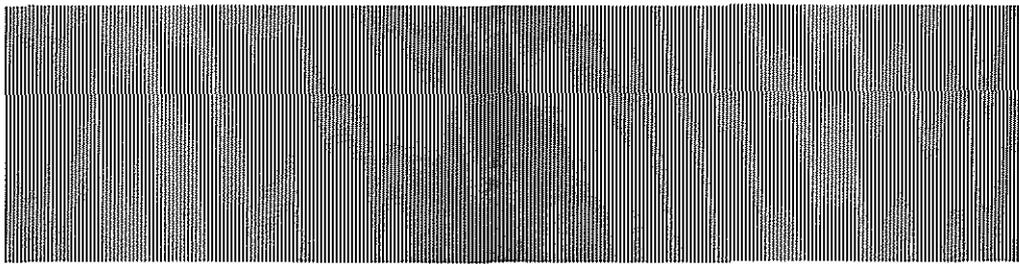


# MICRO WAVE NEWS



Vol. II No. 2

A Monthly Report on Non-Ionizing Radiation

March 1982

## INSIDE...

### HIGHLIGHTS

pp. 4-6

FCC To Consider RF/MW Hazard

FY83 Budget Proposals

NIOSH Criteria Document  
Nears Completion

Canadian VDT Ruling: No Loss of Pay  
for Alternative Work During Pregnancy

Electric Fields Heal Fractures

Navy Issues Project ELF Plan

### INTERNATIONAL REPORT pp. 2-3

WHO RF/MW Criteria Document

Letter from China

### UPDATES

pp. 6-8

Biological Effects

Communications

Compatibility & Interference

Measurement

Medical Applications

Military Systems

Occupational Health

Ovens

People

Power Lines

Satellite Communications

Standards

Technology

VDTs

## Massachusetts To Propose 200 $\mu\text{W}/\text{cm}^2$ Population Standard

The state of Massachusetts will soon propose one of the most stringent general population standards for radiofrequency and microwave (RF/MW) radiation in the country. If adopted as drafted, the frequency dependent standard will be 200  $\mu\text{W}/\text{cm}^2$  in the 30-300 MHz band, rising to a maximum of 1  $\text{mW}/\text{cm}^2$  for frequencies above 1500 MHz and to 20  $\text{mW}/\text{cm}^2$  for those below 3 MHz. An occupational exposure standard identical to the new American National Standards Institute (ANSI) RF/MW standard will also be proposed. Both standards cover the 300 kHz to 100 GHz spectrum.

Robert Watkins, a radiation scientist with the Massachusetts Department of Public Health, said that the proposal had been developed in response to growing public fears over RF/MW radiation sources, especially antenna farms and the PAVE PAWS radar on Cape Cod. "Municipalities were beginning to set their own standards," he added, "so we decided to act."

While 26 states have enabling legislation to set RF/MW standards, only Texas has a regulation applicable to population exposures—a flat or frequency independent, 10  $\text{mW}/\text{cm}^2$  standard. In 1980, Portland, OR, became the first city to adopt an RF/MW exposure standard: 100  $\mu\text{W}/\text{cm}^2$  between 30 and 300 MHz and 500  $\mu\text{W}/\text{cm}^2$  otherwise. And in 1978, New York City's Bureau for Radiation Control proposed a flat standard of 50  $\mu\text{W}/\text{cm}^2$ , which is still pending.

The Massachusetts proposal is now circulating among microwave experts for comment. The state's radiation program office will study their recommendations and issue a revised draft by April 1. A public hearing is scheduled for

*(continued p. 8)*

## RFI at TMI

### Portable Radio Confuses Gas Monitor

Workers with two-way radios resurrected fears that combustible gases were accumulating inside the Three Mile Island (TMI) nuclear plant in Middletown, PA. The No. 2 reactor was on alert for eight and a half hours on February 19-20, until TMI officials unraveled what turned out to be a series of equipment and operator errors, including radio frequency interference (RFI) with a gas measuring meter. In March 1979, the plant was crippled in a major accident; at that time there was widespread fear—later judged groundless—that a bubble of hydrogen gas inside the reactor would explode.

In the course of current preparations for a decontamination experiment, the crew found oxygen levels in the reactor building to be below normal. A couple of hours later they returned with a second gas meter that indicated abnormally high levels of combustible gases—hydrogen and hydrocarbons. The workmen also took an air sample for analysis. Gas chromatography of that sample confirmed that the hydrogen level was too high.

Later investigations showed that the oxygen meter had malfunctioned, that

*(continued p. 8)*

---

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

---

---

# INTERNATIONAL REPORT

---

## WHO RF/MW Criteria Document

The World Health Organization (WHO) recently published a criteria document on radiofrequency and microwave (RF/MW) radiation (100 kHz–300 GHz). It concludes that continuous occupational exposures in the range from 0.1 to 1 mW/cm<sup>2</sup> are safe and that population exposures should be kept "as low as readily achievable," at levels generally lower than those for occupational exposure. The full text of the WHO recommendations (Section 1.2) is reproduced below.

The 134-page report, *Environmental Health Criteria 16: Radiofrequency and Microwave Radiation*, was developed by a working group set up by the WHO and the International Radiation Protection Association. Dr. Moris Shore of the US Bureau of Radiological Health was the chairman of the committee, whose other members were Dr. V. Akimenko, USSR; Professor P. Czerski, Poland; Mme. A. Duchene, France; Dr. M. Faber, Denmark; Professor M. Grandolfo, Italy; Mr. F. Harlen, England; Dr. H. Jammet, France; Dr. J. Kupfer, German Democratic Republic; Dr. M. Repacholi, Canada; and Dr. B. Servantie, France.

The text includes reviews and summary tables of bioeffects research and of various exposure standards. Among the other topics are sources of radiation, conditions of exposure, measuring instruments, radiation absorption in biological systems and safety procedures for occupationally exposed personnel. The document contains a bibliography of more than 300 references and a nine-page glossary.

The report is available in the US from: WHO Publications Center USA, 49 Sheridan Avenue, Albany, NY 12210. Elsewhere, contact the nearest WHO regional office or write to WHO, Distribution and Sales Service, 1211 Geneva, 27, Switzerland.

### *Recommendations for Further Studies, Exposure Limits, and Protective Measures*

#### General recommendations

The basic biophysical mechanisms of interaction of microwaves and RF with living systems still need clarification and further studies.

Work on both theoretical and experimental dosimetry, the calculation and measurement of fields and of energy deposited within simulated or actual biological systems, should be continued and refined.

Results of animal studies are difficult to extrapolate to man, and these studies alone do not constitute a satisfactory basis for the establishment of health protection criteria. They should, therefore, be supplemented by appropriate epidemiological studies in man.

The existing data on power, amplitude, and frequency "windows" seem to warrant continued investigations.

The effects of chronic exposure on sensitivity to convulsant and other drugs are potentially useful and may have a direct bearing on the development of exposure standards.

Long-term, low-level exposures combined with such stresses as high ambient temperature and humidity should be investigated.

There is little published information on dose-effect relationships; reports tend to be limited to whether effects are observed at one particular level of exposure rather than over a range. More dose-related information, even covering small subject areas, would be valuable.

Investigations on the genetic effects and effects on development of microwave and RF radiation should have priority.

Attention should be given to investigating the different sensitivities to microwave/RF exposure of subgroups within the general population.

National and international agreements on exposure limits, ways and means of controlling this type of environmental pollution, and concerted efforts to implement such agreements are needed.

#### Measurement techniques

There is a continuing need for the development of microwave/RF measuring instruments that: (a) give direct readings of electric or magnetic field strength, or power density; (b) are robust; (c) are portable, light-weight, and battery-operated; and (d) are sensitive and can be used over a wide frequency range.

The problem of the design of personal dosimeters also remains to be solved.

#### Safety procedures

Computation techniques or methods that predict the distribution of fields close to deliberate high-power emitters (in the near field) are needed.

Emphasis should be placed on the development of technology to ensure containment and limitation of radiation to the deliberately exposed object, as well as the reduction of leakage emission from devices.

Personal protection devices should be used only as a last resort.

Adequate medical surveillance of occupationally-exposed persons should be provided.

Once exposure limits have been set, safety guidelines or codes of practice concerning safe use and installation design should be developed as soon as possible.

#### Biological investigations

Reports of experimental work should contain sufficient information describing the exposure conditions to allow an estimation not only of the total absorbed energy but also, as far as possible, of the distribution of the energy deposited within the irradiated biological system.

Systematic investigation of the effects of microwave/RF exposure at all levels of biological organization are to be encouraged. This includes effects at the molecular level on sub-cellular components; cells, viruses, and bacteria; organs and tissues; and whole animals. Particular attention should be paid to: (a) long-term, low-level exposures and possible delayed effects; (b) the possibility of differences in sensitivity of various body organs and systems, where specific effects in various animal species are being considered; and (c) the influence of microwave/RF exposure on the course of various diseases, including any possible increase in sensitivity to microwaves/RF that may result because of the disease state.

#### Epidemiological investigations

Epidemiological studies should be carried out in a careful manner, paying attention to the relationship between exposure to microwaves/RF and other environmental factors occurring in the place of work and to the health status of the investigated group. Specific biological endpoints should be selected and adequate examination methods used for such studies. Conventional medical examinations will not provide sufficient information.

Studies should be carried out on (a) workers occupationally

exposed to microwave/RF sources; (b) patients treated with microwave and RF diathermy; and (c) groups within the general population living near high-power microwave/RF sources.

A distinction should be made between occupational and public health protection standards.

#### Exposure limits and emission standards

**Occupational exposure limits:** The occupationally-exposed population consists of healthy adults exposed under controlled conditions, who are aware of the occupational risk. The exposure of this population should be monitored.

It is possible to indicate exposure limits from available information on biological effects, health effects, and risk evaluation. For occupational exposure, values within the range 0.1-1 mW/cm<sup>2</sup> include a high enough safety factor to allow continuous exposure to any part of the frequency range over the whole working day. Higher exposures may be permissible over part of the frequency range and for intermittent or occasional exposures. Special considerations may be indicated in the case of pregnant women.

**Exposure limits for the general population:** The general population includes persons of different age groups and different states of health, including pregnant women. The possibility that the developing fetus could be particularly susceptible to microwave/RF exposure deserves special consideration.

Exposure of the general population should be kept as low as readily achievable and exposure limits should generally be lower than those for occupational exposure.

**Emission standards:** Emission standards for equipment should be derived from, and be lower than, exposure limits where this can reasonably be achieved. A class of equipment may be considered safe and exempt from regulations, if hazardous levels of radiation exposure cannot originate from such a source.

**Implementation of standards:** The implementation of microwave and RF occupational and public health protection standards necessitates: the allocation of responsibility for measurements of radiation intensity and interpretation of results; and the establishment of detailed radiation protection safety codes and guides for safe use, which indicate, where appropriate, ways and means of reducing exposure.

**Other protective measures:** Prevention of health hazards related to microwave and RF radiation also necessitates the establishment of rules for the prevention of interference with medical electronic equipment and devices such as cardiac pacemakers, prevention of detonation of electroexplosive devices, and prevention of fires and explosions due to the ignition of flammable material (vapours) by sparks originating from induced fields.

**Studies related to the establishment of limits:** Studies of the frequency and modulation dependence of biological and health effects are of prime importance. The results of such investigations may make it possible to modify the rationales of present day standards and to identify frequencies at which exposure limits should be lower or higher than those suggested in section 11.

MICROWAVE NEWS is published monthly, except in January and July • ISSN 0275-6595 • PO Box 1799, Grand Central Station • New York, NY 10163 • (212) 794-9633 • Editor: Louis Slesin, Ph.D., Associate Editor: Martha Zybko • Subscription: \$165 per year (overseas \$200) • Copyright © 1982 by Louis Slesin • Reproduction in any form is forbidden without written permission.

## Letter From China

Microwave News has received the following report from the Peoples' Republic of China on two recent microwave bio-effects courses sponsored by the China Microwave Institute in Beijing. We thank Shen Zhi-yuan, a visiting scientist at the Polytechnic Institute of New York, for providing this translation of the original text.

Two short courses on microwave biological effects sponsored by the China Microwave Institute were held in Shanghai (August 1981) and Chengdu (January 1982). The attendees, numbering 241 in Shanghai and 83 in Chengdu, came from all around the country except for Tibet and Taiwan. Among them were professors and lecturers from universities and colleges, physiotherapists from hospitals, researchers from tumor research institutes, engineers and technicians from labor and environmental protection organizations.

The main topics of the courses were common microwave biological effects, the biological and medical applications of microwaves, and the fundamentals of microwave safety protection. The theoretical and clinical problems associated with local microwave thermotherapy for treating some kinds of malignant tumors and common diseases were also included.

China began developing microwave biological effects research for establishing a safety exposure standard of microwave radiation in 1974. Some health studies on the operators of microwave equipment in large cities have been completed.

Since 1978, active research on local microwave thermotherapy together with chemical and radio therapy for curing malignant tumors have been carried out at Beijing, Shanghai, Nanjing and Henan. The research items include: mechanisms of high temperature affecting cancer cells, optimum temperature, dosage and procedures for treatment, and methods for measuring temperature in microwave fields. Beneficial effects on some advanced cancer patients have been observed. In China, some researchers are trying to use local microwave thermotherapy for birth control.

Topics of Shanghai Short Course: 1. Prospects for microwave power applications. 2. Biological effects of microwaves. 3. Physical mechanisms of interactions between living systems and microwaves. 4. Microwave applications in biology and medicine. 5. Microwave thermotherapy for curing cancers. 6. Microwave effects on the human body. 7. A safety exposure standard for microwave radiation. 8. Safety protection from microwave radiation.

Topics of Chengdu Short Course: 1. Fundamentals of microwaves. 2. Biological effects of microwaves. 3. Techniques of microwave thermotherapy and cancer treatment. 4. Microwave local heating technique for male birth control. 5. Clinical microwave thermotherapy. 6. Microwave thermotherapy. 7. Agricultural applications of microwaves. 8. Temperature measurement in microwave fields. 9. Measurements of electromagnetic near field and leakage energy. 10. Principle, operations and maintenance of microwave therapeutic apparatus. 11. Safety exposure standard and protection of microwave radiation.

Reporters: Chen Han-kui\*  
Wu Ding\*  
Shen Zhi-yuan\*\*

\*Microwave Laboratory, Department of Physics, East China Normal University, Shanghai, Peoples' Republic of China.

\*\*Radio Electronics Engineering Department, Zhejiang University, Hangzhou, Peoples' Republic of China; Microwave Research Institute, Polytechnic Institute of New York, NY 11201, USA.

---

# HIGHLIGHTS

---

## FCC To Consider RF/MW Hazards

The Federal Communications Commission (FCC) plans to address radiofrequency and microwave (RF/MW) radiation hazards under its environmental protection rules. Applications for facilities exposing workers or the public to radiation levels of more than 10 mW/cm<sup>2</sup> or exceeding any relevant emission standard would be added to the list of "major actions" requiring environmental assessment and possibly environmental impact statements.

The rules proposed on January 28 are the response to the FCC's 1979 notice of inquiry on radiation hazards (44 *Federal Register* 37008, June 25). The commission has decided that the National Environmental Policy Act (NEPA) "requires us to evaluate exposure of the public from the facilities we authorize" against potentially harmful radiation. Since no federal population exposure standards exist, the Occupational Safety and Health Administration's (OSHA) occupational guideline has been chosen as the gauge for public exposure "until such time as the appropriate federal agency issues standards." The only relevant and applicable emission level at this time is the Bureau of Radiological Health's new oven standard. The commission noted it had "neither the expertise nor the primary jurisdiction" to set safety levels.

The FCC has refused to become involved in the controversy over local and state exposure standards. In its notice of proposed rule making, the commission states it sees "no significant conflict" between these actions and its responsibility under the Communications Act to make available rapid and efficient communications.

Under the proposed rules, an applicant for a new RF/MW source would be required to point out potential radiation exposure and emission problems in a "narrative statement" submitted to the FCC. This report would trigger an evaluation process. After examining the report, the FCC staff could decide to prepare an environmental assessment for the project. If warranted, the commission would then proceed with an EIS. The rule would apply to applications for equipment authorization, construction permits and licenses to transmit.

The commission anticipates the new rules will affect very few RF/MW sources. Most applicants would be in compliance with the OSHA standard and "thus should be categorically excluded" from the requirements. Currently operating facilities and equipment licensed by the FCC would not be reevaluated.

Commenting on the action, the FCC's Dr. Robert Cleveland and Deputy General Counsel Peggy Reed said they did not expect the rules to result in many EIS's. In fact, since NEPA became law in 1970 the commission has prepared only one EIS and that was for a FM tower in a scenic area.

Comments on the proposed rule are due by June 18, and reply comments by August 18.

## FY83 Budget Proposals

The President's budget has met with considerable resistance in Congress, and it will take some time before a compromise is reached. Who the winners and losers will be and how the changes will filter down to affect non-ionizing radiation programs is anything but clear. In fact, some agencies have yet to have their budgets for FY82, already in its sixth month, approved and are still operating on a continuing resolution. Apart from requests for specific applications, non-ionizing radiation programs are rarely line items in agency budgets. So

the details that follow only give a rough indication of what will actually be appropriated and spent.

- *Bureau of Radiological Health:* BRH is still operating on a continuing resolution, so its planning staff was hesitant to discuss FY83 while FY82 is still unsettled. FDA's radiological products line item, which includes ionizing and non-ionizing radiation programs, has been increased by \$946,000, but the equivalent of six staff positions have been eliminated. One indication of hard times is the announcement that the *BRH Bulletin* may cease publication next month unless OMB gives its approval for the expenditure.

- *Department of Defense:* \$72.7 million for PAVE PAWS, of which \$69.4 million is for procurement at the SE site at Robins AFB, GA; \$31.3 million for the PAVE MOVER program; \$79.1 million for over-the-horizon radar; \$79.8 million for the military satellite program; \$10 million for EMP work (\$3 million for Kirtland AFB and \$7 million for RDT&E); \$49.8 million for Project ELF (see opposite page).

- *Environmental Protection Agency:* The agency's radiation (ionizing and non-ionizing) program was cut by \$27,000 and the equivalent of 14 staffers. EPA's Dave Janes said it was too early to judge the impact on non-ionizing radiation work. While research and development was cut by over \$45 million to \$108.7 million, EPA's budget report did note that the radiation program "will focus on evaluating health effects information needed for establishment" of a general population guidance.

- *Federal Communications Commission:* The FCC's budget was cut by \$2.9 million from its \$77.3 million FY82 continuing resolution budget.

- *National Aeronautics and Space Administration:* NASA's 30/20 GHz satcom program has no funds to build a prototype satellite or to start a flight program. About \$5.1 million is slated for completing the development process.

- *National Bureau of Standards:* NBS's budget of \$104 million is about equal with last year's request if one discounts the transfer of the computer institute from NBS to GSA.

- *National Institute for Occupational Safety and Health:* NIOSH is also on continuing resolution. The FY83 proposal is for \$50.5 million, down from \$56 million requested for FY82—which is itself much lower than the House or Senate proposals. One major point here is whether the NIOSH budget bill will bar the use of funds to move the agency down to Atlanta (see updates).

- *National Telecommunications and Information Administration:* NTIA's budget was cut by \$4 million to \$12.4 million for FY83. Most of the cut is in the policy division and administrative support. The agency's satellite program was eliminated.

- *Occupational Safety and Health Administration:* OSHA's budget was increased by about \$14 million over the amount allocated in its continuing resolution. OSHA is planning to make 53,000 inspections in FY83, compared to 52,000 projected for FY82.

## NIOSH Criteria Document Nears Completion

The National Institute for Occupational Safety and Health (NIOSH) criteria document on radiofrequency and microwave (RF/MW) radiation will be ready for external review in the late spring. Speaking from Rockville, MD, Dr. Momtaz Wassef, NIOSH's project manager for the document, said that the NIOSH team was in the process of assigning SAR (specific absorption rate) values for the key papers in the literature and picking levels for the new proposed standard.

Sections of the document have already been reviewed by consultants selected by NIOSH. Listed below are the consultants and the biological effect they reviewed: Dr. Ernest Albert, George Washington University, central nervous system; Dr. Russell Carpenter, Bureau of Radiological Health, ocular; Dr. Ronald Jensch, Thomas Jefferson University, reproduction and teratology; Drs. Don Justesen and Virginia Wolf, VA Medical Center, Kansas City, behavioral; Dr. Robert Lebovitz, University of Texas, auditory; Dr. Robert Liburdy, USAF School of Aerospace Medicine, immunology and hematology; Dr. Shin-Tsu Lu, University of Rochester, cardiovascular; Dr. Sol Michaelson, University of Rochester, general physiology; and Dr. Vernon Riley, Hutchison Cancer Research Center, Seattle, neural and endocrine.

## Canadian VDT Ruling: No Loss of Pay for Alternative Work During Pregnancy

A labor arbitration board in Ontario has ruled that a video display terminal (VDT) operator cannot be penalized for transferring to a non-VDT job during pregnancy. Helen Barss, a data processor at the Ministry of Education, filed a complaint last May after her request for alternative work during her last four months of pregnancy resulted in a temporary job demotion with a cut in pay. On January 21, a three-member Ontario Crown Employees' Grievance Settlement Board ruled that Barss must be compensated for the difference in salaries.

In its decision, the board wrote that Barss's "sole reason for making the request was the belief (we think on reasonable grounds) that the change should be made for the protection of her unborn child." Under the Crown Employees' Collective Bargaining Act, a worker is entitled to the same salary while reassigned to a lower paying job for up to six months if the change is for health reasons.

The board emphasized that it lacked "both the authority and the ability" to decide whether VDTs present a health hazard, though it judged Barss had legitimate reasons for her fear. The decision stated that people are entitled to be skeptical of scientists' conclusions and cited changing opinions about the safety of urea formaldehyde, DDT, 2,4-D, contraceptives and other products.

Barss asked to leave VDT work in her fifth month of pregnancy on the recommendation of her doctor. The ministry argued her job posed no health risks but agreed to transfer her for personal rather than health reasons. Barss worked as a records clerk for the remainder of her pregnancy at \$267 per week rather than the \$286 she regularly earned.

## Electric Fields Heal Fractures

Dr. Andrew Bassett and his colleagues at the Columbia-Presbyterian Medical Center in New York City have concluded

that the treatment of non-healing bone fractures with electric fields is safe and effective and that it could now be "the primary treatment for ununited fractures or arthrodeses."

According to their report published in the February 5 *Journal of the American Medical Association (JAMA)*, pulsing electromagnetic field (PEMF) therapy has worked for over 77 percent of the 1078 patients treated in the US and abroad during the last seven years. The success rate was unaffected by the age of a patient's fracture, the number of operations prior to PEMF treatment or the presence of infection. No adverse side effects have been reported since the technique began trials at Columbia in 1974.

Bassett's system is non-invasive; coils are placed around the site of the fracture to generate PEMFs, which in turn penetrate the body and induce weak electric currents in the bone. Research at the center has shown that these fields modify cell behavior and promote bone growth.

An editorial accompanying the report in the *JAMA* praises the use of PEMFs and the related, but invasive, direct-current stimulation as "a major advance in traumatic orthopedic surgery." The author, Dr. Clinton Compere of Northwestern University Medical School in Chicago, IL, states that the consensus judgment must be that electric stimulation methods are effective.

In an answer to some critics who have asked for double-blind experiments (see *MWN*, May 1981), Bassett and his team argue, "When 75 percent or more of [the subset of patients disabled for more than two years], and in whom spontaneous healing is unlikely, are healed by PEMFs, there is little room for rational doubt that the method is highly effective."

## Navy Issues Project ELF Plan

The Naval Electronic Systems Command has released a work plan for its ELF submarine communications system. The 34-page, illustrated report, *Extremely Low Frequency (ELF) Communications Program in Wisconsin and Michigan; System and Site Definition, Program Plans, Environmental Summary and Supplementary Information*, December 1981, details the schedule for making the system operational by 1986.

The Wisconsin facility at Clam Lake will be upgraded; new transmitting equipment will be installed by 1984. The existing overhead antenna operating with a current of 300 amperes will stay in use. The navy will build two additional antennas in Michigan, each 28 miles long and mounted on poles, at a site still to be determined. When completed, these will carry a current of 150 amperes and operate synchronously with the 28-mile Wisconsin antenna. The Michigan control center will be located at K.I. Sawyer AFB.

The proposed FY83 budget allocates \$49.8 million for Project ELF, of which \$32.3 million is for new equipment in Wisconsin and Michigan.

The navy will issue an environmental protection plan and a draft ecological monitoring program for the Michigan site later this year. The IIT Research Institute (IITRI), which is managing this work for the navy, is now in the process of soliciting proposals for relevant environmental studies. A bidder's conference is scheduled for March 18 at IITRI's main office in Chicago, IL. Although the work plan indicates that the navy does not intend to carry out any ecological studies in Wisconsin, IITRI's Marty Abromavage told *Microwave News* that this decision has been reviewed and that some studies may now be funded if they are judged worthwhile. The navy has budgeted \$750,000 for ELF ecological studies in FY82 and has proposed to spend \$2 million on them in FY83.

The navy intends to protect power and telephone lines against interference in both states and will pay for any mitigation costs.

The report drew criticism from Stop Project ELF (SPE), a group based in Madison, WI. In written comments submitted by SPE, Jennifer Speicher and John Stauber claimed that the navy had reneged on its 1969 commitment to remove the Clam Lake facility once testing had been completed. SPE urged the

navy to prepare an environmental impact statement for the Wisconsin site that included analyses of possible interference with airplane equipment and potential effects on the weather.

Copies of past environmental impact statements for Project Sanguine and Seafarer, the previous names of the ELF system, are available from the Environmental Law Institute, 1346 Connecticut Avenue, NW, Suite 600, Washington, DC 20036, at a cost of ten cents per page.

## UPDATES

**Biological Effects.** . . . Some professors at Virginia Commonwealth University's Department of Pharmacology and Microbiology have set up a consulting firm called Quintox and have won a contract from the Office of Naval Research (ONR) to work on drug-microwave synergy. Professor Albert Munson will head the study of synergistic effects of microwaves and amphetamines on the immune system. VCU's Professor Stephen Cleary will serve as a consultant on the project. The first year's award is for \$75,000; the project will run for two or three years. . . . Drs. Przemyslaw Czerski and Ewa Manikowska have detected chromosomal abnormalities, cell degeneration and cell death in spermatogenic cells of mice exposed to 0.915, 2.45 and 9.4 GHz microwaves. A full description of this new research from BRH will appear in next month's issue. . . . The workshop on *Behavioral Effects of Microwave Radiation Absorption*, reported as tentatively scheduled in last month's issue, will be held March 16-19 outside Salt Lake City as planned. For more information contact: Professor John D'Andrea at the University of Utah, (801) 581-8590. . . . BRH is seeking a contractor to study the electromagnetic absorption characteristics of biological and simulated biological materials. For more information contact David Ramos at the FDA, (301) 443-4420. . . . A US-Canadian team reports on the measurement of the permittivity of biological tissue with an open-ended coaxial cable in the January *IEEE Transactions on Microwave Theory and Techniques* (p. 82). . . . Dr. James Bond of Jaycor in Alexandria, VA, is scheduled to present a seminar on "A Physicochemical Basis for Alterations in Ca Efflux from Cerebral Tissue Exposed to Low Intensity RF Electromagnetic Fields," on March 2 as part of ONR's Washington, DC-area seminar series.

**Communications.** . . . The Office of Technology Assessment (OTA) has issued a report, *Radiofrequency Use and Management: Impacts From the World Administrative Radio Conference of 1979*, which concluded that the US "must begin to develop policies now that will assure that international telecommunication decisions do not jeopardize its political, economic and national security interests." Free summary copies are available from OTA, US Congress, Washington, DC 20510, (202) 224-8996. Or you can order a complete copy from the Government Printing Office, stock no. 052-003-00863-7, \$6.50. . . . Microband Corp. of America, a subsidiary of Tymshare, wants to clear the way for over-the-air delivery of pay TV and other information services in 50 US markets. The company is seeking FCC approval to use multipoint distribution service (MDS) for multichannel systems capable of competing with cable TV. Microband calls its proposed 5-channel system Urbanet. . . . The FCC has approved the first equipment for the Digital Termination Service (DTS). (See *MWN*, October 1981.) Rapac, a radio to transmit digital data within cities, will be available from Local Digital Distribution Co. of Rockville, MD, this summer. The company is a joint venture of M/A-COM Inc. and Aetna Life and Casualty Co. . . . Megapulse Inc. of Bedford, MA, has been awarded \$350,000 to perform a radio propagation study for DOE, and GE will do a \$396,000 study of "mobile radio alternative systems" for NASA.

**Compatibility and Interference.** . . . The new word processors at the State Department are emitting signals that are disrupting the clocks around the offices, according to an item in the February 5 *Washington Post*. The interference has yet to be controlled. . . . The Lawrence Berkeley Laboratory (LBL) is hosting a two-day conference on *Lighting-Electromagnetic Compatibility* on March 18-19. The focus of the

seminar will be the conducted and radiated EM waves from lighting systems operating at high frequencies. LBL will publish the proceedings of the meeting. For more information contact: Rudy Verderber, Room 90-3111, LBL, University of California, Berkeley, CA 94720, (415) 486-5605. . . . The first issue of a new quarterly, *EMC Technology*, appeared in January. The magazine is published by Don White Consultants of Gainesville, VA. Subscriptions are \$20 a year. Contact: Circulation Director, *EMC Technology*, PO Box D, Gainesville, VA 22065. . . . Don White Consultants will be running a 4-day course on EMI/EMC grounding and shielding for the Bonneville Power Administration. . . . And the navy has hired A&T Technical Services, Inc., for support in improving EMI/EMC communications. The contract is worth about \$1.1 million. . . . The International Special Committee on Radio Interference (CISPR) of the International Electrotechnical Commission has published the third edition of its publication (no. 10) *Organization, Rules and Procedures of the CISPR*. It is available from: Bureau Central de la Commission Electrotechnique Internationale, 1 rue de Varembe, Geneva, Switzerland. The price is 41 Swiss francs. . . . CBS and NBC want the FCC to reconsider its recent decision to allow the Field Operations Bureau to shut down interfering news-gathering equipment. (See *MWN*, January/February 1982.) In its petition, NBC notes that the interference during the first shuttle flight—the impetus for the rule—was caused by out-of-band harmonics from the equipment, even though it was operating well within applicable FCC specifications. NBC states that the rules "address a theoretical situation that . . . has never occurred." The broadcasters argue that the rules are too broad and unnecessary. . . . The National Association of Broadcasters (NAB) has begun a program of tracking the frequency and power used by Cuban stations, which are interfering with US radio broadcasters. The NAB will use the data to show the urgency of the problem. . . . A group from the naval Research Laboratory in Washington, DC, has measured the spectral noise density, amplitude probability distribution and spectral content of ambient noise from 1.0 to 4.0 kHz at sites in Italy and Norway. The results appear in the January/February *Radio Science*.

**Measurement.** . . . NBS will host this year's *Conference on Precision Electromagnetic Measurements* in Boulder, CO; June 28-July 1. For more information contact: David W. Allan, CPEM '82, NBS, 325 Broadway, Boulder, CO 80303. . . . Canada's Douglas Hill has developed a new way to calibrate miniature probes used to measure electric fields in biological tissues at 2.45 GHz. His description is in the January *IEEE Transactions on Microwave Theory and Techniques*. . . . And a team from McGill University in Montreal has published a set of design criteria for absorber-lined chambers used in electromagnetic susceptibility measurements in the February *IEEE Transactions on Electromagnetic Compatibility*. . . . The Naval Surface Weapons Center in Dahlgren, VA, is seeking comments from contractors interested in developing a new and more compact RF/MW hazard meter for use aboard ship.

**Medical Applications.** . . . Phosphorus-31 NMR has been used to observe the energy metabolism of human muscle. A team from England, G.K. Radda *et al.*, reports in the February 18 *Nature* (p. 608) that they have used the technique to measure changes in phosphocreatine and pH during exercise of the forearm of persons with muscular disorders. . . . Two new review articles on the application of NMR were published last month. The potential for imaging and in vivo spectroscopy is reviewed in the February 5 *Science* (p. 619) and a more intro-

ductory piece appears in the January/February *Technology* (p. 32). . . . Dr. Richard Heilman of the University of Vermont College of Medicine argues that there is a paradox in the presence of a malaise surrounding imaging technology at a time of its greatest development. In an editorial in the February 25 *New England Journal of Medicine*, "What's Wrong with Radiology?" he explains the paradox in terms of an inability to develop a coherent delivery system. . . . M&D Technology Ltd. will start manufacturing NMR imagers in Aberdeen, Scotland. The university's Professor John Mallard will serve as the new company's scientific director. . . . The January 28 *New Scientist* features an article on bioelectricity, "The Electricity That Shapes Our Ends." . . . RF, microwave and ultrasound hyperthermia for cancer treatment will be the subject of one of the sessions at the *Tenth Annual Northeast Bioengineering Conference* to be held at Dartmouth College, March 15-16. Dartmouth's Dr. Evan Douple will give a keynote speech on hyperthermia. . . . The Association for the Advancement of Medical Instrumentation is holding its annual meeting in San Francisco, May 9-12. Among the sessions are those on hyperthermia cancer therapy, NMR imaging and medical device regulation. For more information, contact: AAMI, 1901 North Myer Drive, Arlington, VA 22209, (703) 525-4890.

**Military Systems.** . . . The air force has decided to expand its experimental over-the-horizon backscatter radar system in Maine to cover a 60 degree sector as the next step in its development. The AF's Electronic System Command at Hanscom AFB, MA, is in charge of the work at the two OTH-B radar sites in Moscow/Caratunk and Columbia Falls, ME. A decision on where to site the full scale system will be made in the next few months. Bangor International Airport is the leading choice. . . . The Naval Surface Weapons Center in Dahlgren, VA, wants to develop a compact, lightweight receiver with a frequency range from 200 Hz to 100 kHz for use on ships and aircraft (*Commerce Business Daily*, February 10).

**Occupational Health.** . . . There is a good chance that OSHA will delete all of its "should" or voluntary standards in the coming months. This would eliminate the 10 mW/cm<sup>2</sup> guideline now on the books, and would make it possible to cite RF/MW violators under the OSHA's general duty clause—possibly for exceeding the new, more stringent ANSI standard. . . . Will NIOSH move to Atlanta or will its director, Dr. J. Donald Millar, come north to Rockville, MD? The drama continues. (See *MWN*, July/August & September 1981.) Congressman David Obey (D-WI) is again pressuring Millar to join the NIOSH staff in the Washington, DC, area. The subject will be aired at House appropriations hearings scheduled for February 25. . . . OSHA is working with the American Electronics Association (AEA), based in Palo Alto, CA, to develop an occupational health and safety program for the more than one million workers in the electronics industry. The agreement calls for the project to start April 1 and to expire September 30 unless renewed. . . . Meanwhile OSHA is closing down 41 of its area offices and laying off some 300 staff members. The agency has also changed its inspection policy so that only those work places which threaten "physical harm or an imminent danger" will be inspected. . . . The American Industrial Hygiene Conference, scheduled for June 6-11 in Cincinnati, OH, will feature papers on non-ionizing radiation.

**Ovens.** . . . Factory shipments of microwave ovens dropped 16% in January compared to last year. According to the latest statistics compiled by the Association of Home Appliance Manufacturers, 304,100 ovens were produced or imported, down from 361,900 in January 1981. Shipments of all major appliances declined 24%. . . . Cober Electronics has published a new four-page brochure describing continuous microwave vulcanization ovens and pre-heaters developed specifically for rubber processors. For a free copy, contact: Cober, 102 Hamilton Avenue, Stamford, CT 06902.

**People.** . . . RCA's Howard Johnson will be retiring on April 1 after 35 years with the company. He will be resigning as secretary of IMPI but

will serve out his term on TEPRSSC. Johnson said that he might do some consulting. It is not clear if anyone will follow RF/MW issues for RCA when Johnson is gone. . . . Verle Blaha has retired from Litton Microwave and become general manager and vice-president of Holaday Industries in Eden Prairie, MN. . . . Sidney Metzger, a member of FMAC, has retired as chief scientist of Comsat. The company has yet to announce who will replace him. . . . Dan Lynch, vice president of Executive Consultants Inc., has become the new executive director of IMPI. The institute recently moved its office from New York City to Vienna, VA.

**Power Lines.** . . . The New York State Overhead Power Lines Project's Advisory Panel met in New York City over the February 19 weekend to select the winning proposals for studies on the health effects of powerline radiation. Some 15-20 projects will receive \$3.5 million. A decision is due by April 1. At a public meeting held during the deliberations, panel chairman Dr. Michael Shelanski of NYU said that "due to funding limitations and the state of the art, the research funded under the program will not yield definitive answers on risk, but will give clear-cut replicable results." The state's Dr. David Carpenter revealed that the project will hire a consultant on dosimetry, who will visit all the funded labs. NYU's Dr. Arthur Upton has resigned from the panel for personal reasons.

**Satellite Communications.** . . . The House Committee on Government Operations has recommended a study be prepared on potential applications of direct broadcast satellites (DBS). Both its report, *International Shortwave Broadcasting and Direct Broadcast Satellites: Voice of America, Radio Free Europe/Radio Liberty, Radio Marti*, December 11, No. 97-398, and the hearing record upon which it is based, *International Broadcasting: Direct Broadcasting Satellites*, are now available from the committee. . . . The FCC is expected to authorize as many as eight interim DBS systems this spring. It decided against reconsidering two rejected DBS applications at a February 18 meeting. . . . Meanwhile, Comsat's Satellite Television Corp. (STC) is gearing up to open a three-channel direct-to-home pay TV service in 1985. A special report on STC appears in the February 22 *Broadcasting*. . . . Ford Aerospace and Communications wants to build one billion dollar's worth of satellites for Intelsat, but the international satcom group plans to negotiate the contract with Hughes Aircraft. This February Ford asked the FCC to block Comsat's participation in the construction project in order to prompt Intelsat to reconsider the bids. . . . Despite the recent bad news, or perhaps because of it, Ford ran two-page ads in the *New York Times* and the *Washington Post* assuring readers "There's a Ford [satellite] in America's Future." . . . AT&T has filed with the FCC to start a nationwide satellite distribution system for radio programs later this year. . . . A review article on business use of satellite communications appears in the February 12 *Science*. . . . The January *Microwave Systems News* offers a view of satcom's role in the 1980's. . . . An interview with the army's Project Manager for Satellite Communications, Colonel Charles Lindberg, is featured in the January issue of *Military Electronics/Countermeasures*. . . . RCA has come up with a new scheme for leasing transponders on its Satcom IV satellite since its November auction, bringing in a total of \$90.1 million in winning bids, was invalidated by the FCC in January. The company has proposed selling each lease for \$13 million, a price it says reflects market demand.

**Standards.** . . . The National Association of Broadcasters has awarded Jane Clemmensen of the University of California, Berkeley a grant for a "Report on the Status of Federal Standards on Non-Ionizing Radiation."

**Technology.** . . . The National Oceanic and Atmospheric Administration has awarded three \$850,000 competitive contracts for designing a new weather-radar system to Raytheon, Sperry and a team from Ford Aerospace & Communications and Westinghouse Electric. The government hopes to replace 300 aging radar units with 160 new ones, capable of giving advanced warning of tornados and flash floods, by

the mid-1990's... The worldwide satellite remote sensing market will reach \$400 million per year by 1990, according to a study by Metrics Inc. of Atlanta, GA. Metrics estimates this market is the fastest growing area of commercial space activity. For information contact: G. William Spann, Metrics Inc., 290 Interstate North, Suite 116, Atlanta, GA 30339, (404) 955-1975... The IEEE MTT Society has published *Low-Noise Microwave Transistors and Amplifiers*, a book of selected reprints. Cost: \$16.95 paper for IEEE members, \$33.95 hardcover or \$25.45 for IEEE members. Order prepaid from the IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854... An article on the macron accelerator, a device that can accelerate gram-size pieces of matter to high speeds and a relative of the rail gun, appears in the January/February *American Scientist*... In contract news, the Defense Nuclear Agency is seeking a contractor to write guidelines for designing electronic circuits in such a way as to avoid electromagnetic pulse (EMP) damage. Contact Robert Henshaw, (202) 325-7658... NASA is negotiating with NOVAR Electronics Corp. of Barberton, OH, for an evaluation of SPS sonic simulator development and microwave propagation effects... Texas Instruments Inc. of Dallas, TX, has won a \$227,104 contract from the FAA to support the installation of MLS prototype ground equipment at Philadelphia International Airport... The Army Armament R&D Command is negotiating with Geo-Centers Inc. of Newton Upper Falls, MA, to evaluate the theoretical possibilities of microwave absorption for detecting chemicals... Yale University will perform experiments on the interaction of electromagnetic waves with metallic fibers under a \$200,000 contract from the Army Research Office.

**VDTs**... Video display terminal (VDT) provisions in the new Newspaper Guild contract with the Montreal *Gazette* include shielding for the flyback transformers of all plastic bodied terminals (see *MWN*, March 1981), annual eye examinations and alternative work for pregnant operators upon request. If reassignment is impossible, a lead apron will be provided... Union official Gary Cwitco of the Communications Workers of Canada estimates 60 to 70 percent of the pregnant VDT operators at Bell Canada take advantage of a labor agreement allowing them to stop VDT work. (See *MWN*, May 1981)... Results from Mt. Sinai's epidemiological study of VDT health effects are still months away. According to Dr. Arthur Frank, the study's director, the first batch of completed questionnaires from participating Newspaper Guild locals is now being processed. (See *MWN*, March 1981)... News in the February 9 *Wall Street Journal* that NIOSH's Baltimore *Sun* study found no marked increase in the incidence of cataracts among VDT operators took institute investigators by surprise. NIOSH's Dr. Shiro Tanaka did not refute the *Journal's* report; he told *Microwave News* that no results have been released on the 400 some eye exams performed for the study. The report will take at least a few more months to complete. (See *MWN*, March 1981)... Commenting on reports of problem pregnancy clusters among clerical workers, Dr. Nancy Binkin at the Center for Disease Control in Atlanta, GA, said "fifty clusters in one year would not be significant, given the large number of workers and VDTs." She warned against lumping together different types of birth defects and miscarriages. (See *MWN*, November 1981 & January/February 1982)... A sympathetic judge in Frankfurt, Germany, dismissed charges against a bookkeeper who attacked his company's VDT with a chair and then set it on fire. According to the January 29 *Guild Reporter*, the employee was frustrated by system failures that regularly forced him to work overtime.

### **Massachusetts Standard** (continued from p. 1)

April 29 in Boston. Since the legislature authorized the state agencies to set a standard for non-ionizing radiation in 1980, the standard becomes official 30 days after its publication in the *Commonwealth Register*, the state's official record. The new rule could be in effect by this summer.

The limits in the population standard are in fact the same as the new ANSI standard except that all values have been reduced by a factor of five. The other major difference is that the averaging time for measuring exposures will be 30 minutes in-

stead of ANSI's six minutes. The variation, Watkins explained, was favored because the standard is designed to protect the public from long-term chronic exposures.

The occupational limits would only apply to medical and educational institutions. The Department of Public Health is, however, working with the state's Department of Labor and Industry, which is likely to issue a similar standard to protect other workers in the state. The averaging time for occupational exposures is six minutes.

In addition, there is a proposed emission standard for microwave ovens: a 5 mW/cm<sup>2</sup> leakage limit for ovens made after October 5, 1971, and 10 mW/cm<sup>2</sup> for those made before that date.

The proposed standard has an exclusion clause which allows the limits to be exceeded "if the exposure conditions are shown by laboratory procedures approved by the Director [of the Radiation Control Program of the Massachusetts Department of Public Health] to produce a spacial peak specific absorption rate below eight watts per kilogram averaged over any one gram of tissue" and an average, whole-body SAR below 0.08 W/Kg for the public and 0.4 W/Kg for workers. Devices with an input power of seven watts or less are also excluded.

The proposal was drafted by an ad hoc committee on non-ionizing radiation chaired by Watkins. Its membership includes Dr. Sol Aronow of Massachusetts General Hospital, Representative Argeo Cellucci of the state legislature, Dr. Samuel Fine of Northeastern University, Dr. Padmakar Lele of MIT, Dr. John Osepchuk of Raytheon and Dr. John Shapiro of Harvard.

The department has published a report which contains an introduction to RF/MW radiation and a rationale for the standard, "105 CMR 122.000: Regulations Governing Machines Which Generate Radio Frequency Electromagnetic Fields." For a copy of the report and the rationale, contact: Robert Watkins, Department of Public Health, Room 770, 600 Washington Street, Boston, MA 02111.

### **RFI at TMI** (continued from p. 1)

radio signals had interfered with the combustible gas meter and that the chromatograph analysis had been faulty. A workman's portable radio had confused the hydrogen gas meter, yielding unreliable readings.

A spokesman for General Public Utilities (GPU), the owner of the plant, refused to disclose either the type of meter which had been susceptible to RFI or the type of two-way radio used at the plant. GPU's Doug Bedell did say, however, that the walkie-talkie in question consisted of a microphone in the worker's face mask with a receiver in the belt of his protective suit.

None of the RFI experts contacted by *Microwave News* were surprised by the incident. They acknowledged that such events are possible, though unlikely. Some warned that the absence of federal standards for RFI made potential problems difficult to control. In a staff report released last July, the Federal Communications Commission concluded: "As our society becomes more and more dependent on electronics and electronic communications, societal problems stemming from RFI can only get worse unless significant parallel action is taken."

A spokesman for the Nuclear Regulatory Commission said it could not compel the release of any information on the interfering equipment. The commission is not investigating the "unusual event" at TMI, but it will review the GPU's report on the incident.