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A Report on Non-Ionizing Radiation

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Cancer Risk Cited in \$25 Million Power Line Award in Texas

A Texas jury has ordered Houston Lighting & Power Co. (HL&P) to pay more than \$25 million in punitive damages to a local school district for "reckless disregard" of children's health in siting a 345 kV power line across school property. The decision, handed down on November 27, was "based almost entirely" on potential effects of electromagnetic radiation, according to H. Dixon Montague, the school district's attorney.

Montague, who is with the Houston firm of Vinson & Elkins, told *Microwave News* that the jury was "amazed" that HL&P would put such a large facility on school property and "shocked" that HL&P would do so when there was a question as to whether electromagnetic radiation causes, or has any relation to, cancer.

Martha Medina, a spokeswoman for HL&P, the nation's fifth largest electric utility, said the company will appeal the decision.

The six-member jury in the County Civil Court At Law No.1 of Harris County found that the utility had abused its discretion in condemning approximately eight acres of the Klein Independent School District's property to build the transmission line. The jury told HL&P to pay approximately \$105,000 in damages for trespassing and \$25 million in punitive damages — \$1 million more than the school district had requested.

The jury also ruled that if the utility does not remove the power line, it will have to pay \$42 million to relocate the three school buildings on the property. According to Montague, the \$42 million figure is based on 1981 dollars and today amounts to more than \$64 million.

(continued on p.11)

Soviet Bioelectromagnetics Research Blossoming

The Soviet Union is stepping up its research program on the biological effects of electromagnetic fields. Two American scientists just back from a tour of Soviet labs reported that Soviet research teams are pulling ahead of their American counterparts at a time when many U.S. labs are closing down or cutting back.

In interviews with *Microwave News* following their return from a three-week tour of Pushchino, Moscow and Leningrad in October, Dr. Bill Guy of the University of Washington at Seattle and Dr. Don Justesen of the VA Hospital in Kansas City, MO, said that they are convinced that the Soviets are making research on electric and magnetic fields a top priority.

(continued on p.9)

GAO Blames Felec and Air Force for Clear Radar Accident

The General Accounting Office (GAO) has concluded that Felec Services, Inc. (FSI) and the Air Force were responsible for the radiation accident at Clear Air Force Station in September 1983 in which six workers were overexposed to radiofrequency radiation.

The GAO, a congressional investigatory bureau, found that any of several actions by either FSI or the Air Force could have prevented — or at least minimized — the accident. "While the actions of one employee did initiate the accident," the GAO explains in its 65-page report, "this simple explanation does not consider the basic problems that allowed the accident to happen and to go undetected for eight minutes. In our opinion, the basic causes are varied, but relate primarily to contractor noncompliance with operational and safety specifications in the contract and systemic problems in Air Force contract management practices."

The accident occurred at the Alaskan base on September 14, 1983, when an FSI technician unknowingly switched on a transmitter that activated Clear's tracking radar, part of the U.S. Ballistic Missile Early Warning System, while eight workers were making repairs on and near the radar dish. The six workers on the dish were later found to have been exposed to levels in excess of safety standards — the highest exposure may have reached 390 mW/cm² (see *MWN*, November 1983 and December 1984).

Felec and DOD Responses

FSI challenged the GAO's conclusions in comments it submitted on a review draft of the report, charging that the report "misrepresents the true facts of the case and the circumstances surrounding" the accident. The company argued that the operating procedures on the day of the accident were in conformance with "Clear site instructions" and explained that the procedures had been modified to adapt to specific situations and conditions at Clear.

The Department of Defense (DOD) accepted the GAO's findings, however, and has agreed to make virtually all of the changes called for in the report. The earlier draft was also circulated to the Alaska Department of Labor, which supported the GAO, and the U.S. Department of Labor, which did not respond. The final report is virtually unchanged from the draft.

Democratic Alaska Congressman Don Young, who asked the GAO to investigate the accident, released the report on November 13. In a prepared statement, Young observed that, "It is now up to the courts to review the circumstances of the accident to determine if compensation is due" to the exposed workers. Four of the workers have filed suits against FSI and RCA (see *MWN*, September/October 1985), which was responsible for Clear for many years before FSI took over. (The Clear facility has been operated by the RCA Service Co., the ITT Arctic Services, Co., the RCA OMS Co. and FSI during its 23 years of

operation. FSI, an ITT subsidiary, has had the operating contract since 1975.)

Interlock Bypass

According to the GAO, the accident would not have occurred if FSI had properly used the key interlock system that was designed to deactivate the radar system before workers entered the radome (radar housing). In fact, the GAO concluded that FSI routinely bypassed the system. Used properly, the interlock system would have made it virtually impossible to turn on the radar while anyone was in the radome.

The GAO also found that FSI failed to correct errors in the configuration of the waveguides and in the wiring of the four transmitters used to power the tracking and three detection radars at Clear — a mistake which contributed directly to the accident. The system had been improperly set up since its installation in 1961: contrary to the original design of the Clear facility, detection radar transmitters were used to power the tracking radar.

On the day of the accident, while performing a preventive maintenance routine, an FSI technician opened the waveguides to the inactive tracking radar — the interlock system would have prevented this, had it been used properly — and failed to close them before continuing his work. Soon afterward, the power to a detection radar was accidentally interrupted, deactivating the automatic transmitter selection function. When the technician manually switched the system back to its "normal" operating mode, power was mistakenly transferred from the detection to the tracking radar, where the eight repairmen were working.

The GAO criticized both FSI and the Air Force for their failure to correct the configuration problem: "...the accident would not have happened if either the contractor or the Air Force had corrected the transmitter layout design as required by contract provisions and regulations governing technical orders."

The GAO also said that FSI had understaffed the facility and had permitted unqualified personnel to operate the radar on the day of the accident. The report notes that FSI had given a qualified worker the day off.

FSI and the Air Force both issued reports soon after the accident, charging that the FSI technician's actions alone had caused the accident (see *MWN*, January/February 1984).

Oversight and Enforcement

The GAO found that the Air Force's Quality Assurance Evaluators (QAEs) responsible for contract compliance were not "technically trained in radar operation and maintenance" and had no "prior training or experience in contract law and procurement procedures or general contract administration requirements." QAEs serve one-year terms, which do not permit them to become sufficiently familiar with radar system contract compliance, the GAO charged. In addition, the Air Force failed to verify and validate technical orders before awarding the Clear contract to FSI, allowing the configuration errors to go uncorrected.

The medical care given to the exposed workers was ade-

quate overall, according to the GAO, although initial examinations of the men were delayed when an FSI manager required some of the workers to complete the repairs on the radar before permitting them to go to a nearby aid station. FSI then waited 24 hours before sending them to the Fairbanks Memorial Hospital Emergency Room, which is approximately 80 miles northeast of Clear. The report cautions, however, that "[The GAO] cannot determine whether this delay aggravated any existing biological problems or created other symptoms related to the radiation accident." It also notes that the men have received "extensive medical examinations" by Air Force and private physicians.

The GAO report, *Radiation Accident: Incident at Clear Air Force Station, Alaska* (GAO/NSIAD-86-9), recommends that the flaws it identified be corrected and that the Air Force survey other radar sites for similar violations. The title of the final report was changed from the draft's title, *Electromagnetic Radiation Hazards: Ballistic Missile Early Warning System (BMEWS), Site II, Clear A.F.S., Alaska*.

Single copies of the report are available at no cost from the GAO, 441 G St., NW, Washington, D.C. 20548.

Medical Devices Susceptible to EMI

Many computerized medical devices are susceptible to spurious electromagnetic signals and are unable to reject power line transients, according to the Food and Drug Administration (FDA). An FDA task force has identified problems in the way these devices are produced, installed and operated.

Speaking at the *IEEE Engineering in Medicine and Biology Society Conference* in Chicago, IL, in September, the FDA's Howard Bassen reported that "software quality assurance, the quality of the AC power and electromagnetic interference are the primary factors causing problems in computerized medical devices."

Bassen, who is the acting deputy director of the Division of Physical Sciences at the FDA's Center for Device and Radiological Health (CDRH) and chaired the task force, cited an example from the FDA's "Recall" data base: The pacer of an implantable cardiac pacemaker was reprogrammed by an electromagnetic field from an anti-theft device.

AAMSI and ECRI Reports

A study by the American Association for Medical Systems and Informatics (AAMSI), a Washington, DC-based group cited by Bassen, concluded that "the most common computerized device problems were caused by AC power line disturbances and electromagnetic interference (EMI) in clinical settings." AAMSI cited the following examples:

- AC power spikes can upset microprocessors, causing them to malfunction and to lose data.
- Electrosurgical units can cause both radiated and conducted EMI.

- The algorithm of pacemakers can be changed by EMI, without the user noticing.

Bassen also quoted data from the Emergency Care Research Institute (ECRI) of Plymouth Meeting, PA, which showed that electrocardiographs were susceptible to EMI from electrosurgical units, fluorescent lights, AC distribution systems and static on operators' hands.

In most cases, Bassen said, the problems can be resolved by shielding. He advocated transferring EMC techniques developed in the defense and aerospace industries to medical device manufacturers.

In a telephone interview with *Microwave News* after the conference, Bassen said that the FDA's Office of Device Evaluation would now put more emphasis on the EMC of medical devices.

Bassen can be contacted at HFZ-130, CDRH, FDA, Rockville, MD 20857, (301) 443-6536.

ELF Research Budgets: Mostly Bad News

Budgets for research on the bioeffects of extremely low frequency (ELF) power line radiation are being cut to the bone, stranding many laboratories just as they are ready to begin important new experiments. Only utility-sponsored research will get a boost in 1986.

At a meeting of contractors working on the bioeffects of electric and magnetic fields for the Department of Energy, the Electric Power Research Institute (EPRI) and New York State held in Alexandria, VA, in early November, speaker after speaker said that their labs would soon close down unless new funds were found (see also following story on neurologic changes).

Interviews with the leading funding agencies indicated:

- **DOE:** The Electric Field Effects Research program's budget has been reduced to \$3 million in fiscal year (FY) 1986 from \$4.7 million in FY85. The decrease was requested in President Reagan's proposed budget and Congress agreed to the cut. (The 1986 Energy and Water Development Appropriations Bill was signed into law on November 1.) Ken Klein, the director of the Office of Energy Storage and Distribution, said that "everybody will be hurt" by the cut and that there would probably be no new projects funded next year.

- **New York State Power Line Project:** The project's \$5 million research budget has been spent or allocated. "There is almost no hope for any more money," according to Dr. David Carpenter, the director of the New York State Department of Health's Division of Laboratories and Research.

- **EPA:** As reported in our last issue, the Environmental Protection Agency (EPA) has moved to disband its research group on non-ionizing radiation. If this occurs, Dr. Carl Blackman's work on ELF fields will end, even though there has been mounting interest in his recent findings on the role of the Earth's magnetic field in turning certain biological processes on and off.

HIGHLIGHTS

• **Navy:** Last year, the Navy stopped working on ELF bioeffects at its Aerospace Medical Research Lab in Pensacola, FL (see *MWN*, September 1984). The Office of Naval Research still has a few ongoing projects, however.

• **EPRI:** This is the one exception. EPRI expects to increase its funding level by 40 percent: from \$1.7 million in 1985 to \$2.4 million in 1986. Dr. Bob Patterson, project manager for EPRI's studies on the bioeffects of electric and magnetic fields, said that he planned to start a National Science Foundation-type program for "less directed and more creative" research with some of the new money.

Brookhaven Lab

Dr. Arland Carsten's plight at Brookhaven National Laboratory is a microcosm of the whole non-ionizing radiation research community. He and his coworkers have completed a study of reproductive and multi-generational effects of 60 Hz electric and magnetic fields on mice at Brookhaven's Medical Department in Upton, NY. (They found no significant effects on a large number of end points in results reported to date.) Carsten's experiment cost \$585,000 — over ten percent of the total NY project's funds. Unless he can find a new source of money, however, Carsten will soon have to give up the specially equipped lab he built for the study, due to keen competition for space. "The lab would be perfect for a study of ELF and leukemia and cancer, an issue on a lot of people's minds," he told *Microwave News*. He said he has gone everywhere for research grants but has come up empty-handed.

"The replacement cost of the exposure facility would likely be more than \$500,000. Many Brookhaven staffers supported me to get the lab and equipment ready for this study, otherwise I could never have built it within the budget. It's a pity to dismantle it when there are so many unanswered questions," he said.

The predicament faced by ELF researchers is similar to that of those who work at higher frequencies (see *MWN*, March 1985).

60 Hz Fields Induce Neurologic Changes in Monkeys

Power line frequency electric and magnetic fields can alter the balance of neurotransmitters in monkeys. This finding by researchers at the New York State Department of Health Laboratories in Albany is the first to implicate 60 Hz electromagnetic fields with changes in neurologic function.

Speaking at a meeting of contractors working on the effects of power line radiation held in Alexandria, VA, on November 6, Dr. Richard Seegal reported that monkeys exposed to a varied schedule of electric and magnetic fields for 63 days showed significant and replicable reductions in the concentrations of homovanillic acid (HVA) and 5-hydroxyindoleacetic acid (5-HIAA) in their cerebrospinal fluid (CSF). HVA and 5-HIAA are metabolites of dopamine and serotonin, respectively, two important neurotransmitters which are linked to motor activity, mood, emotion and sleep.

Decreases in HVA and 5-HIAA may indicate decreases in the firing activity of neurons and changes in circadian rhythms, according to Seegal. Changes in the concentration of HVA in the CSF mirror alterations in the brain, and, while the same may be true for 5-HIAA, it is possible that 5-HIAA concentrations in the CSF reflect changes in spinal cord metabolism.

Seegal and his coworkers, Drs. Robert Dowman and Jon Wolpaw, found that the decreases in HVA appeared to be dose-dependent and reversible. Although the decreases in 5-HIAA also appeared to depend on the dose, they did not appear to be reversible.

No Excess Leukemia Among Wisconsin Electrical Workers

Wisconsin electrical workers had a normal rate of leukemia mortality between 1963 and 1978, according to a letter in the December 5 *New England Journal of Medicine*.

The finding by Drs. Eugenia Calle of the Centers for Disease Control in Atlanta, GA, and David Savitz of the University of Colorado Medical School in Boulder, CO, appears to contradict earlier reports by Drs. Samuel Milham and William Wright (see *MWN*, July/August and December 1982, respectively). The new study used the same occupational groupings as these previous studies.

Calle and Savitz advised that the current practice of combining various occupations into one group of "electrical workers" to test hypotheses is not supportable either by considerations of exposure or by

consistent patterns of elevated risk. They wrote: "We believe that the available evidence concerning the possible association between occupational field exposure and leukemia risk should be viewed with caution until workplace exposures are more realistically considered and adequate epidemiologic studies are conducted on particular cohorts of interest."

Savitz is currently working on an attempted replication study of Nancy Wertheimer's epidemiological study that linked electromagnetic fields with childhood cancer (see *MWN*, September 1983). Results are due this summer. Savitz is moving to the Department of Epidemiology at the University of North Carolina School of Public Health in Chapel Hill at the beginning of the year.

Six monkeys were exposed to the field, and four acted as controls. Three sets of exposure conditions were used, each lasting 18 hours a day for 21 days: 3 kV/m and 0.1 gauss (G), 10 kV/m and 0.33 G, and 30 kV/m and 0.9 G in random order. Samples of CSF were collected after each 21-day exposure.

Seegal believes his findings may apply to humans because of their similarities to monkeys. In addition, he noted that the field strengths used in the study are "comparable to those found in the environment."

The team had hoped to run another pair of control monkeys to complete the experiment, as well as to attempt to determine the thresholds for the observed effects and to find out whether the electric or the magnetic field was the active agent, but the group's funding has run out. The studies were paid for by the New York State Power Line Project, whose \$5 million research budget has now been depleted.

Seegal told *Microwave News* that he is seeking new sources of funding — so far without success.

CDC Confirms Down's Cluster in Vernon; MW Levels Minimal

The Centers for Disease Control (CDC) has confirmed that there is an elevated incidence of Down's Syndrome in Vernon, New Jersey, but found normal rates of other birth defects and cancer. The cluster remains unexplained, however, as preliminary reports of measurements made by the Environmental Protection Agency (EPA) indicate that radiation levels in Vernon Valley are extremely low. (Seven cases of Down's were identified in Vernon, as compared to the 1.43 expected cases.)

In a consultation report released on November 12, the CDC recommended an "intensive examination" of the Down's cases, but ruled out a "comprehensive" health survey of Vernon residents. The CDC advised that a scientific review advisory panel be set up to help the state Department of Health in its future work in Vernon. (See the full text of the CDC recommendations in "From the Field" on p.8.)

"The NJ Department of Health has accepted the CDC recommendations," Assistant Commissioner Dr. Leah Ziskin told *Microwave News*. She said that she is now putting together the panel and hopes to hold the first meeting in January.

Vernon has the largest concentration of satellite communications stations and point-to-point microwave towers in the U.S. Some local residents blame microwave radiation for the Down's cases and other ailments (see *MWN*, May 1985).

No Cause Found

The CDC could not explain what caused the Down's cluster. It dismissed as "unlikely" the possibility that some of the cases were misdiagnosed and/or that the cluster was a random event — the odds of the cluster occurring by

chance were calculated as less than 1 in 1000. Nor could the CDC attribute the increase to maternal age: of the seven observed cases of Down's, five were among women under 30 years old. The CDC said it could not rule out the possibility of an environmental cause and therefore recommended that the cluster be studied further.

According to the CDC, birth weights and birth defect rates (other than Down's) in Vernon were normal and the rates for most cancers were lower than expected.

In mid-November, Richard Tell, chief of the EPA's Electromagnetics Branch in Las Vegas, NV, measured microwave radiation levels in Vernon. According to Dr. Gerald Nicholls, acting chief of the NJ Bureau of Radiation Protection, Tell found levels of 10^{-4} to 10^{-10} uW/cm² in residential areas.

In a telephone interview, Nicholls said that the EPA measurement report would be released by the NJ Department of Health in January or February.

Citizens Against the Tower (CAT), a local-residents' group, criticized the CDC for making no attempt to check whether there were any additional cases of Down's Syndrome in Vernon and for not acknowledging that the cases already identified are clustered within specific areas in the town. "They just want to bury the whole thing," CAT's Elise Kreindler contended.

When asked about these criticisms, Larry Edmonds of the CDC's Center for Environmental Health, the principal author of the CDC report, told *Microwave News* that the New Jersey study team would check to see if there are any other cases of Down's and any special clustering in Ver-

Avon Siting Dispute

Residents of Avon, Connecticut, are continuing to spar with Avon Mountain broadcasters.

On November 19, the town zoning commission approved Astroline Communications' plan to erect a new 750-foot tower for station WHCT (Channel 18) across the street from an antenna farm, but placed eleven conditions on it, including a non-ionizing radiation limit of 10 uW/cm² at the boundary of the tower property and a 90-day restriction on the dismantling of WHCT's nearby 279-foot tower following activation of the new tower.

The residents have appealed the decision in the Connecticut Superior Court in Hartford.

The 10 uW/cm² exposure standard is similar to the one recommended earlier this year by Avon's Director of Health, Hudson Birden, Jr., though he had recommended that the limit apply at the nearest residence, 300 feet from the tower's property line (see *MWN*, September/October 1985).

On November 22, another broadcaster, Channel 13, filed an application to reactivate an unused tower on Avon Mountain, further angering the town residents.

HIGHLIGHTS

non. "I would be very surprised if they came up with anything new," he said.

Kreindler suspects that the satellite stations turned down the power when the EPA came to town. "Usually TV reception in the valley is awful, but two days before the EPA arrived, it cleared up. Then a few days after they left, it returned to normal," she said.

Congresswoman Marge Roukema, who represents the Vernon area, has been monitoring the CDC and EPA studies and has notified CAT that she is looking into the federal government's efforts to set national exposure guidelines for non-ionizing radiation.

EMC Society Meeting

Outlined below are some of the highlights from the papers presented at the 1985 *IEEE International Symposium on Electromagnetic Compatibility (EMC)*, held in Wakefield, MA, August 20-22.

- Isidor Straus gave a detailed overview of the German EMC bureaucracy, explaining how it is governed by directives from the EEC (the Common Market). In "Meeting the VDE Requirements," he explained that the German rules have been "extensively reworked" in the last six months. Straus, of Dash, Straus & Goodhue in Boxborough, MA, described the legislative background of the rules and the groups that actually write the standards — for instance, he noted that the German DKE Subcommittee 761 is the approximate counterpart of the U.S. ANS Committee C63 — and he went into considerable depth on the specific rules and measurement procedures.

- With respect to U.S. standards, Edwin Bronaugh of

Electro-Metrics in Amsterdam, NY, reviewed the forthcoming SAE J1507 report on testing the susceptibility of motor vehicles to radiated signals in the frequency range 20 MHz to 18 GHz. He explained how the facilities and procedures described by the SAE can be applied to the testing of the immunity of other large and complex electronic systems....Julius Knapp and Frank Rose of the Federal Communications Commission (FCC) examined ways of simplifying and streamlining the commission's Part 15 rules on RF devices — including low power transmitters and computers. One change they advocated is to divide the rules into those that apply to intentional and to unintentional radiators. They also suggested the possibility of combining rules for unintentional radiators with the noise limits for industrial, scientific and medical (ISM) equipment under Part 18. They noted that the commission has not yet scheduled action for an overall revision of Part 15, but that a proposal could be issued in early 1986....And Richard Fabina and Joseph Husnay, both of the FCC, described some of the practical problems of testing computer devices with the commission's MP-4 measurement procedures. They emphasized the importance of cable placement and the configuration of the equipment for maximizing conducted and radiated signal levels — the configuration for maximum emissions also varies with frequency.

- Jane Clemmensen and John Meloy of SRI International in Menlo Park, CA, and Ralph Ferraro of the Electric Power Research Institute in Palo Alto, CA, presented the results of tests of seven power line conditioners, isolators and purifiers to filter out harmonics and noise generated by consumer electronic equipment. They found that these filters could reduce the high frequency noise but often at the

Intentional Satellite EMI?

What appears to be the first case of intentional electromagnetic interference (EMI) with a commercial satellite was reported to the Federal Communications Commission in November. A complaint filed by Eastern Microwave, Inc., alleged that a transponder leased by the company on Hughes Communications' Galaxy 1 satellite was subjected to 18 hours of EMI from an unknown source in late October, according to Eastern Microwave's attorney, Charles Helein of Dow, Lohnes & Albertson in Washington, DC.

The Home Satellite Newsletter, which broke the story, noted that a home satellite dish can be cheaply turned into an uplink transmitter that can interfere with any domestic satellite — "U.S. satellite communications could be held hostage by jammers," the Arlington, Virginia newsletter warned.

Revenge against broadcasters who scramble television programming is one widely cited motive for wanting to jam satellite signals. For instance, the

November issue of *STV Magazine* published a fictitious story about an angry HBO subscriber who uses EMI to blackmail the satellite cable network to stop scrambling.

In a letter to the FCC, Helein wrote: "The nature of the signal (unmodulated), its clean quality, the length of interference, the times at which it occurs and the manipulation between [two transponders] suggest a strong possibility that the signal is being deliberately generated to create interference or some licensee is most negligent in its testing procedures. In either case the matter is of grave concern to Eastern Microwave."

Dan Warren, managing editor of *Satellite Week*, a Washington, D.C. newsletter, said in a telephone interview that "people in the industry are nervous," adding that it is easy to interfere with satellites but very expensive to stop and practically impossible to catch the jammer.

expense of increasing the low frequency components by more than 10 dB. In addition, they reported that some of these devices, which can cost up to \$500, do not filter common mode noise because the neutral wire is passed straight through. In a second paper, Clemmensen reported that a small appliance with a variable speed motor can cause havoc to a home computer when both are plugged into the same outlet. She said that in 100 out of 100 tries, ten each with ten different computers, disk read-or-write operations failed due to conducted EMI from a hand drill. Moving the drill to a different outlet or using a 20-foot extension cord stopped the interference, however.

• From the Electromagnetic Fields Division at the National Bureau of Standards in Boulder, CO: Myron Crawford and G.H. Koepke outlined the advantages of using a reverberating chamber compared to an anechoic chamber for susceptibility testing. And P.F. Wilson and M.T. Ma evaluated the use of insertion loss as an indicator of a material's shielding effectiveness. If not done properly, they warned, the data obtained may reflect the measurement procedure more than the material being tested.

• Among the other noteworthy papers were: A description of the "Stanford ELF/VLF Radiometer Project" by Drs. A.C. Fraser-Smith and R.A. Helliwell of Stanford University in Palo Alto, CA, where they are attempting to measure the global distribution of ELF and VLF noise...C.K. Jackson of Hughes Aircraft Co. in Fullerton, CA, addressed how to adapt EMC testing procedures to spread spectrum communication systems...William Rhoades of Xerox Corp. in El Segundo, CA, described how to design equipment to achieve immunity to electrostatic discharge.

The attendance at the symposium's technical sessions was 694; the total attendance, including those visiting the exhibitions, was 1,195. A copy of the proceedings of the symposium is available for \$33.00 (IEEE members) and \$66.00 (non-members) from the IEEE Service Center, Publication Sales Dept., 445 Hoes Lane, Piscataway, NJ 08854, (201) 981-0060. Order No. 85CH2116-2.

Portland RF/MW Proposal Changed to 200 uW/cm²

The City of Portland's (Oregon) Planning Commission has proposed a general population radiofrequency and microwave (RF/MW) radiation standard of 200 uW/cm² — twice the level recommended by the city's Bureau of Planning.

In a November report to the City Council, the Planning Commission does not explain why it rejected the bureau's recommendation — indeed, it does not acknowledge the change.

Knowledgeable sources indicated that the 200 uW/cm² level was a compromise between the city and local broadcasters who opposed the 100 uW/cm² level. Although the radio and television stations have now been appeased, it is not clear how community groups involved in formulating the standard will react.

Steven Gerber, of the Portland Bureau of Planning, who is coordinating the development of the standard, told *Microwave News* that the "200 uW/cm² limit is conservative, with a built-in margin of safety over identified thermal effects."

None of the city's broadcasters will be adversely affected by the 200 uW/cm² standard, according to Gerber. He estimated that one FM station would have had to make some changes if the city had adopted a 100 uW/cm² level.

The Planning Commission recommendation must now be approved by the City Council, the last hurdle in a six-year effort to regulate broadcasters in Portland. The City Council is tentatively scheduled to discuss the RF/MW standard at a meeting on January 26.

The new 200 uW/cm² recommendation could bring the city in line with the standard for Multnomah County, in which Portland is located. The Portland proposal is the same as the public exposure standard adopted by the state of Massachusetts in 1983 and five times stricter than the guidelines of the American National Standards Institute (ANSI).

For a copy of the *RF Regulatory Review Project: Planning Commission Report and Recommendations to the City Council*, contact: Steven Gerber, Bureau of Planning, City of Portland, Room 1058, 1120 SW Fifth Ave., Portland, OR 97204, (503) 796-7706.

NAS-NRC Symposium on Non-Thermal Bioeffects

An advisory committee on "Non-Thermal Effects of Non-Ionizing Radiation" of the National Academy of Sciences-National Research Council's (NAS-NRC) Board on Radiation Effects Research held a one-day *Symposium on Biological Effects of Low-Level Exposures to Non-Ionizing Radiation* on October 29. Attendance at the meeting was limited to invited speakers and observers from federal agencies.

The board set up the advisory committee to determine what role the NAS-NRC should play in the field of non-ionizing radiation bioeffects. According to the board's staff officer, Dr. Stephen Brown, the committee will consider whether there is a need for an NAS-NRC study, and, if so, on what topic.

Brown told *Microwave News* that the advisory committee is preparing a detailed letter on its findings for the board — the letter should be ready for presentation at the board's meeting on December 6-7. There are no plans to release the letter and it may remain an internal document, Brown said.

The following experts were invited to speak at the NAS-NRC symposium: Drs. Ross Adey, Glen Edwards, Om Gandhi, Reba Goodman, Sol Michaelson, William Pickard, Maria Stuchly and Nancy Wertheimer.

The chairman of the NAS-NRC's advisory committee is Dr. Robert Hofstadter of the Department of Physics at Stanford University in Palo Alto, CA. The other members

(continued on p.8)

CDC Recommendations on Vernon, New Jersey

Reprinted below are the recommendations contained in the Report of Centers for Disease Control (CDC) Consultation on Vernon Township, New Jersey issued on November 12, 1985. The principal author was Larry Edmonds of the Center for Environmental Health in Atlanta, GA. See story on p.5.

The Center for Environmental Health (CEH) does not find any evidence that rates of all categories of birth defects and cancer are increased in Vernon Township. The rate of one defect, Down's Syndrome, was elevated from 1975 through 1981. The data available for review suggest that the rates of other outcomes are not unusual. On the basis of the available information, CEH does not believe that a comprehensive health study of Vernon Township residents is warranted, but rather an intensive examination of the Down's Syndrome cases as indicated below. After reviewing the existing data from Department of Health (DOH) and Citizens Against the Tower (CAT) and after considering the existing public health concerns, CEH suggests the following plan:

1. Describe the incidence of Down's Syndrome from 1982 to the present;
2. Conduct a case-control study of cytogenetically confirmed infants with Down's Syndrome for the years 1975 through 1985, including an in-depth family interview;
3. Measure the range of radiofrequency/microwave (RF/MW) radiation in Vernon Township;
4. Regularly review cancer and birth defects data from ongoing surveillance programs;
5. Establish an advisory panel to review planned studies.

1. The first priority in Vernon Township is to describe the current incidence of Down's Syndrome and other chromosomal abnormalities. Most of the data CEH reviewed are from 1975 through 1981. Very little is known about the current situation, particularly for Down's Syndrome. CEH suggests identification of all cases of Down's Syndrome and other defects due to chromosomal anomalies born from January 1982 through December 1985. The case definition should be the following: a resident birth of Vernon Township with the diagnosis of a chromosomal abnormality confirmed by karyotype. If needed, the DOH should make cytogenetic testing available. Case ascertainment should be very intensive and should include review of the infants' hospital records, local physicians, area chromosomal laboratories, area pediatric referral hospitals, school systems, fetal deaths, special child services and self reports including those from community groups. Special efforts should be made to ascertain resident cases diagnosed out of state through review of out of state hospital records, vital records, chromosomal registries and cytogenetic laboratories. These same intensive case finding procedures should be applied for births which occurred from 1975 through 1981, to insure as complete an ascertainment of cases for that period as possible. CEH is willing to review any cytogenetic studies that have been conducted on these families.

2. For each case of Down's Syndrome identified in recommendation 1 (cases born from 1975 through 1985) CEH suggests a detailed interview be conducted with each family and a set of control families. The interviews should include the following: family reproductive and medical history, residential history, occupational history, environmental exposures and other suspected risk factors. The investigation's success relies on the participation of the families of affected children. CEH is willing to consult on the development of a detailed questionnaire and to review the results of any study.

3. CEH recommends that measurements should be taken to de-

termine the range of RF/MW radiation in Vernon Township. All sources of RF/MW radiation should be considered when estimating the range of potential microwave exposure to residents. CEH recommends that priority be given to sampling around and inside the schools adjacent to the satellite dishes. Samples should also be taken at representative areas in the community. The Mayor's Blue Ribbon Panel and CAT should be asked to develop a priority list of 12 sites to be sampled. CEH recommends that, after measurements have been taken around the earth stations' facility boundaries, around and inside the local schools and in representative areas, measurements should be taken at as many of the sites on the priority list as resources permit. These findings should be reviewed by the advisory panel (see recommendation No.5, below) and it is possible they may want more measurements.

4. CEH recommends that the DOH regularly review data on cancer and birth defects from ongoing surveillance programs. Data from Vernon Township and Sussex County should be routinely reviewed. In 1983, the DOH established a statewide birth defect surveillance system. Using this system, the State will be able to monitor Vernon Township and Sussex County with minimal additional effort, and the level of case ascertainment should be very high and timely. Data from Vernon Township and Sussex County should be reviewed every six months and the results should be reported to an advisory panel (see recommendation No.5, below). The cancer registry for New Jersey offers the opportunity to monitor cancer rates. The results of cancer surveillance should be reported in the same manner as those for birth defects surveillance.

5. CEH recommends that a scientific review advisory panel should be established to advise the State Department of Health on scientific issues. The Public Advocate, the Department of Environmental Protection (DEP), the Mayor's Blue Ribbon Panel from Vernon Township and the Citizens Against the Tower each should appoint a responsible scientist to represent it. The panel should review any planned activities and the results of any studies and make recommendations to the DOH. The DOH should be responsible for conducting any health studies in Vernon Township with the advice of the panel. CEH is willing to consult with this group and the Department of Health as appropriate.

NAS-NRC (continued from p.7)

are: Dr. J. Woodland Hastings of the Biology Laboratories at Harvard University in Cambridge, MA; Dr. Sean McGlynn of the Department of Chemistry at Louisiana State University in Baton Rouge; Dr. Michael Shelanski of the Department of Pharmacology at New York University in New York City; and Dr. John Rigden of the Department of Physics at the University of Missouri in Saint Louis.

The members of the Board on Radiation Effects Research are: Dr. Richard Setlow (chairman) of the Biology Department at Brookhaven National Laboratory in Upton, NY; Dr. Jacob Fabrikant of the Donner Laboratory at the University of California in Berkeley; Dr. Oddvar Nygaard of the Department of Radiology at Case Western Reserve University in Cleveland, OH; Dr. Joseph Rall of the National Institutes of Health in Bethesda, MD; Dr. Robert Pound of the Physics Laboratory at Harvard University; and Dr. Eldon Sutton of the Department of Zoology at the University of Texas in Austin.

"No one can say they are not doing good science," Guy said, stressing that, "They have brand-new equipment, they have adopted a good scientific approach and they work in large interdisciplinary teams composed of biologists, biophysicists and engineers." He added that Professor Inal Akoev at the Institute of Biological Physics in Pushchino (south of Moscow) has 50 researchers in his lab alone and that all key personnel have their own IBM personal computers.

"I was very jealous of what I saw there," Guy said of his visit to Akoev's lab. "They have equipment that I just can't afford." Guy is the director of the University of Washington's Bioelectromagnetics Laboratory, one of the best-equipped and best-funded research centers in the U.S.

A similarly envious view came from Justesen: "Akoev has the best shop and is doing the most interesting things imaginable." Justesen contrasted the flourishing Soviet bioelectromagnetics program with the American one, which he described as "crashing in flames." He said that, based on their progress, the Soviets will soon begin to export medical devices such as magnetoencephalographs.

The two researchers' appraisal of the Soviet commitment to understanding bioelectromagnetic phenomena is consistent with previous reports by Americans returning from the Soviet Union (see *MWN*, November 1982).

Soviet Occupational Standards

In Moscow, Professor Boris Savin, director of the Institute of Industrial Hygiene and Occupational Diseases, told Guy that the new Soviet occupational standard, which limits worker exposures to 25 $\mu\text{W}/\text{cm}^2$ for an eight-hour day over the frequency range 300 MHz-300 GHz, will become effective on January 1, 1986. (See *MWN*, September 1983 for details of the Soviet occupational standard as it was first proposed.) The standard, which is based on the total amount of energy absorbed, allows higher exposures for shorter periods of time — for instance, 100 $\mu\text{W}/\text{cm}^2$ for two hours.

According to Guy, Savin said that the Soviet occupational standard may be relaxed in the next few years and that he would like to see greater parity between the safety standards in his country and those in the U.S.

In 1984, the Soviet Union relaxed its exposure standard for the general public from 5 $\mu\text{W}/\text{cm}^2$ to 10 $\mu\text{W}/\text{cm}^2$ above 300 MHz (see *MWN*, June 1985).

The U.S. Occupational Safety and Health Administration has a 10 mW/cm^2 (10,000 $\mu\text{W}/\text{cm}^2$) standard, although the courts have ruled it unenforceable. The voluntary ANSI standard limits worker and public exposures to 1-5 mW/cm^2 above 300 MHz. There are no federal standards to protect the general population from overexposure to non-ionizing radiation.

ELF Standards

Savin told Guy that the new Soviet occupational standard for extremely low frequency (ELF) electric fields from power lines is 5 kV/m for a full, eight-hour work day. For a ten-minute period, the limit is 20-25 kV/m. Guy

said that the standard does not address ELF magnetic fields (see *MWN*, September 1984). The Soviet electrical distribution system operates at 50 Hz.

While in Moscow, Guy and Justesen also visited Professor Yu. Kholodnov at the Institute of Higher Nervous Activity. Here, too, they noted a marked improvement in the quality of the laboratory equipment for studies on DC and pulsed magnetic fields.

In Leningrad, the two Americans toured the Institute of Experimental Medicine and also met with Dr. T. Kalada, who works on occupational health diseases at an institute similar to Savin's.

Joint Statement

At the end of their visit to the Institute of Biological Physics in Pushchino, Guy and Justesen wrote a joint statement with Akoev on the current scientific basis for electromagnetic radiation (EMR) safety standards. They agreed:

- There is some ambiguity in determination of biological significance of the revealed effects of EMR with respect to signalling, adaptive and pathological reactions. There are very few data about the radiation levels and exposure durations associated with induction of pathological changes and with exhaustion of adaptive systems;
- Quantitative correlations between the effects of EMR at different levels of organization of biological systems, from molecular to organismic levels, have not been clearly established. This void of quantitative information hampers attempts to elucidate the role of regulatory systems in the manifestation of the effects at the organismic level;
- A comparative analysis of the effects of continuous wave and modulated irradiation in the range of "Adey windows" and of natural macrorhythms of organisms is much in need;
- There are no controlled studies of the sensory effects of EMR as one of the possible stress factors upon irradiation.

Akoev, Guy and Justesen endorsed the need for greater collaboration between Soviet and American researchers, with more exchanges of scientists and technical publications, as well as more meetings on key problems.

During their tour, Guy and Justesen were guests of the Soviet Union. Their travel was paid for by the National Institute for Environmental Health Sciences, which coordinates the ongoing U.S.-U.S.S.R. exchange program (see *MWN*, September 1983 and March 1985). ●

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CONFERENCES

1986 Conference Calendar

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

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

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

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

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

February 2-7: **Winter Meeting of the IEEE Power Engineering Society**, Penta Hotel, New York, NY. Contact: Nancy Heitmann, IEEE, 345 East 47th St., New York, NY 10017, (212) 705-7893.

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

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

March 12-15: **Joint Meeting of the European Workshop on Nuclear Magnetic Resonance and the World Health Organization**, Monte Carlo, Monaco. Contact: Dr. Robert Muller, University of Mons, Faculty of Medicine, B7000 Mons, Belgium.

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

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

April 2-4: **International Workshop on Physics and Engineering in Computerized Multidimensional Imaging and Processing**, University of California, Irvine, CA. Contact: Dr. O. Nalcioglu, Dept. of Radiological Sciences, University of California, Irvine, CA 92717, (714) 856-5904.

April 8-10: **1986 Test & Measurement World Expo**, Convention Center, San Jose, CA. Contact: Meg Bowen, 215 Brighton Ave., Boston, MA 02134, (617) 254-1445.

April 12-16: **21st Annual Meeting & Exhibit of the Association for the Advancement of Medical Instrumentation (AAMI)**, Hyatt Regency, Chicago, IL. Contact: AAMI, Suite 602, 1901 N. Fort Myer Dr., Arlington, VA 22209, (703) 525-4890.

April 12-16: **64th Annual Convention of the National Association of Broadcasters (NAB)**, Convention Center, Dallas, TX. Contact: NAB, 1771 N St., NW, Washington, DC 20036, (202) 429-5350.

April 13-17: **34th Annual Scientific Meeting of the Radiation Research Society (RRS) and the 6th Annual Meeting of the North American Hyperthermia Group (NAHG)**, Las Vegas, NV. Contact: RRS at 925 Chestnut Street, 7th floor, Philadelphia, PA 19107, (215) 574-3153; and NAHG, c/o Professor John Strohbehn, Thayer School of Engineering, Dartmouth College, Hanover, NH 03755, (603) 646-2609.

April 14-17: **24th International Magnetism Conference**, Hyatt Re-

gency, Phoenix, AZ. Contact: Ms. Diane Suiters, INTERMAG'86, 655 15th St., NW, Suite 300, Washington, DC 20005, (202) 639-5088.

May 5-9: **Magnetic Resonance Imaging 1986: National Symposium**, Orlando Hyatt Hotel, Disneyworld, FL. Contact: Sally Lunn, Educational Symposia, Inc., PO Box 17241, Tampa, FL 33682, (813) 873-2090.

May 12-14: **1986 Microwave Power Tube Conference**, Naval Postgraduate School, Monterey, CA. Contact: Ralph Nadell, Palisades Institute for Research Services, 11th floor, 201 Varick St., New York, NY 10014, (212) 620-3341.

May 12-15: **International Scientific Conference: Work with Display Units**, Stockholm, Sweden. Contact: WWDU, c/o Stockholm Conference Bureau, Box 1617, S-111 86 Stockholm, Sweden.

May 19-22: **18th Annual Meeting of the Conference of Radiation Control Program Directors (CRCPD)**, Charleston, WV. Contact: CRCPD, 71 Fountain Pl., Frankfort, KY 40601, (502) 227-4543.

May 19-24: **1986 Nuclear EMP Meeting**, University of New Mexico, Albuquerque, NM. Contact: C.W. Jones, Dikewood Corp., 1613 University Blvd., NE, Albuquerque, NM 87102.

May 25-30: **Symposium on Electrofusion and Electroporation of Cells and Protoplasts at the 1986 Annual Meeting of the AAAS**, Philadelphia, PA. Contact: Dr. Thomas Rozzell, Office of Naval Research, Arlington, VA 22217, (301) 696-4053. For more information on AAAS meeting, see *Science*, October 11, 1985, p.162.

June 1-5: **8th Annual Meeting of the Bioelectromagnetics Society (BEMS)**, Madison, WI. Contact: BEMS, 1 Bank St., Gaithersburg, MD 20878, (301) 948-5530.

June 2-4: **1986 IEEE MTT-S International Microwave Symposium**, Baltimore, MD. Contact: Marvin Cohn, c/o LRW Associates, 1218 Balfour Dr., Arnold, MD 21012.

June 4-5: **1986 IEEE Microwave and Millimeter Wave Monolithic Circuits Symposium**, Baltimore, MD. Contact: Octavius Pitzalis, Jr., Hughes Research Lab., 3011 Malibu Canyon Rd., MS RL-61, Malibu, CA 90265, (213) 317-5841.

June 8-13: **Gordon Conference on Bioelectrochemistry**, New Hampshire. Contact: Professor Howard Wachtel, University of Colorado, Boulder, CO 80309, (303) 492-7327, or Professor Betty Sisken, University of Kentucky, Lexington, KY 40506, (606) 258-5796.

June 9-13: **1986 International IEEE Antennas and Propagation Society Symposium and National Radio Science Meeting**, Wyndham Franklin Plaza Hotel, Philadelphia, PA. Contact: Charles Allen, GE, Valley Forge Space Center, Room U4018, PO Box 8555, Philadelphia, PA 19101.

June 11-13: **International Symposium on Probabilistic Methods Applied to Electric Power Systems**, Toronto, Canada. Contact: Dr. Samy Krishnasamy, Research Division, Ontario Hydro, 800 Kipling Ave., Toronto, Ontario M8Z 5S4, Canada, (416) 231-4111, Ext. 6086.

June 16-19: **EMC Expo 86**, Sheraton Washington Hotel, Washington, DC. Contact: EMC Expo 86, Suite 200, 117 King St., Alexandria, VA 22314, (703) 548-2802.

June 19-21: **5th International Congress Cardioslim 86**, Monaco. The meeting will include symposia on **Cardiostimulation** (Cardiac Pacing and Electrophysiology) and on **Bio-stimulation** (New Advances in Bio-stimulation). Contact: Dr. J. Mugica, 16 rue Pasteur, 92211 St-Cloud Cedex, France.

June 23-25: **17th Power Modulator Symposium**, Hyatt Seattle, WA. Contact: Leslie Gallo, Palisades Institute for Research Services, 2011 Crystal Dr., One Crystal Park, Suite 307, Arlington, VA 22202.

June 23-27: **Conference on Precision Electromagnetic Measurements (CPEM'86)**, National Bureau of Standards (NBS), Gaithersburg, MD. Contact: Norman Belecki, B146 Metrology Bldg., NBS, Gaithersburg, MD 20899, (301) 921-2715.

June 24-26: **1986 International Conference on Lightning and Static Electricity**, Stouffer Dayton Plaza Hotel, Dayton, OH. Contact: Lawrence Walko, AFWAL/FIESL, Wright-Patterson AFB, Dayton, OH 45433, (513) 257-7718.

June 24-26: **Military Microwaves (MM'86)**, Metropole Convention Center, Brighton, UK. Contact: R.C. Marriott, Microwave Exhibitions and Publishers, Convex House, 43 Dudley Rd., Tunbridge Wells, Kent TN1 1LE, U.K., (0892) 44027.

June 24-26: **8th International Wroclaw Symposium on Electromagnetic Compatibility**, Wroclaw, Poland. Contact: EMC Symposium, Box 2141, 51-645 Wroclaw 12, Poland.

June 29-July 3: **31st Annual Meeting of the Health Physics Society (HPS)**, Hilton Hotel, Pittsburgh, PA. Contact: HPS, Suite 300, 1340 Old Chain Bridge Rd., McLean, VA 22101, (703) 790-1745.

July 26-August 9: **NATO Advanced Study Institute: Physics and Technology of Hyperthermia**, Urbino, Italy. Contact: S.B. Field, MRC Cyclotron Unit, Hammersmith Hospital, Ducane Rd., London W12, UK, (1) 743-4594, or C. Franconi, Medical Physics Institute, University of Rome, Via O. Raimondo, 00173 Rome, Italy, (6) 613-1200.

July 28-30: **21st Annual Microwave Power Symposium**, Crowne Plaza Hotel, Memphis, TN. Contact: International Microwave Power Institute (IMPI), 13542 Union Village Circle, Clifton, VA 22024, (703) 830-5588.

July 30-August 3: **1986 International Tesla Symposium**, Colorado College, Colorado Springs, CO. Contact: IEEE Pikes Peak Section, Suite 115, 330-A West Uintah, PO Box 150, Colorado Springs, CO 80901.

August 13-14: **Symposium with Seminars on Antenna Technology and Applied Electromagnetics**, University of Manitoba, Winnipeg, Manitoba, Canada. Contact: L. Shafai, Dept. of Electrical Engineering, University of Manitoba, Winnipeg, Manitoba R3T 2N2, Canada, (204) 474-9603.

August 20-22: **11th Annual Conference of the Australian Radiation Protection Society**, Sydney, Australia. Contact: D.A. Woods, Office of the Supervising Scientist, PO Box 387, Bondi Junction, NSW 2022, Australia, (02) 387-0666.

August 25-29: **URSI International Symposium on Electromagnetic Theory and 8th Colloquium on Microwave Communication**, Budapest, Hungary. Contact: Professor T. Berceli, Research Institute for Telecommunication, 1525 Budapest 114, POB 15, Hungary.

September 14-19: **1986 IEEE/PES Transmission and Distribution Conference and Exposition**, Convention Center, Anaheim, CA. Contact: Charles White, South Carolina Electric and Gas Co., PO Box 764, Columbia, SC 29218, (803) 748-3518.

September 16-18: **IEEE International Symposium on Electromagnetic Compatibility**, Town and Country Hotel, San Diego, CA. Contact: George Ufen, GRU Associates, 1105 East Commonwealth Ave., Fullerton, CA 92631, (714) 738-0903.

September 17-19: **International Utility Symposium on the Health Effects of Electrical and Magnetic Fields: Research, Communication and Regulation**, Constellation Hotel, Toronto, Ontario, Canada. Contact: John O'Grady, Ontario Hydro, Suite H8 D4, 700 University Ave., Toronto, Ontario M5G 1X6, Canada, (416) 592-3395.

September 23-26: **Heating and Processing 1-3000 MHz**, Cambridge, UK. Contact: British National Committee for Electroheat, 30 Millbank, London SW1P 4RD, U.K.

September 28-October 2: **5th International Conference on Electromagnetic Compatibility**, University of York, U.K. Contact: Conference Secretariat, Institution of Electronic and Radio Engineers, 99 Gower St., London WC1E 6AZ, U.K., (01) 388-3071.

October 6-7: **2nd International Conference on Harmonics in Power Systems**, Winnipeg, Manitoba, Canada. Contact: Robert Hamlin, Room 227, Engineering Bldg., University of Manitoba, Winnipeg, Manitoba R3T 2N2, Canada, (204) 261-4412.

October 14-16: **1st Annual Convention of the Society of Broadcast Engineers (SBE)**, Convention Center, St. Louis, MO. Contact: SBE, Suite 118, 7002 Graham Rd., Indianapolis, IN 46220, (317) 842-0836.

October 19-22: **6th Annual Meeting of the Bioelectrical Repair and Growth Society (BRAGS)**, Utrecht, Holland. Contact: BRAGS, PO Box 64, Dresher, PA 19025, (215) 659-5180.

October 20-24: **11th IEEE International Conference on Infrared and Millimeter Waves**, Hotel Continental, Pisa, Italy. Contact: M. Ingusio, Dept. of Physics, University of Pisa, Piazza Torricelli 2, I-56100 Pisa, Italy, (050) 45222.

November 4-6: **4th International Symposium on Antennas: JINA'86**, Acropolis Convention Center, Nice, France. Contact: J.L. Guiraud, CNET-PAB Centre de La Turbie, 06320 Cap D'Ail, France, (93) 411717.

November 7-10: **8th Annual Conference of the IEEE Engineering in Medicine and Biology Society**, Worthington Hotel, Fort Worth, TX. Contact: Dr. Charles Robinson, Rehabilitation R&D Center, Hines VA Hospital, Box 20, Hines, IL 60141, (312) 343-7200, ext. 2240.

November 30-December 5: **Symposium on Heat and Mass Transfer in Thermally Significant Vessels and the Microcirculation**, Anaheim, CA. Contact: Professor Ken Diller, Biomedical Engineering Center, University of Texas, ENS 612, Austin, TX 78712, (512) 471-7167.

Power Line Award (continued from p.1)

Montague further explained that HL&P remains liable for the \$64 million condemnation damages even if an appeals court later overturns the jury's verdict on HL&P's abuse of discretion.

The decision followed a four-year legal fight that began when HL&P condemned the school district's land for a 100-foot-wide easement. Before the condemnation proceedings were completed, the utility began work on the power line, prompting the district's claim that HL&P acted "with callous disregard for the safety, health and well-being of the 3,000-plus children who attend the schools."

Cancer Risks Argued

Several prominent bioeffects researchers testified at the trial, and the jury heard about the potential cancer-causing

effects of extremely low frequency (ELF) radiation. Dr. Jerry Phillips of the Cancer Therapy and Research Center in San Antonio, TX, Dr. Nancy Wertheimer of the University of Colorado in Boulder and Dr. Harris Busch of the Baylor University Medical School in Waco, TX, appeared on behalf of the school district. HL&P called Dr. Edwin Carstensen of the University of Rochester as an expert witness.

HL&P is represented by Ross Harison of Baker & Botts, another Houston law firm. Harison did not respond to telephone calls for comment but was quoted in the *Houston Chronicle* as having said that the medical evidence introduced by the school district is only a small body of research which says there may be a hazard: "What does that prove? Nothing." ●

BIOLOGICAL EFFECTS

Fluorescent Lights and Skin Cancer...A team of Australian researchers has failed to confirm a previous report of an association between exposure to fluorescent lighting and malignant melanoma. The new case-control study did find some suggestion of increased risk for certain types of skin cancer, but did not agree with the doubling of all melanomas reported in 1982. The 1982 paper, the first to report a link between exposure to fluorescent lights and skin cancer, did not win widespread acceptance because of a number of curious findings: while fluorescent lights at work were linked with melanoma, those at home were not; and the association was greatest for those parts of the body that are usually covered by clothing (see *MWN*, September 1982). The new study, by Dr. D.R. English and coworkers at the University of Western Australia, did find evidence of an increase in Hutchison's melanotic freckles on the head, neck and upper limbs with exposure to fluorescent lights without diffusers in residential rooms and small offices, and of an increase in the rate of "melanoma of unclassifiable histogenic type" with fluorescent light exposure. But the researchers suggested that these may have occurred due to chance. They concluded: "Our results are consistent with the view that the dose of UV radiation received from fluorescent lights is too small in comparison with that from the sun at least in Western Australia to have a measurable additional effect on risk of melanoma." The new study, "Cutaneous Malignant Melanoma and Fluorescent Lighting," appeared in the June 1985 *Journal of the National Cancer Institute*.

Delgado References...In our December 1984 issue, we reported a correction in the rise times of the magnetic field pulses used by members of Dr. Jose Delgado's research team in Madrid, Spain. The official correction was published in the *Journal of Anatomy*, 140, p.721, 1985....A paper describing the failure to find an effect of weak low frequency electromagnetic fields on chick embryos by Dr. Morton Miller and associates at the University of Rochester appeared in the *Journal of Anatomy*, 139, pp.613-618, 1984. As noted in our June 1984 cover story, this experiment was substantially different from those of Delgado and Dr. Jocelyne Leal, which yielded positive results....In September 1984, EPA's Richard Tell and Dr. Ezra Berman visited Delgado and Leal in Spain. A report on their visit is now available from Tell, Electromagnetics Branch, Office of Radiation Programs, EPA, PO Box 18416, Las Vegas, NV 89114, (702) 798-2440.

Static Magnetic Fields...Male workers exposed to static magnetic fields in a chloralkali plant had a normal rate of cancer and life expectancy, according to a Swedish study published in the October 19 issue of *Lancet*. Men who had worked in the plant at least a year were included in the study population. Dr. Lars Barregard and coworkers at the Department of Occupational Medicine at Sahlgren Hospital in Goteborg measured the magnetic fields in the plant to be between 4 and 29 millitesla. They noted that even though

the fields in the plant were static, currents can be induced in the workers as they move around. They concluded: "The cohort studied was small but the confidence limits indicate that there is at least no greatly increased risk of cancer after many years of exposure to strong static magnetic fields."...In France, Dr. A. Bellossi has found that static magnetic fields of 300-800 millitesla had no effect on the growth and development of chemically-induced tumors in mice. See "The Effect of a Static Uniform Magnetic Field on Mice: A Study of Methylcholanthren Carcinogenesis," *Radiation and Environmental Biophysics*, 23, pp.107-109, 1984.

Behavioral Effects...The FDA's Center for Devices and Radiological Health (CDRH) has published the proceedings of a workshop on the effects of microwave radiation on behavior, held in Midway, UT, in March 1982. *Behavioral Effects of Microwave Radiation Absorption* was edited by the CDRH's Dr. John Monahan and Dr. John D'Andrea, who used to be at the University of Utah and is now with the Naval Aerospace Medical Research Laboratory in Pensacola, FL. Among the 14 papers presented at the workshop was one by Dr. Clifford Mitchell of NIEHS on "Soviet Research on Microwave-Behavior Interactions." A limited number of copies are available for free by writing to CDRH, FDA (HFZ-265), 5600 Fishers Lane, Rockville, MD 20857. Ask for publication No. FDA 85-8238 and include a self-addressed mailing label.

COMPATIBILITY & INTERFERENCE

Pesty Pest Control...Ultrasonic pest control devices can cause RFI to TV reception and other types of electronic equipment, according to the FCC — RFI has been reported in the 20-470 MHz frequency range. The devices drive away rats, mice and roaches with noise that is inaudible to humans. Fortunately, FCC staffers have found that the offending interference can be substantially reduced by making a minor change to the device. For more information, contact Joe Husnay, FCC Laboratory, (301) 725-1585.

Resources..."Taming EMI in Microprocessor Systems" by Don White, Kenn Atkinson and John Osburn of Interference Control Technologies, Inc., in Gainesville, VA, is the lead story in the December issue of *IEEE Spectrum*. In their well-illustrated article, the authors propose a systematic approach for dealing with EMI effects. They begin with a blood-chilling example of the dangers of EMI: A ladle of molten steel, moving along an overhead track at a plant in the eastern U.S. in 1983, prematurely poured the hot metal onto the factory floor, killing one worker and injuring four others. The cause of the accident was traced to a walkie-talkie. The RF signal — magnified by a temporary scaffold and picked up by a drop cord acting as an antenna — triggered a switch that caused the ladle to tip....In past issues, we have featured items on EPRI and IITRI research on the susceptibility of railroad signaling equipment to power line interference (see *MWN*, September and December 1983 and April 1985). Two papers from this effort appear in the December issue of *IEEE*

Transactions on Power Apparatus and Systems. The research on this type of EMI is continuing, and new results from Science Applications, EPRI and Southern Pacific Transportation Co. are scheduled to be presented at the IEEE's Power Engineering Society meeting in February (see Conference Calendar).

GOVERNMENT

CIRRPC...Last year, Dr. George Keyworth, II, President Reagan's science advisor, set up the Committee on Inter-agency Radiation Research and Policy Coordination (CIRRPC), under the chairmanship of Dr. Alvin Young. One of CIRRPC's first tasks was to discover which radiation issues were of most concern to its 15 member agencies. Naturally, ionizing radiation problems dominated the list, but non-ionizing radiation did make the cut. In response to an April 25 request from EPA, CIRRPC's Science Panel set up a subpanel "to review existing research programs on radiofrequency health effects and to define appropriate research needs." Dr. Ross Adey of the VA Hospital in Loma Linda, CA, was chosen to chair the group; the other members are EPA's David Janes, Dr. Elliot Postow of the Naval Medical R&D Command and Dr. Moris Shore of the FDA's Center for Devices and Radiological Health. Adey told *Microwave News* that the subpanel report is now in draft form and should be completed in the near future. A copy of CIRRPC's *First Annual Report* is available from CIRRPC, 1346 Connecticut Ave., NW, Washington, DC 20036. (Note that Keyworth recently submitted his resignation to the President.)

INTERNATIONAL

ILO Report...The International Labor Organization (ILO) has released a report on the hazards of occupational exposures to non-ionizing radiation, prepared by the International Non-Ionizing Radiation Committee (INIRC) of the International Radiation Protection Association (IRPA). Approved in late 1981 but only recently published, *Occupational Hazards from Non-Ionizing Electromagnetic Radiation* (ILO Occupational Safety and Health Series Report No. 53) evaluates potential risks of ultraviolet, visible, infrared, microwave, radiofrequency and extremely low frequency radiation, as well as lasers. Based on pre-1981 literature, the document emphasizes the need for further studies of biological effects of RF/MW and laser radiation, but concludes that ELF fields — including those from power lines — are unlikely to present significant health risks. The IRPA/INIRC report also finds that there is uncertainty in the scientific literature about adverse effects of visible light. The first draft of the document was developed by John Villforth and Dr. P. Czerski of the U.S. FDA's Center for Devices and Radiological Health, Dr. Michael Repacholi of Canada's Radiation Protection Bureau (now with the Royal Adelaide Hospital in Australia) and David Sliney of the U.S. Army's Environmental Hygiene Agency. Copies of the document can be ordered for 17.50 Swiss francs from the ILO, CH-1211 Geneva 22, Switzerland.

MEASUREMENT

Power Line Exposures...Since 1979, the Bonneville Power Administration (BPA) has been quantifying occupational exposures to 60 Hz electric fields. A miniature, electric field monitor was developed and worn by BPA workers. According to the results reported by V.L. Chartier and A.S. Capon, both of BPA, and Dan Bracken, a consultant based in Portland, OR, "the job categories with the highest measured exposures are...230 and 500 kV line crews (linemen being the most exposed), 230 and 500 kV substation maintenance electricians and 500 kV substation operators." They found that, "Measured time of exposure above an equivalent unperturbed field of 4 kV/m represents only minutes per day even for the most exposed personnel." Their report appeared in the March 1985 issue of the *IEEE Transactions on Power Apparatus and Systems*. ...Under an EPRI contract, Dan Bracken has also compared the performance of the BPA meter with that of a conducting vest developed by EPRI. (These two electric field monitors were among ten power frequency meters that Bracken identified.) BPA employees wore the meters and the vests as they simulated electricians' tasks, in a truck near an energized test line and during a complete inspection of a 230 kV substation. The total exposures measured with the vest were "quite consistent" (within ten percent) among subjects inspecting the substation; the BPA meter was less consistent, with a 15-25 percent variation. The BPA meter gave even larger (30 percent) variations for the measured electric field for a given task. On the whole, the fields measured with both meters were lower than predicted — up to 80 percent lower in the substation — which Bracken attributes to insulation provided by shoes, asphalt and dry rock in the substation. The two types of meters yielded similar results when worn on the arm or hard hat. But when worn in the shirt pocket, the BPA meter gave readings that were 30-40 percent lower than those obtained in the other locations or from the EPRI vest. Bracken concluded that either meter could be used to determine exposures in an occupational study, but that only the vest was suitable for characterizing public exposures to low-level fields. The report, *Comparison of Electric Field Exposure Monitoring Instrumentation*, (EA-4085), June 1985, is available for \$17.50 from Research Reports Center, PO Box 50490, Palo Alto, CA 94303, (415) 965-4081.

EMI Probe...Hewlett-Packard (HP) has introduced a new probe to help locate radiation emissions for EMI control. When connected to a spectrum analyzer, the HP 11940A Close-Field Probe can yield the signal strength and frequency of the offending radiator. The probe is a magnetic field sensor that provides highly repeatable results in the near field for frequencies between 30 MHz and 1 GHz. Introduced on November 1, the probe costs \$500.00. For more information, contact Allan Armstrong, HP, 1424 Fountaingrove Parkway, Santa Rosa, CA 95401, (707) 577-2528.

Measurement Conference...A number of papers presented at the *2nd Annual Instrumentation and Measure-*

UPDATES

ment Technology Conference, IMTC-85, held last March in Tampa, FL, have been published in Part 1 of the December issue of the *IEEE Transactions on Instrumentation and Measurement*. Among the papers are "Methodology for Standard Electromagnetic Field Measurements" by a group from NBS in Boulder, CO, and "Comparison of Failure Mode Criteria in Electromagnetic Environments" by Joseph Mislan of Dodig in Washington, DC, formerly with the Naval Ship Systems Engineering Station in Philadelphia, PA. The latter paper describes the use of a proximity switch as a detector to allow comparison of susceptibility tests in TEM cells with those from open area test sites.

MEDICAL APPLICATIONS

Resources...Fonar Corp. won a big victory in the NMR imaging (MRI) business on November 21, when a federal judge ruled that Johnson & Johnson (J&J) had infringed upon a Fonar patent. Analysts say that the decision could mean millions of dollars in damages and royalties for Fonar, based in Melville, NY, and a lot more business for the company's lawyers as they try to collect from other MRI manufacturers. Fonar's chairman, Dr. Robert Damadian, told *The New York Times* that the "decision shows there is justice for the little guy in America." J&J said it will appeal....Also on November 21, the Federal Health Care Financing Administration, which runs the Medicare and Medicaid programs, said that it would pay for MRI diagnostic exams for a variety of organs, but not for the heart or lungs, because of possible blurring due to movement....According to a survey by *Diagnostic Imaging* magazine (November), there were 217 MRI systems in operation in the U.S. as of October 1. Technicare, a J&J subsidiary, has sold 64 units and Fonar has sold just 14....On August 20, Clini-Therm won FDA approval to market its external microwave hyperthermia system; then on October 30, the Dallas-based company got FDA approval for its interstitial system, in which radiation is applied directly to the tumor. BSD Corp. of Salt Lake City, UT, is the only other company marketing hyperthermia systems.

MEETINGS

50/60 Hz Bioeffects...There will be a panel session on "Magnetic Field Effects" at the *Winter Meeting of the IEEE Power Engineering Society* in New York City. The session will be chaired by Bill Feero of Electric Research & Management, Inc., in Thomaston, ME. Among those scheduled to participate are: Drs. R.G. Olsen, Tom Tenforde, Bill Kaune, Mays Swicord and David Savitz (see *Conference Calendar*)....North American utilities are sponsoring an international symposium on *Health Effects of Electrical and Magnetic Fields: Research, Communication, Regulation*, September 17-19 in Toronto, Canada. According to John O'Grady of Ontario Hydro, the chairman of the organizing committee, the conference will focus on communication with the public and future government regulation on transmission lines (see *Conference*

Calendar)....The DOE had been considering holding a similar type of meeting in Pittsburgh, PA, next November, but, given the utility symposium, those plans have been pushed back until 1987. Nevertheless, as in past years, there will be a DOE contractors' meeting in the fall of 1986. Anyone who is interested in attending the 1987 meeting, tentatively titled *International Conference on Biological Effects of 50/60 Hz Electric and Magnetic Fields*, should contact Ken Klein, Director, Office of Energy Storage and Distribution, CE-143, SE-052, DOE, 1000 Independence Ave., SW, Washington, DC 20585.

BRAGS...The *5th Annual Meeting of the Bioelectrical Repair and Growth Society (BRAGS)* was held in Boston, MA, October 13-16. A copy of the *Transactions* of the meeting, including abstracts of the more than 50 papers and the BRAGS membership list, is available for \$25.00 plus postage from BRAGS, PO Box 64, Dresher, PA 19025, (215) 659-5180. Next year, the society will meet in Utrecht, Holland, October 19-22; Dr. Reba Goodman is the program chairperson for the conference.

Melatonin Congress...The *1st International Congress on Melatonin in Humans* was held in Vienna, Austria, on November 7-9. Organized by Dr. Franz Waldhauser of the University of Vienna and Dr. Richard Wurtman of MIT, the congress featured 22 papers and more than 40 posters; the proceedings will be published in the *Journal of Neural Transmission*. For more information, contact Wurtman at Room E25-604, Department of Applied Biological Sciences, MIT, Cambridge, MA 02139, (617) 253-6731. See also a report on the congress in the November 25 issue of *Newsweek*.

Electroheat...The Ontario Ministry of Energy and Ontario Hydro sponsored a one-day workshop on *Radiant Wave Electroheat* on December 2 in Toronto, Canada. Among the speakers were Dr. Phil Schmidt of the University of Texas at Austin on an "Overview of Electrothermal Processes" and Dr. Peter Jones of the U.K.'s Electricity Council on "New Developments in Dielectric Heating and Drying." For more information, contact Peggy Kurtin, Workshop Coordinator, Ministry of Energy, 56 Wellesley St. W., Toronto, Ontario M7A 2B7 Canada, (416) 965-1563....Next September 23-26, the British National Committee on Electroheat is holding a conference, *Heating and Processing - 1-3000 MHz*, at St. John's College, Cambridge, U.K. (see *Conference Calendar*).

PEOPLE

Drs. William Wisecup and Lee Rosen have left Aerospace Corp., but will continue to provide contract support for **Ken Klein** at the DOE's Electric Field Effects Research Program. They will continue to do their old jobs through Wisecup's consulting firm: W/L Associates, Ltd., Suite 401, 600 S. Frederick Ave., Gaithersburg, MD 20877, (301) 948-0642. For the record, the DOE has reorganized and Klein is now the director of the Office of Energy Storage and Distribution instead of the Division of

Electrical Energy Systems...**Edwin Bronaugh** of Electro-Metrics has become vice-chairman of ANS Committee C63 on EMC, replacing **Harold Gauper, Jr.**, who recently retired from GE, and AT&T Information Systems' **Donald Heirman** has taken over as chairman of C63 Subcommittee 1 from Bronaugh.

POWER LINES

Harmonics...The IEEE Working Group on Power System Harmonics has published "Power Line Harmonic Effects on Communication Line Interference," an overview of the problem, with examples of the possible complex interactions, in the September issue of the *IEEE Transactions on Power Apparatus and Systems*. The working group is chaired by A.A. Mahmoud of Iowa State University in Ames....William Horton and Saul Goldberg of California Polytechnic State University in San Luis Obispo describe "The Effect of Harmonics on the Operating Points of Electromechanical Relays" in the May issue of the *IEEE-PAS*....And in the December *IEEE-PAS*, H.J. Trussell and J.D. Wang of North Carolina State University's Center for Communications and Signal Processing in Raleigh show how adaptive least square filters can be used to reduce harmonic noise in "Cancellation of Harmonic Noise in Distribution Line Communications."...There will be a session on "Power System Harmonics," chaired by K.R. Chakravarthi of Southern Company Services in Birmingham, AL, at the February meeting of the IEEE's Power Engineering Society in New York City....The *2nd International Conference on Harmonics in Power Systems* will be held in Winnipeg, Canada, October 6-7. Professor G. Thomas Heydt of Purdue University, West Lafayette, IN, is the program chairman (see Conference Calendar).

Resources...The following papers were recently published: "Transmission of Electric Power at Ultra-High Voltages: Current Status and Future Prospects" by Harold Scherer, Jr., and Gregory Vassell of American Electric Power Services Corp. in Columbus, OH, in the August issue of the *Proceedings of the IEEE*.... "Power Line Frequency Electric and Magnetic Fields: A Pilot Study of Risk Perception" by Dr. M. Granger Morgan and coworkers at Carnegie-Mellon University in Pittsburgh, PA, and Paul Slovic and coworkers at Decision Research in Eugene, OR, in *Risk Analysis*, 5, 139-149, 1985.... "HVDC: Wheeling Lots of Power" by Glenn Zorpette in the June issue of *IEEE Spectrum*. Zorpette is an associate editor of the magazine.

STANDARDS

Power Line Noise & ESD...The IEEE has published *Procedures for the Measurement of Radio Noise from Overhead Power Lines and Substations*, a revision of ANSI/IEEE 430-1976, for public comment. The proposal is available for \$7.50 from Sandra Phillips, IEEE, 345 East 47th St., New York, NY 10017. Ask for standard BSR/IEEE 430. Comments are due by January 21....The Electronic Industries Association (EIA) has released *Distribu-*

tor Requirements for Handling Electrostatic Discharge Sensitive (ESDS) Devices, JEDEC Publication No.108, and *Packaging Material Standards for ESD Sensitive Items*, EIA Interim Standard No.5-A. JEDEC No.108 was developed by a committee chaired by Ralph McCullough of Texas Instruments, and IS-5-A was developed by a committee chaired by George Kahler of AT&T Technologies. Copies of JEDEC No.108 cost \$5.00 and copies of IS-5-A cost \$15.00; both from Standards Sales Office, EIA, 2001 Eye St., NW, Washington, DC 20006, (202) 457-4966.

VDTs

Resources...A team of three Pittsburgh, PA, area physicians has published a case report on a 33-year-old man suffering from a skin rash that was probably caused by exposure to a VDT. Drs. Lawrence Feldman and William Eaglstein of the University of Pittsburgh's Department of Dermatology and Dr. Robert Johnson of Franklin, PA, concluded that electromagnetic emissions other than ultraviolet (UV) radiation were the "most likely etiologic factor in this man's condition," which included redness, burning and itching on his hands and forearms. The rash, which lasted for 15 months, cleared up when he spent extended periods away from his terminal; he tested negative for sensitivity to 41 materials from his office. Reporting their results in the February 1985 issue of the *Journal of the American Academy of Dermatology*, the doctors noted that they could not be certain of the cause of the rash because they did not have detailed information about the types of radiation emitted by the VDT, although they tested and ruled out UV. They concluded that as the use of VDTs increases, "more and more patients will surface with this reaction. When sufficient numbers of patients are located, a possible cause may be uncovered."...The DC electrical environment and ion concentrations (both positive and negative) near VDTs are similar to those which occur commonly indoors, according to Drs. Jonathan Charry and William Bailey of the Institute for Basic Research in Staten Island, NY, and Dan Bracken, a consultant based in Portland, OR, in a study paid for by IBM. Their paper, "Evaluation of the DC Electrical Environment in Proximity to VDTs," appears in the October 1985 *Journal of Environmental Science and Health*, published in New York City by Marcel Decker....The Canadian Center for Occupational Health and Safety (CCOHS) has developed a two-day course on measuring VDT radiation. CCOHS researchers Dr. Karel Marha and David Charron will teach the course. Marha has published a series of reports for CCOHS on VDT radiation and, with Charron, was one of the first investigators to detail the distribution of the very low frequency fields near flyback transformers (see *MWN*, December 1983). The course, which costs \$100.00 and has a limited enrollment, was offered once in December, and CCOHS plans to offer it again in the spring. For more information, contact Mrs. Bev Strugnell, CCOHS, 250 Main Street East, Hamilton, Ontario L8N 1H6, Canada, (416) 523-2981.

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