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INSIDE...

Canadian–French Study Supports Occupational Leukemia Risk

Weaker EMF Link to Brain Tumors

A $3 million, industry-sponsored study has found that utility workers with greater than average cumulative magnetic field exposures were three times more likely to develop acute myeloid leukemia (AML) than less-exposed workers. But, because no dose–response relationship was observed, the Canadian and French epidemiologists advised that "caution must be exercised in interpreting the present results as evidence of a causal association."

The case–control study, which appears in the March 15 *American Journal of Epidemiology* (see abstract, p.12), also showed that workers who had the greatest exposures to magnetic fields had twelve times the expected rate of astrocytomas, a type of brain tumor, but this finding was based on a small number of cases. Although a dose–response relationship was not observed for leukemia, a statistically significant trend was found for astrocytomas.

Men who had worked over ten years for the three utilities that participated in the study—Electricité de France-Gaz de France (EDF), Hydro-Québec (HQ) and Ontario Hydro (OH)—and who had been exposed to an average magnetic field of 2 mG or greater had more than twice the risk of acute nonlymphoid leukemia (ANLL) and AML, a type of ANLL, than those with lower exposures.

"Our study speaks further in the direction of an association between AML and occupational exposure to electromagnetic fields (EMFs)," Dr. Gilles Thériault of the Department of Occupational Health at Montreal's

(continued on p.13)

Transient EMFs May Be a Key to the Mechanism of Interaction

A second study by some members of the Canadian–French team may soon steal the spotlight. Thériault's published paper only analyzes 50/60 Hz magnetic field exposure data, but still to come is a separate report from a group at McGill University on high frequency transients—short, intense pulses or sparks of energy that are common in electrical environments.

The transient results could open a new chapter on the possible EMF–cancer risk. Indeed, a new Swedish–American animal study points to the potential importance of transients in understanding the EMF–cancer link. In addition, pulsed electromagnetic fields, which have long been used to speed bone healing, share some characteristics with high frequency transients—for instance, fast rise times.

"Some effects were found in relation to the transients," Dr. Paul Héroux

(continued on p.15)

« Power Line Talk »

Since the fall of 1992, when passage of the Energy Policy Act launched the **National EMF Health Research and Communications Program** (NERP) and put health studies in the hands of **NIEHS**, the fate of ongoing **DOE** research has been in question (see *MWN,* N/D92 and J/A93). So far, the DOE program has survived—actually receiving more money in fiscal year 1994 than the NERP (see *MWN,* N/D93). Now, however, the influential **Senate Energy and Natural Resources Committee** has decided that the DOE program should not have continued. "The existing [DOE] program should be phased out as soon as practicable as the new program is implemented," states a March 9 committee report on the 1995 DOE budget. "The new program created by the Energy Policy Act was intended to subsume the old one," according to the committee, which is chaired by Sen. Bennett Johnston (D-LA). The committee "supports a funding level for the EMF program of $10 million, with no more than $3.5 million of that amount to be used to phase out the old initiative." This leaves $6.5 million for the NERP—the funding level Congress originally set—and would give the program $13 million, with industry matching funds. It is a substantial cut, however, from the amount specified in the President's budget, released in February, which would have provided $10 million for the NERP alone *and* $6 million for the DOE program, or a total of $26 million for EMF research when the matching funds were included (see *MWN,* J/F94).

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There was a moment of drama at the March 2 National EMF Advisory Committee meeting when NIEHS' Dr. **Michael Galvin** announced that if the NIEHS did not receive $25,000 from the DOE within a couple of weeks, peer review of the applications for grants under the NERP would be delayed until the fall and, by implication, research grants would not be awarded until fiscal year 1995. There were a number of stumbling blocks. The NIEHS had yet to collect any funds for the program from the DOE—by law, all money for the NERP is routed through the DOE—and industry had not yet contributed its half of the $8 million due the research program in this fiscal year. DOE's **Marvin Gunn** pointed out that before any money could be transferred, the NIEHS and the DOE had to sign a memorandum of understanding (MOU) that outlines the broad policy issues and an interagency agreement that details the specifics on how the two agencies will work together. Gunn warned that it could take from two to six months to move an interagency agreement through the bureaucracy. And then there was the key substantive issue: the approval of the program's implementation plan. By early April, the industry contributions to the EMF research plan had topped $3 million, the MOU was close to final approval and NIEHS' senior management agreed to advance Galvin the money for the review of the 50 applications for cellular studies and the 40 applications for animal studies. Meanwhile, by mid-June, the DOE will issue a request for proposals on engineering studies, covering measurement standards for personal and environmental exposures, as well as for some occupational settings. As we go to press, **Dan Vander Meer**, one of the NIEHS EMF program managers, said that he is certain that researchers will have the funds to start their experiments by September 30, the end of the 1994 fiscal year. Still unclear, however, are when a final implementation plan will be approved and whether the industry will come up with another $1 million in matching funds.

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"In my judgment, we are 90-95% certain that there is a link between EMFs and cancer," Dr. **David Carpenter**, dean of the School of Public Health at the New York State Department of Health in Albany, said in a talk on March l4. After reviewing the major epidemiological studies linking EMFs with leukemia and brain tumors, he told an audience of lawyers at the **New York City Bar Association** that it would still "be many years before we have all the answers." Nevertheless, Carpenter, who served as the executive secretary of the New York State Power Lines Project, said he believes policymakers should "involve the public in the debate. We should *not* wait until all the research is done." Setting standards can be a contentious process, he said, but "the logical number is 1 mG."

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Jury selection is expected to begin April 14 in the case of **Nancy Jordan** versus two Georgia utilities, **Oglethorpe Power Co.** in Tucker and **Georgia Power Co.** in Atlanta. The trial should be under way by April 18 and is expected to last up to three weeks, said Jordan's attorney, **Bruce DeBoskey** of Silver & DeBoskey in Denver. Jordan, whose suit was filed on July 24, 1991, claims her non-Hodgkin's lymphoma was caused by EMFs from power lines owned by the two utilities (see *MWN,* S/O91, S/O93 and N/D93). The trial, in Georgia Superior Court for Douglas County in Douglasville, was postponed on November 29, 1993, because of the illness of Dr. Peter Wright, an oncologist with The Poly Clinic in Seattle. Wright died in December, but his testimony was videotaped. Oglethorpe Power is being represented by **James Orr** of the Atlanta firm of Sutherland, Asbill & Brennan. **Robert Pennington** of the Atlanta firm of Troutman Sanders is representing Georgia Power. Meanwhile, the trial of **John Altoonian**'s case against **Atlantic Electric Co.** of Pleasantville, NJ, scheduled for April 18, is expected to be postponed (see *MWN,* N/D93). An assistant for **Gerald Corcoran** of Megargee, Youngblood, Franklin & Corcoran in Pleasantville, who is the attorney representing Atlantic Electric, said discovery has not been completed. Altoonian is claiming that EMFs were responsible for his chronic myelogenous leukemia, diagnosed in October 1990. Altoonian's deck and backyard are above an underground 69 kV power line operated by Atlantic Electric.

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The business of legal conferences is booming. The latest offering is the EMF Regulation & Litigation Institute's *Anticipating, Avoiding and Managing EMF Claims,* sponsored by

Business Development Associates in Washington and the Pittsburgh-based law firm of **Kirkpatrick & Lockhart**. A brochure promoting the meeting, scheduled for April 14-15 in Orlando, FL, warns that, "U.S. industry is on the verge of a litigation and regulatory morass that could dwarf Superfund and asbestos." Speakers will include Dr. **Robert Adair**, the Yale University physicist. A few weeks later, May 12-13, the publisher of the *EMF Litigation Reporter* is sponsoring its own conference in Philadelphia. The program was developed by **Paul Gupta** of the Boston law firm of Nutter, McClennen & Fish and **Tony Roisman** of the Washington law firm of Cohen, Milstein, Hausfeld & Toll. Dr. **Abe Liboff**, a physicist at Oakland University, and Dr. **Charles Poole**, an epidemiologist, are among the speakers.

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Tom Watson has applied for membership in the **National EMR Alliance**, but his application probably will not be approved. The New York-based, grass-roots anti-EMF group is not sure the prominent utility attorney is quite whom it wants on its rolls. "We're not cashing his check. It's framed on my wall," said **Cathy Bergman** of the EMR Alliance. Membership would require Watson to agree that "exposure to EMF is hazardous to life and constitutes a significant threat to the public's health," according to the group's bylaws. For his part, Watson, a partner at the Washington law firm of Crowell & Moring, now says he is no longer "avidly seeking" membership—especially not after the alliance sent out a press release advertising his application. "I got a kudzillian copies of the press release faxed to me with comments, some from judges, some from public service companies, some from those in the news media. Some were pretty funny," he told us. Watson maintains he originally sought membership because he "always likes to know what's going on from all perspectives" and not to gather information on the opposition—a possibility suggested in the alliance's press release.

Commentary

The Social Costs of Spin Control

If anyone still thinks it's a good idea for electrical utilities to manage health studies, the handling of the Thériault study should convince them otherwise. The three utilities used their access to suit their own short-term interests—without regard for occupational and public health, or indeed for their own long-term interests.

Electricité de France, Hydro-Québec and Ontario Hydro were privy to the results months ago and spent that time, with the help of public relations specialists, preparing to convince the media and the public that Thériault's results shed little new light on the EMF problem. (The utilities followed the example set by the Electric Power Research Institute's release of the Peters–London study in 1991.) Reading the joint Canadian–French press release, it is hard to see that the study supported the researchers' *a priori* hypothesis of a link between EMFs and leukemia and brain cancer. As Dr. Sam Milham told us, these were not chance findings, but what the researchers were looking for.

The electric utility industry as a whole had access to Thériault before the rest of us, and some, such as the Edison Electric Institute (EEI), abused it. EEI's release had Thériault saying: *"A significant association between exposure to EMF and leukemia and brain cancer has not been obtained"* (EEI's emphasis). The press had to wait a week after the results were announced to talk to Thériault, but EEI, which had advance information, misquoted him.

Those reporters who covered the study got it right for the most part—the *Wall Street Journal*'s headline, "Magnetic Fields Linked to Leukemia," was typical—but others decided it was not newsworthy. For instance, the *Washington Post* ran a short Associated Press wire story, and the *New York Times* let the story pass unnoticed.

It is perhaps a reflection of the utilities' spin control that, on April 5, less than a week after the release of the Thériault study, Nigel Hawkes of the London *Times* wrote: "Occupational studies, among workers exposed daily to high levels of [EMFs], have so far failed to show any damaging effects."

Hawkes may have been thinking of Jack Sahl's study of utility workers, paid for by Southern California Edison. It was ballyhooed as evidence of EMF safety. Now, as Thériault's group points out, Sahl may simply have been looking in the wrong place. Do utility epidemiologists have an incentive to look in the right places?

Thériault's published paper is the official record. But if the utilities had been forced to wait for it, like the rest of us, there would have been less opportunity to spin the results and a better chance that his study would speak for itself.

The epidemiological results of the last 15 years still do not give us a clear picture of the EMF–cancer link. But, despite the carping of a few physicists, there can be little doubt that there is some cancer risk associated with some aspect of EMF exposure. The pressing questions are: "What is causing it?" and "What should we do about it until we know?"

With the possible exception of Dr. David Savitz's soon-to-be-published study of utility workers, no "definitive" experiment capable of resolving the current impasse is on the horizon. Without a major breakthrough, decisions will have to be made with the current data.

The Canadian and French utilities say that the new results do not warrant a change in EMF policies, but we doubt that the public will agree—especially those who are fed up with the utilities' impossible quest for "conclusive" evidence. All this sets the stage for sharper polarization.

Unless the utilities can point to more biologically potent EMF parameters—transients or something else—they will be increasingly forced to meet a 1 mG guideline for 50/60 Hz magnetic fields, which is rapidly becoming the *de facto* standard among those who believe in the EMF–cancer link. If, because of their foot-dragging, the utilities end up wasting a lot of money fixing the wrong EMF problem, they will have only themselves to blame.

Breast Cancer Victim Sues Utility, Blames Office Wiring

A former employee of CBS Inc. in New York City is suing Consolidated Edison Co. of New York, blaming the electric utility for her breast and ovarian cancers, which she said were caused by EMFs emitted by electrical transformers near her work area.

Shirley Marano, who worked in CBS' headquarters building in Manhattan, was diagnosed with cancer in December 1990. Her complaint, filed in November 1993 in the Supreme Court of the County of New York, alleges that Con Ed and as-yet-unidentified manufacturing and maintenance companies failed to warn her of what she contends are health hazards caused by EMFs. CBS, the television and radio network, was not named as a defendant in the suit.

Marano claims that the defendants were negligent in installing the transformers, that they did not comply with reasonable standards and that they did not use construction materials that block EMFs.

Leopold Kaplan of New York City, Marano's attorney, declined to discuss details of the case.

"We think her charges are without merit," said Con Ed spokesman Martin Gitten. "In the future, can we expect more cases like this? I would assume yes. But we're neither worried nor concerned. If they occur, we'll handle them."

Marano's case is unusual: It is one of the first both to link breast and ovarian cancer and EMFs and to cite a building transformer as the source of the exposure. Acknowledging the uncommon allegations, Tom Watson of the Washington firm of Crowell & Moring, who is representing Con Ed in this litigation, said, "It seems to me it's a fairly new type of case and in that sense it's worthy of some note. Beyond that, not a lot more can be said at the moment."

Concerns over EMFs in buildings have been raised consistently during the past few years. A number of recent cancer clusters in office buildings have been studied, although no causal link with EMFs has been established (see *MWN,* M/A93 and S/O93).

EMF exposure in office buildings can be sharply reduced, a costly task in existing offices, less so in new buildings (see *MWN,* M/A93). Con Ed does not shield its equipment in response to customer requests because, Gitten said last year, it is impossible to know what a safe magnetic field exposure is.

Based on extensive magnetic field surveys, Richard Tell, a consultant based in Las Vegas, found that people in commercial office buildings working near conductors may be exposed to very strong magnetic fields, even stronger than those in the work environments of many electrical employees (see *MWN,* M/J91). The ambient magnetic fields in offices may be as high as 3,000 mG, depending on the layout and type of wiring, according to Tell.

"Electrical conductors, then, can be responsible for very high whole-body magnetic field exposures among office workers without their knowledge," Tell noted.

BPA's New Booklet

The Bonneville Power Administration (BPA) has published a new booklet, *Electric Power Lines, Questions and Answers on Research into Health Effects,* but the 3,000 print run is already out of stock. Updated booklets should be available in May.

Topics covered in the booklet range from cancer clusters and EMF regulations to melatonin studies and ways to limit EMF exposure. The updated edition will contain information about the new Canadian–French epidemiological study (see p.1).

The booklet is similar in approach to the now classic *Electric and Magnetic Fields from 60 Hertz Electric Power: What Do We Know About Possible Health Risks?* published four years ago by Carnegie Mellon University (CMU) in Pittsburgh (see *MWN,* M/A89 and S/O92). Over 120,000 of the CMU booklets have been distributed.

The BPA, which serves the Pacific Northwest, is part of the U.S. Department of Energy. The booklet may be obtained by calling (800) 622-4519 or (503) 230-3478, or by writing to Dr. Jack Lee, EFB, BPA, PO Box 3621, Portland, OR 97208.

U.K.'s Doll Is of Two Minds About EMF–Cancer Link

Sir Richard Doll, Britain's best-known epidemiologist, now believes there is a need to investigate the possible link between EMFs and cancer. "Two years ago, I would have said that I am pretty confident that there really isn't an association," Doll said during the British Broadcasting Co.'s *Panorama* program, which was televised on January 31. "Now I am not confident of that at all. I think there is a possibility that there is, and we therefore must investigate it very urgently."

Doll added, "If it turned out that there was a hazard it would be one which would affect a great many aspects of life, but it's not going to be, it certainly is not going to be, a large risk for anybody. It might be a small risk that would be spread very widely which people want to try to avoid."

During a March 9 telephone interview on another television program, Doll again refused to dismiss the possibility of a cancer risk. "The biological evidence is still quite clearly negative; there's no way in which really one could see how it could cause cancer. But there is some much better epidemiological evidence which now certainly suggests the possibility that a risk might exist," Doll said on *Live Wire,* broadcast by a local station in the Bristol area. *Live Wire* is not aired nationally.

Doll gained stature as an epidemiologist during the 1950s when he became the first to link smoking and lung cancer. On *Live Wire,* he conceded the link was made in the absence of a biological mechanism. He went on to say he would do the same for EMFs and cancer today, if the evidence were "correspondingly substantial."

Doll's recent statements reflect a certain ambivalence,

which stands in contrast to position papers prepared for the U.K. National Radiological Protection Board (NRPB). In March 1992, an advisory group, chaired by Doll and convened by the NRPB, released a report stating that there was "no firm evidence" of a cancer risk from exposure to extremely low frequency EMFs (see *MWN,* M/A92). As recently as late last year, the group reaffirmed this stance, allowing that new Scandinavian studies provide "weak evidence" of a childhood cancer risk (see *MWN,* N/D93).

Furthermore, in February, a top U.K. health official told Parliament that existing evidence does not support the adoption of a prudent avoidance policy (see below).

The *Panorama* program, a respected and well-watched show, focused on the Studholme family in Manchester, whose 13-year-old son Simon died in late 1992 of leukemia. The family had moved into their home 19 months before. A lawsuit brought by Simon's parents against Norweb, the local utility, alleges that EMFs from a nearby substation, buried power lines and household wiring caused the cancer (see *MWN,* J/A93 and S/O93).

"As public interest in this issue has grown, other families with childhood cancer cases have come forward intent upon pursuing proceedings against their local electricity boards," Martyn Day, the Studholmes' solicitor, wrote in an article in the London *Times* on March 15.

Day also is representing 50 children from northeast London who are taking Michael Heseltine, the U.K.'s Secretary of State for Trade and Industry, to court to stop activation of six 275 kV power lines. The lines are being installed underground along a six-mile route in a densely populated area. Legal aid to pursue the case was granted by the government in late March. In the U.K., legal aid is provided to those who can demonstrate an economic need and who can show that their claim has merit.

"For Mr. Heseltine not to take action while further studies are ongoing is effectively gambling with children's lives," Day said the day after nearly 100 residents from the affected area met to discuss what they perceived as the lack of concern by the National Grid Co., which is installing the power lines. The National Grid estimates exposure levels at many, if not most, of the homes along the route will be well in excess of 2 mG, according to Day.

Meanwhile, U.K. electricity companies are spending £1.5 million (about $2.25 million) each year on EMF research, according to a letter in the *Times* (March 24) from Philip Daubeney, chief executive of the Electricity Association.

Against this backdrop of widespread public debate, Doll's latest advice has taken on a more personal note. In an April 5 article in the *Times,* Doll said, "If I had grandchildren living near electricity pylons, I wouldn't insist on them moving."

Three Studies Fail To Agree on EMF–Depression Risk

Electrical workers were no more depressed than other workers overall, although some groups showed a slight increase in depressive symptoms, according to a new study led by Dr. David Savitz. Two earlier studies on the possible link between depression and residential power line EMFs had conflicting results. Only one of the three supports the link between EMFs and depression first observed by Dr. Stephen Perry, an English general practitioner, over a dozen years ago.

Savitz, of the University of North Carolina School of Public Health, Chapel Hill, and colleagues at the Centers for Disease Control and Prevention in Atlanta report in the *American Journal of Industrial Medicine* (*25,* pp.165-176, February 1994) that electrical workers who stayed less than ten years on the job suffered more depression than long-term workers. They also found slightly more depression among electricians,

U.K. Government Rejects Prudent Avoidance

On February 21, Alex Carlile, a member of the U.K. Parliament, asked if the government planned to adopt a policy of prudent avoidance. Thomas Sackville, undersecretary of state for health, replied that the need for such action was not supported by research. Their exchange follows:

> *Alex Carlile:* To ask the Secretary of State for Health [Virginia Bottomley] if she will make it her policy to encourage the enactment of a prudent avoidance policy with regard to electrical power line work, which ensures that all future power lines will be sited away from schools and houses until the possible link between [EMFs] and cancer is disproved; and if she will make a statement.
> *Thomas Sackville:* The National Radiological Protection Board [NRPB] and Committee on Medical Aspects of Radiation in the Environment have considered this question and concluded that the available information does not establish that [EMFs] cause cancer. The significance of an epidemiological study depends, among other things, on the strength of the association, the presence of a dose–response relationship, supporting experimental evidence and a credible biological explanation. These tests for causality are not satisfied for the link between [EMFs] and cancer. On the basis of present evidence, the two bodies have not recommended the adoption of a policy of prudent avoidance. The position is being kept under review.

One clue as to the advice the government may have received from the NRPB may be found in an editorial by Dr. Kenneth Duncan, NRPB's medical adviser, which appeared in the board's March 1994 *Radiological Protection Bulletin*:

> Prudent avoidance [may be seen as] an intellectually indolent term to avoid proper assessment of risk and benefits and to escape the opposition that positive decision making sometimes provokes....If we are to come to sensible conclusions in times of scientific and technical advance we must be prepared to have an underlying philosophy which accepts that some risks have to be accepted....Some of these judgments may be unpopular but should not be avoided. It is not prudent to be indecisive, intellectually lazy or cowardly.

a category of electrical workers.

The increases were small and generally not statistically significant, however, and the researchers concluded that electrical workers as a group were no more prone to depressive illness than other workers.

In 1992, Dr. Charles Poole, an epidemiologist in Cambridge, MA, and coworkers reported a stronger link between EMFs and depression (see *MWN,* J/A92). In their paper, which appeared in the *American Journal of Epidemiology (AJE) (137,* pp.318-330, February 1, 1993), they observed a nearly threefold higher prevalence of depressive symptoms among people living near an overhead transmission line than among controls. They characterized the association as "moderately strong."

In contrast, researchers led by Dr. Shari McMahan of the University of California, Irvine, did not find more depressive symptoms among women living adjacent to high voltage transmission lines than among those a block away (see *MWN,* J/A92). The study, which used the same depression scale as Poole (Savitz used a different one), was published in the *AJE (139,* pp.58-63, January 1, 1994).

All the researchers expressed some dissatisfaction with the exposure assessment for the studies. The Savitz group noted that the study's use of job title as proxy for EMF exposure might not be adequate. Poole and colleagues wrote that their estimate of proximity to the transmission line was "extremely crude" and the "major limitation" of the work. And McMahan's team, which relied primarily on distance to power lines, expressed doubts that the supplementary EMDEX measures they used in the study were "necessarily representative" of EMF exposure.

School EMFs Alarm Parents and Teachers Across the Northeast

Reacting to high EMF levels at schools, parents and teachers in several states have followed the example of California activists at the Slater School in Fresno and at the Montague Elementary School in Santa Clara by demanding that affected classrooms be moved. Here is an update:

Classrooms Closed in New Jersey

At Elementary School No.14 in Clifton, children have been moved out of the four classrooms closest to a substation at the urging of parents and teachers. After indoor measurements indicated magnetic field levels ranging from 5.5 mG to 10.8 mG, Superintendent of Schools William Liess transferred the children from three classrooms to another wing, where the magnetic fields are below 3 mG; a fourth class was moved to another school. John Groh, president of the Clifton Teachers' Association, told *Microwave News* that he is relieved because, "We don't want to find out down the line that people have paid a price because of negligence."

Liess made the measurements after a statewide survey, conducted by utilities, of magnetic fields at all schools within 100 feet of transmission lines 69 kV or higher revealed that EMFs at the school were the second highest in the state. In February, the New Jersey Board of Regulatory Commissioners (BRC), which directed the survey, reported that statewide, fields ranged from 0.2-47.3 mG on the property of the schools—no indoor measurements were taken by the utilities, however.

EMF levels on the grounds of the Clifton school were found to reach 41.6 mG by Public Service Electric & Gas (PSE&G), one of four utilities that participated in the survey. The Clifton school is adjacent to a right-of-way for two 138 kV and two 230 kV transmission lines. The Timothy Christian School in Piscataway had the highest readings in the state, according to *The Record,* a newspaper based in Bergen County.

Liess found out about the Clifton school's standing from the newspaper, he said in an interview, adding that he has a "big problem" with that. "We've been floundering around by ourselves," with no guidance from the state or the utility about what the numbers mean, he said.

Neither PSE&G nor the BRC plans to reduce the magnetic fields at any of the schools. The levels found in the survey "are not unusual or unique," Robert McCourt, PSE&G's EMF issue manager, told *Microwave News.* "I don't see any reason for concern," he said. In an interview, BRC's Carmen Armenti, who ordered the survey, said it is difficult to plan a course of action until there is scientific consensus on the issue.

Dr. Daniel Wartenberg, an epidemiologist at the Environmental and Occupational Health Science Institute in Piscataway, favors "a more comprehensive survey" that includes indoor measurements. Wartenberg, chair of the Committee on Non-Ionizing Radiation of the New Jersey Commission on Radiation Protection, said he had recommended such an approach to the BRC prior to the survey.

A classroom was also closed at the Grenloch Terrace School in Washington Township because of high EMF levels. The fields were associated with lighting fixtures in the room and not with a nearby power line, according to the *Star Ledger,* a Newark newspaper. Readings taken by Atlantic Electric Co. for the state survey ranged from 1.0 mG to 4.0 mG.

The results of the state survey were only made available for public inspection in BRC offices in Newark and Trenton. The BRC would not disclose the EMF readings at individual schools over the phone—because such information could be "misinterpreted," according to Sharon Shulman in the BRC press office. Copies of the entire report may be purchased for $90.00 each from: BRC, Electric Division, Two Gateway Center, Newark, NJ 07102, (201) 648-2466.

Kindergarten Abandoned in New York

In New York, a kindergarten classroom was closed in February at the Franklin Early Childhood Center in Hewlett on Long Island following the discovery of elevated magnetic fields, but power line EMFs were not thought to be at fault. There are no high-tension wires nearby.

School officials called in the Long Island Lighting Co. (LILCO) after worried parents pressured them to confirm a reading taken by a parent with a hand-held meter. LILCO found EMFs of over 90 mG in the room, according to Joanne Piluso, who had first measured the fields. The fields are strongest on the floor of the room but their source has not been identified. Superintendent of Schools Dr. Bert Nelson told *Microwave News* that the children were moved "to ease the minds of parents until we can have an expert tell us if there's anything to be concerned

TVA: No Lines Near Schools

"Whenever possible, the Tennessee Valley Authority (TVA) will not site transmission lines near schools and densely populated areas," according to the authority's EMF guidelines, which appear in the March 8 issue of *Inside TVA,* an internal newsletter.

The TVA has followed this policy for "quite some time," according to spokesman Frank Cason, as the public has become more and more involved in TVA's siting decisions. He said that the authority holds public meetings and invites comments on corridors for new transmission lines before deciding on an actual route. "We are a lot more willing now to take social factors into consideration" in locating a line, he added. The TVA is a power wholesaler for Tennessee and parts of six other southern states.

about."

The school district is already dealing with a power line EMF controversy at another school. School officials have been negotiating with LILCO over ways to lower magnetic fields at the Hewlett-Woodmere Middle School, which has a 69 kV transmission line on its property. The school was among those identified in a state survey, released last July, as having EMFs greater than 2 mG (see *MWN,* N/D92, M/A93, M/J93 and J/A93).

LILCO has taken the position that the Hewlett-Woodmere school district will have to pay for any mitigation—a spokeswoman said another Long Island school paid for reconfiguring a line—and proposed three "technically feasible" options to choose from: reconfiguring the line for $150,000; moving the line onto a nearby street for $400,000; or burying the line for $700,000. The utility calculates that the first option would cut EMFs to 1.5 mG or less and the second method to below 1.0 mG. The utility estimates that burying the line might provide the *least* mitigation—saying that under this alternative the fields could still be up to 2.0 mG.

The district came up with a fourth option—have LILCO build a new school farther away from the line. The LILCO spokeswoman, Suzi Halpin, argued that the district is "using the EMF issue to pursue desires for a new school and a new parking lot."

Nelson responded that this was a "distortion" and that he had offered LILCO the opportunity to "join hands in partnership" with the district and create a "model, energy-efficient school." He said he has no quarrel with their rejection of the proposal and that the new school is now a dead issue.

Nelson is still negotiating with LILCO over the cost of reconfiguring or burying the line. He said moving the line is not feasible because the school would have to obtain permission to build structures on private property. In a March 10 letter to Nelson, LILCO wrote that it was "willing to absorb $70,550 of the $161,971" cost of reconfiguring the line. The cost to the district would be $91,421. Nelson noted that the quoted cost had jumped from $150,000 to $161,971.

Nelson said the more expensive burial option is still on the table. Based on the breakdown of expenses provided to him by LILCO, Nelson believes the quote is "padded" and could be reduced. He added that the district has hired EMF consultant Dr. Luciano Zaffanella of Enertech Consultants in Lee, MA, to give advice on which option is better. Zaffanella will also measure magnetic fields inside all five district schools. The two options—reconfiguring or burying the line—will be voted on by the community in May school elections.

Meanwhile, parent Michelle Goldberg, who has been outspoken over the district's slowness to react to EMF concerns, has organized "a tower action committee." She said in an interview that EMFs became an issue at least two years before the state survey, when LILCO found elevated magnetic fields in the middle school music room. A music teacher died of breast cancer in 1992 and subsequently a transformer—thought to be the source of the fields—was removed from an adjacent utility room. Goldberg said she is as concerned about electrical wiring at the school as about nearby power lines.

At least one New York utility has been willing to pay for mitigation of magnetic fields in schools. Niagara Mohawk Power Corp., based in Syracuse, has paid for magnetic field mitigation at five different schools. "We've gotten heat from other utilities, but if it doesn't cost a lot of money to allay customers' concerns, it's worth it," Jack Toennius, Niagara Mohawk's director of environmental licensing and planning, said in a telephone interview. The utility lowered EMFs by reconfiguring or burying the lines (see *MWN,* M/A93 and M/J93).

No School Survey for Connecticut

The Connecticut Interagency EMF Task Force "is not recommending a school survey because there is no consensus as to how the numerical results would be interpreted," according to its January 1994 report. But Carolyn Dupuy of the Connecticut Department of Health Services (DHS) told *Microwave News* that the task force is still "gathering information" and that some type of survey remains a possibility. If a decision is made to go forward, she added, the task force would not want to "limit a survey to schools," but, rather, include any places children gather—day-care centers, homes, housing projects. The task force was set up in July 1991 and is chaired by Dr. Peter Galbraith of DHS (*MWN,* J/A91 and M/J93).

Connecticut 1994 Report on Task Force Activities To Evaluate Health Effects from Electric and Magnetic Fields may be obtained for free by contacting: DHS, Division of Environmental Epidemiology & Occupational Health, 150 Washington St., Hartford, CT 06106, (203) 566-8167.

Voluntary Survey Under Way in Maine

After legislation that would have required electrical utilities to measure EMFs at schools failed to pass, the state Committee on Education asked the utilities to offer schools free EMF surveys upon request and to provide them with background information. The Central Maine Power Co., Bangor Hydro-Electric Co. and Maine Public Service Co. agreed, and at least 37 schools have taken them up on their offer. The utilities plan to present a final report to the committee in September.

School Survey Bill Fails in Maryland

A bill to authorize the state Department of the Environment to "measure the level of [EMF] exposure at any public school or state office building located within 100 feet of high tension lines" will not emerge from the House of Delegates' environmental committee. Delegate Joan Pitkin, who introduced the bill, said in an interview that after the Department of the Environment withdrew support, citing lack of funds, the bill didn't stand a chance. Pitkin has not given up. "I won't go away," she said, and asked, "Do we really want to martyr our children and not protect them more?"

Clippings from All Over

I don't think [EMFs are] a proven health risk. The only thing that power lines do for certain is lower the value of your house.

— Dr. Clark Heath of the American Cancer Society, quoted in *The Record* (NJ), March 29, 1994

The most important study demonstrating health effects from non-ionizing radiation from nonthermal exposures is one recently published [M. Feychting and A. Ahlbom, *American Journal of Epidemiology (AJE), 138,* pp.467-481, 1993]. In this study long-term exposure to ELF radiation from power lines was associated with an increased risk of childhood leukemia. The study is important because it settled the debate of whether or not a non-ionizing type of radiation like ELF can cause cancer. It can. A similar study [S. London et al., *AJE, 134,* pp.923-937, 1991] also found an association between ELF radiation and childhood leukemia....[I]n light of the Feychting study it would be difficult to reject the probability that the association was due to ELF radiation associated with the Denver Wertheimer–Leeper wiring configuration.

—Affidavit of Dr. Richard Scribner, University of Southern California School of Medicine, in support of plaintiffs' case opposing the siting of a WSR-88D, NEXRAD Doppler weather radar in Ojai, CA, January 6, 1994

Utility industry representatives in the U.S. and Canada said the failure of the [Thériault] study to show a "definitive association" between magnetic fields and cancer was welcome. "Frankly, it's a sigh of relief," said Mark Warnquist, partner at LeBoeuf Lamb Greene & MacRae, a Denver law firm that represents utilities in EMF court cases.

—*Wall Street Journal,* March 31, 1994

An increase in the myc transcript has been measured by several investigators in cells exposed to various electric and/or EM fields. ...These findings are important to determining a mechanistic pattern for the effects of EM fields on cells since regulation of the c-*myc* gene plays an important role in initiation and continuance of normal cell proliferation, as well as in the inception of cancer....One conclusion is that a critical sequence responsive to the 60 Hz field lies within [an] approximately 900 [base pair] region....

—Hana Lin, Reba Goodman and Ann Shirley-Henderson, "Specific Region of the c-*myc* Promoter Is Responsive to Electric and Magnetic Fields," *Journal of Cellular Biochemistry, 54,* pp.286-287, 1994

According to Dr. Leonard Sagan, senior health specialist at the Electric Power Research Institute, epidemiologists generally do not consider odds ratios of lower than 2.0 to be statistically significant.

—*EMF News,* a publication of the Edison Electric Institute, p.4, February 7, 1994

Another tumor with rising mortality is primary cancer of the brain and nervous system. The increase has occurred in both sexes and is most pronounced in the 70-74 age group, in whom rates rose more than sixfold between 1950 and 1989. Similar trends have been observed in the United States, Japan, France, Italy, and West Germany. During the past 20 years there have been important developments in techniques for investigating intracranial disease....These changes may have led to better recognition of primary brain tumors that previously would have been diagnosed as stroke or metastatic disease. However, such artifacts of diagnosis are unlikely to provide a complete explanation for the trend, which began at least as early as 1950. Very little is known about the causes of brain cancer....[C]hanges in the overall exposure of the general population to ionizing radiation are insufficient to have had a major impact on brain cancer incidence. More recently, brain cancer has been linked with exposure to magnetic fields from electrical equipment. However, the evidence for a relation is far from convincing. In particular, it is not clear how magnetic fields would influence the biochemistry of cells in such a way as to initiate or promote cancer formation. As yet, therefore, the trends in brain cancer mortality are not satisfactorily explained.

—David Coggon and Hazel Inskip, "Is There an Epidemic of Cancer?" *British Medical Journal, 308,* pp.707-708, March 12, 1994

Many utility industry executives favor the first course: do nothing. They are concerned, apparently, that even minor adjustments in the way they do business might lend credibility to a theory they consider absurd, and might therefore lead to greater panic than currently exists. This view may be sincerely held. It is not, however, sensible. If some connection between EMF and cancer is shown—and the possibility, however remote, does exist—the industry would be vilified in the media and punished in the courts with enormous severity.

—*Inside PR,* "The Magazine of Reputation Management," p.18, January 1994

In many instances, risk assessment has become a code word for those who want to weaken our efforts to protect public health and the environment.

— EPA Administrator Carol Browner, quoted in the *Washington Post,* March 8, 1994

In 1991 we set up a working party to review continuously all the published available evidence [for a link between EMFs from power installations and certain types of cancer], both epidemiological and laboratory-based. The overall conclusion is that there is no proven evidence for the existence of the effects which have been suggested. If any such effects do exist then their incidence within the population, taken as a whole, must be exceptionally small.

—John Williams, Secretary and Chief Executive, The Institution of Electrical Engineers, letter to the *Times* (U.K.), March 24, 1994

Focused research is needed to discover the mechanisms, if they exist, whereby EMFs may promote cancer. Research is also needed on practical ways to reduce exposures to EMFs through mitigation measures and possible behavior modifications. Funding for this research should be provided in such a manner that it does not yield the perception of vested interests in the outcome....All involved parties should understand and, where possible, practice 'prudent avoidance' techniques, and should employ enlightened ways to minimize people's exposure to EMFs in the event that further research confirms a possible connection between exposure and cancer. Public information programs, particularly about the nature of EMFs, the current status of bioeffects knowledge, and overviews of research programs are an important part of this public process.

—William Hendee and John Boteler, "The Question of Health Effects from Exposure to Electromagnetic Fields" (Review Paper), *Health Physics, 66,* pp.133-134, February 1994

EPA Revives NIER Program; Plans To Develop RF/MW Rules

The Environmental Protection Agency (EPA) has reversed its course and will reestablish its non-ionizing electromagnetic radiation (NIER) program, agency officials report. After revealing last summer that it planned to all but eliminate its NIER program (see *MWN,* J/A93), the agency faced pressure from many quarters not to abandon its electromagnetic field (EMF) and radiofrequency and microwave (RF/MW) radiation work.

(Indeed, a request for action on EMFs has come from the President of the United States, see below.)

"We have decided to return to the issue of non-ionizing radiation," Margo Oge, director of EPA's Office of Radiation and Indoor Air (ORIA), told *Microwave News*. In its original budget for fiscal year 1995, which begins next October, the agency had cut its NIER staff from five full-time employees to one. The program will now go back to a staff of five. EPA Administrator Carol Browner "has given her tacit approval," said Dennis O'Connor, a special assistant in ORIA.

A new, comprehensive strategy for the agency's work on EMFs and RF/MW radiation is being developed, Oge said, "because we were not happy with the program we had." Oge explained that she had recently briefed Mary Nichols, EPA's assistant administrator for air and radiation, and that Nichols had generally approved the new strategy. In recent years, ORIA's EMF staff has done literature reviews and published reports and informational brochures, among other activities.

Oge said ORIA will now return to the development of RF/MW public exposure guidelines. The agency may also examine how exposures to EMFs can be reduced voluntarily.

After trying for more than a decade to develop RF/MW rules—and actually circulating draft guidelines for comment—EPA dropped this effort in 1988; the agency has done no work in this area since then, despite a recommendation in 1991 from its Science Advisory Board (SAB) that it complete the limits (see *MWN,* S/O88 and J/A91).

EPA is dissatisfied with the current version of the ANSI/IEEE C95.1 exposure guidelines. In comments submitted late last year in response to the FCC proposal to adopt C95.1, EPA noted "serious flaws" in the guidelines (see *MWN,* J/F94).

Meanwhile, EPA's planned summary of the current scientific evidence on the potential carcinogenicity of EMFs is taking longer than expected to complete. The roughly 30-page

The President Asks EPA for New Report on EMFs and Cancer

President Bill Clinton, fielding a question on EMFs from a child with leukemia, announced on March 19 that he had asked the head of EPA to prepare a report on the possible cancer link. He also noted that he is "somewhat impressed" by the actions of the Swedish government. The comments came during an ABC News special, *Answering Children's Questions,* in which he discussed a variety of issues with schoolchildren at the White House. The producers had arranged to have Kevin Larm of Omaha, NE, who has leukemia, ask a question about EMFs. But Kevin was in the hospital when the session took place, so his brother Patrick asked his question instead.

Kevin did appear in a short videotaped segment, in which he talked about other children in his neighborhood who have developed cancer and about his belief that EMFs were the cause. "The power company says there's nothing to electromagnetic fields, EMFs. I just think it's a big cover-up," he said. The tape showed an electrical substation near his school and a transformer in the Larms' backyard. Peter Jennings hosted the program:

> *Jennings:* Patrick, do you want to talk to the President?
> *Patrick Larm:* I want to ask you his question. I have heard that recent studies have linked EMFs to childhood cancers. Other countries, such as Sweden, are passing laws to set standards. As our President, can you help lower EMFs so hopefully some childhood cancers can be prevented?
> *President Clinton:* That's something we can do something about. We had a study in 1990 which was inconclusive about it. But, you're right, Sweden has concluded that EMFs do lead to higher rates of cancer. So I have asked the person who runs the Environmental Protection Agency for our government to do a review of this and to make a report to me in the near future to try to make a decision about what we should do.
>
> I think we've got to see what the best available evidence is. But I, frankly, was somewhat impressed with the arguments made by the Swedes. We just have to look into it and see whether there's honestly evidence there; and if there is, then we have to take action. And we're looking into it. And you tell your brother to hang in there.

The following week, on March 25, the President met at the White House with Kevin, Patrick and their mother, Julie Larm, and two Nebraska Democrats, Sen. James Exon and Rep. Peter Hoagland. EMFs were again the topic of conversation, according to Hoagland's press secretary, Russ Rader.

Julie Larm told *Microwave News* that she asked the President to issue an executive order prohibiting the construction of new homes, schools and hospitals within 5,000 feet of existing power lines, substations and pollution sources such as oil refineries—and vice versa. She asked the President to sign the order on Earth Day, April 22. Larm helped found Omaha Parents for Prevention of Cancer last year, after finding many cases of childhood cancer near where Kevin attends school. Within a one-mile radius of the substation near the school, at least 11 children have developed cancer within the last five years, she said.

A White House spokesman said that the session with the President was a private meeting and that no public statement was issued. EPA is preparing a response to the President (see p.10). Last summer, Vice President Al Gore also fielded a question about EMFs and childhood cancer, when he appeared on a C-SPAN call-in show (see *MWN,* J/A93).

document, which is being prepared in lieu of a full revision of the agency's 1990 EMF–cancer report (see *MWN,* N/D90, J/A91 and J/A93), had been promised by early 1994. It is now likely to take until September, according to Dr. Robert McGaughy of EPA's Office of Health and Environmental Assessment, who is the principal author.

The President's comments, broadcast in an ABC News special on March 19, came after EPA officials had decided that the five-person program should be revived. But Oge and O'Connor both said that the comments will likely focus new attention on the agency's NIER work. O'Connor said a response to the President is being prepared. It is expected that it will include McGaughy's report. But one staffer, who declined to be named, said, "Clearly we're going to have to do something more. As far as I know, this is the first time any U.S. President has mentioned anything about EMFs."

After plans to eliminate EPA's NIER program became known last year, Sen. Joseph Lieberman (D-CT) wrote to the agency, arguing that the elimination of the EMF program "would be inconsistent with the agency's responsibility to provide full protection of public health and the environment" (see *MWN,* N/D93). He also urged EPA to complete the RF/MW guidelines.

Dr. Genevieve Matanoski of the Johns Hopkins University School of Hygiene and Public Health in Baltimore, who recently became the chair of the executive committee of the SAB (see *MWN,* N/D93), also urged EPA to remain an active player on NIER issues. "Mary Nichols was impressed with the comments we received from Sen. Lieberman and Dr. Matanoski," Oge said.

The existence of the national EMF research and communications program (NERP)—Oge is EPA's representative on the program's interagency committee—may also have motivated the agency's return to the NIER issue. But the effect of the NERP was minor, "compared to the change of management at EPA," Oge said. Both Browner and Nichols were appointed by Clinton.

Any new effort to draft RF/MW guidelines would essentially begin from scratch, Oge said, due to changes in the scientific data. As early as 1984, EPA was ready to base exposure limits on a thermal threshold of 1W/Kg (see *MWN,* J/F84). Plans to propose a 100 $\mu W/cm^2$ general population limit were scrapped, however, just before the guidelines were to be published (see *MWN,* J/A84). In 1986, EPA formally proposed four options: exposure guidelines based on 0.04 W/Kg, 0.08 W/Kg or 0.4 W/Kg, or no action (see *MWN,* J/A86).

NCRP Report on Human Exposures to RF/MW Radiation

After ten years of work, the National Council on Radiation Protection and Measurements (NCRP) has released a guide to radiofrequency and microwave (RF/MW) radiation exposures. The 233-page report provides comprehensive information on various radiation sources and a "how-to" guide for estimating human exposures.

"The report will be useful for evaluating RF/MW hazards," Richard Tell, a Las Vegas-based consultant, who chaired the committee that wrote the report, told *Microwave News*. The report features procedures for evaluating the potential hazards associated with various types of radar, medical devices, communications systems and heating equipment. In addition, it covers broadband and narrowband survey meters and techniques.

A copy of *A Practical Guide to the Determination of Human Exposure to Radiofrequency Fields* (Report No.119), is available for $25.00 from: NCRP, 7910 Woodmont Ave., Bethesda, MD 20814, (800) 229-2652 or (301) 657-2652. (For more on the work of the NCRP, see *MWN,* J/F86 and M/J92. A list of members of the committee that wrote the report appears in *MWN,* N/D92.)

Opposition to Weather Radar in California Stirs Controversy

Homeowners near a new NEXRAD Doppler weather radar in Ojai, CA, are trying to persuade the National Weather Service (NWS) to move the facility. A lawsuit to force the government to reopen the environmental review process has failed, but in the process, the opponents have stirred controversy over possible health risks from powerful radars.

NEXRAD, or next-generation radars, have been built at, or are planned for, more than 150 locations nationwide. Of these, 116 will be operated by the NWS, 14 by the Federal Aviation Administration (FAA) and 26-30 by the U.S. Air Force, according to Lori Arguelles, a spokeswoman for the National Oceanic and Atmospheric Administration (NOAA), the parent agency of the NWS, in Washington. The radars are being built by Unisys, and design and construction are being coordinated by a Joint System Program Office (JSPO) at NOAA's Washington offices. So far, about 60 of the radars are operating, Arguelles said.

Led by actor Larry Hagman, whose home is about 300 yards from the Ojai installation, the radar's opponents have enlisted broad support since construction began last November. California's two Democratic senators, Barbara Boxer and Dianne Feinstein, have each written to the Department of Commerce—which includes NOAA—asking for a new environmental assessment. Rep. Elton Gallegly, a Republican, whose district includes Ojai, has introduced a bill (H.R.3850) that would require a study by the National Academy of Sciences of health risks from facilities such as the Ojai radar and that would prohibit its operation until the study is completed. And on March 3, Hagman, the former star of the television program *Dallas,* appeared on the *Montel Williams Show,* a nationally syndicated television talk show, to discuss the health risks from the radar. (The producer of the show also lives in Ojai.)

Ojai is in Ventura County, about 50 miles northwest of Los Angeles, and both the city and the county have passed resolutions which say that the radar violates local zoning rules.

The lawsuit, filed in federal court in Los Angeles, alleged that the federal government failed to meet the requirements of the National Environmental Policy Act (NEPA) with the Programmatic Environmental Impact Statement that the JSPO re-

leased in 1984 and the Supplemental Environmental Assessment that was completed in the fall of 1992 (see *MWN,* J/A92).

At a hearing in early February, attorneys for the radar opponents asserted that a temporary restraining order should be granted to prevent operation of the radar, because the JSPO had ignored "significant risks that the project may cause cancer, heart disease and increased incidence of congenital [birth] defects." The opponents introduced an affidavit from Dr. Richard Scribner, an epidemiologist at the University of Southern California in Los Angeles, who also lives in the area. He wrote that recent studies—of ELF EMFs, in particular—establish that non-ionizing radiation can cause cancer. (For an excerpt from Scribner's affidavit, see p.8.) District Court Judge Terry Hatter rejected this reasoning and denied the restraining order.

At a subsequent hearing on a motion from the government to dismiss the lawsuit in its entirety, the radar's opponents focused on procedural violations related to the Ojai site, trying to establish that local officials had been misled by the NWS, explained their attorney, Dale Givner of Oxnard, CA. This approach also failed, and Hatter dismissed the suit on April 4.

Givner told *Microwave News* that Hatter had appeared reluctant to consider the health issues, since this would have meant reopening the environmental review process and could have jeopardized the construction and operation of NEXRAD facilities nationwide. "That's a big ball of wax," he said. An appeal is being considered, Givner said, but he added that, "We have come to the conclusion that the likelihood of winning this in court is remote."

"The science shows us that these radars are safe to use," NOAA's Arguelles told *Microwave News.* Asked whether JSPO's environmental review was adequate, she said: "Judge Hatter thinks so. I would stand by that opinion."

With legal avenues all but exhausted, the radar's opponents are pursuing other solutions. Jim Maiella, Rep. Gallegly's press secretary, said that the head of the NWS, Dr. Elbert Friday Jr., told the congressman in early March that the Ojai NEXRAD radar could be moved if someone could be found to foot the bill—about $500,000. "We were encouraged," said Maiella, noting that area residents, including Hagman, were interested in this option. But when a local paper reported this development, Friday wrote to Gallegly that their conversation had been misrepresented and that "the NWS has no intention or plan to move the [Ojai] Doppler weather radar."

Meanwhile, controversy over the Ojai site is prompting questions in Melbourne, FL, where another NEXRAD facility has been in use since 1991. A March 31 report by Marilyn Meyer in a local newspaper, *Florida Today,* cited residents' concerns over the NWS radar and an older FAA radar in the same region that has come under suspicion as a possible cause of clusters of non-Hodgkin's lymphoma and Lou Gehrig's disease (see *MWN,* J/F92, M/J93 and S/O93).

NEXRAD or WSR-88D radars—which operate at 2.7-3.0 GHz, with 750 kW peak output power—have been controversial in other areas as well. In New York, opposition to a proposed site in Sayville prompted public hearings and a 50-page report from the Assembly's Environmental Conservation Committee, examining possible health risks (see *MWN,* M/A92). The NWS dropped its plans for the Sayville site.

European Research Center in Spain Awaits Funding

The European Bioelectromagnetics Association (EBEA) is proposing a $15 million research center in Spain for laboratory studies on the biological effects of non-ionizing electromagnetic radiation (NIER). The proposed European Bioelectromagnetics Center (EBC), which will possibly be sited in Madrid, would also develop medical applications for NIER, explore possible interaction mechanisms, support epidemiological studies and examine electromagnetic compatibility problems.

Three Spanish government ministries have given their support for the EBC, according to Dr. Jocelyne Leal, founder and former president of EBEA and chair of the project. Leal will now present the proposal to the European Community (EC) for support and funding.

The EC will be asked to provide a construction budget of 1.57 billion pesetas (about $11.5 million) and an equipment budget of 560 million pesetas (about $4 million). Under the plan, the EBC would have a staff of eight scientists, eight tech-

Health Concerns Raised Over Russian Radar in Latvia

The health and environmental effects of four high-power radars installed by the Russian military in Skrunda, Latvia, will be the focus of a conference June 17-21.

The radars were installed 25 years ago as part of an early-warning nuclear defense system. They are at the center of a dispute between Latvian authorities, who want them removed by the end of this year, and the Russian military, which wants to keep them functioning until alternative radars can be installed outside the Baltic states. A compromise calling for their removal in four years has been reached, pending ratification by the Latvian Parliament.

Latvian researchers have suggested that possible adverse health and environmental effects have been caused by the radars. Small-scale epidemiological studies of adults and children showed unspecified complaints. Scientists suspect that the radiofrequency radiation could act to worsen the course of existing diseases. Also, trees near the radar were found to grow more slowly.

The Latvian Academy of Medicine in Riga, 78 miles east of Skrunda, sees the next four years as an opportunity for more studies with animals and among local residents.

The four-day conference, *The Effect of Radiofrequency Electromagnetic Radiation on Organisms,* is being organized by scientists from the University of Latvia in Riga. Papers will address existing and ongoing studies and make recommendations for further work.

Conference participants will arrive in Riga and be taken to the Skrunda area for lectures and a field trip. For more information, contact: Dr. Imants Detlavs, Faculty of Biology, University of Latvia, Kronvalda str. 4, LV1842 Riga, Latvia, (371+2) 325656, Fax: (371+2) 225039.

nicians and 13 support personnel. A site for the center has been donated by the University of Alcalá de Henares in Madrid; the Spanish government, the national phone company and a private foundation funded development of EBC's master plan.

"This will be a one of a kind research center," said Dr. Thomas Rozzell of the U.S. National Academy of Sciences in Washington, who is scientific adviser for the EBC project. The main purpose of the center is to provide a carefully controlled laboratory setting for *in vitro* and *in vivo* experiments. The facilities will be adequate to support 10-12 experiments running simultaneously. Rozzell and others noted that the integrity of laboratory exposure systems has often been questioned, and that the center would provide an opportunity to control and characterize the EMF environment rigorously.

The center could help "save huge amounts of money," Leal told *Microwave News,* "because all the facilities, equipment and technical and supporting staff necessary for up-to-date studies will be in one place." Leal said she could not yet predict how soon construction of the center might begin. In 1982, Leal and Dr. Jose Delgado, both of the Hospital Ramón y Cajal in Madrid, published the results of the first studies to show that weak, pulsed, low frequency magnetic fields can affect the development of chick embryos (see *MWN,* Mar83).

The master plan for the EBC, which was published last year, includes a 130-page discussion of the state of the science. A second edition of the plan is being prepared. For more information, contact: Dr. Jocelyne Leal, Dept. Investigación, Hospital Ramón y Cajal, Carretera de Colmenar Km. 9, 28034 Madrid, Spain, Fax: (34+1) 358-1275.

RFI from Ham Radio Prompts Health Worries and Lawsuit

A dispute over radiofrequency interference (RFI) caused by an amateur radio transmitter in Little Egg, NJ—and concern that the radio signals may cause health problems—has escalated into a lawsuit alleging "electronic trespass."

Marlene and Michael Morris and Robert Schnabel complain that their telephones and televisions and an electronic doorbell pick up signals from the transmitter operated by Anthony and Sharon Marino, whose home is between the Morris and Schnabel residences. In their suit, they contend that the RFI has caused emotional distress and loss of property value. They do not allege that the RF radiation has caused health problems, but Marlene Morris said the case is motivated by health concerns.

"I'm doing this because I fear for what I'm going to find out in ten years," Morris told *Microwave News*. "When someone can tell me for sure that this radiation doesn't cause cancer, I'll be satisfied." She explained that the interference "is just an indication that the signals are there."

The Marinos' attorney, Judith Schneider of the Marlton firm of Rawle & Henderson, told *Microwave News* that, "We have tried to resolve this amicably." She said that it is the affected equipment that is faulty, not the Marinos' radio. The Federal Communications Commission (FCC) has inspected the Marinos' home and determined that they are operating legally, Schneider added. The Marinos have tried unsuccessfully to shield the devices in their neighbors' homes.

Schneider said she will argue in court that, "Interference claims such as these are the exclusive jurisdiction of the FCC." The court has agreed to allow the American Radio Relay League (ARRL)—the leading amateur radio organization, based in Newington, CT—to file an amicus brief on behalf of the Marinos.

"This case should never have gone this far," said Christopher Imlay of the Washington firm of Booth, Freret & Imlay, who represents the ARRL. He told *Microwave News* that the New Jersey courts—and all other state and federal courts—"clearly have no jurisdiction" to hear cases like this one. The ARRL brief has not yet been filed.

The case was filed in state Superior Court for Ocean County, in Toms River, in 1991. It was close to being tried last fall, when the lawyer representing the Morrises and Schnabel backed out of the case in a dispute over payment of his fees. The plaintiffs are now represented by Joseph Quinn, who is with the firm of Pringle & Quinn in Belmar.

Thériault Abstract

To determine whether occupational exposure to magnetic fields of 50/60 Hz was associated with cancer among electric utility workers, the authors used a case–control design nested within three cohorts of workers at electric utilities: Electricité de France-Gaz de France, 170,000 men; Ontario Hydro, 31,543 men; and Hydro-Québec, 21,749 men. During the observation period, 1970-1989, 4,151 new cases of cancer occurred. Each participant's cumulative exposure to magnetic fields was estimated based on measurements of current exposure of 2,066 workers performing tasks similar to those in the cohorts using personal dosimetry. Estimates were also made of past exposure based on knowledge of current loading, work practices, and usage. Workers who had more than the median cumulative exposure to magnetic fields (3.1 microtesla (μT)-years) had a higher risk for acute nonlymphoid leukemia (odds ratio (OR) = 2.41, 95% confidence interval (CI) 1.07-5.44). The same observation holds for acute myeloid leukemia (OR = 3.15, 95% CI 1.20-8.27). There was also an elevated risk for mean exposure above 0.2 μT (acute nonlymphoid leukemia, OR = 2.36, 95% CI 1.00-5.58; acute myeloid leukemia, OR = 2.25, 95% CI 0.79-6.46). However, there were no clear dose–response trends with increasing exposure and no consistency among the three utilities. Men whose cumulative exposure to magnetic fields was above the 90th percentile (15.7 μT-years) had an elevated risk for brain cancer (OR = 1.95, 95% CI 0.76-5.00) that was not statistically significant. No association with magnetic fields was observed for any of the other 29 types of cancer studied, including skin melanoma, male breast cancer, and prostate cancer. Controlling for potential confounding factors did not change the results. G. Thériault, M. Goldberg, A. B. Miller, B. Armstrong, P. Guénel, J. Deadman, E. Imbernon, T. To, A. Chevalier, D. Cyr and C. Wall, "Cancer Risks Associated with Occupational Exposure to Magnetic Fields Among Electric Utility Workers in Ontario and Quebec, Canada, and France: 1970-1989," *American Journal of Epidemiology, 139*, pp.550-572, 1994. (Reprinted with permission.)

McGill University, who led the research effort, told *Microwave News*. "Unfortunately," he added, "the analysis shows a lack of dose–response and a heterogeneity among the three utilities."

Dr. Anthony Miller of the University of Toronto, who collaborated with Thériault, agreed: "We are now closer to regarding this as a real association." In an interview, he said that the study was an important effort because of the large number of workers surveyed, the detailed assessment of exposures and the investigation of possible confounders. Dr. Marcel Goldberg of INSERM, the French national health research institute in Paris, was the third principal investigator.

"The results support the link I first identified in 1982 among EMF-exposed workers and later found among amateur radio operators," Dr. Samuel Milham Jr., a consulting epidemiologist based in Olympia, WA, told *Microwave News*. "This is not a chance finding" (see *MWN,* J/A82, N/D87 and J/F89).

"The methods were excellent, but the results are murky," Dr. David Savitz said in a telephone interview. Even so, Savitz observed that the Thériault study "increases the evidence that magnetic fields are linked to cancer." Savitz, an epidemiologist at the University of North Carolina School of Public Health, Chapel Hill, is completing his own major study of cancer among utility workers for the Electric Power Research Institute. He said that he has drafted a paper and plans to submit it for publication soon.

Thériault and coworkers found no connection between magnetic field exposure and male breast cancer, prostate cancer or skin melanoma, three cancers which have also been linked to EMFs in previous studies. Nor did they see a link between EMFs and all cancers combined. There was no cancer risk associated with exposure to electric fields, but Thériault noted that he was planning a further analysis of the electric field data.

The investigators controlled for workers' exposures to known and possible carcinogens—including ionizing radiation and chemicals such as benzene. There was little change in the observed risks when these agents were taken into account. They also controlled for socioeconomic status (SES). For astrocytomas, the team found that by analyzing data according to a "white-collar/blue-collar variable," instead of SES, the risk was reduced from 12 to 1.5 times the expected rate.

The study included 4,151 new cases of cancer from 1970 to 1989 among 170,000 employees from EDF, 31,543 from OH and 21,749 from HQ. Among these were 140 cases of leukemia (47 AML) and 108 cases of brain tumors (41 astrocytomas).

Large Variation Among Utilities

The leukemia risk varied widely among the three utilities. The OH employees appeared to be at a significantly greater risk—those with a greater than median cumulative magnetic field exposure had 38 times the chance of developing AML and a sixfold greater risk of ANLL compared to less-exposed workers. When the data from the three utilities were pooled, the risks fell to three times the expected rate for AML and two-and-a-half times for ANLL. EDF employees faced less than a twofold increased risk of either type of leukemia. For HQ employees, the numbers were too small to allow a statistical analysis.

The researchers noted that for all leukemia there was, in general, a pattern for "an association in OH, a weaker one in EDF and no association in HQ." They added that, "Given this lack of consistency, the combined odds ratios should be interpreted cautiously."

One possible explanation for the interutility variation is that the EDF cohort did not include retirees. Both Thériault and Miller pointed out that much of the leukemia observed in Canada was among older subjects. "By not following French retirees," Thériault said, "We have lost important cases. That could explain the difference."

Miller, the chairman of the Department of Preventive Medicine and Biostatistics at the University of Toronto medical school, said that, taking into account the variation in the follow-up period, "It's not clear there is a big difference among

EPRI on Thériault Study

Reprinted below are excerpts from the Electric Power Research Institute's (EPRI) comments on the Thériault study. They were released on March 31.

Based on the limited information presented, it appears that mean and cumulative magnetic field exposures at EDF were notably lower [than] at the other two utilities. In addition, the job definitions and the exposures within jobs varied significantly among the three companies....

This large and comprehensive study adds substantial new data on occupational exposures in the utility industry and to the consideration of an association between occupational exposure to EMF and cancer.

Among the many strengths of the study are its large sample size, extensive measurements, development of a specific *a priori* hypothesis, detailed assessment of potential confounding by other occupational exposures, and an experienced team of investigators. Also, all analyses were well conceived and implemented, including the choice of cut-points based on the overall exposure distribution.

Several issues in the study design and analysis are problematic. In terms of study design, cases and controls were drawn from three cohorts that were defined and followed up quite differently....

Differences in the cohort definitions and in the levels of exposure make interpretation of the combined results problematic....

In summary, despite many methodological improvements, the results of the Canada–France study are not clear-cut. While the study provides some evidence for the hypothesis of an EMF association with leukemia (in particular AML) and, to a lesser extent, with brain cancer, the authors conclude that "Despite the attempts made in this study to achieve adequate power, definitive evidence of an association between exposure to magnetic fields and leukemia and brain cancer has not been obtained." The lack of an exposure–response relationship and inconsistencies in results among utility cohorts underscore our limited understanding of the risks of exposure to EMF among utility workers and suggest the need for further analyses and additional studies.

Utilities Plan No Change in Policies for EMF Exposures

The three utilities that sponsored the Canadian–French occupational study have no plans to change their policies for workplace or public EMF exposures in light of the study's findings.

"Our recommendation to senior management is that we don't have enough scientific evidence to justify changes in daily working practices—that is, to limit duration or intensity of exposures," Dr. Michel Plante, a Hydro-Québec medical adviser and the Montreal-based utility's liaison to the Thériault study, told *Microwave News*. "Nor is there evidence to change the general exposure levels for the public from Hydro-Québec equipment at this time," he added. Plante cited the lack of "definitive evidence" of a cancer link, but stressed that, "We have the responsibility to do more research."

Ruth Greey, the senior EMF consultant at Ontario Hydro, said in an interview that the Toronto-based utility plans "no changes to what we are doing now." But, she noted, the policy would be reviewed "if a causal relationship between EMFs and cancer is found." She pointed out that the utility had already taken "a precautionary approach" to power line siting.

In a published statement, Electricité de France stated that EMF mitigation strategies are not "justified" by the new results. Although the study lends a "plausibility" to the link between magnetic fields and leukemia and brain tumors, "The problem of the carcinogenicity of EMFs remains a research problem," according to Electricité de France.

the utilities."

Nevertheless, Milham questioned whether the data for the three utilities should have been combined. "It helped overcome the problem of small numbers, but it glosses over the large variations in exposures and case follow-up in the three groups," he said. "I hope they will release a detailed, separate analysis for each utility."

The Canadian–French study features the most detailed estimates of worker exposures ever attempted for the utility industry. For each job category, a time-weighted average exposure was estimated by having a sample of workers—2,000 in all—wear Positron personal meters for a full five-day work week. A worker's cumulative exposure was estimated by combining the exposure data with time spent doing specific jobs.

Relative risks were calculated for those workers with higher than the median cumulative exposures compared to those in the lower half. In addition, the cancer risks were estimated for the 10% of workers most exposed.

Mean magnetic field exposures were generally less than 10 mG, though there were some exceptions. For example, OH hydroelectric operators had mean exposures of 54 mG.

The exposure assessments were not identical for the three utilities. But Thériault maintained that, "There was not enough of a difference in exposure assessment to explain the variation in results." He said that he thinks they may be able to explain the differences with further analysis.

Thériault noted that the measurement data made clear to him that job title was not sufficient to define exposure for a category of workers. "The job site is also important," he said. "Linemen in one part of the country have different exposures from those in other parts." He also cited the variation in exposures at different power stations.

Compatible with Previous Studies

The Thériault group argued that its results are "compatible" with those of the two previous studies for which extensive EMF measurements were also carried out.

Jack Sahl of Southern California Edison in Rosemead and coworkers did not find an association between occupational EMF exposure and leukemia, brain cancer or lymphoma (see *MWN,* M/A93 and J/A93). But the Canadian and French researchers wrote that this apparent inconsistency could be explained by the fact that Sahl had not looked at the risk by leukemia subtype. "Had we limited our analysis to all leukemia, we would have observed a somewhat elevated but not statistically significant odds ratio for the group with exposure above the median level...and, therefore, our conclusions would have been similar to those of Sahl et al."

In an earlier study, Dr. Birgitta Floderus and colleagues at the National Institute of Occupational Health in Sweden found an elevated risk of chronic lymphoid leukemia (CLL) (see *MWN,* S/O92). Thériault and coworkers speculated that the absence of an association between EMFs and CLL in their study might have resulted from the lack of follow-up of older, retired workers at EDF. "This...diminished our ability to observe an association with [CLL] if it did exist," they wrote.

When asked what should be done next, Savitz argued that epidemiological research still has an important role to play, but he cautioned that, "I don't think we are going to learn more from the kind of epidemiology Thériault and I have done, because these methods have not produced clarity so far. We need to do either different epidemiology or additional lab work."

Thériault pointed to the need to control for exposures outside the workplace in occupational studies. More generally, he advised: "Increase and accelerate the research. We may be dealing with a small risk, but in the future non-ionizing radiation is bound to be used a lot more and it is important to know whether there are health impacts."

Detailed Report Available Soon

A technical report by the Canadian–French research team, with more details than are published in the *American Journal of Epidemiology,* will be available the week of May 9 or soon thereafter, Ruth Greey, the senior EMF consultant for Ontario Hydro, told *Microwave News*. The report, which is more than 200 pages long, will contain both electric and magnetic field data, according to Dr. Michel Plante, a medical adviser at Hydro-Québec.

The report will cost about $75 (Canadian). To order, contact: Ruth Greey, Ontario Hydro, 5775 Yonge St., Toronto, ONT M2M 4J7, Canada, (416) 590-2424.

Transient EMFs May Be a Key to the Mechanism of Interaction (continued from p.1)

of McGill's Department of Occupational Health in Montreal told *Microwave News*. Héroux designed the Positron EMF exposure meter used in the Canadian–French study.

In addition to measuring electric and magnetic fields, the Positron meter and its prototype (the IREQ meter) also monitor high frequency transients by sampling signals in the 5-20 MHz frequency range. "Such transients are similar to the sparks on synthetic fabrics in dry air," Héroux explained.

Dr. Ben Armstrong, a biostatistician at McGill's Department of Occupational Health, who is leading the analysis of the transient data, declined to disclose any of the results. But one source, who asked not to be identified, said that the relative risks associated with transient exposures are higher than those associated with 50/60 Hz magnetic field levels. Armstrong said that the transient results have been submitted for publication.

In an effort to explain why his study on 50/60 Hz fields did not provide clear-cut results, McGill's Thériault speculated that, "The right EMF exposure parameter may not have been measured." The transient results suggest that high frequency EMFs may be another important index of exposure—though Thériault cautioned not to overinterpret them because, "It is difficult to understand what we are measuring."

As Dr. Richard Lovely, a senior research scientist at Battelle Pacific Northwest Labs in Seattle, pointed out in an interview, "Measures of magnetic field transients may be more important than the time-weighted average, since transients can affect important biological endpoints such as melatonin" (see *MWN,* M/J93).

A new paper by a team from Sweden's National Institute of Occupational Health (NIOH) and from the M.D. Anderson Cancer Center in Smithville, TX, underlines the potential importance of transients. The Swedish–American team found that chemically treated mice exposed to *intermittent* 50 Hz magnetic fields had significantly more skin tumors than those exposed to *continuous* 50 Hz fields and that the tumors appeared more quickly than in mice treated with the chemical carcinogen only. There also appeared to be a dose–response relationship in terms of tumors per affected animal. The findings corroborated results by the same team published last year in *Carcinogenesis* showing that *continuous* 50 Hz magnetic fields had essentially no effect on the development of skin tumors in a different strain of mice.

The results on intermittent exposures were first presented at last fall's Department of Energy (DOE) review of EMF research in Savannah, GA, by two NIOH researchers, Dr. Bo Holmberg, based in Solna, and Dr. Kjell Hansson Mild, based in Umeå. Mild explained that turning the fields on and off every 15 seconds generates complex EMFs, including high frequency transients. "It's not clear what the [biologically important] exposure is: Is it the intermittency of the field or is it the transient field or is it both?" Mild asked. "We have to dig deeper into this."

In Savannah, Holmberg told *Microwave News* that he could not explain his results but said, "My first bet would be the transients." The new results appear in the February 1994 issue of *Carcinogenesis*. They were deemed important enough by the editors of the journal to be published as an "accelerated paper."

A second report presented at the DOE meeting also highlighted the need to study transients. Dr. Jeffrey Guttman of Enertech Consultants in Campbell, CA, said that he had found preliminary indications that houses classified as "very high current configurations" (VHCC) under the Wertheimer–Leeper coding scheme "had a greater number of externally generated transients" than other houses—though he warned that this finding was based on a small number of observations. VHCC homes are those which have been most associated with childhood cancer in a number of different epidemiological studies.

In a 1990 paper, Armstrong, Thériault and Jan Deadman, also of McGill, reported that a series of measurements with the Positron and IREQ meters indicated that there was a very poor correlation between measures of exposures to power frequency magnetic fields and to high frequency transients. This finding suggests that the relative risks for exposures to 50/60 Hz fields and transients could be quite different.

In an earlier measurement survey with the Positron and IREQ meters, Deadman and a team of McGill and Hydro-Québec researchers reported that "utility workers' exposures were significantly higher than background levels...by a factor of 171 for high frequency transient electric fields."

Armstrong noted that the analysis of the transients was not part of the joint utility study, and only Hydro-Québec and Electricité de France had collected the data.

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UPDATES

CELLULAR PHONE LITIGATION

Motorola Seeks Dismissal...A motion to dismiss the cellular telephone lawsuit brought by Motorola employee Robert Kane will be argued before Illinois Circuit Court Judge Joseph Casciato this spring. Kane alleges that exposure to RF radiation while testing a prototype cellular phone antenna caused his brain tumor (see *MWN,* J/F94). Motorola's attorneys contend that Kane's complaint fails to make a plausible case that the company, or the employees who are also named as defendants, were aware that the tests "posed a high probability of serious harm." Court papers filed in support of Motorola's motion also argue that the case should be dismissed because the Illinois workers' compensation act provides exclusive remedy for on-the-job injuries: "The act clearly prohibits common law or statutory actions against an employer." In their legal papers, Kane's attorneys, led by Gina Fietsam of the Chicago firm of Holstein, Mack & Klein, repeat the allegation that Kane's supervisor, Thomas Hull, asked Kane whether he felt heat while using the prototype antenna. This, and research on RF radiation deposition in the human head that was published by Motorola's Dr. Quirino Balzano, "unquestionably demonstrate Motorola's recognition of the potential for dangerous effects from electromagnetic radiation," states the memorandum they filed opposing dismissal. Motorola's brief also argues that Kane's complaint never states "that his testing of the prototype phone actually caused his brain tumor. This failure to allege causation in and of itself dooms plaintiffs' entire complaint." Kane's attorneys respond: "Plaintiffs have alleged all essential elements of each cause of action. Defendants' knee-jerk motion to dismiss should be denied in its entirety." Motorola is represented by Jeffrey Cashdan of the Chicago firm of Kirkland & Ellis.

COMPATIBILITY & INTERFERENCE

Assessing EMI Risks for Fly-by-Wire... Tests by the U.S. military indicate that "long-standing concerns that fly-by-wire flight control systems are inherently vulnerable to microwave radiation are unfounded," Bruce Nordwall reports in *Aviation Week and Space Technology* (February 14, 1994). Fly-by-wire systems, which use electronics to operate critical aircraft control systems, have become common in newer military and commercial airplanes, heightening EMI worries (see *MWN,* J/F89). The Radio Technical Commission for Aeronautics (RTCA) in Washington is currently studying the EMI risks that portable electronic devices such as laptop computers and CD players could pose to all avionics, including fly-by-wire systems (see *MWN,* M/J93). The military, on the other hand, is examining possible EMI from high-intensity radiation, which could include radars or EMP generators. In one phase of the tests, a digital flight control computer was exposed to microwaves at strengths from 1.4 kV/m to more than 39 kV/m, over a range of RF frequencies. The systems tested were only susceptible "at very high power levels, well above those produced by commercial radar installations," according to the magazine. The study, a collaborative effort among researchers at the Naval Air Warfare Center in Warminster, PA, the Air Force's Phillips Lab in Albuquerque, NM, and the Ar-

my Research Lab in Adelphi, MD, included low-power tests designed to find weaknesses in the EMI shielding. Nordwall also notes that a fiber-optic data bus—generally considered "EMI proof"—was disrupted, "because the optoelectronics were not shielded."

EPIDEMIOLOGY

Research Summaries...A new loose-leaf report from the Electric Power Research Institute (EPRI) aims to provide a quick, easy reference to the results of dozens of major EMF epidemiological studies. So far, the binder includes 27 summaries, covering research up to 1990; another installment, which will make the collection at least as current as the 1992 Swedish residential and occupational studies (see *MWN,* S/O 92), should be available late this year, said Robert Banks of Robert S. Banks Associates Inc. in Minneapolis, which prepared the report for EPRI. After that, updates are planned for about once a year. "The idea was to provide an easy-to-read, comprehensive introduction to the science," said Banks. The summaries run two to five pages, and most include charts with odds ratios or other key results. The introduction to the report notes that, "Each summary was submitted to the primary author for review and all comments received have been incorporated." *EMF Epidemiologic Summaries* (Report No. TR103040) is available for $200; prices for the updates are not yet set. Two additional booklets, *Fundamentals of Epidemiology: Parts 1 and 2* (BR103324 and BR103325), are included as an appendix. These provide an overview of the science of epidemiology and a primer on the statistical methods that are used. They are also available separately; single copies are complimentary. Contact: EPRI Distribution Center, 207 Coggins Dr., Pleasant Hill, CA 94523, (510) 934-4212.

EXPOSURE ASSESSMENT

EMFs from Incubators... Researchers in both the U.S. and Sweden have found high EMFs in incubators commonly used in hospital nurseries for premature babies. Drs. Charles Polk of the University of Rhode Island in Kingston and Shakikant Mehta of Roger Williams Hospital in Providence, RI, measured maximum magnetic fields of 107-289 mG three-quarters of an inch above the bed surface in three different types of incubators. The fields were highest at one end and lowest at the other in all of the incubators (the infants can be placed with their heads at either end). Dr. Gert Anger of the Swedish Radiation Protection Institute in Stockholm, Sweden, tested four different types of incubators from the Karolinska Hospital's neonatal division. In three, the fields were 10-20 mG in a small region of the bed and slowly dropped off to 2-3 mG away from that area. In the fourth, the fields reached 48 mG in one location and exceeded 10 mG over the whole bed. Anger told *Microwave News* that there may be several reasons for the difference between his and Polk's readings: His measurements were taken at two inches above the bed surface because his meter had a larger coil than Polk's, and Sweden uses 230 V, compared with 110 V in the U.S., thereby requiring less current for the same power. In both studies, the researchers were unable to determine the source of the fields because the incu-

bators were only available temporarily. Polk suspects that the high levels are caused by the blower motor, since the space above the bed is heated by hot air circulation and the fields are distributed unevenly. If this is correct, "it should not be particularly difficult to reduce field levels by using different fan motors, by magnetic shielding or by motor relocation," Polk concluded. Anger concurred, explaining that it should be possible to reduce exposure by increasing the distance between the bed and the source of the fields. "These fields are much higher than in the average home away from appliances," Polk noted in a presentation at the *DOE Annual Review of Research on Biological Effects of EMFs,* held October 31-November 4, 1993, in Savannah, GA. Polk and coworkers are preparing a paper for publication. Anger presented his findings at the *3rd Nordic Workshop on Biological Effects of Low Frequency Electromagnetic Fields,* held March 14-15, 1994, in Umeå, Sweden. A paper will be published by the Radiation Protection Institute in mid-April, he said.

MEASUREMENTS

P-1140 Protocol Approved... The U.S. measurement protocol for video display terminal (VDT) emissions received final approval from the IEEE Standards Board on March 17. Known as P-1140, it is largely the same as the Swedish MPRII rules—except that it does not include limits. MPRII, which was completed in 1990, has an appendix with technically achievable guidelines, and these have become the *de facto* international EMF emissions standard for computer manufacturers. Several times during the development of the U.S. protocol, emissions limits were added and then dropped. The P-1140 working group decided that any limits would be beyond its scope, according to Dheena Moongilan of AT&T Bell Labs in Holmdel, NJ, who chaired the panel. Among the other differences between the two protocols, the most significant is that P-1140 requires fewer measurement points. For a time, the working group, which was set up in 1987, attempted to write a measurement protocol for EMFs from *all* types of electronic equipment, but this effort was ultimately abandoned. (For more on the development of P-1140, see *MWN,* J/A87, M/A88, M/J89 and S/O90.) Copies of *P-1140—Standard Procedures for the Measurement of Electric and Magnetic Fields from VDTs from 5 Hz to 400 kHz* are available for $27.00 (plus $4.00 handling) from: IEEE, 445 Hoes Lane, Piscataway, NJ 08855, (800) 678-4333.

New ELF/VLF and RF/MW Meters... Holaday Industries Inc. has introduced an ELF/VLF electric field meter that is "specifically designed to meet the MPRII VDT measurement protocol," according to the company's Dave Baron. The HI-3638, covering 5 Hz to 400 kHz, features fiber optics to isolate the sensor; it can be used with an optional interface for computerized or automated testing. The HI-3638 sells for $2,395, which includes a digital readout. Holaday has also introduced an updated RF/MW measurement system, designated the HI-4000. The system includes two isotropic probes: the HI-4422 ($4,500), which covers 10 kHz to 1 GHz, and the HI-4450 ($9,500), which covers 80 MHz to 40 GHz; both can be

used with the same digital readout or computer interface as the HI-3638. An upgrade of the company's 3000 series, the 4000 system also features fiber-optic isolation of the probes. "The ability of probe connections to perturb the field that is being measured has long been a subject of debate," Baron pointed out, "and this technology should remedy the problem." For more information, contact: Holaday Industries, 14825 Martin Dr., Eden Prairie, MN 55344, (612) 934-4920.

MEETINGS

EBEA Papers... Abstracts of the 148 papers presented at the *2nd Congress of the European Bioelectromagnetics Association* (EBEA), which met December 9-11, 1993, in Bled, Slovenia, are now available. The proceedings, however, will not be published until later this year. The abstracts can be ordered from: Secretariat, EBEA Congress, University of Ljubljana, Faculty of Electrical and Computer Engineering, Trzaska 25, 61000 Ljubljana, Slovenia. The cost is 20 German marks (approximately $12.00 U.S.).

BEMS Special Sessions... The program for the Bioelectromagnetics Society (BEMS) meeting in Copenhagen, Denmark, includes a "Symposium on Epidemiological Studies of Power Fields in North Europe" on June 16 and a "Workshop on the Safety of Mobile Communications" on June 17. For more information, contact: BEMS, 120 W. Church St., Frederick, MD 21701, (301) 663-4252.

VDTs

Pregnancy Studies Reexamined... Nearly all of the occupational epidemiological studies conducted to date have been flawed by the lack of "a clear definition of exposure," according to Dr. Vincent Delpizzo of the Australian Radiation Laboratory in Yallambie. In a review of 21 studies, to be published next fall in the *American Journal of Industrial Medicine,* Delpizzo writes that the "most likely" cause of the adverse pregnancy outcomes observed was ELF EMFs. He bases this view on the 1992 Finnish study (see *MWN,* M/A92, M/J92 and J/F94), and on studies that have found an association between reproductive problems and magnetic fields from sources other than VDTs. These include studies by Dr. Nancy Wertheimer and Ed Leeper on electric blankets and ceiling cable electric heating systems (see *MWN,* M/J86 and N/D88) and by Dr. Jukka Juutilainen on residential exposure to power line magnetic fields (see *MWN,* M/A92). Delpizzo does not recommend further VDT epidemiological studies, however, because VDT emissions have been reduced in recent years. He concludes that studies of the effects on pregnancy of exposure to higher levels of ELF EMFs are needed....Italian researchers led by Fabio Parazzini at the Mario-Negri Institute of Pharmacological Research in Milan have a somewhat different point of view. Writing in the *Journal of Epidemiology and Community Health (47,* pp.265-268, 1993), they conclude on the basis of a meta-analysis of nine case–control studies, that VDTs pose no major risk to pregnant women. They agree with Delpizzo in cautioning that other sources of magnetic fields may be more important than VDTs.

CLASSIFIEDS