MICRO WAVE NEWS

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INSIDE...

HIGHLIGHTS...

Birth Defect and Miscarriage Clusters Stir Up More Fears Over VDTs

The debate over VDT radiation hazards continues despite the government's verdict that the machines are safe. The controversy, initially focusing on alleged microwave-induced cataracts, now includes allegations that VDTs might affect pregnant women. In the last 18 months, there have been at least four reported clusters of miscarriages and infants born with defects among clerical workers in the US and Canada. Each group involved women who either worked on or around VDTs during pregnancy.

The cluster at the *Toronto Star* is best known: 4 out of 7 infants born to a group of VDT operators within a year had defects. Three other clusters have received less publicity: 7 out of 13 Air Canada employees in Montreal miscarried during one year; 3 cases of birth defects and 7 miscarriages out of 15 pregnancies occurred at a defense contracting office near Atlanta over one year; 8 out of 12 pregnancies had adverse outcomes at a Sears, Roebuck office in Dallas within a 14 month period.

Chance is the only explanation offered for these cases. Dr. Nancy Binkin, an epidemiologist at the Center for Disease Control (CDC), explained that clusters will occur simply because so many women work on VDTs. She hypothesized that the one case she investigated was such an "expected-unexpected" cluster.

Several unions representing VDT workers find this reasoning difficult to accept. Commenting for the Ontario Public Service Employees Union

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DOD to Expand Project ELF and Add Fourth PAVE PAWS

The Department of Defense (DOD) announced plans to expand its Project ELF antenna system and build another PAVE PAWS radar in the southwestern US, as part of its program to strengthen and rebuild the nation's command, control and communications (C^3) system.

The Navy will spend $230 million enlarging its extremely low frequency (ELF) submarine communication system, known as Project ELF, designed to send orders to submerged submarines in case of nuclear war. The existing 28-mile test facility, located near Clam Lake, WI, will be upgraded and a new transmitter with a 56-mile antenna will be built on Michigan's upper peninsula, near K.I. Sawyer AFB. The Navy plans to have the system operational by 1985.

Michigan's two democratic senators, Don Riegle and Carl Levin, immediately denounced the move as a waste of money. Northern Michigan Congressman Bob Davis said that he preferred a blue-green laser system to Project ELF. Jenifer Speicher of Stop Project ELF, a local citizen's group, warned that the DOD decision "was just a foot in the door for a much larger system," and vowed to continue to fight the project.

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(OPSEU), Robert DeMatteo said, "I don't know how anyone can chalk up the clusters to chance, to a statistical quirk. They warrant very intense investigations, including radiation testing." A number of Canadian unions, responding to the events at the *Star,* have won the right for pregnant women to do non-VDT work. Labor agreements with Bell Canada, the Open Learning Institute in British Columbia and the Ontario New Democratic Party Caucus now include this option.

This labor concern is not supported by the majority of expert opinion in the US and Canada. At both a House subcommittee investigation on VDTs (see *MWN,* June 1981) and a National Academy of Sciences symposium on VDTs and vision (see *MWN,* September 1981) the consensus was that radiation risks are negligible. Reports from Scandinavia, however, have linked high electrostatic charges from the machines to facial rashes.

Sears, Roebuck and Company

In August 1980, the consulting physician at the regional headquarters of Sears, Roebuck and Company in Dallas, TX, placed a concerned call to CDC in Atlanta, GA. Within the last 12 months, a majority of pregnancies among VDT workers resulted in miscarriages. An investigation by the center's Abortion Surveillance Branch found 7 miscarriages and a premature infant death between May 1979 and June 1980 among workers at the Sears VDT computer center. Four other pregnancies successfully came to term.

CDC could not identify a common factor to explain the 8 out of 12 adverse outcomes, according to its May 1981 report [EPI-80-113-2]. The 5,000-square-foot computer center employed 75 people and contained 29 VDTs. Only two of the eight women worked full-time on the terminals.

The CDC report described VDTs as "an unlikely cause," in part because the risk of miscarriage "was not related either to proximity to the VDTs within the room or to the amount of time spent working with the machines." It continued, "Consistency with known scientific facts is also important in establishing causality. No previous clusters of spontaneous abortion due to VDT exposure have been reported."

The estimated probability that 8 out of 12 pregnancies would be unsuccessful by chance is 6 in 10,000. The expected rate of adverse pregnancies is 16 out of 100 in the US.

CDC calculated the probability of the cluster over a three-year period encompassing 20 rather than 12 pregnancies. By beginning the time interval from August 1977 instead of from May 1979, the expected chances for the cluster rose to 6 in 1,000. Binkin, who was CDC's chief investigator in Dallas, told *Microwave News* that the longer interval was recommended by NIOSH epidemiologists to help identify trends within the population, including its normal rate of problem pregnancies. Since the report was completed, the figures have been recalculated to include a fourth year.

Binkin hypothesized the miscarriages were a chance cluster. In her report she explains: "With 7 million VDT workers in the United States, many of whom are women of reproductive age, we would expect to see—on the basis of chance alone—several clusters similar to the one reported at Sears."

CDC sent another set of questionnaires on pregnancies to Dallas this summer. No problems have been reported since the initial investigation.

Defense Logistics Agency

There were 7 miscarriages and 3 cases of severe birth defects out of 15 pregnancies between October 1979 and October 1980 at a Defense Logistics Agency (DLA) regional contracting office in Marietta near Atlanta, GA. Two other pregnancies conceived in this period failed to come to term—one was ectopic and one was terminated by a therapeutic abortion. An investigation by the Army Environmental Hygiene Agency in February could not find a cause for this cluster: it termed the birth defects an "unusual statistical event."

The Army consulted CDC in setting up its study. The center was also called in by DLA to review the Army report and to speak with employees. According to Larry Edmonds, the participating CDC epidemiologist, some workers were concerned that the Army's role constituted a conflict of interest. He said the center "basically agreed" with the report [Occupational Health Special Study No. 66-32-1359-81].

Investigators reviewed VDT use and then ruled it out as a possible factor. According to the DLA office's health and safety manager, the amount of time each woman spent on a VDT ranged from full-time to a few minutes a week. He said 14 healthy babies have been born since the study period. The office employs 206 women who are below the age of 45.

Air Canada

In the most recently confirmed cluster, 7 out of 13 pregnant employees at Dorval Airport miscarried between February 1979 and February 1981. The women used VDTs as part-time workers at Air Canada's check-in counter. The airline employs about 130 women at this Montreal-area airport.

The Canadian Air Line Employees' Association (CALEA), representing the Air Canada workers, surveyed the women at Dorval early this year and in February requested radiation checks. According to CALEA's Jane Armstrong, both the Department of Health and Welfare and Labor Canada felt tests were not warranted. At the union's insistence Air Canada hired the Canadian Standards Association (CSA) to check for X-rays. CSA found no detectable ionizing radiation among the 26 VDTs tested.

CALEA wants tests for non-ionizing radiation and precautions for VDT users, including alternate work for pregnant women. Armstrong stressed, "We must take a more critical attitude. The government should be much more involved in promoting radiation research, rather than just giving VDTs a clean bill of health."

Air Canada contends VDTs are safe. In a July 1980 position paper, company director of medical services, Dr. Peter Vaughan, cited surveys by the US National Institute of Occupational Safety and Health and concluded VDTs "do not appear capable of producing levels of radiation presenting an occupational hazard."

Frank Stevens, Air Canada's manager of airport services, underscored this position in a recent interview: "We are convinced as a company and as a country that there is no radiation problem."

Canada's Department of Health and Welfare has ruled there is no radiation hazard. According to Dr. Ernest Letourneau, director of the department's radiation protection bureau, surveys of over 200 VDTs performed in Canada over the last ten years support this conclusion. Summarizing these data in an article for the September 15 *Canadian Medical Association Journal,* Letourneau wrote: "VDTs emit no ionizing radiation

(X-rays). There is no evidence that at the detected levels the non-ionizing radiation emitted from VDTs can produce biological effects or pose any hazard to health. Thus, in the absence of a cause it is hard to establish a link between VDTs and cataracts or birth defects."

The absolute statements in this widely read article, as well as Letourneau's use of unpublished data, have drawn criticism from Toronto union officials. The author's assurance that terminals emit no X-rays, for example, appears to contradict a US Bureau of Radiological Health (BRH) report [FDA 81-8153, February 1981] which revealed some units, tested since 1975, emitted X-ray radiation. (See *MWN*, May 1981.)

Letourneau, when asked to comment, explained that the leaking units were old color sets requiring much higher power levels than common black and white VDTs. He said X-rays cannot escape from low power machines. A BRH spokesman said that two out of three models in question were color monitors.

A report on the Canadian surveys, now in draft form, should be published by spring 1982.

Toronto Star

Four cases of birth defects at the *Toronto Star* generated the most fear among VDT users. Four out of 7 pregnant VDT operators in the classified advertising department gave birth to infants with defects between May 1979 and May 1980, but two of the defects, a club foot and a cleft palet, might be explained by family medical history or the condition of the pregnancy. The causes of an underdeveloped eye in a third infant and multiple heart abnormalities in a fourth are unknown. Birth defects occur in approximately three percent of live births in Ontario.

The Ontario Ministry of Labor checked all 296 terminals at the *Star* at the request of the Southern Ontario Newspaper Guild. The classified advertising department accounted for 100 of the machines. According to the ministry's report, no power densities greater than 0.05 mW/cm^2 were detected for 10 MHz to 26 GHz radiation.

The *Star* investigation is continuing. Union and newspaper officials are now attempting to get the four women to fill out a questionnaire prepared by doctors from the University of Toronto. Only two of the women filled out a previous questionnaire made up by the *Star's* physician.

Union spokesman John Bryant confirmed that radiation is still a concern: "There is no proof that VDTs are the culprit, but we are not satisfied by the investigation of the Ontario government nor by their conclusion that VDTs are safe." According to Bryant, VDTs will be an issue in next year's labor negotiations with the *Star.* Among other measures, the union wants to guarantee the option of non-VDT work for pregnant women. *Star* policy now allows for a job change, but the union wants to formalize this rule.

At the time the *Star* story broke, rumors spread about birth defects among VDT operators at the Gander, Newfoundland, telephone company. Since Terra Novel Tel (TNT) installed VDTs in 1976, 1 infant was stillborn and 2 infants had defects out of 31 pregnancies. After the birth of the third baby, the company discovered the other birth problems and had the VDTs checked for X-ray radiation. Canadian National Telecommunications in Toronto, TNT's parent company, checked 98 machines and found no detectable ionizing radiation.

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It is impossible to know how many clusters exist. CDC is the clearinghouse for queries on abnormal pregnancies and birth defects, and receives one or two reports of clusters each month. It cannot evaluate how many of them are significant, however. Edmonds knew of only two other possible clusters involving clerical workers, one in Great Neck, NY, and another in Washington, DC.

American Express Company contacted CDC this year when four women at its Greak Neck building miscarried between June 23 and 29. Altogether, six women miscarried between April and July. A spokeswoman for the company said none of the people involved used or worked near the 15 VDTs in the building. American Express declined to release independent reports on investigations performed by the Fireman's Fund of Connecticut and the Occupational Health Services of Union, NJ, but confirmed no causal links were identified.

In Washington, DC, a CDC survey found 7 out of 20 women in one building miscarried between spring 1979 and spring 1980. The women worked in several different offices. Because of a poor response to the center's questionnaire, Edmonds reported the survey could not confirm or rule out a problem.

The Mount Sinai School of Medicine's epidemiological study of VDT operators could be a key to evaluating "expected-unexpected" clusters. David Eisen of the Newspaper Guild believes the study's comparison of user and non-user populations "could provide the basis for figuring out if anything is happening because of VDTs." Mount Sinai's questionnaires were sent out to seven participating guild locals in late October. Project director Dr. Arthur Frank expects preliminary results by the beginning of next year.

ELF and PAVE PAWS

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Last spring, there were reports that Chief of Naval Operations, Admiral Thomas Hayward, had recommended that the project be scrapped. Within a month, however, Secretary of Defense Caspar Weinberger decided to reactivate the then-mothballed Clam Lake facility. (See *MWN*, April and May, 1981.)

The current design for the ELF antenna is much smaller than previous proposals, Project Sanguine and Project Seafarer, which had 6,400 and 4,000 miles of antenna, respectively. In fact, the antenna is now too small to allow full communication between ship and shore. With this new system, a typical message only tells the submarine to surface in order to receive more detailed instructions.

The Air Force has decided to build a fourth PAVE PAWS radar at Goodfellow AFB, TX, in the southwestern US. The installation is designed to detect and track submarine-launched missiles from the South Pacific. An Air Force spokesman said that the total cost of the Goodfellow radar will be $100 million, compared to $90 million for the previously announced southeastern PAVE PAWS at Robins AFB, GA. Two PAVE PAWS radars are now operating at Otis AFB, MA, and Beale AFB, CA.

Other elements of the Reagan plan to upgrade the C^3 system are to develop and install very low frequency and low frequency receivers on strategic bombers and to develop a new high frequency satellite system to improve battlefield communications.

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In other developments, the Congressional Budget Office has issued a report, *Strategic Command, Control and Communications: Alternative Approaches for Modernization,* outlining various options for the Congress to consider....Eli Brookner of Raytheon has published "A Review of Array Radars," in the October issue of *Microwave Journal.* The article covers COBRA DANE, PAVE PAWS, PATRIOT and many other radar systems....Submarine laser communication will be the subject of a classified session at the IEEE's EASCON '81 "Government-Industry Interchange" at the Washington Hilton on November 17.

RF Sealer Cancer Cluster

The National Institute for Occupational Safety and Health (NIOSH) has failed to identify anything "unusual" about an alleged cancer cluster among women working with RF sealers. The agency could not link six cases of illness at the Beaverite Products plant in Beaver Falls, NY, with any physical or chemical agent. In the absence of any scientific connection between RF radiation and cancer, NIOSH decided to terminate the investigation.

The United Paperworkers International Union, which represents the Beaverite employees (Local 1518), notified NIOSH of the possible cluster in January 1980. At that time, they reported nine cases of cancer among 20 female heat sealer operators. Four of the women had died. Of the nine cases, the union said there were three women with stomach cancer, two with breast cancer, two with reproductive organ cancer, one with lung cancer, and one with pancreatic cancer.

NIOSH investigators, however, were only able to identify six of the women. According to their report, they confirmed three cases of breast cancer, one case of ovarian cancer, one case of lymphoma, and one case of chronic obstructive pulmonary disease.

In a letter to the union dated September 23, 1981, Terry Leet, an epidemiologist with NIOSH, wrote: "Regarding the Beaverite investigation, the distribution of three cases of breast cancer is not unusual, nor is the age of onset (45, 63 and 68)."

In February 1980, NIOSH took radiation measurements at the plant. According to the survey report (dated May 30, 1980), six of the eight sealers at the plant exceeded the present OSHA exposure standard of 10 mW/cm^2, which corresponds to electric and magnetic field intensities of 200 V/m and 0.5 A/m respectively. NIOSH found levels as high as 896 V/m and 1.41 A/m. (These ratings are corrected for the machines' duty cycle, taking into account that the machines are only on and emitting radiation part of the time.) There are no emission standards for RF sealers.

Seven of the RF sealers were in a room enclosed by grounded wire mesh screening. NIOSH took 14 electric field measurements in that room: the average reading was 405.5 V/m.Only one of the seven machines generated partial body exposures which were below the standard, with a measured level of 152.8 V/m. The eighth machine, which was outside the mesh enclosure, had a maximum exposure level of 174.8 V/m.

The wire mesh is designed to prevent RF radiation emissions from interfering with sensitive electronic equipment. The Federal Communications Commission is responsible for preventing these interference problems.

In the course of taking a reading at one of the machines, members of the NIOSH team "experienced heating sensation in the forearms and legs." This phenomenon, they wrote in their report, "is an indication that exposed personnel are absorbing significant amounts of RF energy."

In his letter to Robert Frase, the union's director of occupational health and safety, NIOSH's Leet wrote: "There is no convincing evidence in the scientific literature to indicate that RF radiation causes cancer in humans and animals. Thus, NIOSH plans to terminate its investigations of the alleged cancer cluster...." Leet did note that NIOSH may collect cancer mortality data in its planned RF sealer epidemiology.

Speaking from the union's headquarters in Nashville, TN, Frase said he had to defer to NIOSH's judgment on the cluster since the agency's staff has more expertise than he does, but he went on to say that he would like to see more work done in the area.

In a telephone interview, Leet said that the study population for the NIOSH epidemiology had not been selected yet. He attributed the delays to finding a cohort of RF sealer operators with the desired characteristics. "We feel this is a major study, and we want to make sure that we have eliminated any flaws in study design before we begin," he explained.

RF Sealer Meeting and Booklet

Representatives from the Bureau of Radiological Health (BRH), the National Institute for Occupational Safety and Health (NIOSH) and the Occupational Safety and Health Administration (OSHA) met at BRH in Rockville, MD, on October 7 in another attempt to deal with RF sealers.

According to BRH's William Herman, there was general agreement among the 15-odd participants that there is a significant problem associated with the sealers, that a solution to the problem exists and is technically feasible and that a collaborative approach is necessary. A number of control strategies were also on the agenda, including voluntary performance standards for sealer manufacturers.

Now that the Interagency Regulatory Liaison Group (IRLG) has been dissolved (see opposite page), and with it the RF/MW committee, which was working on RF sealer problems, this informal group may continue some of the IRLG's work. Although another meeting is expected, no date has been set.

Meanwhile, NIOSH and BRH are completing their booklet on control and monitoring techniques for RF sealers. According to NIOSH's Dave West, the booklet is a top priority at the agency's Cincinnati office; it should be in draft form by the end of the year, and be publicly available a couple of months later.

Occupational Health Course

The Rocky Mountain Center for Occupational and Environmental Health (RMCOEH) at the University of Utah is sponsoring a two-day course on "Current Issues and Trends in Controlling Occupational Exposures to RF/Microwave Radiation" next February 17-18. OSHA's Robert Curtis will be the instructor. For more information contact: Ms. K. Blosch, RMCOEH, Building 512, University of Utah, Salt Lake City, UT 84112, (801) 581-5710.

BRIEFS

The Fifth Estate, a Canadian Broadcasting Company public affairs program, aired a segment on microwave and radiofrequency radiation on October 20. The bulk of the show was devoted to the hazards associated with RF sealers. Transcripts of the program are available from: Robin Taylor, Executive Producer, Fifth Estate, PO Box 500, Station A, Toronto, Canada....The Center for Disease Control (CDC) has officially put off the NIOSH move. For a critical look at the troubled agency, see Marjorie Sun's "Reagan Reforms Create Upheaval at NIOSH," in the October 9 *Science*....Anthony Goldin has been named director of OSHA's offices of policy, legislation and regulatory analysis. He succeeds Mark Cowan, who was previously promoted to deputy assistant secretary of labor for occupational safety and health. Goldin comes to OSHA from the CIA, where Cowan also served for five years....According to the *Washington Post* (October 28), the Reagan budget cuts are having an impact on OSHA programs. The average number of monthly workplace inspections between February and August of this year has declined 17% compared to the average between January and October 1980. Follow-up inspections are down 68% and citations for violations are down 27%.

GOVERNMENT

IRLG Comes to a Quiet End

The Interagency Regulatory Liaison Group (IRLG), including its radiofrequency and microwave (RF/MW) committee, has come to a quiet end. The IRLG's charter ran out at the end of September and was not renewed. Several members of the RF/MW committee told *Microwave News* that they had heard nothing official about the IRLG's demise and had first learned about it from the *Washington Post.*

The IRLG was set up in September 1977 by the heads of the Environmental Protection Agency (EPA), the Food and Drug Administration (FDA), the Occupational Safety and Health Administration (OSHA) and the Consumer Products Safety Commission (CPSC) to coordinate regulatory policy on health issues. Members of the RF/MW committee, which was formed in October 1978, sought to work together on bioeffects research and control strategies.

One of the committee's first objectives was to contract the National Academy of Sciences (NAS) for a critical appraisal of the health effects of RF/MW radiation. Due to a string of funding and bureaucratic snafus, an agreement between the IRLG and the NAS was never reached.

In May 1979, the committee drafted a strategy to protect workers from RF sealer radiation: "An IRLG Plan to Reduce Excessive Exposure of Operators to Radiation from RF Sealers." According to the IRLG's most recent regulatory report, issued in December 1980, the member agencies were scheduled to make their final recommendations on RF sealers last summer.

Some of the work of the IRLG's 21 committees will continue under a new body headed by President Reagan's science advisor, George Keyworth. At present, there are no official plans to salvage the RF/MW committee, though some EPA and National Institute for Occupational Safety and Health (NIOSH) and Bureau of Radiological Health (BRH—within the FDA) officials met on October 7 to address RF sealers. (See opposite page)

TEPRSSC Meeting Planned

The Bureau of Radiological Health's Technical Electronic Product Radiation Safety Standards Committee (TEPRSSC) has scheduled a meeting for December 9-10 in Rockville, MD. The main topic on the agenda is the proposed performance standard for sunlamps and ultraviolet radiation lamps. TEPRSSC's Executive Secretary Dr. Zory Glaser said that he expected that there would also be updates on RF sealers and on the BRH microwave oven amendment (see *MWN,* May 1981).

BRH received a large number of nominations for membership to TERPSSC. The final selection process is under way and Glaser hopes to announce the names of the new members, whose terms will begin on January 1, at the meeting. For more information contact Glaser at (301) 443-3429.

BRIEFS

The National Bureau of Standards (NBS) has developed a new, portable meter to measure electromagnetic radiation in the frequency range covering the AM, FM and TV broadcast bands. The isotropic electric field monitor, EFM-5, covers the range between 200 kHz and 1 GHz for fields as low as 1 V/m and as high as 1,000 V/m. A full description of the meter is contained in NBS Technical Note 1033: *Design and Calibration of the NBS Isotropic Electric-Field Monitor [EFM-5], 0.2 to 1000 MHz,* available from the Government Printing office for $4.50. Stock no. 003-003-02311-6....The printed transcript of last May's congressional hearings on VDTs and RF sealers, *Potential Health Effects of Video Display Terminals and Radio Frequency Heaters and Sealers,* is now available from the House Science and Technology Committee. For a copy write to the committee at the House of Representatives, Washington, DC 20515, include a self-addressed mailing label. To order by phone, call (202) 225-5629....

CONFERENCES

Thermoregulation Symposium

The symposium on *Microwave and Thermoregulation* brought together 80 experts from the bioelectromagnetics community and the John Pierce Foundation at Yale medical school on October 26-27. The foundation's Dr. Eleanor Adair, the symposium organizer, described the meeting as "extremely successful."

Adair explained that one of her objectives in setting up the conference was to expose the Pierce Foundation scientists to the current research problems of the microwave community. And conversely, the microwave experts became aware of the technical and scientific expertise that exists at the Pierce labs. "We started a dialogue between the two groups," she said.

In addition to the seven sessions of papers, there was a tribute to the late George Sacher, a former research biologist at Argonne National Lab, who died earlier this year. Professor Charles Susskind of the University of California, Berkeley, delivered the keynote address, "Beyond Thermoregulation," at the symposium banquet.

In an interview at the meeting, Dr. Gregory Lotz of the Naval Aerospace Medical Research Lab in Pensacola, FL, said that he had replicated his experiments that showed dramatic heating of male rhesus monkeys in 225 MHz RF fields at a power density of 5 mW/cm^2, an SAR of 1.5 W/Kg. These results caused quite a bit of excitement when they were first presented at last August's Bioelectromagnetics Society meeting (see *MWN,* September 1981).

Since the summer, Lotz has done some additional work on dosimetry, which indicates that his original SAR estimates may have been too low. A set of measurements using a simple saline block yielded an SAR of 2.7 W/Kg, which is much closer to the resting metabolic rate of the rhesus monkey. "We must still do more work to explain the August results," he said, "and we must get a better handle on just how much energy is getting in as well as how it is distributed and dissipated." Lotz will continue to work at 225 MHz and expects to have more results next year.

Lotz went on to stress that his work may have important implications for hyperthermia as a tool in cancer therapy. If his results can be applied to humans, whole body heating may be more easily achieved by using resonant frequencies.

In his paper at the meeting, Dr. Jerome Krupp of the Air Force School of Aerospace Medicine at Brooks AFB, TX, described his research with a similar system; his experimental results are in general agreement with Lotz's. Krupp used a frequency of 219 MHz and found that the monkeys became hyperthermic at power levels between 7.5 and 12 mW/cm^2—an SAR of 5 W/Kg. While Krupp agreed that the resonance phenomenon was real, he did not detect any hot spots in the living animals. He found only uniform temperature rises. Krupp used anesthetized animals, while Lotz's monkeys were awake. The two sets of animals were also in different positions in the field.

Academic Press plans to publish the papers presented at the symposium by the end of the summer of 1982.

The Food and Drug Administration has compiled the significant preambles for all *Federal Register* documents relating to radiological health and medical devices regulations from April 1978 through March 1980. The volumes are available from the Government Printing Office: Radiological Health, stock no. 017-015-00196-2, $4.50; Medical Devices, stock no. 017-015-00195-4, $8.00....In contract news: the Army Communications-Electronics Command at Fort Monmouth, NJ, has awarded $300,000 to Signatron in Lexington, MA, to "determine the requirements and characteristics of a generic line of sight radio family for the 1990's time frame," and is looking for a contractor to "establish a technical base for microwave testing techniques." The Army Research Office in Research Triangle Park, NC, has signed a $110,186 contract with the University of Kansas, Lawrence, for a study of "microwave dielectric constant dependence on soil tension."

LITIGATION

Radar Case Settlement

Leo Foley, who served aboard an EC-121 constellation and alleged radiation-induced cataracts, has settled his complaint out of court for $25,000, according to Joseph Gregorich, an attorney representing the Lockheed Corp. Gregorich reports that the settlement was reached following a conference of the interested parties in mid-August.

In papers filed in California State Court in Sacramento on April 9, 1979, Foley sought damages from General Electric, Hazeltine, Hughes, Lockheed, Philco-Ford, Raytheon and Telrad-Lionel. He alleged that while serving aboard EC-121 aircraft between May 1957 and December 1975, he had been exposed to radiation from search radars AN/APS 20 and AN/APS 95, height-finder radar AN/APS 45 and navigation radar AN/APS 42.

Foley was represented by San Francisco attorney Seymour Ellison. Ellison could not be reached for comment. Gregorich is with the firm of Kirtland and Packard in Los Angeles.

MW Oven Case May Go to Trial

A suit brought by two legal secretaries against the Amana Refrigeration Co., alleging microwave-induced cataracts, may go to trial next January. Mark Decof of Decof and Grim in Providence, RI, said that he is seeking $3 million from Amana for his clients: half a million for Dolores Delsesto and Lynn (and Michael) Spinella for their cataracts and another million dollars each for punitive damages.

The secretaries—one has a single cataract and the other two—worked at a law firm where there was an Amana oven in the lunchroom. Each woman had an assigned seat in the room, and they were the closest to the oven. The plaintiffs are alleging that the oven caused their cataracts. Decof explained that they are seeking punitive damages because Amana's brochures proclaimed in bold lettering the oven "Does Not Emit X-Ray Radiation," which, they contend, misled them into thinking that there were no radiation risks.

The oven was examined by a mechanical engineer in Providence who found that it did not leak above the federal standard. Decof will argue, however, that the standard does not afford sufficient protection.

Steve Gustafson, legal counsel for Amana in Amana, IA, was out of the country and could not be reached for comment. The original complaint was filed on February 16, 1979, in US District Court in Rhode Island [CV 79-0082].

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MEDICAL APPLICATIONS

NCI Begins Major Hyperthermia Study

The National Cancer Institute (NCI) has begun a five-year, multimillion dollar study of hyperthermia equipment. NCI will spend a little less than a million dollars a year at five teaching hospitals to assess the performance of RF, microwave and ultrasound hyperthermia systems for heating tumors in the major anatomical sites.

The five participating institutions are: the medical schools at Stanford University, the University of Utah and the University of Arizona, the M.D. Anderson Hospital and Tumor Institute at the University of Texas in Houston and the Massachusetts Institute of Technology in cooperation with New England Deaconess Hospital. Among the types of tumors to be treated are those of the brain, head, neck, lung, pelvis and lymph nodes.

Each hospital will test at least two types of hyperthermia equipment. These include the RF Magnetrode unit and the BSD Medical Corp.'s microwave device. The decision on which hospital will test which systems will be made at a workshop to be held at NCI in December.

According to Dr. Francis Mahoney, program director for radiation in NCI's radiotherapy development branch, this work is designed to get better coordination among those working on hyperthermia and to get reliable baseline data on the systems' efficacy.

The Bureau of Radiological Health (BRH) will be working with NCI on this study. BRH will assist with dosimetric and thermometric analyses of the equipment.

BRIEFS

The minutes of the April 2–3 meeting of the Radiology Section of the Obstetrics-Gynecology and Radiology Devices Panel of the Food and Drug Administration (FDA) have been completed and are available from the FDA. At the meeting, the section voted unanimously to deny pre-market approval to the Magnetrode hyperthermia system (see *MWN*, May 1981)....The International Microwave Power Institute (IMPI) voted to set up a new Biomedical Section at its annual meeting in Toronto last June. Drs. Howard Clark of the National Bureau of Standards (NBS) and Augustine Cheung of the University of Maryland are setting up a steering committee to organize the new section. Interested parties should get in touch with Clark: NBS, Bldg. 220, Room B-358, Washington, DC 20234....There will be a session on the Applications of NMR in Biology and Medicine at the AAAS meeting in Washington next January 5. For more information contact the AAAS, 1515 Massachusetts Avenue, NW, Washington, DC 20005 ....In their article, "Recent Developments in Nuclear Magnetic Resonance Spectroscopy," in the October 16 *Science*, Syracuse University's Drs. George Levy and David Craik offered an upbeat assessment of the future of NMR in biology: "The recent developments in NMR studies of cells, organs and whole organisms indicate a bright future for NMR in biomedical disciplines. It will be used by the pharmacologist as a structural probe for new drugs, will aid the pathologist in analyses, and, we believe, will eventually become a routine screening or diagnostic device." With respect to NMR imaging, they wrote: "Routine clinical whole-body scanning of human patients is some years away. However today, in controlled laboratory experiments, it is possible to obtain NMR images of cross sections of human subjects at sufficient resolution (a few millimeters) to yield valuable physiological information."...A similarly optimistic view is expressed by Michael Waldholz in the October 23 *Wall Street Journal's* "Technology" column. Dr. Ronald Ross of Gates Mill, OH, one of the first users of an NMR imager, told Waldholz that he feels NMR will change the way medicine is practiced. A spokesman for Picker International Ltd. is quoted as saying that the company plans to deliver as many as 12 NMR units by the end of the year. Picker is a subsidiary of General Electric Co.

UPDATE

Biological Effects....The radiation physics research group of the School of Aerospace Medicine at Brooks AFB, TX, is looking for a contractor to build life-sized human phantoms that have bone structure and that can be filled with tissue-like liquids. The phantoms will be used to measure internal electric fields and SARs, according to Brooks' John Mitchell.... Meanwhile, dosimetry research is continuing at the University of Utah under AF contract. Mitchell said that a decision has yet to be reached on whether to publish a fourth dosimetry handbook....In a three article series in the second issue of Volume 2 of *Bioelectromagnetics*, a team from the University of Utah report that they were unable to detect frequency-specific athermal effects on protein synthesis at millimeter wavelengths 38–48 GHz and 65–75 GHz....Michael Morgan describes a model calculation of microwave absorption by the cranial structure in the October *IEEE Transactions on Biomedical Engineering*.

Standards....The American National Standards Institute (ANSI) has officially called for public comment on its new safety standard for human exposures to RF/MW radiation. For a copy of the final proposal send $5.00 to the Institute of Electrical and Electronic Engineers (IEEE), Attn: M. Lynch, 345 East 47 Street, New York, NY 10017. Ask for standard No. BSR C95.1 (revision of ANSI C95.1-1974). Send comments to Vincent Condello at the IEEE, with a copy to the Board of Standards Review, ANSI, 1430 Broadway, New York, NY 10018. They are due by December 1.

VDTs....Two bills on VDTs have been prepared for the Ontario provincial legislature. On October 15, Al Kolyn introduced a measure covering VDT ergonomics [Bill 149]. A second bill, addressing radiation as well as ergonomics, will be introduced soon....A demand by clerical staff for extra pay for working on VDTs prompted 1,500 workers at Britain's Lucas Aerospace to walk off the job last month. According to the October 20 *London Times*, the company maintains introducing terminals does not justify more pay. The walkout was called in support of 80 employees threatened with dismissal over the wage demand....Over 290 delegates met in Toronto, October 16–18, for a VDT hazard symposium. According to Robert DeMatteo of the Ontario Public Service Employees Union (OPSEU), one of the meeting's organizers, there was a growing consensus among the delegates that unions should push for universal VDT testing, for legislation regulating radiation and ergonomic factors related to VDTs, for a central labor body to coordinate research and collect information and for the inclusion of VDTs in the collective bargaining process. ...OPSEU has prepared a 62 page booklet, *The Hazards of VDTs*, including radiation and ergonomic issues. A copy can be obtained from DeMatteo, OPSEU, 8th Floor, 1901 Yonge Street, Toronto, Ontario, M4S 2Z5....A survey at the *New York Times* found VDT operators experienced more eye discomfort than non-operators. The September 25 *Guild Reporter* covered the results of the survey conducted last year by three occupational health specialists from the University of Wisconsin. A total of 123 workers participated.

Satellite Communications....The Federal Communications Commission (FCC) has proposed reducing the space between satellites operating in the 4/6 GHz and 12/14 GHz bands to 2 degrees from 4 degrees. The action was prompted by the rapidly increasing demand for orbital slots. According to the FCC's Ron Lepkowski, the commission is now soliciting comments and hopes to make its final decision by the fall of next year.... A special report on "Assessing Antennas for Small Satcom Terminals" appeared in the October issue of *Microwave Systems News*....RCA has taken a new approach for allocating transponders. The company will auction leases for seven transponders on its new Cable Net 2 satellite at Sotheby Parke Bernet in New York City on November 9.

Technology....The Department of Energy's (DOE) Morgantown Energy Technology Center has signed a $56,774 contract with the BDM Corp. of McLean, VA, to develop a prototype microwave diagnostic system to detect and characterize bubbles in a fluidized bed combustor....James Jolley and Charles Dotson give an overview of synthetic aperture radar in the September *Defense Electronics*....RF radiation has been used to heat plasmas in the search for a self-sustaining fusion reactor, according to a report in *Science News*, October 24....DOE has awarded Auburn University in Auburn, AL, $46,300 for theoretical studies of the heating of toroidal plasmas with RF radiation at the lower hybrid frequencies.... Three staffers from the Federal Aviation Administration's Technical Center describe the feasibility of using radar to detect dangerous wind shear at airports in the September issue of *Microwave Systems News*....The September-October issue of *Radio Science* includes a special collection of papers on the effects of the lower atmosphere on radio propagation at frequencies above 1 GHz....Caltech's George Born reviews the largely successful history of Seasat, the first satellite to use microwave remote sensing in the October 22 *Nature*....A report on the use of active and passive microwave remote sensing of Hurricane Allen in August 1980 appears in the October 16 *Science*.

EMP....The Reagan administration's plans to upgrade the command, control and communications system includes the hardening of all Boeing B-52s, according to the October 26 *Aviation Week & Space Technology*. An additional $1,240 million has been requested for FY 83-86 to protect the bombers from electromagnetic pulses (EMP)....William Broad reports in the October 16 *Science* that the Department of Defense has indefinitely postponed the $100 million Satellite X-Ray Test Facility that would simulate the EMP effects of a nuclear blast in space on military satellites....In a letter to the *IEEE Spectrum* (October), Major Philip Corn and Dr. John Corbin of Wright-Patterson AFB, OH, write "lightning presents a localized threat of equal or significantly greater magnitude than [nuclear] EMP over a wide frequency range, from the kilohertz well into the MHz range or beyond." They predict that at least one multi-agency, integrated program will protect aircraft from lightning, nuclear EMP, and electromagnetic interference "in the immediate future."...The IRT Corporation has published a pamphlet on *EMP Susceptibility Analysis*. For a copy write to IRT, 7650 Convoy Court, PO Box 80817, San Diego, CA 92138....Kirtland AFB, NM is looking for a contractor to evaluate the performance of satellite communications systems "while stressed to nuclear effects," *Commerce Business Daily*, October 13.

BOOK REVIEWS

Martin D. Ecker and Norton J. Bramesco, *Radiation: All You Need to Stop Worrying—Or to Start.* New York, NY: Vintage Books, 1981, 226 pp., $4.95 (paper).

Most of the advice these authors offer is about ionizing radiation. Two chapters are devoted to non-ionizing radiation: one on biological effects and standards and another on reducing the risks of over-exposure. The few pages on risk reduction are about microwave ovens.

The overview on health, which lumps together microwave, UV and IR radiation as well as visible light, is spotty; no mention is made of the current efforts to revise the exposure standards. To be useful, the bibliography should have been given more attention. The glossary essentially ignores everything except ionizing radiation jargon.

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Barry M. Casper and Paul David Wellstone, *Powerline, The First Battle of America's Energy War.* Amherst, MA: University of Massachusetts Press, 1981, 314 pp., $7.95 (paper), $18.50 (hardcover).

Powerline chronicles the planning and construction of a 430 mile, 800 KV transmission line from the perspective of those living in its path. The authors contend that the prolonged opposition to the line, which runs from a North Dakota coal field to Minneapolis, illustrates a fundamental conflict between the attitudes of rural Americans and US energy policy. If highly centralized development of coal is pursued, they predict other power lines will meet similar resistance.

This history of the construction project, completed in 1979, contains many interviews with protesting farmers, with less attention given to the pro-line viewpoint. Land use was the central issue in this battle, although the opposition did raise the possible health hazards of high power, direct-current lines later on.

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Wilson Clark and Jake Page, *Energy, Vulnerability and War.* New York, NY: W.W. Norton, 1981, 251 pp., $5.95 (paper), $12.95 (hardcover).

What would happen if the Soviet Union exploded two nuclear bombs 65 miles above Tennessee and Nevada, and then, having used electromagnetic pulses (EMP) to black out all communications, destroyed the nation's oil refineries? Beginning with this premise, Clark and Page argue against highly centralized, and therefore vulnerable, energy systems.

The book, a popular version of a study commissioned by the Defense Civil Preparedness Agency, recommends ways for the country to avoid becoming an "economic basket case." Small scale energy systems, such as solar, wind and geothermal power, are advocated to diffuse an energy war. The authors do not return to hardening strategies or other ways to protect against EMP.

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Sidney Lerman, *Radiant Energy and the Eye,* Vol. 1 of the Functional Ophthalmology Series. New York, NY: Macmillan Publishing Co., 1980, 321 pp., $49.95.

Lerman concisely summarizes current understanding of radiation effects on the eye. Reviews of the most pertinent literature on low frequency to ionizing radiation effects are preceded by a clear presentation of the eye's morphology, composition and function. Each chapter contains illustrations, footnotes and general references.

With respect to thermal and potential non-thermal cataracts induced by microwave and radiofrequency radiation, the author finds that, at power levels of 100 mW/cm^2 and above, thermal damage to the lens is well-documented; at lower levels, however, the potential effects of long-term exposure are still poorly understood and not adequately studied. Citing the work of Stephen Cleary, Lerman states that non-thermal effects following multiple exposures cannot be ruled out. This radiation "may act synergistically with other endogenous or exogenous factors, leading to functional alterations of specific molecules...."

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Leon Kaufman, Lawrence Crooks and Alexander Margulis, eds., *Nuclear Magnetic Resonance Imaging in Medicine.* New York, NY: Igaku-Shoin, 1981, 242 pp., $29.50.

Only a few years ago, NMR imaging was the province of the researcher. Now, as the time grows near for NMR as a routine diagnostic technique, this book provides a useful general introduction to the field.

This collection of original articles was edited and largely written by staff members of the University of California's Radiologic Imaging Laboratory in San Francisco. The heart of the book contains five articles describing the application of NMR for imaging in animals and humans and in measuring blood flow, using proton density maps as well as those of heavier nuclei. An introduction to the physics and hardware of NMR and a discussion of the potential health effects of extended exposures to high magnetic and RF fields are also included.

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Om P. Gandhi, *Microwave Engineering and Applications.* Elmsford, NY: Pergamon Press, 1981, 544 pp., $24.50 (paper), $60.00 (hardcover).

Professor Gandhi has written this text for a yearlong course on microwave engineering. Fifteen chapters cover everything from transmission lines to integrated circuits. Antennas, waveguides, passive and ferrite components, vacuum tubes and semiconductor diodes are all given detailed attention.

Gandhi provides the reader with references, sample exercises, problems and even computer programs. The well-illustrated, typescript book is for mathematically adept students and is intended to teach them how to design microwave components, devices and systems.

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Infrared and Millimeter Waves. New York, NY: Academic Press. Volume 3: "Submillimeter Techniques," Kenneth Button, ed., 1980, 428 pp., $50.00; and Volume 4: "Millimeter Systems," Kenneth Button and James Wiltse, eds., 1981, 364 pp., $46.00.

These annual collections provide comprehensive, technical reviews of the fast developing fields of mm and sub-mm waves by some of the leading researchers. Much of Volume 3 is on detection techniques: an overview chapter is followed by three chapters on specific detectors—Schottky barrier diodes and pyroelectric and photon drag detectors. The rest of the book is devoted to laser systems and spectroscopic techniques.

Various chapters in Volume 4 describe sources of mm wave radiation and their application in radar, missile guidance and imaging. Wiltse's brief introduction to the subject is especially useful to the uninitiated reader; he reviews both the technology and how it is used, listing a large number of references.