the rule. Both men alleged radiation-induced cataracts from exposure to radar. New cataract claims were filed late this year by former radar technicians Coatney and Becker.

Because no radar case has yet been decided by a jury, lawyers are closely watching the Engell suit against ITT, which is scheduled to go to trial this month. Lawyers for Robert Engell, a former radar technician who now has cancer, settled out of court with four other defendants this November, agreeing not to discuss the awards.

The major occupational exposure case to come before a workers' compensation board is now closed. This year a New York state appeals court upheld Antoinette Yannon's award for the death of her husband. Mrs. Yannon successfully maintained her husband's death was caused by chronic radiation exposure while tuning television relay equipment for New York Telephone. In a separate action, Mrs. Yannon is appealing the dismissal of her product liability suit against RCA, a manufacturer of relay equipment.

In litigation against the US government, George Watson has appealed the dismissal of his claim that he suffered genetic damage from exposure to microwaves at the US embassy in Moscow, which caused birth defects in his son. Other embassy cases are still pending.

Plaintiffs in several cases reported this year have turned to the Microwave Radiation Information and Action Center (MRIAC) for assistance. (See *MWN*, September 1981.) J. Stuart Lemle reports that the center is no longer a membership organization, but is now offering consulting services. Lemle is handling one of the Moscow embassy cases.

Summaries of over 30 cases, which are either in progress or have been recently settled, appear on pp. 2–4 and are followed by a list of participating attorneys. (The names of attorneys who are on the list appear in italics in the case summaries.) Included whenever possible are counsel for both plaintiffs and defendants and case numbers. Because a number of attorneys refuse to discuss litigation, however, the list is not complete.

# 1982 RF/MW LITIGATION SURVEY: CASE SUMMARIES

## *Siting Cases*

**In Progress:**

• RCA Americom filed suit against Kitsap County, WA, and its Board of Commissioners on November 17, 1982. Claim: no basis to indicate that Americom's proposed satellite communications station poses health hazards. Specific information submitted by Americom not considered in board deliberations. Company wants court to set aside board ruling denying company's application and to direct county to issue permit. Status: county deputy prosecutor ordered application returned to board on December 3. Board must now reconsider all material and issue another ruling. Attorney for plaintiff: *William Rives.* Attorney for defendant: Patricia Shafer, Kitsap County, WA, deputy prosecutor. See *MWN,* May, July/August and November 1982. [*RCA American Communications v. Kitsap County,* State Superior Court for Kitsap County, Port Orchard, WA, No. 82-2-01177-2.]

• Vashon for Quality Environment (local citizens group) filed a petition against the King County Council, WA, the County Zoning and Subdivision Examiner and Alascom Inc. in October 1982 to block further construction of a satellite communications station. Claim: improper procedures followed by zoning examiner in refusing group's appeal of building permit issued to Alascom in September 1982. Also challenging legality of zoning examiner's permit and variance. Seeking review of proceedings and voiding of county action. Status: pending. Attorney for petitioner: *Michael Gillett. [Vashon for Quality Environment v. King County et al.,* State Superior Court for King County, Seattle, WA.]

• Carole Halloran and other local residents filed suit against the Coventry, CT, Zoning Board of Appeals and US Transmission Systems, an ITT subsidiary, in May 1982. Claim: board acted improperly in processing ITT application to build microwave relay tower. Citizens seek reversal of board's April 20 approval of tower, which they believe poses a health hazard. Status: trial date expected for early next year. Attorney for plaintiffs: *Lawrence Bates.* Attorney for defendant, ITT: *William Hall.* See *MWN,* June 1982. [*Halloran et al. v. Coventry Zoning Board of Appeals and US Transmission Systems,* State Superior Court for Tolland County, Rockville, CT, No. CV-82-27799.]

• Leo and Muriel Shuerman filed suit against Pacific Telephone and Telegraph in 1980 and amended complaints in September 1980 and August 1981. Claim: point-to-point relay transmitter sited near their property and sending a beam across it renders property valueless and may pose health hazards. Seeking inverse condemnation (PT&T, as a quasi-public agency with power of eminent domain, would be required to buy the property) and $10 million in punitive damages. Status: trial date set for April 4, 1983. Attorney for plaintiffs: *Joe Aklufi.* See *MWN,* April 1982. [*Shuerman v. Pacific Telephone and Telegraph,* State Superior Court for Riverside County, Riverside, CA, No. 136703.]

• Filmways Communications of Syracuse, NY, filed suit against the town of Onondaga, NY, in November 1981. Claim: town's 1980 moratorium on construction of new broadcast sources infringes on company's first amendment rights. Company, which wants to build a TV station, seeks lifting of ban (see *MWN,* October 1982) and more than $5 million in damages. Status: pre-trial discovery. Attorney for plaintiff: *Robert Bernius.* Attorney for defendants: *Raymond D'Agostino. [Filmways Communications v. Town of Onondaga et al.,* US District Court for Northern District of New York, No. 81-CV-1293.]

• Attorney *Michael Prigoff* is investigating a possible suit against the operator of a "microwave tower" sited in a residential community. Concern in community that long-term radiation exposure is responsible for cluster of various tumors, some cancerous, among residents.

**Concluded:**

• Cylix Communications Network of Memphis, TN, and Anthony Capodanno lost their appeal of a Township of Haverford, PA, zoning board ruling blocking construction of a low-power satellite communications station in May 1982. Claim: board abused its discretion in denying zoning variance. Status: zoning board ruling upheld. Attorney for plaintiff, Cylix: *John Trevaskis, Jr.* See *MWN,* October 1981. [*Capodanno and Cylix Communications Network v. Zoning Hearing Board of Haverford,* Court of Common Pleas of Delaware County, PA, No. 81-15321.]

• WIXT Television and Albert and Beatrice Peck lost their appeal of an Onondaga, NY, Zoning Board of Appeals decision blocking construction of a TV transmission tower in May 1979. Claim: board's determination was unsupported and arbitrary. Maintained hardship was grounds for land use variance and that tower would pose no health hazards in case filed February 1979. Status: after the judicial review opinion of May 21, 1979, town went on to impose moratorium on new broadcast sources in 1980. Attorney for intervenors in opposition to applicants: *Robert Liegel.* [*Peck and WIXT Television v. Petrie et al.* (Town of Onondaga Zoning Board of Appeals), State Supreme Court for Onondaga County, NY.]

• William Pomeroy's application for a transmitting tower in LaFayette, NY, was denied in 1979. Town ruling cited potential health hazards. Decision followed May 1978 ruling against WIXT proposal by Onondaga, NY (see above). Status: decision not appealed to court. Attorney for intervenors opposed to application: *Robert Liegel.*

• MCI Telecommunications' application for a transmitting tower in Skaneateles, NY, was denied in 1980. Town ruling cited potential health hazards. Decision followed ruling against WIXT proposal by Onondaga, NY (see above). Status: decision not appealed to court. Attorney for intervenors opposed to application: *Robert Liegel.*

## *Radar Cases*

**In Progress:**

• Robert Engell filed suit against General Dynamics, ITT, Raytheon, Rockwell International and Varian Associates in March 1977. Claim: radiation exposure while working on TACAN and other radars from 1964 to 1975 caused pancreatic cancer. Status: out of court settlements reached with all but ITT in November 1982. ITT trial expected to begin in December, jury selection completed in November. Attorneys for plaintiff: *Marc Moller* and *Matthew Shafner.* Attorney for defendant, ITT: *John FitzGerald.* See *MWN,* November 1982. [*Engell v. ITT,* US District Court for Connecticut, Hartford, CT, No. H77-130.]

• Robert Barbee filed suit against Bendix, General Electric, Raytheon, RCA, Reeves Instrument, Western Electric and Zenith Radio in Mississippi in October 1982. Claim: radiation exposure while serving as a radar technician in the armed forces from 1942 to 1951 caused cataracts. Status: waiting for pleadings from defendants. Case previously filed in 1979 in Nevada and dismissed in the Ninth Circuit Court of Appeals because of statute of limitations in Nevada. Attorney for plaintiff: *James Cothren.* Previous attorney for plaintiff: *Brent Leavitt.* [*Barbee v. Bendix et al.,* Circuit Court for the First Judicial District of Hinds County, Jackson, MS. Initially filed in US District Court for Nevada, Las Vegas, NV, No. CV-LV-79238.]

• Joseph Coatney filed a claim with the Veterans Administration (VA) in 1981 and filed suit against General Dynamics, Hughes Aircraft and Westinghouse in 1982. Claim: radiation exposure from onboard radar while serving in navy for six years caused cataracts. Status: Claim for VA benefits still pending. Suit against radar manufacturers pending. Attorney for plaintiff: *John Sweeney.* [Administrative agency: VA. Court: State Superior Court, Los Angeles, CA.]

• Frederick Becker filed a claim with the VA several years ago and is in the process of filing suit against radar manufacturers. Claim: radiation exposure from radar on aircraft he serviced while in armed forces caused cataracts and other injuries. Attorney for plaintiff: *John Sweeney.*

• William Farnham filed suit against Hughes Aircraft, Northrop Aviation and Rockwell International in October 1978. Claim: radiation exposure in air force aircraft from 1951 to 1973 caused cataracts. Status: pre-trial. Defendants' offer to settle not accepted, though out of court settlement still possible. Attorney for plaintiff: *Seymour Ellison.* [*Farnham v. Northrop Aviation et al.*, State Superior Court, San Francisco, CA, No. 744782.]

• Glenn Lough filed suit against ITT, Raytheon, Sperry Rand and Western Electric in 1978. Claim: radiation exposure in 1955 and 1956 while in the armed forces caused cataracts. Status: pre-trial. Attorney for plaintiff: *Seymour Ellison.* [*Lough v. Raytheon et al.*, State Superior Court, San Francisco, CA, No. 744781.]

• Don Turner filed suit against Hughes Aircraft, Lockheed, McDonnell Douglas Aircraft and Northrop Aviation in May 1978. Claim: radiation exposure aboard US aircraft from 1954 to 1967 caused cataracts. Status: pre-trial. Defendants' offer to settle not accepted, though out of court settlement still possible. Attorney for plaintiff: *Seymour Ellison.* [*Turner v. Lockheed et al.*, State Superior Court, Los Angeles, CA (moved from State Superior Court, San Francisco, 738065).]

• Stanley Burgis filed suit against Western Electric in 1980. Claim: radiation exposure from M-33 radar he worked on for nine months between 1952 and 1954 while in the army caused cataracts and retina damage. Status: pre-trial. Attorney for plaintiff: *Jeffrey Slopford.* [*Burgis v. Western Electric,* US District Court for Eastern Pennsylvania, Philadelphia, PA (moved from Pennsylvania state court soon after initial filing).]

• Attorney *Richard Leonard* is preparing a case for a former B-47 aircraft crew member. His client alleges one hour of close-range exposure to an electronic countermeasures device mounted under a plane caused severe injuries. Exposure occurred in the 1960s. Leonard seeking medical experts to support the claim, which is not yet filed.

**Concluded:**

• Joseph Kerch settled his suit against Air America in spring 1982. Claim: radiation exposure from on-board radar and navigational equipment while working as a pilot caused cataracts. Prior to Air America, Kerch served in the air force for 20 years. This workers' compensation case filed in December 1980 under the Defense Bases Act. Status: settled out of court for $30,000. Attorney for plaintiff: *Matthew Shafner.* [*Kerch v. Air America,* Department of Labor, Office of Administrative Law Judges, No. 15-19092 80-LHCA-1388 and No. 15-16930 80-LHCA.]

• Leo Foley settled his suit against General Electric, Hazeltine, Hughes Aircraft, Lockheed Aircraft, Philco-Ford, Raytheon and Telerad-Lionel in 1981. Claim: radiation exposure while serving on EC-121 constellation aircraft between 1957 and 1975 caused cataracts. Case filed April 1979. Status: settled out of court for $25,000. Attorney for plaintiff: *Seymour Ellison.* See *MWN,* November 1981. [*Foley v. Lockheed Aircraft et al.*, State Superior Court, Sacramento, CA, No. 280696.]

• Ronald Karras settled his suit against General Electric and Western Electric early in 1981. Claim: exposure to radiation while working on Nike Hercules radars for 14 years resulted in multiple injuries, including bleeding eyes, deafness and systemic hemorrhaging. Status: settled out of court for $200,000. Attorney for plaintiff: John Phillips of Chicago, IL. See *MWN,* July/August 1981. [*Karras v. General Electric and Western Electric,* Cook County Circuit Court, IL, No. CV-79-L-20237.]

## *Oven Cases*

**In Progress:**

• Mildred Beadles, Delores Terhaar and Patricia Seelye filed suit against Litton Industries, Litton Microwave Division, and City Electronics in December 1980. Claim: a malfunctioning Model 800 microwave oven in the restaurant where they worked burned two of the women and traumatized all three. Approximately $5 million sought. Status: pre-trial. Attorneys for plaintiffs: *Riner Deglow, Leonard Schroeter* and *Robert Scanlon.* Attorney for defendant: *James Connelly.* [*Beadles et al. v. Litton,* Superior Court, Spokane, WA, No. 80-2-04512-6.]

• Joyce McCarty filed suit against Magic Chef in 1978. Claim: her son's lymphatic cancer and eventual death were caused by radiation leaking from a microwave oven where he worked. Status: pre-trial, on hold while McCarty seeks medical experts to support claim. Attorney for plaintiff: *Wallace Stephens.* [*McCarty v. Magic Chef,* Second Judicial District Court, Washoe County, NV.]

**Concluded:**

• Delores Delsesto and Lynn Spinella ended their suit against Amana Refrigeration out of court in March 1982. Claim: radiation from a leaking microwave oven in their company lunch room induced cataracts in both women. Approximately $3 million sought in suit filed February 1979. Status: case dismissed with consent of both parties after one day of trial in March 1982. Both parties refused to give details. Attorney for plaintiffs: *Mark Decof.* See *MWN,* April 1982. [*Delsesto and Spinella v. Amana Refrigeration,* US District Court, Providence, RI, No. 79-0082.]

• Helen Formakis lost her suit against Tappan in November 1981. Claim: counter-top microwave oven malfunctioned and burned her hand. $1 million sought. Status: jury found for defendant. Attorney for plaintiff: *Cecile Weich.* Attorney for defendant: *Remo Acito.* See *MWN,* December 1981. [*Formakis v. Tappan,* State Supreme Court, Bronx County, New York, NY.]

## *US Embassy in Moscow*

**In Progress:**

• George Watson filed suit against the US government in January 1981. Claim: genetic changes and injury from radiation exposure while serving as a marine guard at the US embassy in Moscow caused birth defects in his son. Status: charge that microwave radiation played role in causing defects—negligent failure to warn of hazard under Federal Tort Claims Act—dismissed in spring 1982 under the *Feres* doctrine and is now being appealed. Trial on second charge of medical malpractice by navy doctors set for March 1, 1983. Attorneys for plaintiff: *Peter Danelo* and *Charles Peery.* See *MWN,* January/February 1982. [*Watson v. US,* US District Court, Central District of California, Los Angeles, CA, No. CV 80-5737-CHH. Appeal on first charge filed in Ninth Circuit Court of Appeals, San Francisco, CA.]

• Attorney *John Parker Hills* has filed four cases for people exposed to radiation at the US embassy in Moscow. Two claims filed several years ago with the Department of Labor Employment Standards Administration, Office of Workers' Compensation Programs, were denied by a special claims examiner on July 19, 1982. One of these, filed by the spouse of an embassy employee who died of brain cancer, is being appealed to the Employees' Compensation Appeal Board. Hills also filed an individual and a class action suit for a woman who worked at the embassy and now has cancer. This case, filed with the State Department, is pending. See *MWN,* January 1981.

• Barton Reppert filed suit against the Central Intelligence Agency in July 1981. Claim: seeking documents under the Freedom of Information Act relating to the bioeffects of microwave radiation and to the Soviet microwave irradiation of the US embassy in Moscow. Status: pre-trial. Attorney for plaintiff: *J. Stuart Lemle.* See *MWN,* September 1981. [*Reppert v. CIA,* US District Court, Washington, DC.]

## *Other Work-Related Claims*

**In Progress:**

• Attorney *Robert Young* added a ninth flight controller claim to the eight reported in last year's survey. Claim: radiation from communications, navigation and radar equipment near control towers and possibly cathode ray tube (CRT) displays in the work place caused cataracts. Status: all nine cases pending. [Administrative agency: Department of Labor Office of Workers' Compensation Programs, Branch of Special Claims.]

• Antoinette Yannon is appealing the July 1982 dismissal of her product liability suit against RCA. Claim: husband's illness and eventual death caused by long-term exposure to microwave radiation while

working on TV relay equipment for New York Telephone. Seeking $3.5 million from equipment manufacturer for breach of warranty and negligence in suit filed in May 1976. Status: case dismissed on pre-trial motion in July 1982. Appeal filed this fall. Attorneys for plaintiff: *Jerome Ellis* and *David Paully.* See *MWN,* April 1981, July/ August and November 1982. [*Yannon v. RCA,* State Supreme Court for Richmond County, Staten Island, NY, No. 1009-1976. Appeal filed in State Supreme Court Appellate Division, Second Department, Brooklyn, NY.]

• Frederick Nepa filed a workers' compensation claim against the Port Authority of NY and NJ in February 1979. Claim: radiation from a walkie-talkie he used as a PA policeman caused cataracts. Status: pending. Attorney for plaintiff: *Angelo Gucciardo.* [*Nepa v. Port Authority,* Administrative agency: New York State Workers' Compensation Board, New York, NY.]

• Attorney *Angelo Gucciardo* is handling a workers' compensation claim filed this year for a Long Island, NY, police officer. Claim: radiation from a walkie-talkie caused a cataract. Status: waiting for hearing date. [Administrative agency: New York State Workers' Compensation Board, New York, NY.]

**Concluded:**

• Antoinette Yannon's workers' compensation award for the death of her husband has been upheld in appeals made by New York Telephone. Claim: husband's illness and eventual death caused by long-term exposure to microwave radiation while working on TV relay equipment for New York Telephone. Status: awarded benefits by New York Workers' Compensation Law Judge in 1980. Decision upheld by Workers' Compensation Board on February 26, 1981 and in appeal to a state court on May 6, 1982. Award of $45 per week and $29,000 in retroactive benefits. Attorney for plaintiff: *Angelo Gucciardo.* Attorney for defendant: *Saul Schier.* See *MWN,* April 1981, June and November 1982. [*Yannon v. New York Telephone,* Administrative agency: New York State Workers' Compensation Board, New York, NY, No. 0714-2308 and No. 0752-3602. Appeal filed May 1982 in New York State Supreme Court Appellate Division, Third Department, NY, No. 41045.]

• Sybil Barker and Industrial Indemnity, the workers' compensation carrier for her employer in San Francisco, reached a private settlement for her 1982 partial-disability claim. Claim: visual demands of VDT work caused debilitating eye problem (diagnosed as accommodative spasm). Status: $7,500 settlement reached in October-November 1982 without compensation board ruling. Attorney for plaintiff: *Kathryn Ringgold.* [Administrative agency: State Workers' Compensation Board, San Francisco, CA.] ●

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# HIGHLIGHTS

## Broadcasters Balk at Proposed Massachusetts Standard

At a public hearing convened by the Massachusetts' Department of Public Health in Boston on November 29, representatives from the broadcasting industry complained that the state's draft regulations on non-ionizing radiation are too strict. Neil Smith, a consulting engineer testifying on behalf of RKO General, accused the department of trying to satisfy "irrational" public fears by setting an "unnecessarily stringent standard."

Massachusetts became the first state to propose general population health standards for radiofrequency and microwave (RF/MW) radiation last February. (See *MWN*, March 1982.) The Massachusetts proposal is in fact identical to the recently approved American National Standards Institute (ANSI) standard except that it is five times stricter over the entire frequency range between 300 kHz and 100 GHz. The standard is most strict in the 30–300 MHz band, where it specifies a maximum exposure of 200 uW/cm$^2$. Although the February draft required the registration of all major stationary RF/MW sources and prescribed limits for occupational exposures, the revised draft, the subject of the hearing, limits registration to *new* sources and drops the occupational standard altogether. (A number of different types of sources are exempt from the rules.)

Jules Cohen, a consulting engineer based in Washington, DC, speaking on behalf of the National Association of Broadcasters, said that if Massachusetts could not wait for a standard to be set by the federal Environmental Protection Agency, "the new ANSI criteria should form the basis for the [standard] — not ANSI divided by five." Douglas Rowe, an attorney in Marlborough, MA, representing the Massachusetts Broadcasters Association, agreed saying the ANSI standard is "more than sufficient."

Others have endorsed the new standard however. In a November 22 letter to the Department of Public Health, Professor A.W. Guy wrote that the proposal is "an excellent compromise that should satisfy the concerns of the public about long-term exposure to non-ionizing radiation without unnecessarily being too restrictive to the users of the radio spectrum." Guy was the chairman of the subcommittee that drafted the ANSI standard. Raytheon's John Osepchuk told *Microwave News* at the hearing that the state did an "eminently reasonable" job, which only needs a little refinement. Osepchuk is a member of the *ad hoc* committee that advised the state on developing the standard over the last two years.

The hearing was relatively brief as most of the 35 attendees preferred to listen rather than testify. Participation was livelier at an informal question-and-answer period that followed the hearing. After repeated complaints about the stringency of the standard, Robert Watkins, a radiation scientist at the department, gave three reasons for the decision to add a safety factor to the ANSI standard, which he called an occupational standard despite ANSI's claims to the contrary: (1) the classic distinction between the general public and workers with respect to age, health and length of exposure; (2) the recommendation of international organizations, especially the World Health Organization, for dual standards; and (3) the language in the ANSI standard that, "Because of the limitations of the biological effects data base, these guides are offered as upper limits of exposure, particularly for the population at large ..." As for the origin of the factor of five, Watkins said "our committee picked it."

Another contentious topic was the problem of assigning responsibility for a given level of radiation when there are multiple sources. The only way to deal with it, according to Robert Hallisey, was on a case-by-case basis. Hallisey is the director of the department's radiation control program; he chaired the meeting.

Hallisey said the rules could be promulgated within 90 days of the close of the comment period on December 13. He said that unless "substantial" changes are made after public comments are reviewed, there will be no further hearings. He also noted that the Massachusetts Department of Labor and Industry was developing an occupational standard.

Also testifying were Dr. Don Justesen of the VA Medical Center in Kansas City, MO, on behalf of RKO General and Dr. Russell Carpenter, who retired from the Bureau of Radiological Health in September. Carpenter said that the major problem with RF/MW radiation was the "illusion of risk." He called the level of public ignorance "appalling."

A second hearing on the proposed rules was held in Holyoke, MA, on December 2. According to Watkins, some 25–30 people attended the meeting. He said that they raised similar complaints as those who spoke at the Boston meeting. Ron Peterson of Bell Labs and a representative from Northeast Utilities were among those testifying.

## Leukemia and Electromagnetic Fields: New Evidence and a Dissenting Opinion

Researchers at the University of Southern California (USC) School of Medicine have uncovered new support for the hypothesis that there is a link between leukemia and exposures to electrical and magnetic fields. Three members of the school's Department of Family and Preventive Medicine have found that white males in Los Angeles County whose jobs required contact with electromagnetic fields had a greater risk of developing leukemia, especially acute myelogenous leukemia (AML).

In a letter published in the November 20 *Lancet*, Drs. William Wright, John Peters and Thomas Mack write that their data are consistent with those of Dr. Samuel Milham who reported a similar link among workers in Washington state last July (see *MWN*, July/August 1982). The USC team identified power linemen as one class of workers who are at increased risk of developing both acute leukemia and AML; telephone linemen had a significantly higher chance of getting AML.

Speaking from his office at the Division of Occupational Health, Dr. Wright told *Microwave News* that he had read Milham's letter when it was published and thought that it would be interesting to apply the same methods to data collected by Mack's Cancer Surveillance Program for Los Angeles. He said he would like to continue this line of research and is looking for a suitable cohort population.

Although the USC researchers warn that the sample size is small and that the workers could have been exposed to other carcinogenic agents, they conclude that the connection between leukemia and non-ionizing radiation deserves further study.

Meanwhile, Dr. Robert Liburdy of the New York University Medical Center takes issue with Milham's paper in a letter to the *New England Journal of Medicine* (November 25). Citing work from the National Institute for Occupational Safety and Health (NIOSH) and the World Health Organization (WHO) and the epidemiological study of employees at the US embassy

in Moscow, Liburdy judges that the "mechanism of interaction of electrical and magnetic fields with biologic materials, although not well understood, differs importantly from the etiology of cancer, which is also not well understood. Negative results do not conclusively rule out a health risk; the data, however, argue against an association."

### Busy Times for ANSI C63

Members of the American National Standards Institute (ANSI) Committee on Radio-Electrical Coordination (C63) have been very active revising existing standards and initiating new ones. At meetings held November 3–4 in Washington, DC, they made substantial progress on a number of fronts related to electromagnetic compatibility (EMC), especially with respect to instrumentation and the measurement and control of radiation emissions.

The C63 Committee is in the process of revising two of its standards and has completed work on its one draft standard: ANSI C63.2-1980, *Specifications for Electromagnetic Noise and Field Strength Instrumentation, 10 kHz to 1 GHz;* ANSI C63.4-1981, *Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 10 kHz to 1 GHz;* and ANSI C63.12 (draft), *Recommended Practice on Procedures for Control of System Electromagnetic Compatibility.*

Outlined below are reports of various subcommittee 1 (Techniques and Development) activities, most of which were presented at its November 3 meeting:

• A draft addition to ANSI C63.4 on "Open Area Test Sites," has been forwarded to the full committee for a vote. According to subcommittee chairman Edwin Bronaugh of Electro-Metrics in Amsterdam, NY, most members approved the draft. Representatives of the Federal Communications Commission (FCC) were concerned over the use of broadband antennas to be specified in the new standard. The commission staff prefers making measurements with tuned dipole antennas and is seeking more data before a vote is taken by the full committee next February. The FCC members abstained in the subcommittee balloting.

• The proposed revisions to C63.2 and C63.4 to extend their frequency range down to 20 Hz and up to 18 GHz are nearing completion. A task force chaired by Marge Stone of AEL Industries in Farmingdale, NJ, has finished working on the lower frequencies for both standards. William Lambdin of Electro-Metrics has nearly completed the revisions to C63.2 for higher frequencies. Only the revision extending C63.4 to 18 GHz, coordinated by James Klouda of Elite Electronics Engineering in Downers Grove, IL, will not be ready for balloting until next summer.

• Don Heirman of Bell Labs in Holmdel, NJ, has developed a first draft for an addition to C63.4 on "Immunity Measurements of Electronic Products." Heirman expects to have a second draft by February and a version ready for a subcommittee vote by June.

• Preparation of a national EMC standard is underway under the direction of Herb Mertel of EMACO in San Diego, CA. The document will compile all EMC standards in the US, either by inclusion or by reference.

• A draft standard for measurement of radiated emissions from and susceptibility of medical devices is being circulated for comment among subcommittee members. The work of the task force, chaired by Al Smith of IBM in Poughkeepsie, NY, has been partially stalled by the loss of several members. A decision on how to proceed will be made at the next subcommittee meeting.

At the full C63 committee meeting on November 4, following the subcommittee session, a decision was made to accept the draft C63.12 EMC standard as final without modification. At the next meeting a new task force chairman will be appointed by members of subcommittee 1 to begin working on refinements to this standard.

The C63 meeting also featured reviews of on-going revisions of the International Electrotechnical Vocabulary and efforts towards international standardization. And Professor Ralph Showers, chairman of the C63 committee, reported on the International Special Committee on Radio Interference (CISPR) meeting held in Stockholm in September. (Showers, who is with the Department of Electrical Engineering at the University of Pennsylvania in Philadelphia, is also the president of CISPR.) *Microwave News* will run an update of CISPR activities in a future issue.

Bronaugh has tentatively scheduled a meeting of subcommittee 1 for next February. A date for the next C63 committee meeting has not been set.

# UPDATES

**Biological Effects** ... *Radio Science,* the journal of the American Geophysical Union, has published the proceedings of URSI's *Symposium on Biological Effects of Electromagnetic Radiation,* held in Helsinki in 1978, as a supplement to its September-October 1982 issue (Volume 17, Number 5S). Among the papers is the study of the effects of prenatal and postnatal exposure to 2450 MHz radiation on squirrel monkeys, which caused quite a stir when it first appeared at a poster session four years ago. At that time, Dr. Joel Kaplan and co-workers reported that, while most of the monkeys suffered no ill effects, there was a high mortality rate among those animals exposed to an average SAR of 3.4 W/Kg before *and* after birth. EPA, the sponsor of the original study, agreed to supply more money for a replication study to see whether this new effect was more than a statistical anomaly—a possibility given the small sample size and the fewer than expected deaths among the controls. The results of that second experiment, reported in a *note added in proof* to the original paper, "did not support those obtained in the initial experiment. No differences were found between irradiated and control monkeys in the number of abortions, stillbirths or livebirths that occurred or in the number of offspring that died." In a telephone interview from his office at SRI International, Kaplan said that he believed the matter was now settled. At EPA, Dr. Joe Elder, the acting director of the division that supported the SRI work said, "The suggestions that were raised by the first study have now been satisfactorily answered." This view was echoed by Dr. Michael Gage, who is a co-author of the paper and one of Elder's colleagues at EPA. Though Gage agreed that the question of lethality is now settled, he still favors more work on behavioral teratology, a research area he describes as "not very well explored." Among the 24 other papers in the collection are: "Measurements of Electric and Magnetic Stray Fields Produced by Various Electrodes of 27 MHz Diathermy Equipment" by a team from Finland; "Coherent Oscillations in Biological Systems: Interaction with Extremely Low Frequency Fields" by F. Kaiser of the Institute of Theoretical Physics at the University of Stuttgart; "ELF Magnetic Fields in Electrosteel and Welding Industries" by a group from Linkoping University in Sweden; and "Population Exposure to VHF and UHF Broadcast Radiation in the [US]" by R. Tell and E. Mantiply of EPA ....In another teratology study, a group from Thomas Jefferson University in Philadelphia, PA, reports on the effects of prenatal exposure of rats to 10 mW/cm² of 915 MHz for six hours a day throughout gestation in the October issue of *Radiation Research.* They found "no significant teratogenic activity" at this exposure level—a level which did not induce a "significant" increase in the rat's body temperature (average SAR = 3.57 W/Kg)....And a team from EPA has

found that the exposure of pregnant rats to 425 MHz continuous wave radiation (SAR = 3.1–6.7 W/Kg) "may lead to increased mitogen-stimulated responses by lymphocytes." Writing in the September issue of the *Journal of Microwave Power*, the authors state that they do not know what mechanism is responsible for the observed changes, though it does not appear to be frequency dependent: "Whether these changes in lymphocyte response reflect an alteration in the functional integrity of the exposed animal's immune system remains to be investigated."... Dr. Gregory Lotz of the Naval Aerospace Medical Research Laboratory in Pensacola, FL, has issued a technical report, *Hyperthermia in Rhesus Monkeys Exposed to a Frequency (225 MHz) near Whole-Body Resonance*, describing the work that prompted great interest when he first presented it at the 1981 BEMS conference (see *MWN*, September 1981). At power levels in excess of 5 mW/cm² (SAR = 2.3 W/Kg), Lotz observed "severe hyperthermia" and concludes that "the effects on rhesus monkeys of exposure to a resonant frequency (225 MHz) were substantially greater than what could be predicted based upon straightforward comparisons of dosimetric information (SAR) and the effects of exposures to a much higher frequency (1290 MHz)."...Do non-thermal effects of RF/MW radiation exist? Professors Herman Schwan and Sol Michaelson, neither one a stranger to this continuing debate, offer opposite views in recently published papers. In a presentation at last year's 10th *L.H. Gray Conference* (see Medical Applications Update), Schwan describes "observed non-thermal effects of alternating fields" and states that he believes that "ponderomotoric" forces are responsible—these are caused by electrical fields acting on non-polar particles. Among the non-thermal effects listed by Schwan are: pearl chain formation, movement in inhomogeneous fields and changes in the shape of cells as well as their destruction and fusion. Michaelson takes an opposite view in an unfavorable review of the World Health Organization's (WHO) criteria document on RF/MW radiation (see *MWN*, March 1982). In the October issue of *Radiation Research*, Michaelson writes: WHO's "unqualified acceptance of postulated non-thermal bioeffects with resonant frequency dependence and 'windows' is not justified by the evidence. There are many scientists who hold a working hypothesis that all RF/MW bioeffects are explainable as the result of internal heating (albeit nonuniform throughout the organism). Much of the literature on 'non-thermal' effects is marred by artifacts, conceptual problems or misinterpretation of data. It is regrettable the author(s) of the present document neglected to fully explore and take such factors into cognizance." Overall, he finds the document "distressing" because it "does not come up to the high scientific caliber and accuracy of the usual WHO publications."...Another paper presented at the Gray Conference argues for the presence of non-thermal effects of microwaves. A group of German researchers report on experiments in which they monitored the growth rate of yeast exposed to radiation in the frequency range 41.640–41.835 GHz. Previous work had indicated the occurrence of "very remarkable effects": the growth rate increased and decreased at certain specific frequencies and there were a number of resonances, each with a line-width of about 10 MHz. The new work provided confirmation. They conclude, "There are changes in yeast growth rate, caused by low intensity microwave irradiation. These effects depend on frequency, showing a strong resonant-like behavior, and are not correlated to the microwave power used. These effects are not explainable in terms of simple thermal response."...Commenting on the paper connecting fluorescent light with skin cancer (see *MWN*, September 1982), Allan Jensen of the Danish National Institute of Occupational Health proposes that polychlorinated biphenyls (PCBs) may be the more likely toxic agent. PCBs can be emitted by fluorescent light fixtures, especially after the burnout of a ballast. His letter appears in the October 23 issue of *Lancet*....The *IEEE Transactions on Microwave Theory and Techniques* will publish a special issue on "Electromagnetic Wave Interactions with Biological Systems" in July 1984. Georgia Institute of Technology's James Toler is the guest editor of the collection. Papers are due by October 12, 1983.

**Communications**...The New Jersey Department of Health will investigate a possible link between microwaves and birth defects and cancer in Vernon, NJ. Responding to local fears stirred up in a siting battle over a proposed RCA Americom relay tower, the Sussex County Health Department contacted the state's Epidemiology and Disease Control Division late last month. (There are already a number of RF/MW sources in Vernon. See *MWN*, November 1982.) A health department spokeswoman said the Sussex request is routine except for the possible link with microwaves: the department gets "a number of cancer clusters reports" every month. Charles Lawson, an epidemiologist with the department's Parental and Child Health Services, said the analysis would probably include a review of local hospital records for 1979–1981 and whatever other information the county board could provide. According to Lawson, this type of analysis usually takes over six months to complete. Meanwhile, Americom is scheduled to host a public meeting to discuss its proposed tower on December 11....NTIA plans for developing long-range international telecommunications policies appear in the November 2 *Federal Register* (47 *FR* 49694).

**Compatibility & Interference**... Competition between land mobile services and UHF-TV stations for spectrum space continues and promises to get worse: often, the result is unacceptable interference. A classic example is WVEU, Channel 69 in Atlanta, GA. The station, operating at 800–806 MHz from the roof of the Peachtree Plaza Hotel, has been forced to broadcast at an ERP of 2.63 kW, 30 dB or a thousand times below its authorized level, because of out-of-band interference with land mobile (806–807 MHz) repeaters located on the same roof. As the "newcomer" WVEU has the responsibility for correcting the RFI problem. Last April, the station asked the FCC for permission to operate at 50 percent power but the petition was denied on September 29. The station has now filed a petition for reconsideration. Also in November, the commission proposed rules to allow the operation of public land mobile units on UHF Channel 14 in Pittsburgh, PA (see 47 *Federal Register* 53752, November 29). According to Ralph Justus of the FCC's Broadcast Bureau, "Unless the spectrum is managed to afford protection between these services, the interference problem is going to recur many times over the next 20 years." He cites UHF stations in Tyler, TX, Boulder, CO, San Diego, CA, and Washington, DC as other potential trouble spots. The commission's Private Radio Bureau has released an interim report, *Future Private Land Mobile Telecommunications Requirements*.... With respect to satellite communications, the FCC has issued an alert on the need to consider the potential for RFI in designing and manufacturing direct broadcast satellite home receivers. Specifically, the commission noted that, based on theoretical considerations, out-of-band emissions from terrestrial systems could fall into the 12 GHz band, as could harmonics from ISM equipment — especially microwave ovens—and very high-power radars....On September 10, the American Satellite Co. of Rockville, MD, filed a petition asking the FCC to adopt standards that would protect against RFI from the improper operation of transmitting earth stations. One commission staffer told *Microwave News* that the FCC has not received a large number of complaints with respect to RFI from satcom stations and that "there are differences in opinion on how serious this problem is."...The October 11 issue of *Broadcasting* features a summary of comments submitted on the FCC's proposed rule for resolving FM blanketing interference (see *MWN*, May 1982)....And the FCC has found that, while cordless telephones do not comply with its rules on radiated signals, they do not constitute a serious problem: it has received few RFI complaints from amateur radio operators in the 1.8–2.0 MHz band. The FCC plans to propose new rules for cordless telephones in 1983 .... State policemen have begun noticing that signals from their walkie talkies can interfere with their Breathalyzer units, used to test the sobriety of drivers. A spokesman for Smith & Wesson, the manufacturer of the units in Springfield, MA, admits such RFI, though rare, can occur....George Washington University's Continuing Engineering Education program is sponsoring a course on *Electromagnetic Interference and Control* in Washington, DC, January 10–14. For more information, call (800) 424-9773.

**Government**... For a brief moment in early October there were rumors that EPA management had officially approved long stated plans to set safety levels for public exposure to RF/MW radiation. Work on the guidance has been going on for some time: EPA's Office of Research and Development in Research Triangle Park, NC, is in

the final stages of preparing a criteria document on the effects of non-ionizing radiation—due for release early next year—which will serve as the basis for the guidance. And a group at the Environmental Sciences Division of DOE's Lawrence Livermore Laboratory in Livermore, CA, is studying the economic impact of the guidance (see *MWN*, December 1981). EPA Assistant Administrator Kathleen Bennett did approve the advanced notice of proposed rule making (ANPRM), but Administrator Anne Gorsuch has yet to sign it. As we go to press at the end of November, there is still no sign as to when the ANPRM will appear in the *Federal Register*....The National Center for Devices and Radiological Health (which absorbed BRH) is reviewing its reporting and record-keeping requirements for radiation emitting products as required under the Radiation Control for Health and Safety Act of 1968. According to present rules, manufacturers must submit data on the operation, labeling and design of electronic devices as well as incidents of accidental radiation exposure. In addition they must maintain records on quality control procedures, test results and methods for controlling radiation emissions. Among those devices using non-ionizing radiation that fall under these regulations are: microwave heating equipment, RF heaters and sealers and diathermy machines. A task force at the center is assessing whether or not the regulations are still needed and is soliciting public comment. As the center's John Bailey put it: "We are looking to see if there is a better or alternative way of satisfying the act." For more information see the notice in the November 16 *Federal Register* (47 *FR* 51706) or call Bailey, (301) 443-3434. Comments are due by February 14, 1983; Bailey hopes to have recommendations ready by next September....The Consumer Product Safety Commission (CPSC) has proposed rules to decide when to release complaints on specific products. The proposal, published in the November 5 *Federal Register* (47 *FR* 50283), would make it easier for CPSC to disclose information to the public .... NIOSH's Division of Biomedical and Behavioral Science in Cincinnati, OH, is looking for a chief for its Physical Agents Effects Branch to replace Dr. Wordie Parr who is retiring at the end of the year. A candidate must be an engineer or a physicist and be able to direct a research program on the health and safety impact of occupational exposures to radiation, noise, vibration as well as high and low temperatures and pressures. The salary range is $41,000–$48,500. For more information contact: Jon Ruse, Personnel Office, NIOSH, 4676 Columbia Parkway, Cincinnati, OH 45226.

**Measurement**...A team from Italy's National Research Council in Florence has developed an RF hazard monitor to protect workers against overexposure to RF heater and sealer radiation. The patented instrument has a flat frequency response in the 2–100 MHz range, with an overall accuracy of ±2.5 dB with a typical value of ±0.7 dB. The monitor incorporates applicable safety standards: red and yellow indicator lights turn on in the presence of "excessive" power levels. In the description of the monitor, presented in the September issue of the *Journal of Microwave Power*, the team advises that it could also be used in a number of other applications, including exposures to AM and FM broadcast radiation, short-wave diathermy and military communications....The publication of NBS' draft handbook for its Electromagnetic Calibration Services Voluntary Laboratory Accreditation Program, due out this month, has been held up as the bureau resolves a number of tricky technical questions. According to NBS' John Locke, the draft handbook should be available early next year. ...In a paper to appear in a forthcoming issue of *IEEE Transactions on Instrumentation and Measurement*, David Wait of NBS' Boulder laboratories reviews NBS' noise measurement program for antenna systems with gains between 51 and 65 dB in the 1–10 GHz frequency range. For large antennas, 11–28 meters in diameter, radio stars are used as the known noise source. For smaller antenna systems, 4–5.5 meters in diameter, the moon is the preferred source....Among the papers to be presented at the *National Radio Science Meeting* in Boulder during the first week in January are "Preliminary Results from Measurements of 800 MHz Radio Transmission into Residential Buildings" by a team from Bell Labs in Holmdel, NJ, and "Measurements of the Microwave Dielectric and Attenuation Properties of Plants" by two researchers from the Remote Sensing Lab at the University of Kansas in Lawrence. For details see Conference Calendar on p. 10.

**Medical Applications**...The National Center for Devices and Radiological Health's Radiological Devices Panel is set to meet on December 8 and 9 in Rockville, MD. On the agenda are a review of the current status of NMR imaging devices and a premarket approval application for a RF/MW hyperthermia machine. The identity of the manufacturer seeking approval is confidential until the meeting. Dr. R.D. Saunders of the NRPB in the UK was scheduled to review the British experience with NMR, but will not be able to attend. At the request of the National Electrical Manufacturers Association (NEMA), there will be a discussion of the reorganization of the BRH and the Bureau of Medical Devices. What concerns NEMA, according to one of its staff, is that BHR's past authority should not get diluted by the change. For more information contact: Dr. Robert Phillips, (301) 443-3426....The North American Hyperthermia Group (NAHG) will hold its third annual meeting during the Radiation Research Society's conference February 27–March 7 in San Antonio, TX. For more information contact: Dr. Dennis Leeper, 925 Chestnut Street, Philadelphia, PA 19107. The abstracts of the papers from this year's NAHG meeting, held in Salt Lake City, UT, April 17–19 are published in the August issue of *Radiation Research*....The Proceedings of the 10th *L.H. Gray Conference: Ultrasound, Microwave and Radiofrequency Radiations: the Basis for Their Potential in Cancer Therapy*, held in Oxford in July 1981, are published in a supplement to the March 1982 issue of the *British Journal of Cancer*. Among the large number of papers is one from Poland that compares the effects of whole-body and local microwave hyperthermia on the immune system. Drs. M. Janiak and S. Szmigielski of the Center for Radiobiology and Radioprotection in Warsaw report that local heating is preferable to whole-body hyperthermia because the former does not inhibit the immune response....Fonar announced a breakthrough at the Radiological Society of North America meeting in Chicago at the end of November: a new 3,000-gauss permanent magnet for use in whole-body NMR imagers. A spokesman for Fonar said the magnet has a very small fringe field and is therefore much easier for hospitals to house. He added that Fonar hopes to get FDA approval for its NMR units in the first half of 1983. The news sent the price of Fonar stock to new highs....The program for the first annual *Meeting of the Society for Magnetic Resonance Imaging* to be held in Colorado Springs in February is now available. See Conference Calendar on p. 10 for details.

**Military Systems**...Wisconsin Governor-Elect Anthony Earl has confirmed his campaign commitment to oppose Project ELF, the navy's land-to-submarine communication system. In a post-election statement, he called it "primarily an offensive system which would not help to move us along the road to arms control and arms reduction," and announced plans to contact Michigan's Governor-Elect James Blanchard to work together against the project. On another front, the Wisconsin Natural Resources Board passed a resolution affirming its opposition to Project ELF on November 17....The Department of Transportation has approved the construction of the H-3 highway project, part of which will be under the coast guard's Omega antenna (see *MWN*, July/August 1982). Construction could begin in January. ...The navy is building an AEGIS Combat System Center on Wallops Island, VA. In a November 1 notice in the *Federal Register* (47 *FR* 49437), the navy announced that it would not prepare an environmental impact statement for the project but that an environmental assessment had been completed. The navy notes that, "The radars utilized do constitute a hazard zone extending some 2,000 feet seaward; however, the beam is elevated to keep radiation levels at the shoreline within the standard of 10 mW/cm² for continuous exposure. Continuous monitoring and built-in system checks will automatically turn off the equipment if radiation levels are excessive so that there is no perceived hazard to operating personnel, shoreside or surface inhabitants."

**Mobile Communications**...Allocating cellular mobile phone markets is proving to be a tough job. The second FCC cellular construction permit went to AT&T's Boston subsidiary last month. But at about the same time, the Justice Department asked the FCC to delay issuing permits to phone companies until the commission clears up

questions over its licensing procedures, which some applicants argue are anti-competitive. And the commission must now wade through almost 400 applications received for the 30 second-largest cellular markets.

**Ovens**...It looks as if a large number of people are planning to put a microwave oven under their Christmas trees, or at least that is what retailers are betting on. Factory shipments of ovens exceeded 470,000 in October, the largest number for any month in history. A spokeswoman for the Association of Home Appliance Manufacturers, which compiles these statistics, noted that microwave ovens are popular gift items in the current economic climate because they meet the needs of working women. Even with a record-breaking October, microwave oven shipments for the year are still down 11.2 percent over the first ten months of 1981....A one-month-old baby girl was hospitalized with third degree burns on the left hand, right foot and abdomen in Caledonia, MI, on October 31. State police Detective Sgt. Robert Golm suggested that the burns were caused by the microwave oven in the home of the baby's parents; the police have impounded it. Golm told *Microwave News* that there were no defects in the oven and that it would not operate with the door open. "We do not feel it was an accident," he said. The case is now being handled by Barry County Prosecutor Judy Hughes. Repeated attempts to reach Hughes were unsuccessful....A November 29 pre-trial conference on the FTC's complaint against Amana Refrigeration Inc. for deceptive advertising (see *MWN*, November 1982) was rescheduled for December 9. On November 30, the FTC moved for a "summary decision," according to FTC attorney Andy Sachs. If accepted, there would be no trial; a decision would be issued by the administrative law judge hearing the case....Thermador/Waste King Co. has reissued a booklet, *Microwave Nutrition Report*, first released in 1977, which compares the reduction of Vitamin C (ascorbic acid) in fruits and vegetables cooked in microwave ovens and by other conventional methods: "In 18 out of 24 instances studied, the ascorbic acid content of the microwave cooked product was significantly higher than that observed after the conventional and convenient methods were used." The studies were carried out by Professor Gertrude Armbruster at Cornell University's Division of Nutritional Sciences. Copies are available from the company at 5119 District Blvd., Los Angeles, CA 90040....General Electric has introduced a new line of microwave ovens. Its Dual Wave system cooks food from the top with a rotating antenna and from the bottom with a static wave guide. GE is marketing eight models in the line, with prices ranging from $300 to $550. Among their features are "Auto Roast" with automatic temperature control and "Auto Defrost."...The International Electrotechnical Commission has published its standard IEC 705-1981, *Methods for Measuring the Performance of Microwave Cooking Appliances for Household and Similar Purposes.* A copy is available for $14.00 from the American National Standards Institute, 1430 Broadway, New York, NY 10018.

**Power Lines**...DOE held a meeting to review its sponsored research on 60-Hz electric field effects, November 15-18 in Denver, CO. Representatives from seven research groups presented progress reports on 28 different projects. A limited number of copies of the abstracts of the papers are available from Kenneth Klein, Electric Energy Systems Divison, CE-143, DOE, Forrestal Building, Mail Stop 5EO52, Washington, DC 20585. No other proceedings of the meeting will be prepared. DOE is still operating on last year's budget under a continuing budget resolution. As a consequence, Klein said in an interview, it is doubtful that any new contracts will be signed this fiscal year: all available money will be devoted to work already in progress....The Minnesota Environmental Quality Board (MEQB) is scheduled to meet on December 16 to review a number of studies on the effects of the Cooperative Power Association-United Power Association DC power line (running from a coal field in North Dakota to Minneapolis-St. Paul) and to consider whether its construction and operation permit requirements adequately protect health and safety. According to a presentation by Professor Frank Martin of the University of Minnesota, Minneapolis, at a November 13 MEQB public meeting, preliminary evidence from a study of dairy cattle indicates no ill effects due to the 400 kV line. The board's ion monitoring program did uncover one surprising result: a relatively high concentration of small ions (5,000/cc) a quarter of a mile downwind from the line. Final reports are scheduled for release in January. For more information contact: MEQB's George Durfee, 15 Capitol Square Building, 550 Cedar Street, St. Paul, MN 55101, (612) 296-2878....Last month we reported on a Swedish study linking power lines with cancer. We have now learned that one of the authors, Professor Bengt Enander of the Royal Institute of Technology in Stockholm died in June 1981; he was only involved in the early stages of the project helping Dr. Lennart Tomenius make magnetic field measurements. Dr. Tomenius was the principal author of the report.

**Satellite Communications**...The Stamford, CT, Citizen Action Group is pressing for satcom station siting rules. A proposed city ordinance that would require current and future station operators to perform environmental impact studies is now before the Health and Protection Committee of the Stamford Board of Representatives—the town council. According to a group spokesman, local concern focuses on Group W Satellite Communications' new Stamford facilities. If the draft ordinance passes a committee vote, which the group expects will happen soon, a public hearing on the rules will be held early next year....Progress toward developing direct broadcast satellite (DBS) services continued last month as seven applicants joined Comsat's Satellite Television Corp. in winning FCC construction permits for DBS systems....As the future grew brighter for domestic DBS last month, the international picture dimmed. According to a November 29 report in *Broadcasting*, a UN special political committee voted to bar direct satellite transmissions across national borders without the receiving country's consent.

**VDTs**...According to Dr. Michael Rosenberg, chief of reproductive health at NIOSH in Cincinnati, negotiations are still underway for a planned reproductive study of VDT operators. As we reported last month, NIOSH is in the process of setting up an epidemiological study, which will include over 5,000 pregnancies, to investigate charges that the sets are associated with miscarriages and birth defects. Rosenberg said that the negotiations should be concluded by the beginning of the new year....NIOSH is also planning a reproductive study of women exposed to PCBs. This work is unrelated to VDTs, but may be of interest to those who believe they are exposed to these chemicals in the office either from fluorescent light fixtures or from VDT capacitors and transformers. (See also Biological Effects Update.) NIOSH will investigate 200 women who worked at a New York factory that manufactured transformers between 1940 and 1976. Rosenberg is the project officer for the PCB study....Two ergonomics studies are also getting started. NIOSH has contracted with Dr. Marvin Dainoff of Miami University in Oxford, OH, to evaluate three of its in-house studies on the effects of adjustable furniture and lighting, separately and together, on worker health and productivity. In another project scheduled to begin this January, NIOSH will monitor the vision and blood pressure of 24 professional typists for nine months in an experimental study of VDT workplace design. The institute's Dr. Michael Smith is the project officer for both projects....An Ontario task force investigating VDTs has recommended shielding all flyback transformers and testing all units for X-rays before they leave the manufacturer. The group's draft report, *Possible Health Hazards of Video Display Units*, also calls for a major epidemiological study of potential reproductive hazards, including radiation and PCBs. It advises that when alternative work is not available, pregnant operators should be eligible for workers' compensation, with the employer making up any loss in income. The task force, chaired by Dr. Gordon Stopps of the University of Toronto, presented its draft report to the Ontario Ministry of Labor's Advisory Council on Occupational Health and Safety on November 30....Maria Stuchly and colleagues at the Radiation Protection Bureau of Health and Welfare Canada in Ottawa have a different view of potential VDT hazards. They made measurements of ELF (5-500 Hz) magnetic fields and RF (10-200 kHz) electric fields from VDTs. For the three units tested for ELF, most emissions were at 60 Hz and its harmonics, with higher levels for even harmonics than odd ones. At 30 cm from the front of the screen, magnetic fields were between 0.097 and 0.217 A/m. Only one reading was taken close to the transformer at the back of a unit, the Perkin Elmer Model 550: there

the magnetic field was 4.019 A/m. According to bureau scientists, these radiation levels were in line with other electrical devices; for instance, a hand mixer has been found to have localized fields of 9.295 A/m. They say that ELF magnetic fields around VDTs "are of such low intensities that they are very unlikely to have any biological effects, let alone represent a health hazard." The bureau staff tested 57 models (86 sets) for RF radiation and found emissions in this frequency range were also well below safety limits. At the operator's position, 30 cm from the screen, electric field intensities for 20 models were in the range between 1 and 5 V/m and for 37 models below 1 V/m. Maximum readings were generally found near the flyback transformer, but for three models the maximum reading was found at the screen, with emissions dropping from above 200 V/m to less than 70 V/m at a distance of 10 cm. For 10 other models, maximum readings above 200 V/m, but not specified, were identified on the top, side and back of the units....Plans are still in the works for introducing a VDT safety bill into the Connecticut Legislature. State Senator Michael Skelley is likely to submit a bill to the legislature's Labor and Public Employees Committee early next year (see *MWN*, November 1982).... A VDT safety bill introduced in the British Columbia Legislature failed to receive consideration this year. Private members bill No. M210 was introduced by legislator Karen Sanford in October.... The Australian Council of Trade Unions published its "Guidelines for Working with Screen-Based Equipment" in its *Health and Safety Bulletin* this May. The 44-page report lists cataracts and pregnancy problems among potential VDT hazards. It states that "no satisfactory long-term follow-up study of operators of [VDTs] has been performed,and so statements to the effect that the equipment does not or cannot damage, e.g. eyes or eyesight, are without foundation. In the light of disastrous experiences associated with introduction of new technologies in the past, [union] affiliates should regard screen-based equipment as a likely cause of severe health effects until it is shown to be safe." The guidelines were edited by John Mathews and Nick Calabrese, ACTU/VTHC Occupational Health and Safety Unit, Trades Hall, Box 93, Carlton South, 3053 Victoria, Australia....The Newspaper Guild has warned its locals not to accept VDT radiation tests performed by the Research Institute of the American Newspaper Publishers' Association. Guild President Charles Perlik argues that an impartial third party should perform the tests.

**Etc.**..The papers presented at the Ann Arbor meeting on risk analysis and microwaves (see *MWN*, December 1981) have been edited by University of Michigan Professor Nicholas Steneck and have just been published by the San Francisco Press. In one of the conference's more controversial and widely circulated papers, Allan Frey criticizes Professor Bill Guy's experiment on the long-term, low-level effects of 2450 MHz radiation. (The study, funded by the air force, is now nearing completion at the University of Washington, Seattle.) When the paper was first distributed, Guy and his co-workers asked Steneck for the opportunity to respond, and Frey in turn was allowed a brief reply. All of this was to be published in the book, but as Steneck notes, on seeing Frey's second statement, Guy's group withdrew its critique. Steneck published Frey's reply anyway; in it Frey asks, "Why did Guy take on a project which involved the expenditure of approximately $1.5 million of public funds with the known critical sensitive tests ruled out by the sponsor for a nonsensical reason? Is this science?" *Risk/Benefit Analysis: The Microwave Case* is available for $15 from the San Francisco Press, Box 6800, San Francisco, CA 94101....In an article published in the summer 1982 issue of *Science, Technology & Human Values*, Steneck argues for involving historians in policy deliberations. He uses the microwave debate as a case study, which "shows how history has been misused, abused and neglected ..." Steneck is with the Department of History at the University of Michigan....There is a new computer game called *Microwave* on the market. The objective is to direct Teddy the Salvage Man through a maze so that he can repair equipment and computers (thereby collecting points) while avoiding attacks by alien beings. Teddy can outrun the aliens or fight them off with dishes that spew out lethal microwaves. This writer who has little talent for such games nevertheless found *Microwave* quite addictive. The game is designed for an Apple II computer; it is available for $34.95 from Cavalier Computer Corp, PO Box 2032, Del Mar, CA 92014. ●

# CONFERENCE CALENDAR

- January 5–7: *National Radio Science Meeting*, University of Colorado, Boulder, CO. Contact: T.E. VanZandt, NOAA/ERL/R445, 325 Broadway, Boulder, CO 80303.

- February 14–18: 1st Annual *Meeting of the Society for Magnetic Resonance Imaging*, Broadmore Hotel, Colorado Springs, CO. Contact: SMRI, Suite 506, 4720 Montgomery Lane, Bethesda, MD 20814.

- February 14–19: 7th *International Conference on Infrared and Millimeter Waves*, University of St. Jerome, Marseille, France. Contact: Kenneth Button, National Magnet Lab, MIT, Cambridge, MA 02139.

- February 27–March 3: 31st Annual *Meeting of the Radiation Research Society*, Hyatt Regency, San Antonio, TX. Contact: RRS, 925 Chestnut Street, Philadelphia, PA 19107. The 3rd Annual *Meeting of the North American Hyperthermia Group* will be held simultaneously, February 27–March 1.

- March 8–10: *Microwave Systems Applications Technology*, Sheraton Washington, Washington, DC. Contact: Richard Hartman, EW Communications, 1170 East Meadow Drive, Palo Alto, CA 94303.

- March 8–10: 5th *Electromagnetic Compatibility Symposium and Technical Exhibition*, Zurich, Switzerland. Contact: Dr. T. Dvorak, EMC-83, ETH Zentrum-IKT, 8092 Zurich, Switzerland.

- April 5–8: *International Magnetics Conference*, Franklin Plaza Hotel, Philadelphia, PA. Contact: F.J. Friedlander, School of Electrical Engineering, Purdue University, W. Lafayette, IN 47907.

- April 6–7: Annual *Meeting of the National Council on Radiation Protection and Measurements*, Washington, DC. Contact: NCRP, 7910 Woodmont Avenue, Bethesda, MD 20814.

- April 10–13: 61st Annual *Convention of the National Association of Broadcasters*, Las Vegas Convention Center, NV. Contact: NAB, 1771 N Street, NW, Washington, DC 20036.

- April 12–15: 3rd Annual *International Conference on Antennas and Propagation*, University of East Anglia, Norwich, UK. Contact: IEE, Savoy Place, London WC2R OBL, United Kingdom.

- May 2–5: 2nd Annual *Test & Measurement World Expo*, Convention Center, San Jose, CA. Contact: Meg Bowen, Conference Director, 215 Brighton Avenue, Boston, MA 02134.

- May 15–19: 15th Annual *Meeting of the Conference of Radiation Control Program Directors*, Eldorado Hotel, Reno, NV. Contact: Charles Hardin, CRCPD, 65 Fountain Place, Frankfort, KY 40601.

- May 22–25: 18th Annual *Meeting of the Association for the Advancement of Medical Instrumentation*, Loews Anatole, Dallas, TX. Contact: AAMI, Suite 602, 1901 N. Fort Myer Drive, Arlington, VA 22209.

- May 23–26: *International IEEE/APS Symposium and National Radio Science Meeting*, University of Houston, TX. Contact: Professor Liang Shen, Department of Electrical Engineering, University of Houston, TX 77004.

- June 1–3: *IEEE/MTT-S International Microwave Symposium*, Sheraton Boston Hotel, Boston, MA. Contact: Frank Leith, Alpha Industries, 20 Sylvan Road, Woburn, MA 01801.

- June 12–16: 5th Annual *Bioelectromagnetics Society Meeting*, University of Colorado, Boulder, CO. Contact: BEMS, 1 Bank Street, Gaithersburg, MD 20878.

- June 21–23: *International Aerospace and Ground Conference on Lightning and Static Electricity*, Fort Worth, TX. Contact: Nick Rasch, FAA Technical Center, ACT-340, Atlantic City Airport, NJ 08405.

- July 18–21: 20th Annual *IEEE Conference on Nuclear and Space Radiation Effects*, Sheraton Gatlinburg Hotel, Gatlinburg, TN. Contact: E.F. Hartman, Div. 9336, Sandia National Laboratories, Albuquerque, NM 87185.

- July 18–22: 7th *International Symposium on Bioelectrochemistry and Bioenergetics*, Stuttgart, West Germany. Contact: Professor M. Blank, Department of Physiology, Columbia University Medical School, 630 West 168th Street, New York, NY 10032.

- August 23–25: *IEEE International Symposium on Electromagnetic Compatibility*, Hyatt Regency-Crystal City, Arlington, VA. Contact: Aaron Sullivan, Jr., 7121 Wolf Tree Lane, Rockville, MD 20852.

- August 23–26: *URSI International Symposium in Electromagnetic Theory*, Santiago de Compostela, Spain. Contact: Dr. J.L. Sebastian, Dept of Electricidad y Electronica, Facultad de Ciencias Fisicas, Ciudad Universitaria, Madrid (3), Spain.

- October 3–5: 3rd Annual *Meeting of the Bioelectrical Repair and Growth Society*, San Francisco, CA. Contact: Dr. Lorraine Day, San Francisco General Hospital, 1001 Potrero, San Francisco, CA 94110.

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# VDTs: VLF Measurements

Researchers at the Canadian Center for Occupational Health and Safety (CCOHS) have measured "relatively strong" emissions of very low frequency (VLF) radiation near the flyback transformers of some video display terminals (VDTs). They also have demonstrated a "practical method" for shielding against these emissions.

The center's Dr. Karel Marha and David Charron found that a simply constructed copper foil hood "greatly reduced VLF levels" around the terminals.

These results are described in a draft version of *The Very Low Frequency (VLF) Emissions Testing of CCOHS Video Display Terminals*. The document is currently under review and is scheduled for publication by CCOHS in early 1984.

The VLF electric field exceeded 300 V/m at 20 cm from the casings of several terminals near their flyback transformers, although significantly lower levels were found in front of the screen. Marha and Charron used an IFI EFS-1 meter which goes off scale at 300 V/m and so the maximum readings are unknown.

Emissions from flyback transformers are pulsed, with peak values from five to ten times greater than average readings, according to CCOHS spokesman Jim Purdham. The intensity of the individual pulses was not measured.

### Pulsed v. Continuous Waves

Purdham said in a telephone interview that the authors hope their findings will lead to research on the biological effects of pulsed waves as compared to those of continuous waves. He said the draft report "helps define the research that's needed."

*(continued on p.7)*

# NCRP To Study ELF Bioeffects

The Environmental Protection Agency (EPA) has asked the National Council on Radiation Protection and Measurements (NCRP) for a critical review of the biological effects of extremely low frequency (ELF) radiation.

Under a three-year, $150,000 contract, the NCRP will assemble a committee of experts to evaluate studies from around the world on the effects of ELF electric and magnetic fields, including those from high voltage overhead power lines.

W. Roger Ney, executive director of NCRP, said that the council is now in the process of assembling Scientific Committee No. 79 to write the report for EPA. Nominees for chairman and members of the committee are being weighed and will be presented to NCRP's Board of Directors at its December 13 meeting. (There are usually six to ten experts on NCRP committees.)

Speaking from his office in Bethesda, MD, Ney said that the committee will assess what standards might be needed in addition to surveying the available literature.

*(continued on p.7)*

## EBI v. Inco Case Settled

Electro-Biology Inc. (EBI) has retained its patent for the Bi-Osteogen bone regenerating system after a two-year court battle against three subsidiaries of Inco Ltd. In an out of court settlement, the Fairfield, NJ, company also acquired Inco's patent for treating bone breaks with pulsed electromagnetic fields (PEMFs). The November 11 agreement removes the threat of competing devices entering the market under licensing agreements from Inco.

Although the terms of the settlement are confidential, sources close to the proceedings report that Inco received no money or future royalties because, they speculated, EBI probably would have won its suit.

EBI sought a judgment from the Federal District Court for Southern New York, New York City, in 1981 (81 Civ. 7592) to uphold the validity of its patent, which defines specific electromagnetic signals that enhance bone growth. Inco held an extremely broad patent for PEMF bone treatment. (Inco Ltd. is a Canadian corporation.)

The suit focused on whether EBI obtained the rights to the Bi-Osteogen signal illegally. In a countersuit filed in 1982, Inco accused Dr. Arthur Pilla, one of the founders of EBI, of developing the idea for the Bi-Osteogen generator while still working for the Electric Storage Battery Corp. (ESB), which later became an Inco subsidiary called Exide. During Pilla's four-year tenure at ESB he was obligated to assign all discoveries to ESB. Pilla left ESB in February of 1975; EBI filed a trademark application for its device that June, which claimed the machine had been in existence since April, and Pilla and a colleague filed a patent application for certain PEMFs that fall.

Pilla maintains that the Bi-Osteogen signal was not discovered and patented until mid-1976. In an interview he explained that the 1975 filing was so general that it was rejected by the patent office.

After Pilla left ESB he went to work at Columbia University where John Ryaby and Dr. Andrew Bassett were already on staff. The three researchers started EBI in 1975. Pilla currently works at Columbia part time, and is a professor of orthopedics at Mt. Sinai Medical Center in New York City.

Though not a central issue in EBI v. Inco, the scope of the two patents raises interesting questions about PEMF treatment in general and EBI's formidable market position in particular. Are some signals more effective than others, and which signals fall under EBI's patents? As yet there are no clear answers.

Inco's former patent, filed by ESB employee Michael Manning in 1972 (US Patent No. 3,893,462; 1975), covers the therapeutic use of a wide range of PEMF signals with differing pulse rise and fall times. EBI's patent, on the other hand, specifies very complex signal characteristics defined by Pilla and Ryaby (US Patent No. 4,105,017; 1978). EBI claims the Bi-Osteogen waveform is what makes treatment work, though it does not rule out the possibility that other signals are effective.

Many researchers suspect that the type of signal used to stimulate bone growth is unimportant. For example, a number of scientists told *Microwave News* that it appears almost any signal will work, from PEMFs to ultrasound, but various systems and signals may be best suited for different applications.

Nevertheless, with Telectronics and a number of other companies now developing bone generators with signals similar to EBI's, new patent infringement claims may be filed. Asked about the Telectronics device, which is already in clinical trials, EBI Vice President Richard Reisner told *Microwave News* that his company "will take appropriate legal action" if the Telectronics signal is covered by the Manning or Ryaby-Pilla patents.

Some observers believe EBI's market position is so strong that it will ignore Bi-Osteogen look-alikes as long as competitor sales remain small. The EBI generator is by far the most widely used bone regenerating device and the only PEMF unit cleared by the Food and Drug Administration which does not require surgically implanted electrodes. According to Reisner, the generator had a 77 percent success rate for the 13,000 bone fractures treated to date. Another 7,000 patients are currently using the device.

Surprisingly, the settlement has done little to boost Wall Street's opinion of EBI. Stock prices for the fast-growing company plunged 60 percent, to about $12 per share, in late October because of a drop in third quarter earnings. Paul Combs, a stock analyst for Morgan Stanley & Co., explained that at present, a slowdown in the demand for its product outweighs the importance of patent protection for EBI. As we go to press, EBI is trading in the low teens. Its past year high was 34.

## Uncertain Link Between RF/MW and Cancer

Dr. William Morton of the University of Oregon has completed a revised report of his study linking nanowatt-levels (billionths of W/cm$^2$) of radiofrequency and microwave (RF/MW) radiation to leukemia. His analysis of radiation exposure and cancer rates among Portland residents has failed to pass peer review at the Environmental Protection Agency (EPA), however.

The EPA-sponsored study, begun in 1978 and initially completed in late 1981, is the first to link environmental RF/MW exposures to cancer (see *MWN*, January/February 1982). Morton, a professor at the university's Health Sciences Center in Portland, believes his findings for frequencies in the very low frequency (VLF) and FM bands could be significant and recommends further studies among the general population.

[At extremely low frequencies (ELF), Dr. Nancy Wertheimer and Ed Leeper have found an association between power line radiation and leukemia. A similar link has been found in a number of studies of occupationally exposed groups (see *MWN*, March 1983).]

Because of unfavorable peer reviews, EPA will not publish the Portland study. Dr. Joe Elder of the agency's Experimental Biology Division in Research Triangle Park,

NC, told *Microwave News* that Morton's project is being closed out and that the agency has no plans to fund similar investigations. Elder said the difficulty of documenting exposure histories for the public is a key problem.

The agency is currently doing a retrospective study of workers exposed to RF/MW radiation at MIT's radiation research lab. Elder noted that these exposures are certain to be greater than those experienced by the general population.

In an interview Morton said although there were unavoidable problems with his study, he is convinced that only more research will yield adequate exposure guidelines and calm public fears. Morton plans to publish his findings independently of EPA.

Though his 1981 preliminary report indicated a link between radiation levels and adenocarcinoma of the uterus, breast cancer and leukemia, further analysis revealed an association only with leukemia.

Radiation levels for the low VHF (54-88 MHz), FM (88-108 MHz) and high VHF (176-216 MHz) bands were extrapolated from EPA measurements made in 1977. According to these measurements, the average RF/MW level in Portland is 0.02 uW/cm$^2$. Morton assumed that the levels were constant over the 1963-1977 period for which cancer incidence and mortality were checked. No information is available on how RF/MW radiation patterns in Portland changed over this period.

## Soviets Again Beam Microwaves at US Embassy in Moscow

The Soviet Union resumed beaming microwaves at the US embassy in Moscow last summer, according to US Ambassador Arthur Hartman. The irradiation was intermittent with average power levels outside the embassy of 2 uW/cm$^2$. The microwaves were detected on average for two hours a day (never longer than four hours a day) between July 14 and October 19.

At a press briefing in Moscow on November 10, Hartman said that the microwaves were not a health hazard but that he had filed a formal protest with the Soviet Foreign Ministry "as a matter of principle." Two days later Reuters reported that the Foreign Ministry denied that microwaves were being aimed at the US embassy.

This is the first acknowledged resumption of the Moscow signal since the summer of 1979. The irradiation of the embassy was first discovered in 1953 and continued periodically at various frequencies and intensities for the next 26 years. In 1976 protective screening was installed on the windows at the embassy.

An informed source told *Microwave News* that the new signal comes from a single source, south of the embassy. The microwaves were primarily 7 GHz, with some components as low as 2 GHz, he said. The two-microwatt intensity was measured on the embassy roof.

The reason for the Soviets' use of microwaves remains unknown, though theories abound. Among the most popular hypotheses are that they are trying to interfere with embassy communications or are eavesdropping on conversations inside the embassy building. (Hartman said that the new signals did not cause any interference.)

In a new book, Martin Ebon takes the speculation one step further: the Soviets may be trying to alter the minds of embassy personnel or even read their minds by "tuning microwaves to the level of brain waves, possibly amplifying their intensity, then effecting a 'feedback' that could range from remote monitoring of brain wave activity to recording emotions, images or thoughts."

Ebon thinks that the Soviets' continued use of microwaves over so many years testifies to their utility and that "the potential of microwave technology in intelligence-gathering and brain manipulation is, literally, unimaginable." He even suggests that President Carter was subjected to some esoteric form of brain manipulation during the Vienna SALT II conference to explain what he calls Carter's "erratic, virtually manic-depressive" behavior when he returned home from Vienna.

One expert commented that he would be surprised if the Soviets could pull off something like this. "It's pretty far out," he said.

Ebon's *Psychic Warfare: Threat or Illusion* was published by McGraw-Hill ($15.95).

## ELF Fields Inside Homes Near Power Lines

Household wiring makes a significant contribution to the ambient electric fields inside homes located near power lines, according to two new studies.

### GE and PSE&G

In a collaborative effort between General Electric (GE) and New Jersey Public Service Electric and Gas (PSE&G), measurements were taken in a house located 95 meters from a 500 kV transmission line and 49 meters from a 13 kV distribution line. The electric field was measured while the transmission line and house power were each "on" and "off." The results indicate that E-fields "created by the house wiring were a significant part of the total field inside the homes."

For those combinations of transmission line and house power in which at least one was "on," the measured E-fields were in the 1-10 V/m range, with maxima of 14-24 V/m. When both the transmission line and house power were turned "off," the E-fields were below 1 V/m. A limited number of measurements of magnetic (H) fields and space potentials were also made.

E-fields measured in a house located a mile from the 500 kV power line were essentially the same as those within 100 meters of the line. The maximum reading was 16 V/m.

Interestingly, the E-field was often greater in the house near the power line when the transmission line was turned *off*. In a telephone interview, GE's Dr. Don Deno explained that when household and power line fields combine, they can do so "in unpredictable ways." The important point, he said, is that the contributions from the wiring and the transmission line to the E-fields are of the same order of magnitude.

Deno said that measuring space potentials is preferable to E-fields. He added that the unique element in this study is that the transmission line had been turned off. "That's an expensive proposition," Deno said.

Among the other results, Deno and co-workers found that houses can shield external electric fields by a factor of eight. That is, if the E-field outside a house is 80 V/m, the field inside is 10 V/m. In addition, they measured the fields generated by appliances. For example, the E-field is 250 V/m at 30 cm from an electric blanket and 90 V/m at the same distance from a stereo. Deno's paper appears in the October issue of *IEEE Transactions on Power Apparatus and Systems*.

Deno said that he is preparing two detailed reports on E-field measurements and is also collaborating with Michael Silva of ENERTECH in Pittsburgh, PA, on a measurement study for the Electric Power Research Institute (EPRI).

### SRI International

Ray Vincent of SRI International, Menlo Park, CA, presented similar data to those of GE and PSE&G on November 7 at the Department of Energy-EPRI contractors meeting in Kansas City, MO. In measurements taken for EPRI, Vincent and collaborator Jane Clemmensen found that the E- and H-fields in a house 7-10 meters from a 69 kV transmission line and a 13 kV distribution line were primarily due to the house wiring and consumer appliances. Similar results were obtained for homes near only a 13 kV distribution line.

The SRI researchers also conclude that it is important to measure both the E- and H-fields for 60 Hz radiation because one is always in the source's inductive zone. Also, they argue that whenever possible harmonics and subharmonics should be measured.

Clemmensen said that, in general, the SRI results are "consistent" with Deno's. But she does not agree with Deno's preference for measuring the space potential. "It is not a quantity defined by the IEEE," she said, "so you are better off sticking with the E- and H-fields."

The SRI measurement study will be published as an EPRI report.

## Is There Any CW Radiation?

"There is essentially no CW radiation in domestic, industrial or military environments." With these words, Dr. Ross Adey has challenged the relevance of a paper in *Science* that supports the new ANSI standard and the Environmental Protection Agency's (EPA) recent draft report on the bioeffects of radiofrequency and microwave (RF/MW) radiation.

At a meeting of Department of Energy (DOE) and Electric Power Research Institute (EPRI) contractors in Kansas City, MO, on November 8, Adey argued that the conclusions of a study by a research group at the University of Rochester were misleading. Drs. Norbert Roberts, Jr., Shin-Tsu Lu and Sol Michaelson examined the viability and function of white blood cells after a two-hour exposure to 2450 MHz continuous wave (CW) radiation (see *MWN*, May 1983). The results, which were published in the April 15 issue of *Science*, were supportive of the new American National Standards Institute (ANSI) RF/MW safety standard.

Adey said that "2450 MHz CW radiation does not occur outside the lab; it has no relevance to the real world." For example, he added, not even microwave ovens emit CW radiation. Adey said he decided to speak out because the Rochester paper had been widely cited in the press.

Michaelson, who was in the audience, replied that Adey's comments were "totally irrelevant to the proceedings of the meeting." He refused to respond beyond saying that he found them "personally insulting." The DOE-EPRI meeting was a forum on the bioeffects of high voltage power lines.

Turning to EPA, Adey said that the agency's emphasis on the thermal effects of RF/MW radiation in its criteria document is "totally inappropriate" (see *MWN*, October 1983). In addition, he charged that the membership of the special panel of the Scientific Advisory Board (SAB) assembled to review the EPA report was too heavily weighted with experts on thermal effects, with insufficient representation by those knowledgeable about non-thermal effects (see Adey's letter to EPA p.8).

EPA's David Janes replied that "it would be premature to say how the agency will set standards for public exposures to RF/MW radiation, but we want all the help we can get." The SAB panel is not the only source of EPA advice, Janes added.

## NAS Briefing on Non-Ionizing Radiation

The Board on Research on the Effects of Radiation at the National Academy of Sciences (NAS) has scheduled a briefing on non-ionizing radiation for December 5 in Washington, DC. Dr. Stephen Cleary of Virginia Commonwealth University in Richmond, Dr. Przemyslaw Czerski of FDA's National Center for Devices and Radiological Health and Dr. Michael Marron of the Office of Naval Research have been invited to address the board.

June Ewing, the board's staff officer, said that the background briefing was in line with the board's oversight function: to monitor radiation issues and to advise the academy on developments as they occur. The five-member board chaired by Institute Professor Salvador Luria of MIT has no ongoing program or funding for non-ionizing radiation.

According to Ewing, the briefing was prompted by recent press reports on non-ionizing radiation in general and the New York State Power Lines Project in particular.

The review of current research on the biological effects of non-ionizing radiation and federal regulatory activities is only one part of the agenda. The briefing will be closed to the public, although representatives of federal agencies will attend as observers. Ewing left open the possibility of a public meeting sometime in the future.

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# CONFERENCES

***January 11-14: National Radio Science Meeting,*** University of Colorado, Boulder. Contact: S.W. Maley, Dept. of Electrical Engineering, University of Colorado, Boulder, CO 80309, (303) 492-7004.

***January 16-20: Microwave Signatures in Remote Sensing,*** URSI Commission F Specialist Meeting, Toulouse, France. Contact: Dr. Richard Moore, Remote Sensing Laboratory, University of Kansas Center for Research, 2291 Irving Hill Drive, Lawrence, KS 66045, (913) 864-4836.

***January 17-19: Instrumentation & Measurement Society Technology Conference (IMTC) 1984,*** Aboard the Queen Mary, Long Beach, CA. Contact: Robert Myers, 1700 Westwood Blvd., Suite 101, Los Angeles, CA 90024, (213) 475-4571.

***January 27-29: Symposium on NMR Imaging,*** Fontainebleau Hotel, Miami Beach, FL. Contact: American College of Radiology, 6900 Wisconsin Ave., Chevy Chase, MD 20815, (301) 654-6900.

***January 30-February 3: IEEE Power Engineering Society: 1984 Winter Meeting,*** Hilton Hotel, Dallas, TX. Contact: Gerson Berman, Texas Power & Light Co., 1511 Bryan, PO Box 6331, Dallas, TX 75222, (214) 748-5411, ext. 5666.

***February 6-8: NIH Consensus Development Conference on Use of Diagnostic Ultrasound Imaging in Pregnancy,*** National Institutes of Health, Bethesda, MD. Contact: Michaela Richardson, NIHCD, Bldg. 31, Room 2A32, 9000 Rockville Pike, Bethesda, MD 20205, (301) 496-5133.

***February 23-25: Biological Effects and Therapeutic Applications of ELF Electromagnetic Fields,*** Venice, Italy. Contact: Dr. Luigi Zecca, Association for Biomedical Applications of Electromagnetism, Via Gentilino 9/a, 20136 Milan, Italy, (02) 8321655.

***March 13-14: 1984 National Radar Conference: Radar Technology for the 80's,*** Atlanta, GA. Contact: Dr. Edward Reedy, Georgia Institute of Technology, Engineering Experiment Station, Radar & Instrumentation Lab, Atlanta, GA 30332, (404) 424-9621.

***April 2-5: 3rd Annual Test & Measurement World Expo,*** Brooks Hall, San Francisco, CA. Contact: Meg Bowen, 215 Brighton Ave., Boston, MA 02134, (617) 254-1445.

***April 4-5: 20th 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.

***April 14-19: 19th Annual Association for the Advancement of Medical Instrumentation Meeting and Exhibit,*** Washington Hilton, Washington, DC. Contact: AAMI, 1901 North Fort Myer Drive, Suite 602, Arlington, VA 22209, (703) 525-4890.

***April 24-26: IEEE 1984 National Symposium on Electromagnetic Compatibility,*** Hyatt Regency Hotel, San Antonio, TX. Contact: William McGinnis, Southwest Research Institute, PO Drawer 28510, San Antonio, TX 78284, (512) 684-5111, ext. 2721.

***April 29-May 4: 9th Conference & Exposition on Overhead and Underground Transmission and Distribution,*** Bartle Exposition Hall, Kansas City, MO. Contact: Walter Ros, GE, Bldg. 2, Rm 507, 1 River Rd., Schenectady, NY 12345.

***April 30-May 3: 5th Annual Meeting of the Canadian Radiation Protection Association,*** Banff, Alberta. Contact: Stuart Hunt, C-7 Civil Electrical Engineering Bldg., University of Alberta, Edmonton, Alberta T6G 2G7, Canada.

***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 7-12: 6th International Radiation Protection Association (IRPA) Congress,*** International Congress Center, Berlin, West Germany. Contact: R. Neider, Bundesanstalt fur Materialpurfung (BAM), Unter den Eichen 87, D-1000 Berlin 45, West Germany.

***May 30-June 1: IEEE MTT-S International Microwave Symposium,*** San Francisco, CA. Contact: Dr. Ferdo Ivanek, Harris Corp., Farinon Division, 1691 Bayport Avenue, 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.

# EXCERPTS

The Federal Communications Commission (FCC) received nine sets of comments on how to regulate radiofrequency (RF) lighting to minimize interference problems. The comments came in response to a commission notice of inquiry (NOI) published in the August 17 *Federal Register* (48 *FR* 37235) (see *MWN*, September 1983). Energy efficient RF bulbs are expected to come into widespread use in the near future.

Not everyone agrees with the commission's view that industry rather than government should police RF lighting emissions. Anova Electronics, AT&T, the National Association of Broadcasters and the National Radio Broadcasters Association told the commission RF lighting could create significant interference and supported federal standards.

Industry self-regulation was favored by General Electric, the National Electrical Manufacturers Association and the Lighting Systems Research Program at Lawrence Berkeley Laboratory and the American Radio Relay League.

## Comments on FCC Inquiry on RF Lighting RFI

***American Radio Relay League:*** It is apparent that the interference potential of this type [North American Phillips SL-18 bulb] of RF lighting device is most acute at medium frequencies such as the AM broadcast band. It might be assumed that some potential for interference exists with respect to household carrier current electronic systems, such as intercoms or some security systems....From the point of view of interference potential to amateur radio stations, the league believes it both necessary and sufficient for the commission to require labeling of each RF light bulb to provide user information to educate consumers and users about interference potential to radio receivers.

***Anova Electronics:*** Anova Electronics has developed a fully integrated intelligent system for communications, control and protection within the home and small businesses. RF lighting has the potential for interfering with the operation of the Anova system and others which utilize power line carrier technology....Anova urges the commission to adopt a regulatory scheme for RF lighting devices which would protect communications users of the radio spectrum both radiated and via power line carrier, from interference caused by RF lighting devices.

***AT&T:*** In summary, our position is that the commission, not the lighting industry, should regulate the RF emission of such devices, and FCC regulation should be accomplished under Part 15, rather than Part 18 of the [FCC] rules....We believe the central issue of RF interference requires the commission to apply appropriate regulatory requirements to control potential interference and harm to radio licensees and telephone equipment operators. The lighting industry simply will not adopt emission limits and related interference control mechanisms that would provide the same degree of protection that is afforded by the commission's rules. With incentives obviously different from those of the commission, the lighting industry would likely establish more liberal limits for RF emission, thus creating a higher potential for interference to other equipment operators.

***General Electric:*** The FCC favors the use of industry-supported voluntary standards on RF design limits, and GE strongly agrees. GE recognizes the importance of a sound approach to interference control for what will become widely used lighting sources. The industry appears to be on a path of promoting good practices for interference control which, coupled with the voluntary industry standard, should minimize potential problems....Pending the adoption of a voluntary industry standard or FCC regulations appropriate to lighting sources, we recommend that the Part 18 certification requirement be eliminated. In its place, GE recommends that manufacturers be allowed to verify that their products comply with the proposed emanation limits and then to market their products, subject only to a labeling requirement....General Electric Company, which manufactures and uses equipment in the different frequency spectrums, has a particularly high interest in promoting good RF lighting practices.

***Lawrence Berkeley Laboratory:*** We believe the FCC should give the lighting industry a chance to develop voluntary industry standards through an organization such as NEMA....Limits should reflect different environments because the applicances in each would differ, i.e., commercial buildings have computers and communications systems; residential environments have radios, TV sets, etc. In commercial buildings wiring is in conduits; in homes power lines are not shielded.

***Motorola:*** LORAN-C is a low frequency navigation system which operates on a center frequency of 100 kHz. The associated receivers are susceptible to interference in the band from about 75 kHz to 125 kHz. Harmonic energy from the RF lighting devices described in the instant proceeding represents a potential source of interference in this band for terrestrial LORAN-C users. It seems unlikely that direct radiation at this low frequency from these devices will be of significance. There is, however, some possibility that energy may feed onto and throughout the power distribution system and then radiate at points quite removed from the devices themselves.

***National Association of Broadcasters:*** It is clearly probable that AM radio reception will suffer interference when used by persons who live and/or work in multi-unit complexes where RF bulbs may constitute the main source of lighting. Moreover, because the radiated energy emitted by RF lighting pollutes the electrical wiring of a building, AM radio stations that use power lines to transmit broadcast signals ("carrier current radio") may be ineffective in buildings where even just one RF light bulb is plugged into an outlet....RF lighting poses a significant problem of interference to AM radio and to possibly other broadcast and communications services operating in the 10 kHz to 80 MHz range. NAB believes that the commission should not defer to the lighting industry the authority to regulate the interference potential of these devices. ...The RF lighting industry has little incentive, if any, to adopt voluntary standards to reduce harmful interference to licensed broadcast communication services.

***National Electrical Manufacturers Association:*** NEMA feels strongly that such a voluntary standard should be given an opportunity to prove effective and completely supports the commission's

position that regulatory requirements should be enacted only as a last alternative....It is the position of NEMA such RF lighting devices do not represent a serious potential for interference to authorized communication services....NEMA's position is that evidence to date supports a conclusion that [broadband emissions from RF light bulbs] do not represent a serious interference potential, nor do they represent a threat to safety and air navigation services....The technical standards designed to limit emissions from ISM equipment in general as presently exists in Part 18 is most definitely inadequate. Limits roughly approximate to the recently enacted computer rules are felt to provide very adequate protection for authorized communication services from harmful interference from RF lighting devices....

***National Radio Broadcasters Association:*** It is imperative for the FCC, rather than the industry, to regulate the development and use of these new devices....The results of preliminary lab tests are alarming. They demonstrate that AM radios can receive objectionable radiation interference as far away as several meters from RF light bulbs.

## VDTs: VLF Measurements

*(continued from p.1)*

Earlier this year, a CCOHS report suggested that "pulse-modulated fields could be biologically more harmful than [unmodulated] fields." The center recommended an interim limit of 60 V/m at 30 cm for all non-ionizing radiation from VDTs (see *MWN*, January/February 1983).

CCOHS scientists, including Marha, have suggested that pulsed VLF may be one of the agents suspected of causing miscarriages and fetal abnormalities among VDT operators. Clusters of pregnancy-related problems have been documented at eight sites (see *MWN*, July/August 1982).

### Non-Uniform Fields

CCOHS's Purdham also discussed the effect the new measurements could have on where VDTs are placed in automated offices. An operator seated near the flyback transformer of a neighboring terminal might be exposed to VLF emissions if the terminal is not shielded. Purdham said that "if problems are being caused by VLF radiation —and we don't know that they are— configuration of VDTs becomes an important factor." VLF levels are significantly lower away from the flyback transformer.

CCOHS researchers measured 38 VDTs used at the center. Of these, 13 Hewlett-Packard units gave the high-level VLF readings. Much lower levels were produced by 25 Wang terminals, which require "no further attention," the report states. The Wang units contain a thin metallic lining inside their plastic casing to block non-ionizing radiation.

The investigators took readings at graduated distances from the terminals and at various heights above, below and level with them. The EFS-1 is a broadband (10 kHz to 200 MHz) electric field meter with sensitivity from 1 V/m to 300 V/m. It is made by Instruments for Industry of Farmingdale, NY.

Robert Bouzon, a spokesman for Hewlett-Packard (HP), told *Microwave News* the HP terminals tested by CCOHS are approximately seven years old and that HP's more recent units are shielded with metallic linings. He said that the company began using containment shielding in 1980 to prevent radiofrequency interference (RFI) and that new HP units meet RFI standards set recently by the Federal Communications Commission.

Bouzon said the CCOHS study was "curious" because the investigators did not test newer HP terminals although he acknowledged that "many thousands" of the older models are still in use. He refused to disclose a precise figure.

CCOHS's Purdham said the tests were run to gather information about terminals used at the center, not to evaluate a range of VDTs. The center owns HP terminal models 2621A and 2621P. The "P" model has a printer built into the top of its casing, which Marha and Charron say blocks emissions. The "A" model produced slightly higher readings on the side near the flyback transformer.

A Wang spokeswoman said that the company would not comment until it had seen the report.

Dr. Hari Sharma of the University of Waterloo, Ontario, said in a telephone interview that the CCOHS measurements generally are in line with readings he has taken. Sharma's tests at Surrey Memorial Hospital in Vancouver, British Columbia, found comparable VLF levels (see *MWN*, April 1983). A final report on his measurements is expected soon. ●

## NCRP *(continued from p.1)*

The EPA contract follows soon after a congressional subcommittee asked the agency to look into the bioeffects of radiation from power lines (see *MWN*, June 1983). EPA is in the process of developing a standard for public exposures to non-ionizing radiation, but excluding ELF. In the preamble to the NCRP contract, EPA notes that its Office of Radiation Programs is contemplating a complimentary standard for ELF.

Another NCRP committee (No. 53) has completed a draft of a report on the bioeffects of radiofrequency and microwave (RF/MW) radiation (see *MWN*, October 1981). Ney said that the draft is now being reviewed by the full council membership. He predicted that the study, which has been under way since 1977, will be released in the fall of 1984. ●

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# FROM THE FIELD

## Letter to EPA from Dr. W. Ross Adey

*On November 1, Dr. W. Ross Adey wrote to William Ruckelshaus, Administrator of the Environmental Protection Agency (EPA), concerning the agency's recently released* Biological Effects of Radiofrequency Radiation *(see* MWN, *July/August and October 1983). Reprinted below is the full text of Adey's letter (see also story p.4).*

Dear Mr. Ruckelshaus:

The Environmental Protection Agency has recently issued a draft report on biological effects of radiofrequency/microwave (RF/MW) radiation as a step towards establishing a general exposure standard. I write as a research scientist with more than 20 years experience in this field, and as the leader of interdisciplinary and interinstitutional teams that have made many pioneering contributions to our knowledge of biological effects of low level nonionizing electromagnetic fields including microwaves.

When finally established, this standard would be expected to fill important needs in defining acceptable limits for human exposure. To be effective and credible, it would therefore seem of the utmost importance that, on the one hand, this standard be based on the most comprehensive scientific information available, and on the other, that it should utilize the most relevant and realistic scientific models.

I respectfully submit that this draft report has serious deficiencies in both criteria; deficiencies that may be expected to hamper initial acceptance of the proposed standard and to grievously impede its further development as new and important scientific information becomes available.

The cutoff date for scientific material evaluated in the report is stated to be December 1980. In this rapidly growing scientific field, much new work has appeared in the past three years on biological effects of low level RF/MW fields. Many of these findings bear directly on the establishment of safety standards.

Evaluation of the scientific literature in the draft and the models developed by EPA's Office of Research and Development as a basis for the proposed standard are primarily concerned with heating as the principal cause of harmful effects in man and other living organisms. It is proposed to extrapolate down to "nonthermal" levels of exposure from thermalizing levels as the basis for a safety standard.

I respectfully submit that there is no scientific validity in this approach. Moreover, there is now unequivocal evidence that many significant neurologic, endocrine and immunologic responses occur in living tissues exposed to RF/MW fields at levels below those producing frank heating. These data have been evaluated in a recently completed study by the National Council on Radiation Protection (Panel 53), extending over the past seven years. This panel report emphasizes the unique character of the mechanisms underlying these interactions which are considered to rest on quantum mechanical mechanisms as distinct from the equilibrium thermodynamics that describes heating responses.

Amongst the findings in research since 1980 pertinent to a safety standard for RF/MW field exposure is the disclosure of effects at cell membranes mediated by pulsed and sinusoidally modulated microwave fields at non-thermalizing levels, and the coupling of these effects at cell surfaces to the cell interior. They involve the susceptibility of cell membranes to neurotransmitters, hormones and antibodies. There is impressive evidence of modification of immune functions of blood and tissue white cells by microwave fields below frank heating levels. Millimetric microwave fields have been shown to increase and decrease cell growth by exposure at closely adjacent wavelengths, and similar fields alter the genetic structure of mammalian sex cells. Although the full significance of these findings in such problems as aging and cancer must await future research, the sequence of administrative steps to the establishment of safety standards should proceed with current knowledge of low level interactions as essential cornerstones, rather than by extrapolation from irrelevant premises derived from the unrelated field of thermoregulatory pathophysiology.

It is clear that the proportion of the US population exposed to even a single heating dose of microwaves over an entire lifetime is negligible. I submit that this alone makes an approach to standard setting through heating models quite inappropriate. At the same time, there is strong evidence that many of these interactions between tissues and low level microwave fields have a specific character that relates to pulsed and other forms of amplitude modulation of the imposed field. Therefore, an appropriate biophysical model for standard setting should take account of known modulation-dependent bioeffects. These modulation patterns are produced by virtually all military, industrial and domestic microwave devices.

Membership of the Scientific Advisory Board Panel of the Office of Research and Development, chaired by Professor Charles Susskind, is restricted to those with backgrounds in thermoregulatory physiology and in the engineering aspects of tissue heating. In no way does this panel reflect the clear importance of specific consideration of so called "athermal" microwave bioeffects. It is to these weak fields that the US population will be exposed over a lifetime. Prudence would suggest that serious consideration should be given to evidence suggesting the potentially hazardous character of certain of these fields.

Standards established on this basis might be slightly lower than those derived from thermal models. However, they would not be expected to interfere with operation of any existing military, industrial or domestic systems. Of profound importance for future developments in standard setting, there would be a rational scientific basis for continuing review of new knowledge of biological effects attributable to low level exposures.

Thank you for your consideration.

Sincerely,

W. Ross Adey, MD
Associate Chief of Staff for Research and Development
Jerry L. Pettis Memorial Veterans' Hospital
11201 Benton Street, Loma Linda, CA 92357

## AF's Summary of Circumstances for Radar Accident at Clear AF Station

*Last month, we reported on a radiation accident at Clear Air Force Station near Fairbanks, Alaska, in which a tracking radar —part of the Ballistic Missile Early Warning System— was accidentally turned on. On November 22, we received the following statement from Vincent Murone of the Directorate of Aerospace Safety in the Air Force's Inspection and Safety Center at Norton Air Force Base in California.*

At approximately 3:35 pm on September 14, 1983, nine personnel at the Clear Air Force Station site were possibly exposed for about seven minutes to high frequency radio radiation. Of the nine, seven were employees of FELEC Services, Incorporated, the company that has the Air Force contract for maintenance and operation of the radar facility at the site, and two were US government employees from the Sacramento California, Air Logistics Center.

One individual was positively not exposed because he was outside the area. Therefore, the other eight are undergoing medical evaluation.

During a normal shutdown of the tracker radar assembly, crews were sent in to perform preventive maintenance work. The tracker had been locked off to prevent RF energy from entering the feedhorn of the tracker and the area where they were to work. Then, the site crew, joined by civil engineering welders and civil service employees who were inspecting the tracker screen, entered the tracker. Work continued throughout most of the day. At about 3:35 pm, two technicians discovered that the transmitter was working and that there was RF energy being fed through the feedhorn toward their work area. They then signaled everyone to evacuate the tracker pedestal where they were working. Preliminary indication is that a key lockoff position on the transmitter was opened by a technician without standard and proper safeguards being employed.

Initially, the eight workers were examined at the FELEC Services, Incorporated, clinic at Clear Air Force Station and then on Thursday, September 15, they were transported to Fairbanks by government vehicle where additional medical examinations were done at the Fairbanks Memorial Hospital. Initial examinations indicated that their medical conditions were not life threatening, long term debilitating or chronic. Blood, chest X-rays and eye checks were made by physicians and an ophthalmologist at Fairbanks Memorial Hospital. Preliminary results indicate no apparent ophthalmological problems. The physicians suggested funduscopy (eye examinations) for the next six months and a neurological examination. Complete physical examinations at the hospital did not reveal any obvious abnormal findings.

On Thursday, September 15, one individual who did not feel well was admitted for observation. The other seven individuals were released and instructed to return for additional examination if any problems developed. These people returned to work. A second individual returned to the hospital on Monday, September 19, for further observation.

A thorough investigation is currently underway, looking into how the breakdown in safety procedures occurred and how safety procedures can be improved. Although there are certain data existing surrounding the event, it is impossible to determine exact exposure time or level; best estimate is that no one was exposed for more than 8 minutes.

# UPDATES

## BIOLOGICAL EFFECTS

**Potential Epidemiology Populations...**A recent EPA report identifies eight population groups exposed to radiation as potential subjects for epidemiological studies. *Potential Human Study Populations for Non-Ionizing (Radiofrequency) Radiation Health Effects* (Report No. EPA-600/S1-82-017) recommends: RF heat sealer operators, high frequency (HF) tube welders, medical diathermy operators in VA hospitals and in rehabilitation facilities, children attending schools near broadcast towers, state policemen, security guards and radar technicians. The report, which was prepared for EPA by JRB Associates of McLean, VA, cautions that no single study group is ideal. An agency staffer said that EPA is "fairly cautious" about moving forward and added that it is not a given that a "Problem Definition Study," the next step toward an epidemiological study, will be taken. The EPA report (Order No. PB 83-147447) is available for $14.50 from the National Technical Information Service, Springfield, VA 22161.

## COMPATIBILITY & INTERFERENCE

**Resources...**Richard Schulz, editor of the *IEEE Transactions on EMC*, has left IITRI in Annapolis, MD, to join Xerox's Office Products Division. Schulz will work with Xerox's Regulatory Agency Requirements group in Dallas. His new address is: Mail Stop 114, Xerox Corp., 1341 West Mockingbird Lane, Dallas, TX 75247....Although the *1982 Wroclaw EMC Symposium* was never held, the papers that would have been presented have now been published. The two-volume record includes 74 papers (41 in English and 33 in Russian) and runs 750 pages. A copy is available for $30.00 in the US and Canada and $36.00 elsewhere. Order from James Hill, EMXX Corp., 6706 Deland Dr., Springfield, VA 22152. Checks should be made out to "IEEE-EMC Society."...The Electric Power Research Institute (EPRI) has been sponsoring research on ways to avoid interference caused by induced voltages on pipelines and railroad signal wires from power lines (see *MWN*, June and September 1983). The research is now complete and the EPRI reports prepared. For pipelines, the report (RP742-2), *Power Line—Induced AC Potential on Natural Gas Pipelines for Complex Right-of-Way Configurations*, has three volumes: Volume 1 ($29.50) describes the development of analytic methods for solving EMI problems; Volume 2 ($34.00) is a handbook for graphic analysis for those without access to a computer; and Volume 3 ($10.00) is a user's guide to a newly developed computer program, PIPELINE, to calculate induced voltages with sample examples. The printing of the final report (RP 1902-1) on railroads, *Mutual Design of Overhead Transmission Lines and Railroad Communications and Signal Systems*, has been delayed for a few months. It also comes in three volumes: Volume 1 is an engineering analysis for designing a mutually acceptable siting design, with technical appendices in Volume 2. Volume 3 is a user's manual for a computer program, TRAIN. The price of the latter set of reports has yet to be set. Order from: Research Reports Center, PO Box 50490, Palo Alto, CA 94303, (415) 965-4081....The FCC's Office of Science and Technology has issued *Analysis of Technical Possibilities for Further Sharing of the UHF Television Band by the Land Mobile Services in the Top Ten Land Mobile Markets*, (No. FCC/OST R83-3). A copy is available from the International Transcription Services, FCC, Room 248, 1919 M St., NW, Washington, DC 20554. For more information, contact FCC's Victor Tawil at (202) 653-8113.

# UPDATES

## GOVERNMENT

**Advisory Committees...**DOE has set up a new advisory committee, the Health and Environmental Research Advisory Committee, to help address the impacts of energy projects and to recommend levels of funding within the health and environment research program. The committee's charter was approved on November 22; its chairman and membership have yet to be named. A committee staffer said that he did not think the committee would review research on transmission lines. But, he added, plans are still in their formative stages. For more information, contact DOE's Gloria Decker, (202) 252-8990....The Radio Technical Commission for Aeronautics' (RTCA) Special Committee 156 on Potential Interference to Aircraft Electronic Equipment from Devices Carried Aboard will meet in Washington, DC, December 1-2, to discuss the extent of the RFI problem caused by the use of portable computers and games on planes (see *MWN*, October 1983) and to develop a work schedule for the committee. For more information, contact RTCA, (202) 682-0266....NTIA's Frequency Management Advisory Council (FMAC) will meet in Washington, DC, on December 6. The agenda is the same as it was for its last meeting on September 21: the constitution and convention of the International Telecommunications Union (ITU), High Definition Television and government and industry coordination to minimize interference from radiation devices. For more information, contact Charles Hutchison, (202) 377-0805.

## MILITARY SYSTEMS

**Developments at Clear...**The Air Force has disclosed that human error caused the accident in which workers were overexposed to radiation at Clear Air Force Station near Fairbanks, Alaska (see *MWN*, November 1983). A technician turned on the tracking radar (see From the Field p.8). One of the exposed workers, Richard Eldridge, has been fired by FELEC Services Inc., a subsidiary of ITT. Eldridge told *Microwave News* that he was informed that he lost his job because he had violated his employment contract by being absent from work without permission. In fact, he said, he and his doctor had notified FELEC that he would take medical leave to seek expert medical advice. A spokesman for FELEC said that Eldridge was fired for reasons that had nothing to do with the radiation incident. He refused to reveal the specific reasons because, he said, ITT policy prevents him from discussing personnel matters. ...Alaskan Senator Ted Stevens (R) has become interested in the accident and is making inquiries about how it happened and how future incidents can be prevented....FELEC is preparing a High Accident Potential (HAP) mishap report; it was due to be released by the end of November, but has been delayed for about a month.

**SE and SW PAVE PAWS Radars...**Raytheon Co.'s Equipment Division of Wayland, MA, has won a $77 million contract to build, install and test the Air Force's third PAVE PAWS radar at Robins AFB in Georgia. The phased array radar is designed to detect sea-launched ballistic missiles at a range of up to 3,000 miles off the US's southeastern coast and can also track satellites in earth orbit. Work is scheduled to begin in the spring of 1984 and the radar should be operational in late 1986. Raytheon built the first two PAVE PAWS radars, now in operation at Otis Air Guard Base on Cape Cod, MA, and at Beale AFB, CA. It also has an option for the fourth PAVE PAWS system planned for Goodfellow AFB, TX....SRI International prepared the environmental assessment for the AF's southwest radar system at Goodfellow (Report No. USAFSAM-TR-83-13). It concluded that chronic exposure of humans to the RF radiation outside the exclusion fence "is not likely to be harmful." With respect to RFI, it found that there may be some interference with TV reception and other home electronic systems and with UHF land mobile and amateur radios, depending on which site is selected. In addition, SRI predicted that there would be no hazards associated with fuel handling or cardiac pacemakers at ground level beyond the exclusion fence and that electroexplosive devices could be safely used beyond about 1.2 miles for the basic system and 2.4 miles for the optional, higher power system.

**Under the Ice...**Tests run last year indicate that the navy's ELF communications system can send messages to submarines under the North Pole ice cap, according to Vice Admiral Gordon Nagler, director of command and control in the office of the Chief of Naval Operations. This is the suggestion of Nagler's testimony to a closed hearing of the House Appropriations Committee's subcommittee on defense last March. What Nagler actually said is uncertain because the recently released transcript of the hearing has been heavily censored....James B. Schultz reviews the progress being made on an alternative submarine communications system, blue-green lasers, in the November *Defense Electronics*.

**EMP in Michigan...**There was a pulse of sixties-style activism at the University of Michigan's Ann Arbor campus when demonstrators took over an engineering lab to protest research on EMP being carried out by Professor Thomas Senior. The students want to stop all military research at the university.

## OCCUPATIONAL HEALTH

**RF Sealer Studies...**Two new RF sealer studies are under way. The Swedish National Board of Occupational Safety and Health will begin testing 100 RF sealer operators in January for potential ill effects of radiation exposure. Among the tests to be administered is one designed to check finger motion —the fingers are closest to the radiation source. Data collection will take about a year. In an interview Dr. Kjell Mild, the principal investigator for the study, said that he had not yet decided whether the worker population would be male or female. Most of the RF sealers in Sweden operate at 27 MHz, though some use 13 or 40 MHz. Mild is based in Umea on Sweden's eastern coast, about

300 miles north of Stockholm....The FDA has issued a contract to the Maryland Department of Health and Mental Hygiene's Office of Environment Health to locate most of the RF sealers used in the state. During the first year of a planned two-year study, the researchers will measure the RF exposure levels in the work places and assess other potential hazards. Next year, if FDA funds are available, a study population of exposed operators will be identified and the feasibility of completing an epidemiological study will be determined.

**Cancer in the Electronics Industry...**A Swedish study on the incidence of cancer in the electronics industry has identified a "slight excess risk of cancer" in the industry as a whole. But "blue collar workers in the industry had twice the risk of getting pharyngeal cancer compared with the working population in general." There may also be a "slight excess risk of lung cancer." Dr. D. Vagero of Huddinge University Hospital and Dr. R. Olin of Stockholm's Royal Institute of Technology report that when they looked at specific categories within the Swedish electronics industry, "certain clusters appeared." For instance, there was a raised relative risk of nasopharyngeal cancer among men in the radio and TV industry, and cancer of the nasal cavities for other electronic workers. The researchers are quick to point out that methodological problems should be considered when their results are interpreted. The study appears in the *British Journal of Industrial Medicine, 40,* 188, 1983.

## POWER LINES

**Resources...**The Aerospace Corp. has prepared a report summarizing the status of research projects being funded by DOE, the Electric Power Research Institute and the New York State Power Lines Project on (1) 60 Hz electric and magnetic fields, (2) DC electric fields and ions and (3) spark discharges and conducted currents. The report includes recommendations for future research. A limited number of copies of *Biological Effects from High-Voltage Transmission Lines: Research Guidance,* No. DOE/CE/76007-1, September 1983, are available from Kenneth Klein, Electric Energy Systems Division, CE-143, Forrestal Bldg., Mail Stop 5E052, DOE, Washington, DC, 20585....Researchers at the Tennessee Valley Authority (TVA) have been measuring electric and magnetic fields in the vicinity of its high voltage transmission lines and have developed a model for calculating fields for various types of terrain and ground cover. They found their predictions agreed with actual measurements. *TVA's 500 kV Electric and Magnetic Fields: Measurements and Analyses,* No. DOE/ET/29016-1, September 1983, is available from the National Technical Information Service, Springfield, VA 22161....One of the criticisms leveled against Dr. Nancy Wertheimer and Ed Leeper's epidemiological studies relating cancer to power lines is that they have no precise data on exposures to the 60 Hz fields. The two researchers respond to this argument in a letter published in the November 18 issue of *Science.*

## STANDARDS

**IEC & EIA...**The International Electrotechnical Commission (IEC) has published two new standards: *CISPR 18-1-1982, Radio Interference Characteristics of Overhead Power Lines and High Voltage Equipment—Part 1: Description and Phenomena* ($72.00); and *CISPR 19-1983, Guidance on the Use of the Substitution Method for Measurements of Radiation from Microwave Ovens for Frequencies above 1 GHz* ($11.00). IEC has also released the following three six-month draft rules: *77A(Central Office)3, Amendment to Publication 552-2: Disturbances in Supply Systems Caused by Household Appliances and Similar Electrical Equipment—Part 2: Harmonics* ($5.00); *12F(Central Office)81, Publications 489-2 and 489-4, Appendix D and Publications 489-3 and 489-5, Appendix H: Guide for Construction of a 3-Meter Radiation Test Site for Measurements above 100 MHz of Equipment Emitting RF Electromagnetic Energy* ($5.00); and *12F(Central Office)83, Publication 489-3, Appendix G and Publication 489-5, Appendix G: Guide for Construction of a 30-Meter Radiation Test Site for Equipment Receiving RF Electromagnetic Energy* ($5.00). Copies are available pre-paid from the International Sales Dept., ANSI, 1430 Broadway, New York, NY 10018....The Electronic Industries Association (EIA) has approved a new standard, *Recommended Practice for the Measurement of X-Radiation from Direct-View TV Picture Tubes,* (No. RS-503). A copy is available for $5.00 from Standard Sales Dept., EIA, 2001 Eye St., NW, Washington, DC 20006.

## VDTs

**IEEE Survey...**An informal readers' poll by *The Institute,* a monthly publication of The Institute of Electrical and Electronics Engineers, found that 17 percent of the respondents experienced eyestrain, headaches or back and neck aches that they associated with VDT use. Eighty-two percent identified no health problems due to work at VDTs. In September, *The Institute* asked readers to report their VDT experiences in an item accompanying a report on the National Academy of Sciences VDT report released earlier this year (see *MWN,* July/August 1983). Three-fourths of those who responded were regular VDT users, and six out of ten of this group described their terminals as well designed.

**Conference Report...**A new call for an interim occupational standard governing VDT non-ionizing radiation emissions came out of the PACE conference on VDTs held in Toronto, October 27-28. It was one of several consensus recommendations adopted at a conference-closing session, moderated by Chris Dodge, a science policy specialist with the US Library of Congress. Conference participants also urged that ELF research comparing VDT users and non-operators be accorded "highest priority" by government agencies. Finally, more rapid development of non-CRT display technologies that would produce less non-ionizing radiation was endorsed. At an earlier session, Dodge told

participants that weak ELF fields have been shown to enduce a host of ailments....A new hypothesis that might help explain VDT-related ailments was presented at the conference, as well. Eric McLuhan, a communications consultant in Ontario, said that VDT-induced stress disorders result from a clash between the right and left hemispheres of the brain. While a visual image, such as a screen display, stimulates the right half of the brain, language or information on the screen reaches the left side. What results, according to McLuhan, is a "war in the brain," causing severe stress. For more information about the conference contact PACE's president, Andrew Michrowski, 100 Bronson Ave., Rm. 1001, Ottawa, Ontario K1R 6G8, Canada, (613) 236-6265.

**Resources...**The American Council on Science and Health (ACSH) has published *Health and Safety Aspects of Video Display Terminals*, a 22-page pamphlet intended to "present the current scientific evidence" on VDTs. ACSH concludes that alleged radiation hazards do not exist, reported cataracts and pregnancy problems apparently are due to chance and vision and musculo-skeletal difficulties can be "caused or aggravated" by ergonomic factors. It costs $2.00 from ACSH, 1995 Broadway, New York, NY 10023, (212) 362-7044....The risks of X-ray and microwave radiation from VDTs are discounted, and ELF emissions are only slightly more suspect in an analysis offered by a radiation protection officer from MIT. James L. Jones writes that "research suggests that any effects [of ELF], if found, will be subtle and low-level." *Video Radiation: Fears Out of Focus* is published in the MIT *Technology Review*, October 1983....The National Academy of Sciences is sending an errata sheet to recipients of its report *Video Displays, Work, and Vision*. The results of a report done by the Newspaper Guild are incorrectly presented. Contact NAS's Pepper Leeper, 2101 Constitution Ave., NW, Washington, DC 20418, (202) 334-2000 for a copy of the corrections.

### ETC...

**IMPI Publications...**International Microwave Power Institute (IMPI) has issued the proceedings of its symposium held in Philadelhia, PA, last July (see *MWN*, July/August 1983). The collection consists primarily of abstracts of the original papers, though some of the contributions are more detailed. A copy is available for $20 from Barbara Jean Frye, IMPI, Tower Suite 520, 301 Maple Ave., Vienna, VA 22180, (703) 281-1515....IMPI has also published its first *International Directory of Electromagnetic Heating and Instrumentation 1983/4* for $15.00 (members) or $18 (nonmembers)....The March 1983 issue of *The Journal of Microwave Power* (an IMPI publication) features a collection of papers on "Electromagnetic Techniques in Energy Applications." Topics include RF/MW radiation applications for heavy oils, oil shale and coal....The September 1983 issue is devoted to "Electromagnetic Techniques in Medical Diagnosis and Imaging." Topics include NMR, thermography, millimeter waves and measuring lung water content.

# SHORT COURSES

***January 16-20:*** ***Fundamentals of Radar Cross Section,*** St. Cloud, FL. Fee: $695. Contact: Southeastern Center for Electrical Engineering Education (SCEEE), Central Florida Facility, 1101 Massachusetts Ave., St. Cloud, FL 32769, (305) 892-6146. Repeated ***April 30-May 4:*** Los Angeles, CA ($745).

***January 17:*** ***EMC: The FCC Means Business,*** San Francisco, CA. Fee: $595. Contact: Carol Clark, McGraw-Hill Seminar Center, 331 Madison Avenue, Suite 603, New York, NY 10017, (212) 687-0243. Repeated ***April 3:*** Boston, MA.

***January 23-27:*** ***Microwave High-Power Tubes and Transmitters,*** Los Angeles, CA. Fee: $875. Contact: Continuing Engineering Education, George Washington University (GWU), Washington, DC 20052, (800) 424-9773.

***January 31-February 2:*** ***Millimeter Wave Systems & Technology,*** Atlanta, GA. Fee: $535. Optional fourth day on millimeter wave radar for $180. Contact: Dept. of Continuing Education, Georgia Institute of Technology (GIT), Atlanta, GA 30332, (404) 894-2547.

***February 8-9:*** ***Microwave Devices & Sources,*** Atlanta, GA. Fee: $475. Contact: GIT, see January 31 above.

***February 13-17:*** ***Advanced Radar Technology,*** Orlando, FL. Fee: $795. Contact: Linda Billard, Technology Service Corp. (TSC), 8555 16th St., Suite 300, Silver Spring, MD 20910, (800) 638-2628.

***February 14-17:*** ***Modern Microwave Techniques,*** San Diego, CA. Fee: $675. Contact: TSC, see February 13 above.

***February 16-17:*** ***Grounding, Bonding & Shielding,*** San Diego, CA. Fee: $625. Contact: GWU, see January 23 above. Repeated ***April 9-10:*** Washington, DC; ***May 17-18:*** Ottawa, Canada; ***May 21-25:*** Hamburg, West Germany.

***February 21-24:*** ***Microwave Solid State Devices and Circuits,*** Los Angeles, CA. Fee: $895. Contact: UCLA Extension Short Course Program, PO Box 24901, 6266 Boelter Hall, Los Angeles, CA 90024, (213) 825-1047.

***February 27-March 2:*** ***Spread Spectrum Systems and Interference Rejection Techniques,*** Los Angeles, CA. Fee: $895. Contact: UCLA, see February 21 above.

***March 5-7:*** ***Planning & Implementing an NMR Imaging Facility,*** Washington, DC. Fee: $695. Contact: GWU, see January 23 above.

***March 12-16:*** ***Radiowave Propagation for Communications Systems Design,*** Orlando, FL. Fee: $875. Contact: GWU, see January 23 above.

***March 15-16:*** ***Lightning Protection,*** Orlando, FL. Fee: $625. Contact: GWU, see January 23 above. Repeated ***June 4-5:*** Washington, DC.

***March 19-23:*** ***Flat-Panel and CRT Technologies,*** Los Angeles, CA. Fee: $895. Contact: UCLA, see February 21 above.

***March 22-24:*** ***NMR: A Primer for Radiologists,*** Hilton Head Island, SC. Fee: $375. Contact: K.V. Pyles, Foundation for Education in Magnetic Resonance, 111 Glade Park East, Kittanning, PA 16201, (415) 545-7085.

***April 30-May 4:*** ***High Frequency Spectrum: New Concepts and Technologies,*** Washington, DC. Fee: $875. Contact: GWU, see January 23 above.

# MICRO WAVE NEWS

**Vol.IV No.10** **A Monthly Report on Non-Ionizing Radiation** **December 1984**


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

# WHO-IRPA ELF Health Report

The World Health Organization's (WHO) and International Radiation Protection Association's (IRPA) criteria document on extremely low frequency (ELF) radiation recommends limiting long-term exposures to "levels as low as can be reasonably achieved," especially for the general population, until more is known about ELF biological effects.

The newly released report concludes that, "It is not possible from present knowledge to make a definitive statement about the safety or hazard associated with long-term exposure to sinusoidal electric fields in the range of 1-10 kV/m," although there is no need to limit access to areas which will result in "intermittent exposure" to electric fields below 10 kV/m.

The 131-page document, prepared by a joint WHO-IRPA committee, provides an overview of bioeffects research for 0-300 Hz radiation and offers tentative conclusions about the significance of reported findings. For example, the authors state that cellular, physiological and behavioral effects observed in *in vitro* and animal studies cannot be extrapolated to humans, although these studies "serve as a warning that unnecessary exposure" to these fields should be avoided.

The committee stresses that current knowledge of the mechanism of ELF biological interaction is very limited and that as yet there is no theory

*(continued on p.5)*

# Hopkins Lab Sets 100 uW/cm² RF/MW Safety Standard

The Johns Hopkins University Applied Physics Laboratory (APL) has adopted a "flat" 100 uW/cm² safety standard for exposures to 30 MHz-100 GHz radiation. The standard applies to all lab employees, whether or not they work with radiation emitting devices.

The new APL standard differs from other radiofrequency and microwave (RF/MW) radiation limits in two key ways. First, it is much stricter than other occupational standards. Indeed, it is in line with the limit the Environmental Protection Agency was about to propose for the general public last summer. (EPA has now indefinitely delayed its radiation guidance, see *MWN*, October 1984.) The APL limits are ten times lower than the 1982 American National Standards Institute (ANSI) guidelines for the 30-300 MHz band, and *fifty* times more stringent than ANSI for frequencies above 1500 MHz. It is a hundred times stricter than the current, though older, Occupational Safety and Health Administration (OSHA) and Department of Defense RF/MW standards.

The APL standard also differs by being frequency-independent or "flat" above 30 MHz, as opposed to the increasingly common "well-shaped" limits which are most restrictive at whole-body resonant frequencies (approximately 30-300 MHz).

Below 30 MHz, the standard increases to 10 mW/cm² at 3 MHz and remains at that level down to 300 kHz.

***(continued on p.5)***

## Delgado Group Corrects Pulse Rise Times

Due to an engineering error, Dr. Jose Delgado's research group misreported the rise times of pulsed magnetic fields in a key paper published last year. While the disclosure does not affect the group's finding that pulsed magnetic fields can have profound effects on the development of chick embryos, it will force a reassessment of which pulse shapes induce teratogenic effects (see *MWN*, March and November 1983).

Dr. Jocelyne Leal disclosed the error at a seminar at the Center for Devices and Radiological Health (CDRH) in Rockville, MD, on November 14. She explained that an inappropriate filter had been used to measure the rise times. Leal is a senior researcher in Delgado's lab and has led the group's chick embryo studies.

In a telephone interview with *Microwave News* from Madrid, Spain, Leal dictated the corrected rise times — each is the mean value of ten measurements. She said that the measurements were made with a Tektronix 7854 oscilloscope, equipped with a 7A15A vertical amplifier.

The table compares the revised rise times with those which were originally published in A. Ubeda *et al.*, "Pulse Shape of Magnetic Fields Influences Chick Embryogenesis," (*Journal of Anatomy, 137*, 513, 1983).

According to the original paper, pulse A had a teratogenic effect at certain intensities, pulse B and D upset the development of the embryos, while pulse C had no effect. (The pulse repetition rate was 100 Hz with a pulse duration of 500 microseconds (usec)).

| Pulse Type | Reported Rise Time (usec) | Actual Rise Time (usec) | Field Intensity (uT)[1] |
|---|---|---|---|
| A | 100 | 85-100 | 0.4-104 |
| B | 2 | ~2 | 0.4 |
| C | 42 | 6.9 | 1.0 |
| D | 42 | 1.7* | 1.0 |

* maximum value: 3.5 usec
[1] microtesla

The authors have sent a correction to the *Journal of Anatomy*.

Interestingly, although it now turns out that Delgado and Leal did not use a 42 usec rise time, Dr. Kjell Hansson Mild of the National Board of Occupational Safety and Health in Umea, Sweden, has shown that magnetic field pulses with a 40 usec rise time cause harmful effects in developing chick embryos (see *MWN*, June 1984).

On November 15, several researchers who are working on replicating the chick embryo studies met with Leal in an effort to ensure that all the experimental parameters used by the various groups are as similar as possible. Among those present at the Rockville, MD, meeting were Richard Tell and Dr. Ezra Berman of the Environmental Protection Agency (see *MWN*, January/February 1984), Dr. Mays Swicord of CDRH, Dr. Michael Marron of the Office of Naval Research, and Mild and his associate Dr. Monica Sandstrom.

## ISM Rules Simplified

The Federal Communications Commission (FCC) is moving ahead with plans to simplify its rules for industrial, scientific and medical (ISM) equipment. The changes proposed on November 21 include publishing emission measurement methods in a separate bulletin and eliminating the three-year recertification requirement for RF lighting devices and other ISM equipment.

The commission opened Docket 20718 six years ago in order to overhaul the decades-old Part 18 Rules which have become complicated and in some cases confusing. While authorization and measurement requirements will be clarified to accommodate the wide range of current ISM equipment, including microwave ovens, the FCC's emission limits will remain unchanged pending further study. An FCC spokeswoman said that it will be at least a year or two before any action is taken on the limits.

Under the proposed rules, emission measurement methods will be consolidated and published in Bulletin MP-5, *Methods of Measurements for Industrial, Scientific, and Medical Equipment*, which will incorporate the procedures for microwave ovens now published in OCE Bulletin 20.

A new authorization program will simplify the old rules, which provided inconsistent definitions and in some cases multiple programs for the same equipment. Now, only notification procedures will be necessary for most devices, with the exception of the following: consumer ISM equipment will require certification, except for microwave ovens which must meet the more stringent "type approval" requirements; and ultrasonic equipment generating less than 500 watts and operating below 90 kHz and one-of-a-kind equipment will require verification. The commission will start a sampling program to assure compliance.

RF lighting devices marketed under the new rules must continue to meet the technical standards established for computing devices in Part 15 Subpart J pending further action, (see *MWN*, September 1983 and October 1984).

Comments on the commission's third notice of proposed rule making (49*FR*47628, December 6, 1984) (which includes an appendix with the revised measurement methods) are due by January 7 and reply comments by January 22. The first two notices appeared in the *Federal Register* on October 6, 1978 (43*FR*46326) and February 15, 1979 (44*FR*9771). For further information, contact Liliane Volcy, Office of Science and Technology, FCC, Washington, DC 20554, (202) 653-8247.

# Clear Radar Accident: One Year Later

The Occupational Safety and Health Administration's (OSHA) reenactment of the radar accident at Clear Air Force Station in Alaska indicates that worker exposures could have been significantly different from those previously estimated by the U.S. Air Force.

In an October 25 report released by Alaska Congressman Don Young, Robert Curtis of OSHA's Health Response Team states that the highest exposure may have reached approximately 390 mW/cm$^2$. The Air Force survey, conducted shortly after the September 14, 1983 incident, concluded that the maximum exposure was 105 mW/cm$^2$. Some of OSHA's figures for the field intensities are lower than those released by the Air Force and some are higher, indicating the presence of complex fields.

Six welders and technicians were exposed to 420 MHz radiation when a high-power tracking radar (AN/FPS-92) was accidently turned on while undergoing routine maintenance (see *MWN*, November 1983 and January/February 1984). The Clear radar is part of the Ballistic Missile Early Warning System (BMEWS).

A basic problem in attempting to estimate the exposure levels remains unresolved. No one agrees on what the output power was when the radar was turned on. The workers believe the power setting was 1.5-1.7 megawatts (MW), whereas the Air Force maintains that it was 0.9-1.5 MW. The OSHA simulation was run at 1.5 MW.

Curtis and co-worker Dr. Allan Heins positioned a number of probes at various heights in the spots where the workers believe they were at the time of the accident. Based on a series of measurements, they estimate that the greatest exposure for worker Karl Kepler could have been twice as high as the Air Force's figure of 105 mW/cm$^2$. Their measurements also indicate that Edgar Forsling's exposure may have reached approximately 390 mW/cm$^2$, as compared to the Air Force estimate of 45-55 mW/cm$^2$.

The 1982 American National Standards Institute (ANSI) occupational limit for exposure to 420 MHz radiation is 1.4 mW/cm$^2$. The current Alaska state occupational standard is 10 mW/cm$^2$. The Air Force also has a 10 mW/cm$^2$ safety standard.

Other developments related to the Clear accident include:

- The U.S. General Accounting Office (GAO) will soon complete a draft of its report on the radar accident. The report, requested by Congressman Young, will review the general performance of ITT Felec Services Inc., which operates the Clear station for the Air Force. GAO is placing special emphasis on the safety practices at the base and the medical treatment of the six workers after the accident. The final report is scheduled for release next spring.
- On October 26, Felec paid a $420 fine and agreed to institute new procedures that should prevent another accident. In its agreement with the Alaska Department of Labor, Felec did not admit any fault or liability.
- In a June letter to EPA Administrator William Ruckelshaus, Young asked the agency to participate in the investigation of the Clear accident. At the end of July, Ruckelshaus responded that EPA staffers would calculate RF radiation levels around the station, using existing models.
- At this summer's Bioelectromagnetics Society meeting in Atlanta, GA, John Mitchell of Brooks Air Force Base in San Antonio, TX, presented some preliminary data on 58 confirmed cases of overexposure (over 10 mW/cm$^2$) to radar radiation documented in Air Force files. According to Mitchell, most of the accidents involved partial body exposures to radiation in the 1-10 GHz frequency range. Most incidents lasted less than six minutes. He concluded that few clinical patterns emerge from looking at all the cases together. Mitchell is preparing a report on Air Force radar accidents.
- There are very few case reports on radar accidents in the medical literature. Two which are available are: Robert A. Williams and Thomas S. Webb, "Exposure to Radiofrequency Radiation from an Aircraft Radar Unit," *Aviation, Space and Environmental Medicine, 51,* 1243-1244, 1980; and Samuel Forman *et al.*, "Psychological Symptoms and Intermittent Hypertension Following Acute Microwave Exposure," *Journal of Occupational Medicine, 24,* 932-934, 1982.

### Swedish Research

Given the paucity of information on the long-term effects of exposure to radar radiation, there is now much interest in the research of Dr. Hans-Arne Hansson of the University of Goteborg in Sweden. Hansson has been examining radar workers for the Swedish military and he presented some provocative preliminary findings at the workshop on *Electromagnetic Waves and Neurobehavioral Function,* held in Corsendonk, Belgium, last August.

In a summary of the workshop, London-based Dr. Tom Rozzell of the Office of Naval Research reports on some of Hansson's findings:

> "Some [of the examined radar workers] appeared to have a type of frontal brain syndrome. These he referred to a neurology unit at the local hospital. At the hospital, their cerebrospinal fluid was examined for its protein pattern. It was found that there was an increase in a certain acidic (pH=4.9) protein that is not present in more than 10,000 patients that have been examined at this clinic and which served as controls. Thus there appears that there can be some long-term effects of microwaves and that, in the case of the radar workers, there appears to be severe brain damage. It is significant that the radar workers were examined independently by two psychiatrists and were found to be free of any other diseases or things like alcoholism that could account for their decreased brain function. The work is continuing and is not ready for open discussion at this time because of the low number (11) of cases studied to date."

Rozzell's report from the Corsendonk meeting appears in the October 1984 issue of the *Bioelectromagnetics Society Newsletter.*

## FCC Revises Cable TV Rules To Avert RF Interference

The Federal Communications Commission (FCC) has revised its Part 76 rules to protect against interference from cable TV to aeronautical and marine radio services. The commission concluded that action is necessary because new frequency assignments for aeronautical radio may increase the risk of interference in coming years, and because it has found cable operators are lax in complying with existing rules.

The cable industry's overall past record of relatively little interference has not assuaged FCC concern. A key reason is the Federal Aviation Administration's decision in the past few years to assign communications frequencies at only 50 kHz, and now even 25 kHz, intervals. Commission staff also suspect that incidents go unreported because affected parties may have considered cable to be a closed system and therefore overlooked it as a possible source of interference.

The rule changes adopted October 26, based on a 1980 proposal, include extending new mandatory frequency "offsets" to all cable systems. In this case, cable TV operators are required to maintain a minimum interval between their carrier frequencies and aeronautical service frequencies. Currently, offset requirements only apply to systems within 60 nautical miles of an aeronautical station.

In addition, operators face more stringent rules for demonstrating compliance with signal leakage requirements and for monitoring systems in the 108-136 and 224-400 MHz aeronautical radio bands. Monitoring entails routine checking of a system for excessive leaks. Operators are now specifically required to monitor their entire systems at least once every three months.

Cable systems in operation before the order goes into effect will be allowed to continue under existing rules for five years.

The commission notes that it has considerably stepped up its enforcement activities, issuing 22 fines totalling $161,000 to cable TV systems in the last three years for failure to comply with pre-notification and frequency offset requirements (see *MWN*, March 1984). And the FCC plans "to continue to increase its compliance and enforcement efforts."

In its new rules (49*FR*45431, November 16, 1984), the commission cites five cases of interference with aeronautical services as reasons for action. One case in particular — involving aeronautical interference near Flint, MI, caused by a major break in a cable system — has made the FCC "considerably less confident" than when it issued a notice in March 1980 that "cable operators will diligently control signal leakage on their systems or operate safely without frequency offset requirements." (The commission's first report and order appeared in 1977.)

According to the FCC's Bernard Gorden, no case of interference has been documented since the Flint incident in late 1980. He explained that, "we are looking to the future now rather than waiting for something to happen," as the number of both aeronautical and cable TV channels grows sharply in coming years.

In each of the cited cases, listed below, signal leakage exceeded the permissible limit of 20 uV/m at 3 meters:

- April 1976: Sammons Communications of Pennsylvania caused noise in aircraft receivers near Harrisburg, PA.
- September 1978: Antietam Cable TV created a potential interference problem near Hagerstown, MD, with signal leakage into aeronautical radio frequencies.
- October 1978: Oxnard Cablevision in Oxnard, CA, caused intermittent interference in communications between aircraft and an air traffic control center.
- April 1979: Coastal Cable Company caused interference to aircraft communications as planes approached the Wilmington, NC, Airport.
- August and September 1980: Comcast Cablevision Corp. caused the most serious interference problem reported to date. Aircraft flying in the vicinity of Flint, MI, repeatedly experienced interference when attempting to communicate with the air traffic control center in Oberlin, OH. The problem was tracked to annular cracks in the outer sheathing of a cable line.


# CLASSIFIEDS

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# SHORT COURSES

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

# CONFERENCES *(continued from p.12)*

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

September 27-30: **7th Annual Conference of the IEEE Engineering in Medicine and Biology Society,** Americana Congress Hotel, Chicago, IL. Contact: Dr. Barry Feinberg, Kendall Co., 411 Lake Zurich Rd., Barrington, IL 60010, (312) 381-0370.

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

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

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

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

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

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

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

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

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

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

## WHO-IRPA ELF HEALTH CRITERIA

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

### Health Risk Evaluation

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

### Conclusions and Recommendations

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

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

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

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

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

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

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

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

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

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

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

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

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

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

## JHU-APL RF/MW Safety Standard

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

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

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

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

**Radiofrequency Exposure Limits (Averaged Over 0.1 Hour)**

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

(f=frequency in MHz)

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

Mark W. Woods, Chairman
Safety Committee

H.L. Hall, Jr.
Safety Officer

### Definitions

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

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

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

**Power density:** The time average of the Poynting vector.

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

### *Discussion*

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

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

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

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

# UPDATES

### *BIOLOGICAL EFFECTS*

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

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

### *COMMUNICATIONS*

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

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

## COMPATIBILITY & INTERFERENCE

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

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

## INTERNATIONAL

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

## MEDICAL APPLICATIONS

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

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

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

## MEETINGS

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

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

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

## OVENS

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

## POWER LINES

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

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

## STANDARDS

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

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

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

## VDTs

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

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

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# CONFERENCES

## 1985 Conference Calendar

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

July 22-24: **22nd Annual Conference on Nuclear and Space Radiation Effects,** followed by July 25-26: **1985 Hardened Electronics and Radiation Technology (HEART) Conference** Monterey, CA. Contact: K.F. Galloway, Div. 726, NBS, Gaithersburg, MD 20899, (301) 921-3541.

July 22-25: **1985 International Symposium on Microwave Technology in Industrial Development —Brazil,** Campinas, Brazil. Contact: Attilio Jose Giarola, SBMO Symposium Committee, UNICAMP-CCPG (Reitoria), CP 1170, 13100 Campinas, SP, Brazil.

August 11-16: **14th International Conference on Medical and Biological Engineering and 7th International Conference on Medical Physics,** Espoo, Finland. Contact: Congress Office, PO Box 105, SF-00251 Helsinki, Finland.

August 19-21: **10th Annual Conference of the Australian Radiation Protection Society,** Melbourne, Australia. Contact: Dr. T.H. Gan, Australian Radiation Lab, Lower Plenty Rd., Yallambie, Victoria 3085, Australia.

August 20-22: **1985 IEEE International Symposium on Electromagnetic Compatibility,** Hilton at Colonial, Wakefield, MA. Contact: Dr. Chester Smith, PO Box 536, Bedford, MA 01730, (617) 271-7086.

August 20-22: **International Symposium on Antennas and Propagation,** Kyoto International Conference Hall, Kyoto, Japan. Contact: Professor Kazuaki Takao, Dept. of Electrical Engineering, Kyoto University, Kyoto 606, Japan.

August 26-28: **1985 International Symposium on Antennas and EM Theory,** Beijing, China. Contact: Professor Mao Yukuan, Northwest Telecommunication Engineering Institute, Xi'an Shaanxi Province, China.

August 26-30: **International Conference on Magnetism 1985,** San Francisco, CA. Contact: Diane Suiters, Suite 300, 655 15th St., NW, Washington, DC 20005.

September 10-12: **7th Annual Electrical Overstress/Electrostatic Discharge Symposium,** Radisson South Hotel, Minneapolis, MN. Contact: Michael Martin, 3M/Static Control Div., 2111 W. Braker Lane, Bldg. 501, PO Box 2963, Austin, TX 78769, (512) 834-3117. *(continued on p.5)*

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

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

## MICROWAVE-DRUG SYNERGY

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

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

*(continued p. 5)*

## *Wall Street Tunes In*

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

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

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

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

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

## CWA Cancer Cluster

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

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

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

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

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

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

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

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

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

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

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

## NIOSH Epidemiology

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

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

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

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

## Medical Surveillance

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

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

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

## Mount Sinai Epidemiology

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

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

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

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

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

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

## WISH Seminar

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

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

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

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

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

## Ohio Training Course

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

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

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

## NBC Precautions

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

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

## CWA Training Session

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

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

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

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

# Comments on the Proposed BRH/FDA Standard for Diathermy Products

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

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

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

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

### Cancer Therapy

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

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

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

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

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

### University of Washington Medical School

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

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

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

### Operator Risks

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

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

### Standard Physical Therapy

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

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

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

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

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# MICROWAVE-DRUG SYNERGY

*(continued from p. 1)*

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

### Librium v Valium

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

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

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

### Replications Attempted

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

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

*(continued p. 6)*

**Summary Table of Microwave-Drug Experiments**

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

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

# GOVERNMENT

## *CONGRESS*

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

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

## *AGENCIES*

### Federal Aviation Administration

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

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

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

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

FAA has released a number of reports on the MLS:

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

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

### Federal Communications Commission

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

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

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

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

**Other Drugs**

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

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

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

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

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

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

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

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

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

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

### Federal Trade Commission

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

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

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

### National Highway Traffic Safety Administration

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

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

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

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

### National Institute for Occupational Safety and Health

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

### National Telecommunications and Information Administration

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

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

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

### Navy

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

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

# AROUND THE COUNTRY

## NY State Transmission Lines Study

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

# REPORTS

## *RECENTLY RECEIVED*

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### DC Bioeffects

M.J. Frazier and M.M. Preache, *Design, Construction and Testing of a DC Bioeffects Test Enclosure for Small Animals*, Final Report, Department of Energy, November 1980, No. DOE/RA/10157-1.

### Diathermy

P.S. Ruggera, *Measurements of Emission Levels During Microwave and Shortwave Diathermy Treatments*, Bureau of Radiological Health, May 1980, No. FDA 80-8119.

### Dosimetry

C.H. Durney, *et al.*, *Radiofrequency Radiation Dosimetry Handbook*, Third Edition, USAF School of Aerospace Medicine, August 1980, No. SAM-TR-80-32.

### Instrumentation

W.A. Herman and D.M. Witters, Jr., *Microwave Hazard Instruments: An Evaluation of the Narda 8100, Holaday HI-1500, and Simpson 380M*, Bureau of Radiological Health, June 1980, No. FDA 80-8122.

### Solar Power Satellites

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

Institute for Telecommunication Sciences, *Environmental Assessment for the Satellite Power System–Concept Development and Evaluation Program–Effects of Ionospheric Heating on Telecommunications*, Department of Energy, August 1980, No. DOE/ER/10003-T2.

*Program Assessment Report: Statement of Findings*, Satellite Power Systems Concept Development and Evaluation Program, Department of Energy, November 1980, No. DOE/ER-0085.

C.M. Rush, *et al.*, *Impact of SPS Heating on VLF, LF, and MF Telecommunications Systems Ascertained by Experimental Means*, Department of Commerce, April 1980, No. NTIA-R-80-37.

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