MICRO WAVE NEWS

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Boeing Pays $500,000 To Settle Strom EMP-Leukemia Suit

Medical Program for EMP Workers

In the largest settlement for an electromagnetic field (EMF) injury ever recorded, the Boeing Co. of Seattle, WA, has agreed to pay more than $500,000 to Robert Strom, who claims that he developed leukemia from on-the-job exposures to electromagnetic pulse (EMP) radiation.

In addition, the out-of-court agreement provides for a comprehensive medical program for the approximately 700 Boeing employees who have worked with EMP since testing began in the 1960s. The settlement became final on September 21.

"The total value of the settlement could be well over $1.5 million," Michael Withey of Schroeter, Goldmark & Bender in Seattle, WA, told *Microwave News*. Withey is the lead attorney representing Strom and his wife Barbara on behalf of Trial Lawyers for Public Justice (TLPJ), a nonprofit group based in Washington, DC. "This landmark settlement confirms that electromagnetic radiation is hazardous to the public health and creates a mechanism for proving that fact in future cases," he said.

"It was an incredible victory. We got virtually everything we were hoping to get out of this litigation," Arthur Bryant, executive director of TLPJ, said in a telephone interview.

The class action suit, which was filed in June 1988 in King County, WA, Superior Court, charged that Boeing had long known of the health risks associated with EMP exposure, yet never warned workers or took any precautions to protect them (see *MWN*, J/A88). It further alleged that Boeing,

(continued on p.11)

Federal Health Agencies Put EMFs on Their Research Agendas

Under the prodding of Congress, federal agencies charged with protecting public and occupational health are taking a new look at electromagnetic fields (EMFs). Meetings are being scheduled and research agendas are being revised to address growing public concerns.

NTP Plans $6-10 Million Animal Studies

The National Toxicology Program (NTP) is planning a series of major animal studies on the reproductive, developmental and carcinogenic effects of extremely low frequency (ELF) EMFs. The studies will involve as many

(continued on p.12)

ELF NEWS

« Power Line Talk »

A map that appears to show a clustering of cancer cases in **Guilford, CT**, over the past 20 years, has the town in an uproar. State health officials drew up the map in response to allegations made by **Paul Brodeur** in the July 9 *New Yorker* of an abnormal number of brain tumors and other central nervous system cancers among people living near a substation and power lines (see p.9). When the map made a fleeting appearance at an August 20 public meeting, some town residents were struck by the apparent clustering of cases along the route of a Connecticut Light & Power line coming from the substation. After the meeting the health department refused to release the map, claiming it would violate the privacy of the cancer victims. But a few weeks later, local activist **Bob Hemstock** got hold of a copy when, he says, the department included the map in the literature it was distributing in response to public inquiries. Not surprisingly, within a few days the map made headlines in the local newspapers (for instance, in the October 3 *New Haven Register*). The map does indeed show a pattern of cases on Meadow Street near the substation, as well as one along Long Hill Road, on which, according to Hemstock and confirmed by Northeast Utilities, runs a 13.8 kV line. There are also a number of cases in the area where a 115 kV transmission line crosses Long Hill Road. The health department is now releasing a modified version of the map, indicating only the general locations of the cases. And no one is admitting that the cancer rate is abnormally high in the area. There is "no clustering," maintains Dr. Sandy Geschwind of the state Department of Health Services.

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Denver, CO's new international airport is being held hostage to a power line siting dispute. The line in question, a 16-mile segment of a 230 kV line, runs right through the middle of the airport site. Officials in Adams and Aurora Counties want the Public Service Co. of Colorado to consider burying the line, rather than rerouting it around the airport—the utility's current plan—according to the September 11 *Denver Post*. Burying the line would reportedly cost $100 million, while moving it east of the airport would run about $18 million. An August 21 *Post* editorial praised county officials for their concern over potential EMF health hazards, but pointed out that the proposed route would run through largely vacant farmland: "If millions of dollars are to be spent to eliminate any risks posed by high-tension lines, the money should be used first to bury the miles and miles of existing cable that were strung through residential areas before the potential hazards became known."

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It's no longer possible to deny EMF health risks categorically, according to the 1989 congressional OTA report, but some people disagree. National Cancer Advisory Board member Dr. **Roswell Boutwell** recently testified that "...sufficient scientific literature is available to assess whether exposure to power frequency fields results in the initiation, promotion or progression of cancer, and there is no scientific basis for the assertion that such exposure is associated with any of those effects," as reported in the August 5 *Asbury Park Press*, a New Jersey newspaper. Boutwell testified in May on behalf of **Jersey Central Power & Light** (JCP&L) at a hearing on the siting of a 230 kV line in Middletown, NJ (see *MWN*, J/A89). He was last seen as a utility expert witness in the 1988 Marcy-South case, for which he was paid approximately $75,000 (see *MWN*, N/D88). After a long-drawn-out battle with JCP&L, residents and the township appear to have won. On September 25, JCP&L announced that it is deferring construction of the line until the mid-1990s "as a result of a slowdown in economic activities in the state, compounded by uncertainties resulting from the Persian Gulf crisis."

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Schools may become the next major battlefield in the EMF conflict. As parents learn more about EMF health effects, they are demanding measurements and, when necessary, reductions of EMF levels in classrooms and schoolyards. Conflicts over EMFs in schools are not new. A few years ago, a school district in Houston, TX, forced Houston Lighting & Power to remove a high-voltage transmission line from school property at a cost of $8.6 million (see *MWN*, J/A88). Since then, complaints involving EMFs in schools have been heard around the country. In 1988, California adopted guidelines requiring a minimum distance between schools and power line right-of-ways (see *MWN* M/J88). What *is* new is the coverage of this issue in the popular press. In one of the most widely read articles, **Paul Brodeur** describes how parents have challenged school boards and utilities over "unacceptably" high field levels measured in and around schools (the article appears in the September 25 ***Family Circle***). One of the controversies cited by Brodeur is in Montecito, CA, where school officials have opted for a low-cost way to practice "prudent avoidance" by relocating desks and roping off certain "hotspots" to insure that students are not exposed to levels above 2 mG (see p.8). And in Fountain Valley, CA, field levels in schools were found to range from 2 mG to as high as 130 mG. **Southern California Edison** researcher Jack Sahl thinks such readings may warrant an investigation, and he told the *Los Angeles Times* (September 2) that, "My position would be: Let's find out what's going on here."

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Dr. **John Peters**'s childhood leukemia study results won't be ready until the beginning of 1991 (see *MWN*, N/D89)—contrary to reports in the September 7 ***Science*** that Peters would present results at the October EPRI utility meeting. Peters told us that he definitely won't be finished by October, nor will he

EMFs in the Press

Public interest in possible health hazards from electromagnetic fields (EMFs) continues to intensify. Here is our latest listing of recent articles and letters in the press (see *MWN*, N/D89).

American Health: Paul Raeburn, "The Switched-On House: Concerns Grow About [EMFs] and Household Devices," March....***Barron's:*** John Nicholson, "Rays of Gloom?" (letter to the editor), August 13....***Byte:*** Bill McGinnis, "Of Monitors and Emissions," September....***Columbia Journalism Review:*** Louis Slesin, "Uncovering Radiation: VDT Stories That Still Don't Make the News," July/August....***The Economist:*** "Very Debatable Units," September 1....***Family Circle:*** Paul Brodeur, "Danger in the Schoolyard," September 25....***Glamour:*** "Fast Facts About VDT Dangers," August; Cindi Leive, "Why I Can't Stop Thinking About My Computer," October....***IEEE Spectrum:*** Eleanor Adair, "Nurturing Electrophobia"; Karen Fitzgerald, Granger Morgan, Indira Nair, "Special Report—[EMFs]: The Jury's Still Out, Part 1: Biological Effects, Part 2: Societal Reverberations, Part 3: Managing the Risks," August....***Issues in Science and Technology:*** C.A.L. Basset, "Premature Alarm over [EMFs]," Spring; letters in response, Summer....***Journal of the American Medical Association:*** David Savitz, "Electric Current and Health" (a review of Brodeur's *Currents of Death*), August 1....***The Lancet:*** J.B. Sibbison, "USA: Danger from [EMFs]," July 14....***Maclean's:*** Diane Brady, "Tension in the Air," August 6....***Macworld:*** Jerry Borrell, "Is Your Computer Killing You?" (editorial), Paul Brodeur, "The Magnetic Field Menace," July; letters in response, October....***The Nation:*** David Corn, "I'm Typing as Fast as I Can," July 2; Herbert Kohl, "Screen Test" (editorial), August 27/September 3....***Nature:*** Seth Shulman, "Cancer Risks Seen in [EMFs]," June 7; David Lindley, "Risky Arguments over Cause and Effect," August 9; Seth Shulman, "All Aboard the Bandwagon," August 16....***New Scientist:*** Andy Coghlan and Nina Hall, "How Magnetic Fields Could Upset Your Ions," August 4....***New Woman:*** Sue Browder, "Warning: Your Home May Be Hazardous to Your Health," October....***New York Times:*** Peter Lewis, "Worries About Radiation Continue, as Do Studies," July 8; Natalie Angier, "Rising Incidence of Brain Tumors Is Drawing Attention and Concern," July 31; Peter Lewis, "Of Magnetism and Monitors," August 7....***The New Yorker:*** Paul Brodeur, "Annals of Radiation: Calamity on Meadow Street," July 9....***Science:*** Robert Pool, "Is There an EMF-Cancer Connection?" September 7; "[EMFs]: The Biological Evidence," September 21; "Flying Blind: The Making of EMF Policy," October 5....***Science News:*** Janet Raloff, "EPA Suspects ELF Fields Can Cause Cancer," June 30....***Scientific American:*** Granger Morgan, "Exposé Treatment Confounds Understanding of a Serious Public Health Issue" (a review of *Currents of Death*), April; Tim Beardsley, "Shocking Genes: [EMFs] Stimulate Gene Activity," July....***Time:*** "Danger from a Glowing Screen," June 18; Philip Elmer-DeWitt, "Hidden Hazards of the Airwaves," July 30....***USA Today:*** Rae Tyson, "Questions Raised About Power Lines and Health," March 15....***U.S. News & World Report:*** Marjory Roberts, "Computer Waves," September 10....***Wall Street Journal:*** "Everyday Electric Items Are Causing Concern," September 25....***Washington Post:*** Michael Specter, "Can Human Disorders Flow from Waves of Household Current?" May 7....***Whole Earth Review:*** Robert Horvitz, "Inhabiting the Electromagnetic Environment," Fall....***Woman's Day:*** Mary-Lou Weisman, "Should You Be Worried About Electricity?" May 22.

be ready for the DOE contractors review in November. His team at the University of Southern California is "working feverishly" to complete the data by the end of the year, he said. *Science* is running a three-part series by Robert Pool examining the EMF health effects debate. The second part appeared in the September 21 issue and the third in the October 5 issue.

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Dr. **Philip Cole** may have to revise his often-repeated argument that an EMF-cancer link is unlikely because increases in the power grid over the past few decades have not been matched by proportionate increases in cancer rates. A new paper in the August 25 issue of *The Lancet* shows that cancer rates have been soaring over the past two decades among people over 54. A team of international researchers led by Dr. **Devra Lee Davis** of the Mount Sinai Medical Center reports that over the past 20 years the incidences of brain and CNS tumors, breast cancer, multiple myeloma and melanoma have risen steeply in the U.S., Japan and four European countries. "The changes in many types of cancer are so dramatic and rapid that they cannot be ignored," Davis told the August 24 *New York Times*.

Epidemiology Roundup: Three New Links to Cancer

Leukemia Among Finnish Linemen

Finnish workers with "probable" exposures to extremely low frequency (ELF) electromagnetic fields (EMFs) had a statistically significant 90% increased risk of leukemia, according to a new study by Dr. Jukka Juutilainen and coworkers. For central nervous system (CNS) tumors and acute myeloid leukemia (AML), the risks increased by 30% and 50%, respectively.

Workers with "possible" EMF exposures also had increased cancer risks—40% for all leukemia, 40% for AML and 30% for CNS tumors.

"It's one more paper where an increased leukemia and brain cancer risk was identified," Juutilainen told *Microwave News*. Preliminary results of the study were first presented at a 1987 conference (see *MWN*, M/J87). Juutilainen, of the Department of Environmental Sciences at the University of Kuopio in Finland, recently reported that residential ELF exposures could be linked to early pregnancy loss (see p.6).

Among those who worked in jobs with probable exposures, linemen and cable jointers had the highest incidence of leukemia, while telephone installers and repairmen showed the greatest risk for CNS tumors. The team noted that electricians—a group which in past studies has been identified as having a higher incidence of cancer—did not have an elevated leukemia risk.

"I believe our results show that it is less likely that a confounder—other than EMFs—is responsible, since we found increased risks in a variety of different occupations," Juutilainen said.

The team investigated 25-to-64-year-old male industrial workers in Finland between 1971 and 1980 and grouped them into three exposure categories: "probable," "possible" and "no exposure." The probable exposure group included electrical occupations; the possible exposure group covered jobs in which electric motors or welding are commonly involved.

The results appeared in the *International Archives of Occupational and Environmental Health, 62*, pp.289-293, 1990.

Leukemia Risks for Navy Electricians

U.S. Navy electricians were two-and-a-half times more likely to develop leukemia than were other naval personnel, according to a new study by Dr. Frank Garland and colleagues at the Naval Health Research Center in San Diego, CA. The team called the finding "intriguing in the light of several studies showing an excess risk of leukemia associated with exposure to EMFs."

Garland and coworkers surveyed naval personnel on active duty between 1974 and 1984 and identified 102 cases of leukemia. The elevated risk for electrician's mates was the only statistically significant (though borderline) increase for a specific job category. Electrician's mates, like their civilian counterparts (electricians and electric power linemen, for example), are exposed on the job to EMFs.

Machinist's mates—the group most likely to be exposed to leukemogenic agents such as benzene and related compounds and ionizing radiation—did not show an increased risk.

The team used "person-years at risk"—instead of occupational histories—to calculate incidence rates. One knowledgeable source pointed out that the main weakness of this type of study is that it equates "one person working at a job for four years" with "four people working at that job for one year each"—which may not be the same for calculating exposure-related illnesses.

Garland declined to comment on the study.

The paper appeared in the *American Journal of Epidemiology, 132*, pp.293-303, 1990.

Cancer Among Swiss Railway Engineers

A new study from the University of Bern showed that Swiss railway engineers had significantly elevated mortality rates for blood and lymphatic cancers (see *MWN*, N/D89). A team led by Dr. Christoph Minder of the Department of Social and Preventive Medicine found that railway engineers, who are chronically exposed to ELF fields, had a statistically significant 60-70% increased risk compared with technical personnel and a nonsignificant 40% increased risk compared with workers in the metal construction and machine building industries.

"The results obtained are consistent with the findings of many other occupational studies" showing an increased leukemia mortality link, the team concluded.

Minder and Drs. M. Balli-Antunes and D.H. Pfluger looked at mortality data on male railway engineers for the years 1969 to 1983, noting that the average duration of employment was probably more than 30 years. They estimated that the engineers may have been exposed to magnetic field levels up to 10 G, although no direct measurements were taken.

Their paper appeared in the first issue of the new journal *Environmetrics (1*, pp.121-130, 1990), which is published in Canada.

Conflicting Parental Occupational Studies

Two studies in consecutive issues of the *American Journal of Epidemiology* illustrate the conflicting views on parental occupational EMF exposures and their effects on children.

In the June 1990 issue, Drs. J.R. Wilkins and Vickie Hundley reported a 90% increased risk of neuroblastomas among children of men exposed to EMFs at work. Wilkins, of Ohio State University, and Hundley, of the Ohio state Department of Health, both in Columbus, noted that there is an "apparent consistency" between their findings and those of Drs. Christine Johnson and Margaret Spitz, who in 1985 reported an elevated risk of neuroblastomas among children of men who had prolonged on-the-job exposure to EMFs—particularly electronics workers (see *MWN*, J/A85). Spitz and Johnson later reported a statistically significant increased risk of CNS tumors among children of men employed in jobs involving EMF exposures (see *MWN*, M/A90).

In the May 1990 issue, however, Dr. Greta Bunin and coworkers had reported no significant association between parental occupational EMF exposure and neuroblastomas. Bunin, of the Children's Hospital of Philadelphia, PA, did find a four-fold increase in the rate of neuroblastomas among children of electrical and electronic products assemblers, but it was not statistically significant.

The two papers appear in the *American Journal of Epidemiology, 131*, pp.776-780 and pp.995-1008, 1990. In 1988, Dr. Philip Nasca found no consistent association between parental occupation and CNS tumors (see *MWN*, J/F89).

Savitz and Loomis on Electrical Workers

Drs. Dana Loomis and David Savitz have published their paper showing that male electrical workers had a significantly elevated rate of mortality from brain tumors. There was also a slight increase for leukemia among certain occupational groups, but in general, leukemia was not associated with electrical work.

These results "corroborate reports of increased mortality from brain cancer among electrical workers, but give only

limited support to suggestions of excess deaths from leukemia," they concluded.

Loomis and Savitz, both at the University of North Carolina School of Public Health in Chapel Hill, found that "brain cancer was concentrated among men aged 65 or older, whereas leukemia was associated with electrical work only among younger decedents and those with acute lymphocytic leukemia."

The results have been slightly revised since Loomis and Savitz first reported the findings in 1989 (see *MWN*, N/D89). The paper appeared in the *British Journal of Industrial Medicine, 47*, pp.633-638, 1990.

Wertheimer and Leeper on Breast Cancer

In an August 13 memo, Dr. Nancy Wertheimer and Ed Leeper called attention to data from their original adult-EMF cancer study indicating an EMF-female breast cancer link. Wertheimer and Leeper addressed their memo to researchers who are studying the association between EMF exposure and breast cancer (see *MWN*, N/D89 and J/A90).

They pointed out that their 1982 paper showed a statistically significant increased risk of breast cancer among women who lived near high-current power lines (see *MWN*, J/F83) and, in their 1987 follow-up paper, they showed that the strongest association was seen among women diagnosed before they reached the age of 55 (see *MWN*, N/D87).

See Wertheimer and Leeper's papers: *International Journal of Epidemiology, 11*, pp.345-355, 1982, and *Annals of the New York Academy of Sciences, 502*, pp.43-53, 1987.

Around the U.S.: Litigation & Regulation

EMF Wrongful Death Suit Dropped

On September 11 the mother of a teenage leukemia victim dismissed her wrongful death suit against the Clark County, WA, Public Utilities District (PUD). The suit, filed in June 1990, alleged that exposure to electromagnetic fields (EMFs) at home and at school was to blame for the 1987 death of Ariana Hightower, who had been a student at the Crestline Elementary School (see *MWN*, J/A90).

Between 1982 and 1989, there were seven reported cases of cancer among Crestline students (see p.9). An investigation by the Southwest Washington Health District recently concluded that magnetic field levels at Crestline were similar to those at other schools and were probably not to blame for the apparent cluster.

Clark PUD General Counsel Wayne Nelson said that the dismissal "was voluntary...and presumably reflects their findings that electric and magnetic fields at Crestline School were not significant and were not the cause of the girl's leukemia."

NJ Scraps 200 mG Limit, Opts for ALARA

The New Jersey Commission on Radiation Protection has dropped its proposal to set a 200 mG magnetic field limit at the edge of power line right-of-ways (ROWs), according to Dr. Fred Sterzer, the chairman of the commission's Non-Ionizing Radiation Advisory Committee (see *MWN*, J/A90). Instead, Sterzer told *Microwave News*, utilities will be required to demonstrate to the state Department of Environmental Protection (DEP) that field levels from any new transmission line will be "as low as reasonably achievable" (ALARA).

The commission's new proposal will also prohibit the siting of playgrounds under power lines, and will require warnings to be posted at playgrounds that are already located under power lines.

The proposal requires all utilities planning to build new lines to get permits from the DEP, which will consider design, siting and economics when applying the ALARA standard. Sterzer gave the following example: If the line is planned near a playground, the field levels will have to be "very, very low," but if it goes through an unpopulated area, there will be more leeway.

The proposed 200 mG limit had been criticized as too weak by some citizens, who pointed to studies that link adverse health effects with levels as low as 2 mG. The new proposal will probably be addressed at the commission's next meeting on October 18.

NY Sets Interim 200 mG Standard

The New York Public Service Commission (PSC) has formally adopted an interim magnetic field limit of 200 mG at the edge of power line ROWs. The interim standard, which was proposed in March, is based on the concept of prudent avoidance (see *MWN*, M/A90). Originally, the PSC had supported the recommendations of a staff task force which advocated a 100 mG limit (see *MWN*, M/A88). The new 200 mG limit applies at 75 feet from new 345 kV lines, 60 feet from new 230 kV lines and 50 feet from lines operating at lower voltages.

EMF-Prudent Avoidance Meeting

A workshop on *Exploring the EMF Dilemma: Prudent Avoidance & Public Involvement* will be held January 17-18, 1991 at the Dunfey San Mateo Hotel in San Mateo, CA. NewsData Corp., the publisher of *Clearing Up* and *California Energy Markets*, two weekly regional utility and energy industry newsletters, is sponsoring the meeting. For more information, contact: NewsData Corp., ATTN: Conference Coordinator, Box C900928, Queen Anne Station, Seattle, WA 98109, (206) 285-4848.

HIGHLIGHTS

The Talk of Prague

"We are participants in one of the great revolutions in the history of biology," Dr. Ross Adey† of the VA Hospital in Loma Linda, CA, told an overflow crowd at the symposium on the *Interaction of Electromagnetic Fields [EMFs] with Biological Systems*, organized as part of the triennial URSI meeting.* A week of meetings in Prague, Czechoslovakia, during the last week of August indicate that the revolution is thriving in Europe—perhaps more so than in the U.S.

After reviewing the literature linking EMFs to cancer, Poland's Dr. Stanislaw Szmigielski concluded, "My personal opinion is that the cancer risk is significant—but it will take two-to-three years to resolve." Szmigielski is at the Center for Radiobiology and Radiation Safety in Warsaw.

In an interview with *Microwave News*, Szmigielski said that the data collection has been completed for his prospective epidemiological study of Polish servicemen exposed to radiofrequency and microwave (RF/MW) radiation and that the analysis is now under way (see *MWN*, J/F87 and J/A89). Because of the potential military implications of the study, Szmigielski indicated that he is not yet sure how the findings will be announced. "We will need permission to publish the results," he said. "But if it is denied, we will present them at conferences."

In other news, Szmigielski is planning new experiments on the immunological and carcinogenic effects of RF/MW radiation using a new exposure system, designed and built by Dr. Piotr Debicki of the Department of Electronics and Microwave Techniques at the University Technical School in Gdansk, Poland. The system will allow thermal and subthermal exposures at 2450 MHz with sinusoidal modulation.

On the regulatory front, Szmigielski anticipates a major re-evaluation of Polish safety standards for exposures from 50 Hz to 300 GHz. He predicted that, if the effort is funded, work will begin in 1991 directed by Dr. Henrik-Richard Korniewicz, a physicist at the Central Institute of Labor Protection in Warsaw.

Finland's Dr. Jukka Juutilainen, of Kuopio University's Department of Environmental Sciences, reported that, as residential magnetic fields rise above 1.3 mG, women are more likely to suffer early pregnancy loss, as measured by changes in human chorionic gonadotropin (HCG) in their urine—the technique is very sensitive and can indicate clinically unrecognized miscarriages. Women exposed to more than 6.3 mG at home had a rate of early pregnancy loss five times greater than that of those living in homes with low magnetic fields. The trend of increasing risk with higher exposures was statistically significant.

More than half the women who participated in the study lived in apartment buildings and very few used electric heat, Juutilainen said in an interview. He said that it was not at all clear what the sources of the magnetic fields were but he speculated that household wiring may be partially responsible.

Juutilainen cautioned that his study was limited by the small number of cases, but added that, "Together with the experimental findings suggesting effects of extremely low frequency (ELF) magnetic fields on embryonic development, the new results encourage continued investigation of the relationship between ELF magnetic fields and pregnancy." (Juutilainen has also recently published an epidemiological study linking on-the-job exposures to cancer; see p.3.)

Germany's Dr. Ute Boikat, a scientific advisor at the Hamburg Department of Labor, Health and Social Affairs, reported that there is growing concern at the local and national levels over power line EMFs. As a result, last year, Hamburg authorities advised that power lines not be built near homes and that there be a 15-meter right-of-way (ROW) on each side of 110 kV lines.

Also in 1989, the Federal Office of Radiation Protection in Salzgitter recommended an even larger ROW—60 meters on each side of 110 and 380 kV lines. Boikat stressed that this was not a regulation per se, but rather an exercise in "prudent avoidance." She noted that the 60-meter ROW is controversial and that utilities are challenging its scientific basis. "My opinion is that the power companies are concerned over liability for future damages," she said.

Boikat also said that there is continuing German interest in studying the possible pregnancy risks associated with working with video display terminals (VDTs), but that research has been frustrated by the inability to secure funding.

In a poster presentation, Drs. Yuri Dumansky and Mikhail Shandala of the Republican Scientific Hygienic Center in Kiev, U.S.S.R., reported that the recommended exposure levels for 50 Hz electric fields are 0.5 kV/m inside homes and 1.0 kV/m in residential areas—and no one should be allowed in areas where the levels exceed 20 kV/m.

The closing session of the symposium promised details of RF/MW radiation occupational and public health standards in the U.S.S.R. and in China. Unfortunately, Drs. Boris Savin of the Institute of Industrial Hygiene and Occupational Diseases in Moscow, Li Ji-xi of Xidian University in Xi'an and Zongqun Zhao and coworkers of Beijing Medical University were unable to attend and the session was canceled.

France's Dr. Bernard Veyret, of the University of Bordeaux, reported that interest in the European Bioelectromagnetics Association continues to grow and that its first scientific meeting will be held in Brussels, Belgium, in December 1991 (see *MWN*, M/J89 and N/D89).

†Adey's invited paper appears in J. Bach Andersen, ed., *Modern Radio Science 1990*, New York, NY: Oxford University Press, which was distributed at the conference and will be marketed by Oxford in January 1991. As at past conferences, a review of recent research was released in Prague. See G. Hyde, ed., *Review of Radio Science 1987-1989*, Brussels, Belgium: International Union of Radio Science (URSI), 1990. The volume includes a well-referenced chapter on "Biological Effects of Electromagnetic Fields," edited by Dr. Maria Stuchly. It is available for $20.00 (including surface postage) from: URSI, 3 Avenue Circulaire, B-1180 Brussels, Belgium.

**XXIII General Assembly of the International Union of Radio Science* (URSI), Prague, Czechoslovakia, August 28-September 5, 1990.

Sweden Proposes Voluntary ELF Emission Limits for VDTs

On October 4, the Swedish National Board for Measurement and Testing (Statens Mät och Provstyrelse, or MPR) recommended the first guidelines to limit emissions of extremely low frequency (ELF) electromagnetic fields (EMFs) from video display terminals (VDTs). The board called for an ELF magnetic field limit of 2.5 mG at 50 cm from a VDT. The MPR also proposed an ELF electric field limit, as well as revised guidelines for very low frequency (VLF) electric and magnetic fields.

"There is not a complete consensus in Sweden on the limits," Lars-Erik Paulsson, of the Swedish National Institute of Radiation Protection (NIRP), told *Microwave News* in a telephone interview. Paulsson is the chairman of the working group that drafted the measurement and emission guidelines. He said that Swedish unions want a lower ELF limit—to be defined by the minimum level that can be measured by the new protocol.

In announcing the new guidelines, the MPR stressed that the emission limits are voluntary as the board does not have the authority to regulate occupational health risks. Similarly, the testing of VDT emissions is not mandatory. The MPR noted that the recommended limits are based on what is technically feasible to measure and on what is achievable "today or within the near future." MPR's Merih Malmqvist told *Microwave News* that the guidelines are not based on health risks because "there are no proven biological reasons" for limiting VDT EMFs, according to Swedish experts.

The MPR is issuing two different documents: a description of the test methods and a "handbook" to help people interpret the test results. The emission guidelines are in the handbook and apply to all types of displays, not only those with cathode ray tubes.

The draft documents were released on October 8, with comments due by October 31. The final guidelines will be published on December 1. The revised test methods will go into effect on January 1, 1991. Paulsson said that he does not expect many changes in the final version because the key problem, the disagreement over the magnetic field limits, "cannot be resolved."

For both ELF and VLF magnetic fields, the guidelines specify that measurements be taken in three planes: one around the middle of the terminal, one 25 cm above the center and one 25 cm below it. In all, 48 readings are now required (the previous protocol called for 82). Thus, to comply with the guidelines, the proposed magnetic field limits would have to be met around, above and below a VDT.

The limit for VLF magnetic fields is now 0.25 mG (25 nT) average root mean square (rms), rather than the previous limit of 0.5 mG (50 nT) peak. "The two limits are essentially the same," Paulsson explained, since the magnetic field emissions limits are specified by average rms rather than peak levels.

The guidelines recommend an ELF electric field limit of 25 V/m at 50 cm from the front of a terminal and a limit for VLF electric fields of 2.5 V/m at 50 cm from all sides of a VDT.

EPA To Study Maglev EMFs

The Environmental Protection Agency (EPA) will investigate the electromagnetic fields (EMFs) associated with magnetic levitation (maglev) trains for the Federal Railroad Administration.

Under an interagency agreement signed in August, EPA's Office of Radiation Programs will measure the electric and magnetic fields from the German Transrapid system, as well as other maglev technologies.

EPA is also charged with interpreting the measured EMFs in relation to potential adverse health effects and comparing them to U.S., German, Japanese and Swedish exposure standards and to standards set by national and international regulatory groups.

The test protocols now call for measuring the magnetic field (B) rather than the time rate-of-change of the magnetic field (dB/dt). The protocols for electrostatic fields remain the same.

The former Swedish guidelines and testing protocols for VDT EMFs only covered VLF fields from 1 kHz to 400 kHz (see *MWN*, S/O88 and M/J89). Now, two frequency ranges are specified: 5 Hz–2 kHz in the ELF band and 2 kHz-400 kHz in the VLF band.

Meanwhile, in the U.S., the Institute of Electrical and Electronic Engineers' (IEEE) P-1140 Working Group has established an ad hoc committee to develop a standard testing methodology for VDT ELF and VLF EMFs. In 1987, P-1140 was charged with developing testing standards solely for VDT VLF EMFs. In 1989, its authority was extended to all types of electronic equipment (see *MWN*, J/A87, M/A88 and M/J89).

At an August 21 meeting, the group concluded that the strong interest in VDT test methods and the existence of Swedish guidelines justified developing VDT test methods separately, not only for VLF EMFs, but for ELF EMFs as well. The working group does not, however, anticipate recommending emissions limits.

The ad hoc committee, which held its first meeting in Cupertino, CA, on September 20 under the chairmanship of Stan Roberts of Apple Computer, is drafting a standard, which will be discussed at its next meeting on November 8.

Ron Petersen, a cochairman of P-1140, told *Microwave News* that he thinks that the IEEE testing protocols will closely resemble Sweden's. Roberts said that, while the committee is considering adapting the Swedish protocols, it is looking at other testing methods as well.

Copies of the Swedish test methods and the handbook will be available in English on December 1. The test methods will cost approximately 800 Swedish Krona ($145.00) outside Sweden; the price of the handbook has not yet been set but will be approximately 400 Krona ($72.50). Order from: Merih Malmqvist, National Board for Measurement and Testing, Box 878, S-501 15 Borås, Sweden, (033) 16 55 53, Fax: (033) 10 13 92.

SPECIAL REPORT

Cancer Clusters and EMFs: A True Link or an Epidemiologist's Nightmare?

Paul Brodeur's account of cancer and other illnesses among people living near a Guilford, CT, substation in the July 9 *New Yorker* has sparked widespread interest in the question of disease clusters and electromagnetic fields (EMFs).

The issue of EMFs and clusters is not, in fact, new. It continues to be one of topical concern,* not only for power line EMFs, but for radiofrequency and microwave (RF/MW) radiation. Indeed, the study of clusters, which is more often associated with chemicals and nuclear radiation, is a hot topic of debate. An editorial in the September 22 *Lancet* focuses on the split in the scientific community over the desirability of studying clusters: For some, such study is a "keystone of medical progress," providing insight into new diseases; for others, it's an "epidemiologist's nightmare"—the search for an elusive, possibly nonexistent, cause under mounting pressure from an outraged community.

The following is a compilation of reported occupational and residential cancer clusters that have been linked—correctly or incorrectly—to various sources of EMFs. Both cluster reports and epidemiological surveys are included.

*Recent articles and journals covering the cluster debate include: "Guidelines for Investigating Clusters of Health Events," *Morbidity and Mortality Weekly Report*, July 27, 1990; Raymond Neutra, "Reviews and Commentary: Counterpoint from a Cluster Buster," *American Journal of Epidemiology, 132*, pp.1-8, July 1990; Chris Raymond, "Nagging Doubt, Public Opinion Offer Obstacles to Ending 'Cluster' Studies," *Journal of the American Medical Association, 261*, pp.2297-2298, April 28, 1989; Richard Rothenberg, Karen Steinberg and Stephen Thacker, "The Public Health Importance of Clusters: A Note from the Centers for Disease Control," proceedings from a *National Conference on Clustering of Health Events, American Journal of Epidemiology, Supplement, 132*, pp.S3-S5, July 1990.

ELF EMFs

Jacksonville, FL: Ovarian Tumors

Between 1974 and 1978, five girls living near a 69 kV power line in Jacksonville, FL, developed endodermal sinus tumors—an extremely rare type of ovarian cancer (see *MWN*, J/F85). The girls ranged in age from 1.5 to 18 years old. A team led by Dr. Tim Aldrich, now at the North Carolina Department of Health Services, wrote that these malignancies were "so rare that virtually no information has been compiled concerning their etiology" and that this cluster was "too remarkable to go unreported." They proposed that magnetic fields from the power line may have had "a mutagenic or a promoter effect," complementing initiation by lead or polycyclic hydrocarbons from a nearby lead smelter plant and highway. Genetics (all of the girls were black) or some combination of genetic and environmental factors may also have been contributors, suggested the team. See T.E. Aldrich, A. Glorieux and S. Castro, "Florida Cluster of Five Children with Endodermal Sinus Tumors," *Oncology, 41*, pp.233-238, 1984.

Milltown, NJ: Brain Tumors

For the past 42 years, Irene Pardun has lived in a house in Milltown, NJ, along the right-of-way of a 230 kV and a 138 kV power line. Pardun said that when she moved in, there was also a substation within 100 feet of her back door—the substation was dismantled in 1976. In 1981, Pardun was diagnosed with a nonmalignant brain tumor, which was surgically removed. Since that time, she has noticed the high incidence of cancers and tumors in her neighborhood. Pardun gave the following information to *Microwave News:* Two doors down from her home, a 14-year-old girl died of a brain tumor in 1961, and in 1989, the girl's mother was diagnosed with a brain tumor. An eight-year-old girl who had previously lived there died of cancer in 1960. Two houses down the street in the other direction, a man died of a cancer in the mid-1980s; his daughter, who currently lives next door, was recently diagnosed with cancer. In a four-family house directly across the street, a three-year-old boy died of cancer in 1957, and a woman died of a brain tumor in 1989. In addition to her brain tumor, Pardun has suffered from recurring cysts, some requiring surgery. Her daughter was diagnosed with myasthenia gravis—a progressive muscular disease—when she was 12. Magnetic field levels in Pardun's backyard on a weekend morning this March were 12-15 mG; inside the house, they were above 10 mG.

Monroe County, NY: Brain Tumors

An investigation of a cluster of childhood brain tumors by the Monroe County (NY) Health Department concluded "...beyond a reasonable doubt that a common source for these cases of childhood brain cancer does not exist." Dr. Mark Merkens, the former deputy director of the department, told *Microwave News*, "I found nothing that tied my patients together in any way." In 1986, a local pediatric oncologist reported seeing four children ages five through nine with brain tumors within an 18-month period. Among these were three girls who attended the same school. Eight cases of childhood brain tumors and three of adult brain tumors were eventually identified in the area. Rochester Gas & Electric measured EMFs in six of the children's homes and found that, in most instances, the levels were under 2 mG except near appliances. None of the homes was located near high-voltage power lines or substations, according to a parent of one of the children. See Mark J. Merkens, *Investigation of Childhood Brain Cancer Cluster Irondequoit and Webster—Census Tracts 110 and 113*, Final Report, Monroe County Health Department, Rochester, NY, May 11, 1989.

Montecito, CA: Leukemia at a School

Between 1981 and 1989, six children in Montecito, CA, were diagnosed with leukemia or lymphoma—five times the expected rate. Of these, four attended the Montecito Union Elementary School, which is located next to a 66 kV overhead power line, three lower-voltage underground lines and a substation. State health officials investigating the cluster stated in a February 1990 report that they "found nothing that would increase cancer risk in the area." A recent survey showed average field levels of 5-30 mG along the north side of the school and approximately 1 mG in most classrooms (the exception was the computer room, with an average of 4-10 mG) and a hotspot of 920 mG next to a pad-mounted transformer in the parking lot; levels of 12 mG and 17 mG were measured at 36 inches and 6 inches, respectively, from the ground above the buried lines (see *MWN*, M/A90). In March, the school board voted unanimously to limit the students' exposures to less than 2 mG by relocating playgrounds and marking off areas with EMF hotspots. There was also an unexplained childhood leukemia cluster in Montecito in the 1950s. See *Investigation of the Montecito Leukemia and Lymphoma Cluster*, Final Report, California Department of Health Services, February 1990; *Montecito Union School Magnetic Field Survey*, Draft Report, California De-

partment of Health Services, May 1990; and Melinda Burns, "Pathologist Suggests Montecito Had Cancer Cluster in 1950s," *Santa Barbara News-Press*, June 14, 1990.

Guilford, CT: Cancer on Meadow Street

A number of residents of Meadow Street in Guilford, CT, have been afflicted with tumors (four brain tumors among them), birth defects, cysts or severe headaches, according to Paul Brodeur in the July 9 *New Yorker*. Meadow Street, which has only ten houses, is the site of a high-voltage substation and power lines. At an August 20 public meeting, state Department of Health Services (DHS) officials briefly displayed a residential map of all Guilford residents who developed brain tumors between 1968 and 1988, which, they said, showed no clustering around the substation. When the map was made public, however, it did indicate an apparent clustering of cancers along the route of a power line running north from the substation (see p.2). DHS epidemiologist Dr. Sandy Geschwind told *Microwave News* that the number of cases is too small to show a true cancer excess. In 1989, George Corrigan of Northeast Utilities took measurements at 48 Meadow Street, the house directly across the street from the substation, and found background levels of 1 mG inside the house and 5 mG beside the substation. Measurements of the whole street were taken in July 1990 revealing field levels of 3-36 mG in front of the houses (the high reading was found next to a riser on a pole) and 7-16 mG in front of the substation, Corrigan told *Microwave News*. See Paul Brodeur, "Annals of Radiation: Calamity on Meadow Street," *The New Yorker*, pp.38-72, July 9, 1990, and Jonathan Brinkman, "Map Raises Doubts of Power Line Safety," *New Haven Register* (CT), pp.15,21, October 3, 1990.

Darrington, WA: Neighbor's Cluster Concern

In a Darrington, WA, neighborhood there have been at least 12 cases of cancer in 19 homes located near two 230 kV power lines, according to Betsy Diedrick, a local resident—in the four houses closest to the lines there were cases of leukemia, lymphomas and brain tumors. An investigation by Dr. Samuel Milham Jr. of the Washington state Department of Health did not reveal any systematic increase of cancer incidence in the area. "It doesn't look like there's anything suspicious," he told *Microwave News*, noting that there were various types of cancer, with no one type predominating. However, Diedrick's survey did generate enough concern among other residents to compel the Snohomish Public Utilities District to relocate a planned substation to an unpopulated area. See Bill Dietrich, "Of Current Concern," *Pacific* (magazine in the Sunday *Seattle Times and Post-Intelligencer*), April 8, 1990; the cover story features Diedrick's map of the cluster.

Vancouver, WA: Crestline School

Between 1982 and 1989, there were seven cases of cancer reported among students who attended the Crestline Elementary School in Vancouver, WA, according to Dr. Karen Steingart of the Southwest Washington Health District. Adjacent to the school's property are a 12.5 kV distribution line and a 115 kV transmission line. Steingart's investigation failed to uncover a cause for the cluster. She told *Microwave News* that measurements taken by the Clark County Public Utilities District (PUD) showed that Crestline does not have significantly elevated EMF levels compared with other schools in the area. She also noted that there were four different types of cancer among the seven children, and four of the seven had lived in the area for less than one year prior to diagnosis. Last June, the mother of a former Crestline student who died of leukemia in 1987 filed a "wrongful death" suit against the PUD, claiming that exposure to EMFs from power lines at home and at school and from a substation near her home caused her daughter's cancer. The suit has since been dropped (see p.5).

RF/MW Radiation

Griffiss AFB, NY: Childhood Leukemia

In a letter to the editor in the November 23, 1963 issue of *The Lancet*, Dr. Samuel Milham Jr. documented a cluster of acute leukemia deaths between 1948 and 1960 among children in Rome, NY. Milham, who is now with the Washington state Department of Health, was unable to identify a common factor, although he "was convinced there was a huge excess," he recently told *Microwave News*. Milham first began to consider a possible connection with RF/MW exposures after reading two studies by Drs. John Lester and Dennis Moore in the *Journal of Bioelectricity (1*, pp.59-76 and pp.77-82, 1982), which showed higher rates of cancer among, respectively, people living on hills in the path of radar signals and people living in counties with an air force base. "I said 'Aha!' when I read them," Milham continued—he recalled seeing a big strategic air command base with "huge radars...looming over" the town: "I could see the radars around the town when I was visiting people." Milham said, however, that, at this point, a link between the cluster and the radars is "pure conjecture."

Rutherford, NJ: Childhood Cancer

In early 1978, a cluster of leukemia and Hodgkin's disease was identified among children living in Rutherford, NJ—many of whom attended the Pierrepont School. Of the potential causes considered, two were RF radiation emitters: the ITT RF/MW test facility in nearby Nutley and Clifton, and the many commercial radio broadcast antennas in the area. The then National Bureau of Standards (NBS) measured the RF levels at the school in May 1979 and the Environmental Protection Agency (EPA) measured them again in July and August 1980. The cause of the cluster was never discovered. See letter of NBS's C.K.S. Miller to New Jersey Department of Environmental Protection, July 17, 1979; EPA's David Hawkins's letter to Congressman Andrew Maguire, February 6, 1980; and Jill Jonnes and Michael Hoyt, "One Stone Left Unturned in Rutherford Cancer Inquiry," *New Jersey Monthly*, pp.38-39, March 1979.

Beaver Falls, NY: RF Sealers

In 1980, the National Institute for Occupational Safety and Health (NIOSH) investigated an alleged cluster of six cases of cancer—including breast and ovarian cancers and lymphoma—among 20 female RF heat sealer operators at the Beaverite Products plant in Beaver Falls, NY (see *MWN*, N81). NIOSH's Terry Leet, the principal investigator, terminated the project, stating that, "There is no convincing evidence in the scientific literature to indicate that RF radiation causes cancer in humans and animals." A NIOSH RF survey of the plant found electric and magnetic field levels as high as 896 V/m and 1.41 A/m, respectively (see also *MWN*, J/F82). Indeed, members of the survey team reported experiencing "heating sensation in the forearms and legs," indicating that "exposed personnel are absorbing significant amounts of RF energy."

Ragerville, OH: AT&T Workers

In 1981, NIOSH could not identify a link between a cluster of five cases of cancer among seven AT&T long lines workers and one cleaning woman employed at a site in Ragerville, OH, and exposure

to MW radiation (see *MWN*, F81). The NIOSH team measured maximum levels of 0.1 mW/cm^2 at the site, but there was some uncertainty as to the actual exposures to RF/MW radiation. James Cole of the Communications Workers of America Local No.4354, who called for the investigation, maintained that the cause of the cluster was associated with the site: "I suspect there could still be a hazard, but we aren't sophisticated enough to measure it or find it."

Portland, OR: Cancer Excess

In the early 1980s, Drs. William Morton and David Phillips of the Oregon Health Sciences University in Portland reported a significant association between certain types of cancer (including leukemia and breast cancer) and RF/MW radiation. They observed the strongest link with the VHF bands—54-88 MHz and 176-216 MHz. See Morton and Phillips, *Radioemission Density and Cancer Epidemiology in the Portland Metropolitan Area*, a report to EPA, June 1983. For another Portland area cluster report, see Michael Daley et al., "Community Fear of Non-Ionizing Radiation: A Field Investigation," *IEEE Transactions on Biomedical Engineering*, 32, pp.246-248, March 1985. (See also *MWN*, J/F82 and My82.)

Lualualei, HI: Cancer and Navy Towers

Between 1979 and 1985, children living within five miles of the U.S. Navy communications complex in Lualualei on Oahu, HI, developed leukemia at four times the expected rate (see *MWN*, M/J87). The Navy measured the RF/MW levels inside the Radio Transmitter Facility (RTF) and at its border. On the basis of those measurements, the Navy concluded that, "There is *no* reason to believe" that people living outside the RTF boundary are suffering any adverse biological effects from electromagnetic radiation (Navy's emphasis). In 1982, when the measurements were taken, the RTF had one VLF antenna, one LF antenna and several HF antennas. There were also a number of MW towers. Concern over the cluster continues to this day: the issue was raised at a state hearing in June 1990.

Honolulu, HI: Excess near Broadcast Towers

In 1987, the Hawaii Department of Health reported that people living near radio and TV broadcast antennas in Honolulu had "significantly higher" cancer rates than those living in other parts of the city (see *MWN*, M/J87). In the past, towers were sited in downtown residential areas to preserve the scenic beauty of the surrounding hills, but in 1986, the Honolulu City Council adopted a zoning regulation barring new broadcast towers in residential and business districts (see *MWN*, N/D86). A 1984 radiation survey of Honolulu by EPA and the Federal Communications Commission found the highest levels of RF radiation ever measured in an urban area (see *MWN*, J/F85).

Giants Stadium, NJ: Football Players

Between 1980 and 1986, four New York Giants football players were diagnosed with cancer. The Giants play in the New Jersey Meadowlands Sports Complex in East Rutherford, where RF radiation residential exposures from 15 AM radio broadcast antennas within eight miles of the complex are among the highest in the country (see *MWN*, N/D88). An epidemiological study of stadium workers (non-players) failed to support a link to RF, though a formal report has yet to be released. See memorandum from Dr. Philip Landrigan, *Meadowlands Sports Complex Cancer Investigation: Executive Summary*, Mount Sinai School of Medicine, New York, NY, July 1989, and Eve Markowitz, "Music Not Only Thing in the Air," *The Record* (NJ), May 6, 1990.

Thurso, Scotland: Leukemia near Dounreay

A cluster of leukemia among children living on hills in the small town of Thurso on the northern coast of Scotland eludes explanation. In a 1988 report, the U.K. Committee on Medical Aspects of Radiation in the Environment (COMARE) was unable to link the cluster to radioactive emissions from the Dounreay nuclear complex, less than ten miles from Thurso. Halfway between Thurso and Dounreay is a U.S. Navy communications complex at Forss—similar to the one in Lualualei, HI (at left). Despite calls for an investigation of the possible link between the cluster and the Forss station, COMARE has not pursued this lead. A new analysis is expected soon. See COMARE, *Investigation of the Possible Increased Incidence of Leukaemia in Young People near the Dounreay Nuclear Establishment, Caithness, Scotland, 1988*, and Louis Slesin, "Thurso & McFarland: A Second Look at Two Childhood Cancer Clusters," *SCRAM* (Edinburgh, Scotland), pp.13-16, February/March 1989.

McFarland, CA: Childhood Cancer

In McFarland, CA, 13 children have developed cancer since 1975, but state health officials have been unable to determine why. Investigations into pesticides as the potential cause of the cluster have not identified anything to distinguish this agricultural community from other towns in the area (see *MWN*, J/F88). Indeed, a report released on May 10, 1990 by the state Department of Health Services concluded that the childhood cancer rates in Kern county—in which McFarland is located—and in three neighboring counties "are not statistically different than rates seen elsewhere in California or in other parts of the United States." What may set McFarland apart is a high-power Voice of America (VOA) shortwave transmitter—located in nearby Delano—with nearly two million watts in total output, which broadcasts at 9 and 11 MHz. A number of experts and McFarland residents believe that the VOA station may play a role in the etiology of the cluster; the possibility of a synergy between toxic chemicals and RF radiation is also being considered. In 1989, EPA measured RF levels in McFarland and found nothing unusual (see *MWN*, M/A89 and J/F90).

Mount Sutro, CA: Childhood Cancer

Between 1973 and 1985, children under the age of 15 in San Francisco's Noe and Eureka valleys developed cancer at twice the expected rate (*MWN*, M/A89). The search for a cause has centered on Mount Sutro tower, a radio and TV tower, and on radioactive and toxic chemical emissions from a nearby hospital. There are five VHF and four UHF TV stations and four FM radio stations transmitting from Mount Sutro tower. In December 1988, engineers from Hammett & Edison, a San Francisco consulting firm, found levels in the range of 3-10 $\mu W/cm^2$ near the base of the tower and 0.5 $\mu W/cm^2$ with a maximum of 2.6 $\mu W/cm^2$ in Noe and Eureka valleys. A recent survey by Dr. Steve Selvin at the University of California, Berkeley, indicated an unusual number of cancer cases in the area around the tower. "This is just a hint of a possible clustering, and not a very good hint," Selvin cautioned in an October 1990 interview with *Microwave News*. The state Department of Health Services will look into the cluster.

Upper Cape Cod, MA: High Cancer Rates

Elevated rates of cancer—particularly lung cancer and leukemia—have been documented among residents of five upper Cape Cod towns, according to an exploratory survey by the Massachusetts Department of Public Health (see *MWN*, M/J88). Researchers at the Boston University (BU) School of Public Health are nearing the end

of a $500,000, two-year investigation of a potential link between the high cancer incidence and such environmental factors as high- and low-frequency radiation from the nearby PAVE PAWS radar and from power lines. BU's Dr. Ann Aschengrau, one of the lead investigators, told *Microwave News* that they expect to issue their report this December.

University of Rochester, NY: NHL

There have been at least 12 cases of non-Hodgkin's lymphomas (NHLs) among employees and students who worked or still work at the University of Rochester's River Campus. Five of the cases are among people who worked at Lattimore Hall. No cause for the cluster has been identified, although some have pointed to the campus's 1,000-watt FM radio antenna located 100 feet from Lattimore Hall (see *MWN*, J/A90). Dr. James Melius of the New York Department of Health told *Microwave News* that, "It's a striking cluster," and that RF radiation is a "legitimate concern." A June 9, 1990 RF survey of Lattimore Hall and nearby buildings found no detectable levels, but the meter used in the survey—Holaday Industries' HI-3002—was not sensitive enough to detect levels in the microwatt range. For more on the cluster, see Mary Ellin Arch, "Mystery of Lattimore Hall," *Times-Union* (Rochester, NY), May 21, 1990, and "Still Puzzling over Cancer 'Cluster,' " April 10, 1990.

EMP-Leukemia Lawsuit Settled *(continued from p.1)*

along with codefendant Lovelace Biomedical and Environmental Research Institute in Albuquerque, NM, used Strom and the other Boeing EMP workers as research subjects without their knowledge or consent. The case against a third codefendant, EG&G, was dismissed.

Unlike many previous EMF settlements, the Boeing agreement is a matter of public record. Part of the settlement with Lovelace remains confidential, however.

Boeing does not admit any liability. "Neither the suit nor the settlement has anything to do with Mr. Strom's leukemia," Russ Young, a Boeing spokesman, told *Microwave News*. "We haven't seen any conclusive scientific evidence that EMP poses a health hazard, but we continue to treat it with great care." However, he added that, "We readily acknowledge that there are still questions about EMP health risks."

Indeed, the leukemia causation issue would not have been directly addressed had the case gone to trial because of the 1988 denial of Strom's workers' compensation claim that EMP radiation caused his leukemia. Although the claim was being appealed, the superior court judge ruled that the parties had to abide by the workers' compensation decision and could not introduce the issue. (Strom ultimately dropped the claim as part of the settlement.)

Medical Program

The Boeing medical program will provide up to ten years of free medical examinations for the 700 EMP workers. Participation will be voluntary, although Young said that all EMP workers exposed to 5 kV/m or more are currently required to undergo medical screening. In addition, Boeing and Lovelace will contribute over $200,000 to a medical fund to be used by an independent medical administrator to evaluate the examinations and assist workers with any EMP-related concerns.

All Boeing EMP workers, except for Strom, can still seek compensation for any illness or injury due to on-the-job EMP exposures.

Strom, a Boeing employee for the past 29 years, worked with EMP from 1983 through 1985, testing its effects on the electrical and electronic components of the MX "Peacekeeper" missile. He worked inside a shielded room containing the EMP power supply and pulsers which, he said, were fired hundreds of times a day. In 1985, at the age of 45, Strom was diagnosed with chronic myelogenous leukemia. He continues to work for Boeing in its commercial avionics division.

"I feel vindicated," Strom told *Microwave News*, but added that he feels "somewhat bittersweet" about the settlement: "It would have been good to go to court and argue the health issues." If the suit had gone to trial, some of the country's leading EMF experts would have testified (see *MWN*, J/A90). Strom acknowledged that the trial might have taken years.

With at least $100,000 of the settlement money, Strom and his wife Barbara plan to establish the Robert Carl Strom Foundation to "ensure that the public continues to learn about the terrible hazards of electromagnetic radiation." The foundation will provide information to the general public through schools, unions and other organizations, sponsor symposia on EMFs and support legislation and EMF-related litigation. An inaugural reception honoring the Stroms will be held in Seattle on November 8. It will be open to the public.

The settlement paves the way for a host of future EMF-health effects lawsuits, according to Withey. "We have amassed significant medical and scientific evidence that EMFs, from power lines near our schools and in our neighborhoods and from

Terms of the Settlement

Listed below are the major points of both the Strom and the class action settlements.

- Boeing pays Robert Strom $500,000 in cash and in an annuity for his family.
- Boeing sponsors a comprehensive medical program for the class of approximately 700 Boeing EMP workers that includes:
  1) Ten years of medical examinations—participation by workers is voluntary;
  2) A $200,000 fund from Boeing and Lovelace to cover expenses associated with the medical exams;
  3) The appointment of a medical administrator, approved by both parties, to oversee the program.
- Strom releases Boeing from all claims, including his workers' compensation claim.
- All of the other class members retain their right to seek compensation for injuries and illnesses related to occupational EMP exposures.

electrical and electronic products like electric blankets and VDTs, do cause biological effects, including leukemia, lymphomas and brain tumors." Withey predicted that, "There is going to be massive litigation." Bryant agreed, adding that, "This case is only the beginning of our efforts to protect the public from these dangers."

The Lovelace Connection

During the discovery phase of the case, the Stroms' legal team turned up a number of documents that revealed that both Boeing and Lovelace had long been aware of the potential health hazards of EMP exposures. For instance, in 1979, Dr. William Morgan, Boeing's chief of radiation health protection, circulated a memo stating that there were indications that EMP radiation disturbs "the whole chemical balance within the body" (see *MWN*, S/O88).

Lovelace researchers working on an EMP bioeffects survey were informed by Boeing in the early 1970s of three cases of leukemia and lymphomas—and instances of other blood abnormalities—among approximately 200 Boeing EMP technicians working at a Montana test site between 1968 and 1972. Yet in its February 1977 report, *Review of Occupational Safety and Health Aspects of EMP Exposure*, Lovelace concluded that "...no adverse health effects of [EMP] exposure have been determined from either the repeated physical examinations performed or the personal observations of the nearly 600 individuals covered in this review." In 1988, Dr. Samuel Milham Jr. of the Washington state Department of Health called for a national study of EMP workers after reviewing the same data (see *MWN*, N/D88).

Strom charged in court documents filed in 1990 that Lovelace's "manipulation, suppression and cover-up of the cancer incidence and potential adverse health effects of EMP exposure..." led to Boeing's relaxation of its in-house EMP exposure standard. The standard was first set at 0.4 kV/m in 1970, but rose to 1 kV/m and then to 5 kV/m over the next seven years. In 1977, the year of the Lovelace report's release, Boeing raised the standard to 50 kV/m (see *MWN*, J/A87).

Over the past two years, the case has captured the attention of the national media. On March 5, 1989, CBS-TV's *60 Minutes* broadcast a segment with Mike Wallace on the Stroms' claims (see *MWN*, N/D88 and M/J89). An update aired on September 2, 1990. Although Wallace did not make the leap from EMP to other EMF-related health risks, some have. For example, an editorial in the August 19, 1990 *Seattle Post-Intelligencer* declared that: "In addition to improving the lot of workers in Boeing plants, this case has helped focus public attention on a potential health hazard that as yet is little understood by scientists and the medical profession—the effect of exposure to electromagnetic fields on the human body. Disturbing—if as yet not definitive—findings in numerous studies suggest that much more is to be learned about [EMFs] before anyone can say with certainty that they do not harm humans."

For information on the Strom Foundation and the inaugural reception, contact: Michael Withey, Schroeter, Goldmark & Bender, 810 Third Ave., Suite 500, Seattle, WA 98104, (206) 622-8000.

Federal Agencies on EMFs *(continued from p.1)*

as 2,000 animals and cost as much as $6-10 million, according to Dr. Gary Boorman of the National Institute of Environmental Health Sciences (NIEHS).

The NTP initiative is the largest government effort to date to investigate EMF health effects. As one observer put it, "The new attitude at NIEHS is entirely appropriate. They have woken up and smelled the coffee." The NTP coordinates research for the Department of Health and Human Services (of which NIEHS is a part), the Food and Drug Administration (FDA) and the National Institute for Occupational Safety and Health (NIOSH).

The draft protocol for the cancer study calls for exposing mice and rats of both sexes to magnetic fields of 20 mG, 200 mG, 2 G or 10 G over a period of two years. Boorman is also considering exposing one group of animals to fields that are switched on and off to gauge the impact of intermittent exposures.

The first draft of the protocol had called for exposures at 2 mG, but, at a September 19 public meeting in Research Triangle Park, NC, a number of experts argued that 2 mG was too close to background levels. The discussion also convinced the NTP to double the number of animals per dose group from 50 to 100. The final protocol is still under review, because, as Boorman pointed out in a telephone interview, "No one really knows what is best." The NTP anticipates issuing a request for proposals by the end of January 1991, and the studies are expected to begin by next fall.

Boorman said that the NTP studies are being coordinated with the two ongoing major animal studies—one at the University of California at Los Angeles, sponsored by the Electric Power Research Institute (EPRI), and one at the University of Quebec, sponsored by Health and Welfare Canada, Hydro Quebec and Ontario Hydro (see *MWN*, J/A89 and M/J90). Health and Welfare Canada also has a smaller, in-house animal study under way.

NIEHS is also planning to fund studies on mechanisms of EMF interactions. Dr. Chris Schonwalder of NIEHS's Division

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of Extramural Research and Training told *Microwave News* that he plans to issue a "program announcement" by the end of this winter. But, he added, "We are ready to entertain applications now." Schonwalder said that NIEHS could fund three or four grants, each in the $120,000-150,000 range.

For more information, contact: Dr. Gary Boorman, Chief, Chemical Carcinogenicity Branch, NIEHS, PO Box 12233, Research Triangle Park, NC 27709, (919) 541-3440; Dr. Chris Schonwalder, Chief, Scientific Programs Branch at NIEHS, (919) 541-7634.

EPA's Cancer Assessment and Research Agenda

The second review draft of the Environmental Protection Agency's (EPA) *Evaluation of the Potential Carcinogenicity of Electromagnetic Fields* is now scheduled to be released in early November (see *MWN*, M/J90). EPA's Science Advisory Board (SAB) is assembling an expert panel to review the document—a meeting is tentatively scheduled for mid-January 1991. Dr. Genevieve Matanoski of Johns Hopkins University's school of public health in Baltimore, MD, will chair the SAB panel.

On June 28, EPA gathered a panel of experts from outside the agency to review the cancer report. To date, the agency has refused to release the panel's written comments, submitted after the meeting. Dr. Robert McGaughy of EPA's Office of Health and Environmental Assessment (OHEA), the project manager for the report, told *Microwave News* that the comments will be released with the second review draft. This external review draft, which will be available to the public, will incorporate the advice of the peer review panel.

EPA is planning to release a *National Research Agenda for Human Exposures to EMFs* as a companion report to the cancer assessment. It will address exposure assessments, biological effects and control technologies for EMFs in the 0-500 kHz frequency band.

EPA's Dr. Joe Elder, who is in charge of writing the agenda, told *Microwave News* that it will not be limited to cancer but will also cover reproductive, developmental, immunological and nervous system effects. Elder stressed that the agenda will address research needs for all government agencies, not just EPA, as well as for private sector organizations, such as EPRI.

For more information, contact: Dr. Robert McGaughy, OHEA (RD-689), EPA, 401 M St., SW, Washington, DC 20460, (202) 382-5898; Kathleen Conway, Science Advisory Board (A-101F), EPA, 401 M St., SW, Washington, DC 20460, (202) 382-2552; Dr. Joe Elder, Office of Health Research (MD-51), EPA, Research Triangle Park, NC 27711, (919) 541-2542.

FDA and Electric Blankets

On the morning of November 14, staffers from the FDA's Center for Devices and Radiological Health (CDRH) will host a seminar on ELF health risks with a special emphasis on electric blankets.

The FDA's interest in electric blankets—a marked change from last year, when the agency dismissed such concerns (see *MWN*, M/J89)—was prompted by 18 members of Congress. In a June 26 letter, first addressed to the U.S. Consumer Product Safety Commission and later to the FDA, they urged immediate action to require a warning label on all electric blankets to discourage their use by children and pregnant women and a public service advertising campaign to publicize the possible hazards. The FDA has the legal authority to regulate "electronic products" such as video display terminals (VDTs) and electric blankets. The members of the House of Representatives wrote that the federal government "has a moral obligation" to warn the public.

Among those signing the letter were Rep. George Miller (D-CA) and Rep. Peter Kostmayer (D-PA), each of whom has held congressional hearings on power line EMFs (see *MWN*, N/D87 and M/A90, respectively).

The seminar will be followed by a meeting of the CDRH's Technical Electronic Product Radiation Safety Standards Committee (TEPRSSC). The safety of electric blankets is on TEPRSSC's agenda for the afternoon of November 15, according to the committee's executive secretary, Arlene Underdonk. A number of ionizing and ultraviolet radiation issues will also be discussed.

For more information, contact: Arlene Underdonk, Office of Standards and Regulations (HFZ-83), CDRH, 5600 Fishers Lane, Rockville, MD 20857, (301) 443-3426.

NIOSH Workshop for a National Research Strategy

NIOSH will hold a scientific workshop in Cincinnati, OH, on January 30-31, 1991 "to develop a national research strategy on the health effects of electromagnetic radiation on workers." At the meeting, the available data will be reviewed, gaps in knowledge will be identified and a research agenda will be discussed. The workshop, which will cover EMFs below 1 kHz, will be open to the public, but attendance will be limited to 250.

Philip Bierbaum, the director of NIOSH's Division of Physical Science and Engineering, who is organizing the workshop, told *Microwave News* that NIOSH Director Dr. Donald Millar had called for the meeting. "Dr. Millar wants to understand what NIOSH should be doing in this area," he said. There are indications that Millar was prompted to study EMFs after a number of congressional inquiries were directed at NIOSH.

For more information, contact: Philip Bierbaum (R-2), Electromagnetic Radiation Workshop, NIOSH, 4676 Columbia Parkway, Cincinnati, OH 45226, (513) 841-4321.

UPDATES

BIOLOGICAL EFFECTS

Now in Print... Two key papers, already much discussed in policy debates, have now been published in *Bioelectromagnetics, Vol.11*, No.2, 1990: (1) The results of the Henhouse Project on the effects of weak PMFs on developing chick embryos—they were first presented in June 1988 (see *MWN*, M/A88), and (2) The findings of Dr. Kurt Salzinger and coworkers on the altered behavior of adult rats exposed perinatally to ELF fields—this study was part of the New York State Power Lines Project; in its report, the project's scientific advisory panel called Salzinger's results "dramatic" (see *MWN*, J/A87)....The results of a 1988 study by Dr. W.Q. Sturner and colleagues which found babies who died of sudden infant death syndrome (SIDS) to have depressed melatonin levels (see *MWN*, S/O88) were published in *Forensic Science International, 45, pp. 171-180*, 1990. Sturner, the chief medical examiner for Rhode Island, along with Dr. Richard Wurtman and other researchers from the Massachusetts Institute of Technology in Cambridge, found that mean melatonin concentrations in cerebrospinal fluid were significantly lower in SIDS infants than in infants who had died of other causes. Though possible reasons for the depressed melatonin levels were not discussed, the paper comes at a time when more and more research is pointing to a connection between exposure to EMFs and altered pineal-melatonin rhythms (see *MWN*, M/J88 and J/A90). Sturner declined to comment on a possible link between SIDS and EMFs, noting that, "We don't work in that area."

EMP

Army Says No to Health Effects Study... The U.S. Army does not plan to study the health of personnel who worked at its EMP test facility in Woodbridge, VA, according to the August 31 *Potomac News*, a Prince William County, VA, newspaper. This comes despite preliminary findings by Dr. Samuel Milham Jr. of the Washington state Department of Health that Boeing employees who worked with EMP suffered leukemia and lymphomas at ten times the expected rate (see p.1 and *MWN*, N/D88). The Army has also declined to look into potential effects on residents in the surrounding area—denying requests from state and county officials—claiming that the responsibility lies with the state health department. However, one state health official said that he does not have the necessary staff for such a study. In April, the *Potomac News* featured a five-part investigative series on the Army's record on EMP safety at the Woodbridge facility (see *MWN*, M/J90). The Army shut down the Woodbridge EMP simulators in 1988—as part of a legal settlement—after 17 years of operation (see *MWN*, M/J88).

LITIGATION

Some Legal Advice..."Injuries from NIER are classic examples of the results of a love affair carried on in ignorance of the risks," writes Bruce DeBoskey in the August 1990 issue of *Trial*, the magazine of the Association of Trial Lawyers of America; he goes on to suggest that, "Creative plaintiffs' lawyers can help remedy this alarming situation by representing the victims of the electronic age." DeBoskey, of Silver & DeBoskey in Denver, CO, recently won an undisclosed sum in settling a case of RF radiation exposure. DeBoskey's two clients claimed that living next to an FM radio tower had caused one to develop non-Hodgkin's lymphoma and had exposed the other to an increased risk of cancer (see *MWN*, S/O89 and M/J90). DeBoskey believes that industry faces "serious punitive damage problems" from its long-standing knowledge of the potential hazards of NIER. Moreover, for those industries that have been "funding research designed to show the absence of harm to workers or....[that] have taken affirmative steps to prevent the institution and enforcement of exposure limits....potential liability is even greater."...An article in the *Columbia Journal of Environmental Law, 15*, No.2, pp.359-388, 1990, warns that the EMF health effects issue is here to stay. "As water and air pollution were to the 1970s, and hazardous waste and toxic chemicals to the 1980s, electromagnetic fields will be an environmental issue of the 1990s," writes law student John Weiss.

MEDICAL APPLICATIONS

MRI Safety... Drs. Emanuel Kanal and Frank Shellock, two physicians who have long been concerned with the possible risks associated with magnetic resonance imaging (MRI), together with Dr. Lalith Talagala have published a detailed review, "Safety Considerations in MR Imaging," in the September 1990 issue of *Radiology* (*176*, pp.593-606). Kanal and Talagala are at the Pittsburgh (PA) NMR Institute; Shellock is at the Cedars-Sinai Medical Center in Los Angeles, CA. Their paper includes 155 references. The last major review was by Dr. Jerome Beers in *Magnetic Resonance Imaging, 7*, pp.309-331, 1989 (see *MWN*, J/A89)....Shellock also published a review last year: "Biological Effects and Safety Aspects of Magnetic Resonance Imaging," *Magnetic Resonance Quarterly, 5*, pp.243-261, 1989. See also his recent study, with two associates at Cedars-Sinai, "Heating of the Scrotum by High-Field Strength MR Imaging," *American Journal of Roentgenology, 154*, pp.1229-1232, June 1990....The FDA's Dr. Whit Athey has also been doing research on MRI; see "A Model of the Temperature Rise in the Head Due to Magnetic Resonance Imaging Procedures," *Magnetic Resonance in Medicine, 9*, pp.174-184, 1989. During the summer, the FDA released a report it commissioned from Dr. J. Patrick Reilly on *Peripheral Nerve and Cardiac Excitation by Time-Varying Magnetic Fields: A Comparison of Thresholds* (No.MT90-100). Specifically, Reilly was asked to investigate the potential health risks from the on-and-off switching of the magnetic fields used in MRIs. Single copies are available from Athey at: Office of Science and Technology (HFZ-133), CDRH, 5600 Fishers Lane, Rockville, MD 20857, (301) 443-3840....Dr. Jeffrey Gold and coworkers at the Cornell Medical Center in New York City have published "Safety of Metallic Surgical Clips in Patients Undergoing High-Field Strength Magnetic Resonance Imaging" in *Annals of Thoracic*

Surgery, 48, pp.643-645, 1989....And a group at Baylor College of Medicine in Houston, TX, led by Dr. Naresh Prasad, has found that "immune response may be enhanced following MRI exposure." See their abstract, "Delayed Tumor Onset Following MR Imaging Exposure," presented at the *9th Annual Scientific Meeting of the Society of Magnetic Resonance in Medicine*, held in New York City, August 18-24, 1990.

Hyperthermia Consensus... In May 1989, an *International Consensus Meeting on Hyperthermia* was held in Trento, Italy, to assess the current status of hyperthermia for the treatment of cancer. The consensus statement, complete with copious references, appears in the *International Journal of Hyperthermia, 6*, pp.837-877, September/October 1990.

PEOPLE

Dr. **Howard Wachtel** has taken a one-year sabbatical from the University of Colorado in Boulder to be a visiting scientist at EPRI. Wachtel will be investigating the neurological effects of EMFs....Dr. **Dan Lyle** has joined Dr. **Mays Swicord**'s lab at the FDA's Center for Devices and Radiological Health. He will be continuing his studies on the effects of EMFs on calcium metabolism, which he was working on when he was a member of Dr. **Ross Adey**'s research group at the VA Hospital in Loma Linda, CA. Swicord told *Microwave News* that Lyle's appointment "indicates a growing emphasis on ELF issues at the center."...Dr. **Jerome Beers** has joined the Radiology Department at Columbia-Presbyterian Hospital in New York City.

VDTs

FDA To Test VDT EMFs... The FDA's Center for Devices and Radiological Health has announced that it will measure emissions of X-rays, ultrasound, VLF and ELF EMFs from television sets and VDTs at its Winchester, MA, lab—the first comprehensive government testing program since 1981 (see *MWN*, Mr81 and My81). The FDA began devising test protocols on October 1 and expects measurements to be completed within 18 months. The agency plans to evaluate more than 100 TVs and VDTs....With concern over possible health effects mounting, several magazines have attempted to do their own tests of ELF EMFs from VDTs—with conflicting results. For example, in the December 12, 1989 *PC Magazine*, Winn Rosch reported fields of more than 60 mG 24 inches in front of an NEC monitor—a much higher level than expected. Rosch next told readers of the February 1990 *MacUser* that they could expect similarly high EMFs from a Macintosh Plus. In contrast, *Macworld* reported much lower levels in its own measurements of ten Macintosh-compatible monitors as part of its July 1990 special report on VDT EMFs. *Macworld* nevertheless called these levels "worrisome." *U.S. News & World Report* published readings taken from 30 different monitors in its September 10, 1990 issue. The magazine averaged the results among three different categories: VDTs, black-and-white PCs and color PCs (the distinction between a VDT and a PC is not clear), and though the levels were similar to those reported in *Macworld*, *U.S. News* concluded that they gave a "message of comfort." *Infoworld* is reportedly planning its own tests.

U.S. Air Force Dismisses VDT EMFs...VDT radiation poses no health hazard, according to a new report from the USAF. The report concludes that, "While research continues on low level ELF effects, results of studies so far have proven no link between ELF and detrimental effects on humans....no reassignment of pregnant VDT workers is warranted," and that, "No basis exists for recommending radiation control measures for VDTs." A copy of *Ergonomics and Radiation Effects from Video Display Terminals and Workstations* (AFOEHL Report 90-043EH00542DXX) is available from: Occupational and Environmental Health Laboratory, Human Systems Division, Brooks AFB, TX 78235.

ETC...

Microwave Month... October is "International Microwave Month," according to the Campbell Microwave Institute in Camden, NJ. The institute reports that its research shows that 86% of children 6-17 years old use MW ovens and that "only" 10% of children under the age of six use them. As for their mothers, most said that their kids liked using MW ovens "a lot" and that "only 10% indicated that they were 'very concerned.'"

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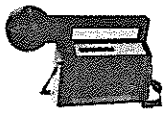

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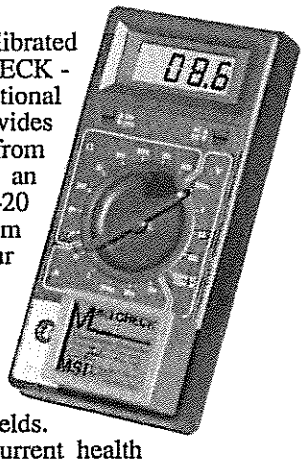

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