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The Deep Roots of Public Skepticism

NCI Study Links Appliance Use and Childhood Leukemia But Institute Calls EMF Effect "Unlikely"

Children's use of several types of electrical appliances was associated with significant increases in the risk of leukemia in a new study by the National Cancer Institute (NCI). But the NCI argues that it is "unlikely" that electromagnetic fields (EMFs) are the cause.

The NCI study on appliances and acute lymphoblastic leukemia (ALL) used the same cases and controls as its 1997 power line study. For electric blankets, hair dryers and video games, most of the increases in risk were statistically significant, including all those for children with the most years of exposure. There was, however, no clear increase in risk with years of exposure (see table, p.12).

Watching television and using curling irons, microwave ovens or sound systems with headsets were also linked to some significant increase in the risk of ALL, the most common form of leukemia among children.

The NCI team also found some increased risks among children whose mothers used certain appliances during pregnancy. Children whose mothers had used electric blankets while pregnant had a 59% higher risk of ALL, a statistically significant finding. Significant risks were also found for children whose mothers had used heating pads or humidifiers during pregnancy.

"The inconsistencies in the data and the lack of a dose-response trend make us think that EMFs are not likely to be the cause," Dr. Elizabeth Hatch of the

(continued on p.12)

More Calls Mean More Headaches in Scandinavian Cell Phone Study

Heavy users of cellular phones had more headaches and other subjective symptoms in a recent Swedish-Norwegian study. Complaints increased along with calling time, indicating a clear dose-response trend.

About 12,000 Swedish and 5,000 Norwegian mobile phone users took part in the study, which was led by Drs. Kjell Hansson Mild of Sweden's National Institute for Working Life (NIWL) in Umeå and Gunnhild Oftedal, now with the Norwegian University of Science and Technology in Trondheim.

Dose-response trends were observed for a variety of symptoms. "The trends reached statistical significance for warmth sensations behind and on the ear, headache, fatigue and burning sensations in the facial skin," Mild told *Micro-wave News*.

In Norway, for example, when compared to those who used a mobile phone less than 2 minutes a day, the risk of headaches doubled for those with 2-15

(continued on p.11)

« Power Line Talk »

A lobbying campaign to save the **DOE EMF research** program appears to be having some success. There is now a chance that the program may not close down in September, as DOE had originally planned (see *MWN*, M/A97). On April 2, **Shirley Linde** and Dr. **Peter Bingham** of the National EMF Advisory Committee (**NEMFAC**) met with **Dan Reicher**, the DOE Assistant Secretary for Energy Efficiency and Renewable Energy, to plead the case. Bingham argued that, "There is a convergence of opinion that the work should continue," he later told *Microwave News*. In an interview, Bingham pointed to the incontrovertible evidence of EMF cellular effects. "We must persevere and understand this more and decide the public health implications," he said. Bingham, who recently retired from **Philips Labs** in Briarcliff Manor, NY, explained that, "Within the company, a number of my colleagues do believe we owe it to our customers to ensure that our products are safe." Speaking at the NEMFAC meeting in Washington on May 8, Bingham echoed what he had told Reicher: It would be a "national disgrace" if the program was not kept in place. At the April 2 meeting, Linde presented Reicher with more than 1,000 signatures of breast cancer activists and survivors who support more DOE EMF research. The petitions had been collected by **Nancy Evans** of San Francisco, a member of the Breast Cancer Fund's board. Linde, the chair of NEMFAC, said that Reicher appeared to be receptive and that she was cautiously optimistic. But, she stressed, Reicher had made no promises to keep the program in place. Reicher has also been the target of a letter-writing campaign. On April 24, Rep. **Nancy Pelosi** (D-CA) wrote to Reicher to point out that closing down the DOE program "could cause the U.S. to lose the immeasurable expertise of these scientists and their historical understanding of EMF exposure and health effects." Dr. **Ross Adey** of the University of California, Riverside, who has long received DOE support for his EMF research, had made a similar case in a March 28 letter to DOE Secretary **Federico Peña**. His letter also argued that knowledge of potential hazards could lead to therapeutic applications of EMFs. The decision on whether to save the program has been complicated by Peña's decision to leave the DOE in June and by the fact that President Clinton has not yet named a successor. In a May 14 reply on behalf of Peña, Reicher told Adey that, "[I]n light of remaining public concern as well as new scientific results, some of which you outline in your letter, we are presently considering possibilities for a continued federal EMF research effort."

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The Scientific Advisory Committee for **EPRI's** EMF research program has some new members. In fact, half of the panel has joined in the last three years. New since 1995 are Drs. **Jennifer Kelsey** of Stanford University in Stanford, CA, **Susan Preston-Martin** of the University of Southern California in Los Angeles, **Charles Stevens** of the Salk Institute in La Jolla, CA, **Roger Webb** of the Georgia Institute of Technology in Atlanta and **Jerry Williams** of the Johns Hopkins Oncology Center in Baltimore. EPRI refused to say exactly when the new members joined the committee. After discussing the matter with the head of EPRI's

EMF research, Dr. **Leeka Kheifets**, spokesperson **Barbara Klein** told *Microwave News* that this information is "confidential." She explained that, "We don't just give it out." Stevens, who chaired the **National Academy of Sciences** panel on EMFs that issued its report in 1996, is also a member of **Motorola's** advisory board on product safety (see *MWN*, J/F98).

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It's now a matter of law in California: You can't file a civil suit over a power line EMF personal injury claim. In 1996, the state's Supreme Court ruled in the **Covalt** case that the **California Public Utilities Commission** (CPUC) had sole jurisdiction over EMF property disputes (see *MWN*, M/J95, S/O95 and N/D96), and an appellate court later applied the same logic to the **Ford v. PG&E** brain cancer case (see *MWN*, M/A95, M/A97 and J/F98). On March 18, the California Supreme Court refused to consider an appeal in *Ford*, leaving the CPUC in charge of personal injury cases as well. But it is unclear what impact this will have beyond the borders of California. On March 20, an Indiana judge rejected the idea that the **Indiana Utility Regulatory Commission** should decide all EMF claims in that state. Lawyers for **Indiana Michigan Power Co.** called the *Covalt* decision "thorough and well reasoned," but could not convince the Marshall County Circuit Court to follow the California courts and dismiss the suit by **Raymond and Tina Runge** (see also p.5).

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Summaries of the research projects on EMF bioeffects sponsored by the **RAPID** program are now available on the Internet. Go to: <www.niehs.nih.gov/emfrapid/html/resinfo.htm>.

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The **breast cancer** studies by **Germany's** Drs. **Wolfgang Löscher** and **Meike Mevissen** were the subject of the most contentious exchanges at the NIEHS' *in vivo* EMF research symposium, held in Phoenix, April 6-9. Some progress was made—for instance, there was general agreement that while Löscher and Mevissen had not seen a significant increase in tumor incidence or in tumor multiplicity (number of tumors per animal), they had found a flux-dependent increase in tumor growth. But a number of those in Phoenix do not think that the observed increase points to any real health hazard. At one point, Dr. **Gary Boorman**, who is more and more openly skeptical that EMF animal studies show any cancer risk, presented a table showing that out of six initiation-promotion studies conducted at exposures of 50 Hz and 1 G, five had found no effects. But one study was quickly deleted because it had, in fact, been done at 100 mG. Boorman, who directs the EMF RAPID program at the NIEHS, apologized, saying that he had been up until 3 a.m. the previous night assembling the list. Then Dr. **Larry Anderson** dismissed another of the studies, which he had himself conducted at the Battelle labs in Richland, WA. Anderson pointed out that in this 13-week exposure study, the controls had received too much initiator (the carcinogen DMBA) to leave room to show any promoting action of the magnetic field (see *MWN*, M/A98). Boorman's tally

was now three of four showing no effect. Löscher was not pleased with Boorman's table: "You left out the dose-response studies. What is the chance that the dose-response [we found] is just nothing?" he asked. "I think it's possible," Boorman replied. Some, like Dr. **Jerry Williams** of Johns Hopkins University in Baltimore, argued that chronic bioassays were "more relevant" than initiation-promotion studies and that those bioassays had essentially shown no increased risk from EMF exposure. Others disagreed. Dr. **Hiroshi Yamasaki** of the International Agency

for Research on Cancer in Lyon, France, said that the DMBA studies are "very important, because we are all exposed to carcinogens." In any case, he told *Microwave News*, "The German studies are too credible to throw away." For his part, Williams said in an interview that, "If EMFs have a biological effect, it is small, subtle and complex." When it was time to go home to Hannover, Löscher commented that he had been "very frustrated, because people tried to introduce a false interpretation to our data." Still, he said, it had been "a constructive meeting."

The Talk of Phoenix and Charleston: Searching for "Real World" Transients

"The more careful we are to make sure that the exposures are sinusoidal—with no transients—the less and less effects we see. It's almost blatant," said Dr. Larry Anderson at the third, and last, NIEHS science symposium,* held in Phoenix in April.

Anderson, of the Battelle labs in Richland, WA, made his comments during a discussion of EMFs and melatonin. The 40-odd participants agreed that while controlled laboratory experiments on humans and animals have yielded mixed results, all five observational studies of humans exposed to EMFs at work or at home do show a reduction in melatonin levels (see *MWN*, M/A97).

This distinction between such laboratory and environmental exposure studies parallels that between animal and epidemiological studies of EMFs and cancer. Overall, both residential and occupational epi studies show a small but consistent EMF-cancer risk, but controlled animal experiments tend not to. At the NIEHS *in vivo* effects symposium in April, only Dr. Wolfgang Löscher reported consistent EMF effects in his animal studies—and these are controversial (see p.2 and *MWN*, M/A98).

Part of the answer to this apparent paradox could be that the electromagnetic environment that people actually experience day to day is not well represented by pure sinusoidal 50 or 60 Hz magnetic fields. That is, transients or some other, more complex EMFs may be responsible for the observed effects.

To test this hypothesis, the NIEHS last year asked Dr. David McCormick of the IIT Research Institute (IITRI) in Chicago to see if harmonic, transient or intermittent EMFs could alter pineal function in live rats (see *MWN*, J/F97). In Phoenix, McCormick announced that his melatonin results were "uniformly negative." These results will be presented at the *Annual Meeting of the Bioelectromagnetics Society* in St. Petersburg Beach, FL, June 7-11.

McCormick's new findings might have appeared to put the transient hypothesis to rest. But another Phoenix participant, Dr. Antonio Sastre of the Midwest Research Institute in Kansas City, MO, pointed out that IITRI's exposure facility could not in fact generate most of the transients that occur "in the real world."

"The IITRI exposures resemble 'real world' transients about as faithfully as Ken and Barbie resemble real men and women," Sastre told *Microwave News*. He explained that the IITRI facility was "artificially bandwidth-limited," because it generated transients with a frequency content that stopped at a few kilo-

hertz. In the real world, he said, frequencies can reach hundreds of kilohertz, if not the low megahertz range.

There are indeed an infinite variety of transients in the real world. These short, intense pulses, or spikes, of energy are quite different from gently undulating sine waves, at least in part because of their high frequency components.

William Feero of Electric Research and Management Inc. (ERM) in State College, PA, who designed the IITRI facility, confirmed that it could only generate transients with frequencies up to 2 kHz. Feero explained that the reason was largely budgetary. "High frequency transients are doable in a lab," he said in an interview, "but it's not cheap."

The transients used by IITRI were collected in a real world environment and then "replayed" to the lab animals, as Fred Dietrich of ERM's Pittsburgh office noted at the DOE engineering symposium,† held in Charleston, SC, at the end of April. But when challenged by Sastre, Dietrich conceded that they were all "low frequency," with no "fast" transients.

The distinction between the two is significant. As the frequency content of the transients goes up (at least up to about 100 kHz), so does the ability of living cells to detect the signal, thus eliminating the objection of some physicists who claim that environmental EMFs are drowned out by the background level electromagnetic noise in the human body (see *MWN*, S/O95).

How common are slow and fast transients in the environments where people live and work? No one really knows. The DOE RAPID engineering program has essentially ignored them. "Nobody has yet done a decent transient dosimetry study for an average person in the normal environment," Feero said.

But Sastre pointed to a survey of more than 5,000 transients in 21 homes by Dr. Jeffrey Guttman of Energetech Consultants in Campbell, CA, which found that virtually all had frequency components above 10 kHz (see also *MWN*, M/A94 and S/O95).

In 1994, Dr. Gilles Thériault of McGill University in Montreal, Canada, put a spotlight on the transient issue when he reported a strong association—with a clear dose-response—between exposures to high frequency transients and the incidence of lung cancer among electric utility workers (see *MWN*, N/D94).

At the Charleston meeting, Charles Boeggeman, of PECO Energy in Plymouth Meeting, PA, asked why no one has looked at possible confounding of power line epidemiological studies

* *Clinical and In Vivo Laboratory Findings*, organized by the National Institute of Environmental Health Sciences (NIEHS), Phoenix, AZ, April 6-9, 1998.

† *EMF Engineering Review Symposium*, organized by the Department of Energy (DOE), Charleston, SC, April 28-29, 1998.

by high frequency signals. Part of the answer is that Hydro-Québec, the Canadian utility that owns Thériault's transient data, took it away from the McGill group and barred further analyses by any researchers other than its own (see *MWN*, N/D94).

While university researchers are still denied access to these data, Hydro-Québec's own researchers are trying to identify possible sources of electromagnetic transients. Dr. Michel Plante and coworkers at IREQ, Hydro-Québec's research arm, plan to present their findings at the IEEE's 1998 Summer Meeting of the

Power Engineering Society in San Diego on July 14.

Even though the future of EMF research is cloudy in the U.S., with no government funds committed for next year, work on transients is seen by many as a priority. "We need to deal with transients," said Dr. Daniel Driscoll of the Department of Public Service in Albany, NY, at the Charleston meeting.

And in Phoenix, Dr. Gary Boorman, who leads the RAPID program at the NIEHS, told *Microwave News*, "I think we made a mistake not looking at transients and breast cancer."

Most Americans Are Exposed to Less than 1 mG, But More than 1 Million Average Over 10 mG

The majority of the U.S. population is exposed to power frequency magnetic fields that average less than 1 mG. More than 6% are exposed to more than 3 mG, however, and some 1 million Americans are exposed to average fields greater than 10 mG.

These are some of the findings of the most detailed measurement survey ever undertaken (see Table 1). Dr. Luciano Zaffanella of Enertech Consultants in Lee, MA, who led the project, presented the survey results on April 29 at the Department of Energy's *EMF Engineering Review Symposium* in Charleston, SC. The project was commissioned by the EMF RAPID program.

The study involved more than 1,000 people, who wore magnetic field meters for 24 hours while keeping diaries of their activities. The meters sampled the fields over the frequency range 40-1,000 Hz every half-second. The results presented here are time-weighted averages.

Some of the other key findings are:

- About 26% and 9% of the people spend more than 1 hour in fields greater than 4 mG and 8 mG, respectively;
- About 1.6% of the people are exposed to at least 1,000 mG during the 24-hour period;
- About 3% of the students are exposed on average to more than 2 mG at school;
- The greatest average fields were recorded at work and the lowest average fields were recorded at home in bed (see Table 2);

- There is essentially no difference between the exposures of men and women;
- Exposures are very similar in different regions of the country;
- Electrical and service occupations have the highest average on-the-job exposures.

Zaffanella defined electrical occupations in the same way that Dr. Samuel Milham had in his July 22, 1982, letter to the *New England Journal of Medicine*, which first linked worker exposures to EMFs with leukemia (see *MWN*, J/A82). Electrical occupations include electricians, power station operators and line workers. Those in the service sector include cooks, housekeepers, policemen, prison guards and waiters. Zaffanella pointed out that those working in fast-food jobs may be exposed to high fields from a host of electrical appliances.

Zaffanella also noted that the frequency content of exposures at school is different from that at home: There is a "much higher" contribution from the third harmonic (180 Hz) at school "due to the widespread use of fluorescent lights."

"Our results are not that different from those of our 1,000-home study," said Zaffanella, comparing his new results with those from his 1993 survey for the Electric Power Research Institute (see *MWN*, J/F94 and M/J96).

Dr. Dan Bracken, a consultant based in Portland, OR, who organized the Charleston meeting, is assembling a book with the results of the EMF RAPID research projects. The final reports of each project will also be available from the National Technical Information Service in Springfield, VA, (703) 605-6000, Internet: <www.ntis.gov>.

Table 1: Estimated Average Magnetic Field Exposures of the U.S. Population*

Average 24-Hour Field (mG)	Population Exposed (%)	95% Confidence Interval (%)	People Exposed (millions)
>0.5	76.3	73.8-78.9	197-211
>1.0	43.6	41.0-46.5	109-124
>2.0	14.3	11.9-17.2	31.8-45.9
>3.0	6.3	4.8-8.3	12.8-22.2
>4.0	3.35	2.4-4.7	6.4-12.5
>5.0	2.42	1.67-3.52	4.5-9.4
>10.0	0.43	0.21-0.90	0.56-2.4
>15.0	0.1	0.02-0.55	0.05-1.5

*Based on population of 267 million

Table 2: Magnetic Field Exposures for Various Activities (in mG)

	Home	Bed	Work	School	Travel	24-Hour
Subjects*	1,010	996	525	139	765	1,012
50th %ile†	0.75	0.48	0.99	0.60	0.98	0.87
90th %ile	2.49	2.44	3.32	1.64	2.18	2.38
95th %ile	3.89	3.63	5.00	1.77	2.73	3.38
Mean (SD‡)	1.29 (2.54)	1.11 (2.06)	1.73 (3.09)	0.82 (0.70)	1.22 (0.99)	1.25 (1.51)

*Number of participants with valid data †Percentile ‡Standard deviation

Bank Made \$50,000 Settlement in Indiana EMF Property Lawsuit

An Indiana bank agreed to a \$50,000 settlement of a power line lawsuit that appears to be the only case of its kind. After financing Raymond and Tina Runge's purchase of a home, the bank became the target of their EMF suit in 1991. The settlement came about a year later, but was little noticed at the time.

The Runges got more attention on March 20 of this year, when a state judge refused to dismiss their separate lawsuit against Indiana Michigan Power Co. (I&M). While the court found that there was insufficient evidence that EMFs from a 345 kV I&M power line in the Runges' backyard had caused their medical problems, their claims of negligence, failure to warn and infliction of emotional distress were allowed to stand (see also p.2).

The Runges moved into the Middlebury, IN, house in March 1989, after purchasing it for approximately \$61,000. They say they experienced repeated shocks from stray voltage while walking in the backyard. Tina Runge's obstetrician advised her to move after she suffered a miscarriage in December 1989, citing reports of EMF-related pregnancy loss in experiments with mice. Her husband's physician urged him to move as well. Raymond Runge has metal sutures and clips in his skull, which hold a permanent plastic plate in place, and his doctor was concerned that induced currents in the metal might cause seizures or brain damage.

The family filed suit against I&M in 1990. But in 1991 the Runges opened a new page in EMF litigation when they sued Ameritrust National Bank of South Bend, IN, which held the mortgage on their home. The Runges accused the bank and the title company of failing to inform them fully of the terms of a permanent easement, which I&M had purchased in 1969, allowing the utility to operate high-voltage power lines on the property with few restrictions. I&M built the power line in the property's backyard in 1971.

Around 1992, Ameritrust gave the Runges title to the property, releasing them from the \$50,000 still owed on the mortgage.

"We were going to give the house back to the bank, so they could sell it or do whatever they wanted with it," Raymond Runge said in a recent interview. "But we told them, you make sure you disclose all the information we've gathered on the problems we've had to anyone who buys it." The Runges gave Ameritrust copies of the letters from their physicians and EMF measurements taken in the backyard and inside the home, as well as other documentation. Magnetic field readings as high as 30 mG were measured in the Runges' backyard.

"When the bank came back and said, 'The house is yours,' it's our opinion that they just didn't want the liability," said Runge.

The Runges then sold the house at auction for approximately \$11,000—on the condition that it be moved to another location. "I didn't want to be responsible for someone else getting exposed to the EMFs," Ray Runge told *Microwave News* this May. "No way in hell was I going to put any other family through what we went through." Ironically, he and his wife still own the land. "What I'd like to do is donate it for EMF research," Runge said.

Key Bank of South Bend, IN, which has absorbed Ameritrust, did not respond to a request for comment. Attorney Curt Renner

of Watson & Renner in Washington, which is representing I&M, said his firm had not been involved in the suit against the bank, but he suggested that, "The bank may have just decided it was cheaper to settle than to fight it in court."

In their continuing suit against I&M, the Runges charged that a range of medical injuries—including the miscarriage, headaches, sleeplessness, depression and skin rash—were caused by EMFs from I&M's power line. A judge in Marshall County Circuit Court ruled this March that the Runges had failed to present evidence of these claims. But he refused to dismiss the other seven counts of the lawsuit, and specifically mentioned that, "The shocking sensation itself is an injury for which damages may be recoverable."

"We're pleased that the judge agreed with us and dismissed the medical injury claims," said Renner. "This is no longer an EMF case *per se*. It's now an electric shock case." I&M is a subsidiary of one of the largest utilities in the U.S., American Electric Power (AEP) of Columbus, Ohio, but Renner said that AEP is not involved in the suit.

The Runges' attorneys, Robert Palmer and Spencer Walton of May, Oberfell & Lorber in South Bend, IN, maintain that Indiana law "allows the Runges to recover [damages]...for any fear and emotional distress resulting from exposure to excessive magnetic fields resulting from I&M's negligence....This emotional distress was increased by the opinions they received from physicians who advised them to leave the property."

If the judge's ruling is not appealed, Renner said, a trial date is likely to be set for sometime later this year.

EPRI Weighs Study of Female Breast Cancer and EMFs at Work

Next year, the Electric Power Research Institute (EPRI) may launch a major epidemiological study of occupational EMF exposure and breast cancer in women.

EPRI has issued a request for proposals (RFP) for a feasibility study, with responses due by June 15. The winning team will have nine months to develop a detailed plan for the large-scale effort.

"Breast cancer rates are highest in North America and northern Europe and lowest in Asia and Africa," with a 30-fold variation among countries, notes the RFP. "It has been suggested that one factor [in these differences] could be the use of electric power, which leads to higher exposures to light-at-night or to magnetic fields," EPRI states. Both have been reported to suppress the production of melatonin.

There have been few studies of women's exposure to EMFs at work, and EPRI points out that these have often suffered from small numbers and/or poor exposure assessment.

In 1996, Dr. Patricia Coogan of Boston University reported that women in jobs likely to have high EMF exposure had a rate of breast cancer that was 43% higher than other female workers (see *MWN*, S/O96). In 1994, Dr. Tore Tynes, then of the Cancer Registry of Norway in Oslo, found even higher rates in a study of female radio and telegraph operators aboard ships (see *MWN*, J/A94). A 1993 study by Drs. Dana Loomis and David Savitz of

the University of North Carolina, Chapel Hill, found that the risk for female electrical workers was 40% greater than for women in the general population (see *MWN*, N/D93). But a 1995 re-analysis of that same data, by Dr. Kenneth Cantor of the NCI in Bethesda, MD, found no increase in risk (see *MWN*, M/A95).

Last year, Sweden's Dr. Maria Feychting reported ambiguous results from her study of women living in homes near high-voltage power lines, with an indication that EMFs increased breast cancer risk among women who were both under 50 and estrogen-receptor-positive (ER+) (see *MWN*, N/D97).

There are now three ongoing residential studies of EMFs and female breast cancer (see *MWN*, S/O96).

In EPRI's current RFP, researchers are asked to specify how they would ensure a large enough number of subjects at high

levels of exposure. They are urged to consider how to include transients in their exposure assessments.

EPRI prefers to sponsor an epidemiological study of workers in the electric utility industry, but it concedes that there may not be enough women with sufficient history of employment in electric industry jobs with high EMF exposures. Thus, proposals to study women in other industries would also be considered.

EPRI expects to decide who will do the feasibility study by the end of July. In 1991, EPRI's Dr. Leeka Kheifets voiced support for such work at an EMF workshop (see *MWN*, J/F91). At that time, three recent studies had linked male breast cancer to EMF exposures on the job (see *MWN*, N/D89, J/A90 and J/F91).

EPRI refused to make a copy of its recent RFP available to *Microwave News*.

HIGHLIGHTS

Norwegian Navy Report on Birth Defects Cluster: Cover-Up Alleged

A bitter controversy has surrounded the Norwegian navy's report* on birth defects among children whose fathers served on the *Kvikk*, a torpedo boat equipped for electronic warfare. Naval officers have accused the government of a cover-up and assert that not all children were counted.

Dr. Jan Helge Halleraker, chief medical officer at Haakonsværn Naval Base in Norway, told *Microwave News* that the navy "found no connection between working on the *Kvikk* and congenital malformations." Halleraker said that all children had in fact been included, and called the criticisms "unfair."

Espen Keim, who was the second-ranking officer aboard the *Kvikk*, said he was not surprised by the official conclusion because, he stated, the Norwegian military is led by "cowards." In remarks to Norwegian newspapers, Keim charged that, "Any other conclusion would have caused a scandal, because NATO and Norway use the same standards." Thus, Keim argued, a different conclusion would have had "wide repercussions."

Keim is the father of three children who were born with birth defects. "Two of my children died shortly after birth. Why are they not counted in the report?" Keim demanded, according to *Aftenposten* (March 3), Norway's largest newspaper.

The article also quotes Admiral Hans Kristian Svensholt, the navy's Inspector General, as saying, "The number of babies with birth defects born to servicemen on board the *Kvikk* during this time period is higher than normal, but the number is not so high as to show a statistical link to radiofrequency and microwave [RF/MW] radiation."

"The research is trustworthy because the most advanced experts at home and abroad have participated," Svensholt told the newspaper *Nationen* (March 3). A NATO conference on the *Kvikk* birth defects cluster was held in Norway last August (see *MWN*,

S/O97; also J/A96), and naval personnel from Britain, the Netherlands and the U.S. helped carry out the study.

The report refers briefly to a 1971 study by Dr. Peter Peacock on birth defects among children of helicopter pilots at Fort Rucker, AL, which Peacock suspected were linked to radar exposure. The U.S. Army blocked Peacock from doing further research by denying access to medical records (see *MWN*, J/A96).

Norges Offisersforbund, Norway's labor organization for military officers, supports Keim's criticisms of the report. "It appears that the two deceased children were not included in the statistics," it stated. Erling Petter Roalsvig, a representative of the public employees' federation YS Stat, told *Aftenposten* (March 3) that the navy report appears to have been tailored to fit the desired conclusions.

Halleraker told *Microwave News* that the navy had met with a group of concerned parents to discuss criticisms of the study. After the first couple of days of controversy, the navy announced that parents would be given an opportunity to see the raw data for the study, to ensure that all of their children had been counted.

In an interview with *Aftenposten* (March 8), Admiral Svensholt responded to some of the public criticism. "The report does not state that such [RF/MW] radiation is not dangerous," he said. "It states that no connection can be proven. This conclusion contains an uncertainty."

Despite repeated requests, *Microwave News* was unable to obtain a copy of the report from Halleraker. An English translation, which he said was being prepared for "NATO colleagues," was also not made available. A copy of the report in Norwegian was later obtained from the Bergen newspaper *Bergens Tidende*.

The report states that out of 85 children born to fathers who served on board the *Kvikk*, the Norwegian navy received reports of 11 who were born with birth defects, although some of these children's fathers served before 1987, at which time high-power antennas were installed on the ship.

"It cannot be concluded that there is any connection between the actual birth defects and the high frequency EMFs on board the *Kvikk*," the report concludes. It cites epidemiological studies of naval personnel, mapping of fields of RF/MW exposure on board the boat and "relevant medical literature."

* *Mulig Sammenheng Mellom Høyfrekvente Elektromagnetiske Felt og Medfødte Misdannelse* [Possible Connection Between High Frequency Electromagnetic Radiation and Birth Defects] (No.633-71331-100-002), February 9, 1998.

U.K.'s NRPB Workshop on Exposure Metrics and Dosimetry

The National Radiological Protection Board (NRPB) is organizing an *International Workshop on Exposure Metrics and Dosimetry for EMF Epidemiology*, to be held September 7-9 in Oxfordshire, U.K. Sir Richard Doll, the country's leading epidemiologist, will chair the meeting, which will address both EMF and RF/MW issues.

The objectives of the meeting include the development of protocols for pooling data from different studies and identifying ways for industry to provide practical assistance.

The workshop is by invitation only. Dr. Alastair McKinlay, the head of the NRPB's non-ionizing radiation department, told *Microwave News* that only "those with extensive expertise in the field" were being invited. Observers and journalists cannot attend, he said. The proceedings will be published.

The NRPB is also sponsoring a one-day course on *Epidemiology of EMFs and Human Health*, to be held on September 10. The speakers will include some of those attending the workshop. The cost of attending the course is £170 (approx. \$275). Further details are available on the NRPB's Web site: <www.nrpb.org.uk>.

Among those scheduled to participate at the workshop are: Drs. Anders Ahlbom and Birgitta Floderus of the Karolinska Institute (Sweden), Dr. Q. Balzano of Motorola (U.S.), Dr. Elisabeth Cardis of the International Agency for Research on Cancer (France), Dr. Leeka Kheifets of the Electric Power Research Institute (U.S.), Dr. Martha Linet of the National Cancer Institute (U.S.) and Dr. Mary McBride of the British Columbia Cancer Agency (Canada).

"I have no problem with the report's conclusion, in light of the available data," Dr. Tore Tynes of the Norwegian Radiation Protection Authority in Østerås told *Microwave News*. While Tynes was skeptical that any children had been deliberately left out, he noted that some officers and enlisted personnel "with rather short-term stays on board are not identified and included." He called this "a problem." Tynes previously reported that Norwegian women working as shipboard radio and telegraph operators had an elevated rate of breast cancer (see *MWN*, J/A94).

Dr. Lorentz Irgens of Norway's Medical Birth Registry in Bergen stressed that, "We cannot draw the conclusion that there is no connection between RF/MW radiation and birth defects," according to *Bergens Tidende* (March 5). Registry officials will conduct a study of birth defects among children of all naval personnel who served between 1967 and 1997, examining whether the rate of defects is linked to jobs that involve exposure to RF/MW radiation.

Most of the report's discussion of RF/MW exposure focuses on a 750 W high frequency (2-30 MHz) transmitter. Despite having measured radiation levels in 124 different locations, the navy provides no information on power densities anywhere on the ship. The report does note that when high frequency antennas transmit at 750 W, it is possible to exceed the navy's safety standard. It states that radar antennas on the *Kvikk*, with peak pulse

power of 25 kW and 200 kW and operating at 8.5-9.6 GHz, were not a significant source of exposure due to their placement and low average power.

Halleraker told *Microwave News* that the navy is currently conducting a second study of those who had served on the *Kvikk*, using measurements on board to define which jobs caused the most RF/MW exposure. The Navy will attempt to see if any dose-response patterns exist.

Japan Boosts Research on EMFs and RF/MW Radiation

Public and scientific interest in the possible health effects of non-ionizing radiation are on the upswing in Japan. The government has increased support for EMF and RF/MW radiation health research with the participation of a number of its ministries and of scientists around the country.

A fresh round of activity began when the current fiscal year started in April. The Ministry of Trade and Industry is sponsoring EMF-cancer animal studies and the Japanese Environment Agency is planning an EMF epidemiological study. The Ministry of Posts and Telecommunications (MPT) is looking into RF/MW bioeffects.

Japanese officials have been reluctant to disclose specific figures for funding, but a source at the MPT said that \$300,000 was allocated in 1997 and \$400,000 was earmarked for 1998. (In Japan, researchers' salaries are generally not included in project budgets.)

Last December, the MPT outlined plans for a five-year program. It has established a committee of 17 scientists, drawn primarily from universities and medical centers, to direct the effort. The MPT has also formed a study group to update Japan's RF/MW exposure guidelines.

The Environment Agency's National Institute for Environmental Studies (NIES) in Ibaraki is conducting a feasibility study for an EMF-childhood cancer epidemiological study, according to the institute's Dr. Michinori Kabuto. Funding for the full-scale study has yet to be approved.

Speaking in Tokyo in April (see below), Dr. Anders Ahlbom of the Karolinska Institute in Stockholm, Sweden, expressed support for a Japanese EMF epidemiological study. Ahlbom later told *Microwave News* that such a study would include a substantial exposed population because exposure levels appear to be high, especially in Japan's metropolitan areas.

The Environment Agency is also coordinating the investigation of EMF health effects, said Kabuto, who has been working to establish a network of Japanese EMF scientists. The group, which now numbers over 100 researchers, held its first meeting in January.

The boost in government funding has been spurred by public interest—and, apparently, public apprehension. The new national effort was established to "dispel public concern" and insure that technologies that generate electromagnetic radiation can be used "safely and with peace of mind," the MPT stated. "There has been a rapid increase in public concern" about possible EMF health effects, Kabuto noted, "which has stimulated the govern-

ment to respond.”

Interestingly, these developments coincide with the decline of EMF research in the U.S. “It seems unfortunate that the Japanese effort is gaining momentum just as the EMF RAPID program in the U.S. is drawing to a close,” one observer, Dr. Yoshihisa Otaka of the Mitsubishi Chemical Safety Institute in Kashima told *Microwave News*.

Japan is taking advantage of U.S. expertise, however. For example, Dr. Charles Graham of the Midwest Research Institute in Kansas City, MO, told *Microwave News* that last year he advised Japan’s NIES on setting up a human EMF exposure facility.

A measure of Japan’s interest in the EMF health issue came at an April 7 symposium in Tokyo, *Exposure to Electromagnetic Fields and Related Health Risks*. The symposium drew an audience of approximately 450, according to attendee Dr. Thomas Tenforde, a member of the International Commission on Non-Ionizing Radiation Protection (ICNIRP). Tenforde works at the Battelle Pacific Northwest Labs in Richland, WA.

While utility and telecommunications company representatives predominated, one observer said that the diverse audience also included anti-power line activists.

The seminar featured presentations by many ICNIRP members and by its former chairman, Dr. Michael Repacholi, who now directs the WHO International EMF Project in Geneva, Switzerland. Both power frequency EMFs and RF/MW radiation were covered. Among the presentations were talks by Ahlbom, by Tenforde on mechanisms of static and low frequency EMF interaction and by Dr. Alastair McKinlay of the National Radiological Protection Board in Chilton, U.K., on the Euro-

Executive To Bring Britain’s First Cell Phone-Brain Tumor Lawsuit

A 27-year-old business executive in the U.K. has charged that her brain tumor was caused by microwave radiation from her cellular phone. If she files suit, it would be Britain’s first personal injury action against the cellular phone industry, according to the British Broadcasting Corp.

“Our client has no family history of cancer,” said her solicitor, Tom Jones of Thompsons law firm. “She has never been exposed to radiation in any other form, [and] there’s no other reason why she should have a brain tumor.” Jones would not provide his client’s name and released few other details about the case. Thompsons, which has its main office in London, describes itself as the country’s largest personal injury law firm.

The case has also received press attention in the U.K. from the *Times* (May 16), the *Guardian* (May 16), the *Mirror* (May 15) and *Sunday Business* (May 17). See also *MWN*, N/D97.

pean Commission Expert Group’s program of mobile phone safety research (see *MWN*, M/A97).

The ICNIRP members were in Tokyo for the commission’s annual meeting. Dr. Masao Taki of Tokyo Metropolitan University, also an ICNIRP member, arranged for them to appear at the symposium, which was hosted by both the Environment Agency and the Japan Health Physics Society (see also p.9).

Australia and New Zealand Keep “Flat” RF/MW Exposure Standard

An Australian-New Zealand standard-setting committee has decided to retain its frequency-independent 200 $\mu\text{W}/\text{cm}^2$ limit for public exposures to RF/MW radiation—at least on an interim basis.

The interim standard, designated AS/NZS 2772.1, was issued on March 5 by Standards Australia and Standards New Zealand. The standard, which must be withdrawn, confirmed or revised by March 5, 1999, is a revision of the Australian standard first adopted in 1985 and renewed with minor changes in 1990 (see *MWN*, M/A86). At that time, it was also affirmed by New Zealand (see *MWN*, J/F90).

The 1985 and 1990 versions of the standard endorsed the ALARA principle, which holds that exposures to RF/MW radiation should be kept “as low as reasonably achievable.” In the revised standard, the ALARA language has been cut.

Instead, the standard includes a recommendation that exposures “should be kept to the lowest levels that can be achieved” consistent with current international practice and cost efficiency. Avoidance of unnecessary exposures is “considered prudent,” reads the rationale for the new standard, since knowledge of possible health effects is “incomplete.”

The foreword to the interim standard states that Committee TE/7, which developed the standard, found “no conclusive evidence” that nonthermal effects of radiation above 10 MHz pose

a health hazard.

A number of groups wanted the standard to take more explicit account of possible nonthermal health effects. Voting against the final draft were TE/7 members representing “occupational health and safety, a major group of scientists and the general public,” Dr. Ivan Beale of the University of Auckland in New Zealand told *Microwave News*, adding, “How can the public have confidence in a standard that has been rammed through in this way?” Beale represents the public on the committee.

AS/NZS 2772.1 also covers workplace exposures, for which it retains a flat limit of 1 mW/cm^2 for radiation above 10 MHz.

In keeping its frequency-independent limits, AS/NZS 2772.1 continues to differ from the RF/MW exposure standards issued by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) and by the American National Standards Institute (ANSI), which have the strictest limits only in the 10-400 MHz and 100-300 MHz frequency ranges, respectively (see *MWN*, Mr84, J/F88, N/D91 and N/D92).

Other flat limits include that instituted in 1984 by the Johns Hopkins University Applied Physics Lab (JHU-APL) in Laurel, MD, for its employees, which is set at 100 $\mu\text{W}/\text{cm}^2$ for the 30 MHz-100 GHz band (see *MWN*, D84). In 1993, the U.S. Air Force’s (USAF’s) Phillips Lab at Kirtland Air Force Base, NM, issued a similar rule, departing from other USAF policies (see

Vermont Law Backs Towns Seeking To Regulate Towers

Under a new Vermont law, communities can adopt zoning laws regulating telecommunications towers and can put new towers on hold for up to six months while they write their ordinances.

The measure is "a win for local control, helping towns plan for a technological landscape that is constantly shifting," declared Governor Howard Dean (D) at the signing ceremony for Vermont's H.616 on April 15.

The law also authorizes towns to hire technical experts to review permit applications and bill applicants for the experts' fees. If a moratorium is challenged, the town can call on the state's lawyers to defend it in court. To assist communities that do not have zoning rules for towers, the Vermont League of Cities and Towns in Montpelier has written a model ordinance.

The law affects towers only; antennas mounted directly on buildings, such as churches, are outside its scope. No moratorium may extend past July 1, 1999.

Vermont has been a hotbed of controversy over the expansion of wireless telephone service. Federal Communications Commission Chairman William Kennard visited the state in March and heard both sides of the dispute at a crowded town meeting in Hardwick (see *MWN*, M/A98).

The text of H.616 is available on the Internet at: <www.leg.state.vt.us>.

MWN, S/093). The Hughes Aircraft Co. in Fullerton, CA, adopted the JHU-APL standard in 1991 for personnel in its military radar unit (see *MWN*, S/093).

Interestingly, all these standards assume the same threshold for ill effects—that RF/MW exposures are safe for whole-body specific absorption rates (SARs) below 4.0 W/Kg. Above this level, thermal insults are known to occur. A safety factor of 10 is incorporated for occupational exposures, resulting in a maximum SAR of 0.4 W/Kg. For public exposure limits, a further safety factor of five is added to obtain a maximum whole-body SAR of 0.08 W/Kg.

The TE/7 committee opted to retain the flat limit, despite a move to adopt a well-shaped limit similar to the ICNIRP's. The telecommunications companies Telstra and Optus opposed the change, fearing public reaction to any increase in the limit. Dr. Ken Joyner, a former Telstra scientist now with Motorola, told *Microwave News*.

Dr. Michael Repacholi, former chair of the TE/7 subcommittee that drafted the RF/MW standard, told *Microwave News* that the adoption of a well-shaped limit was requested by the Australian and New Zealand standards organizations, which were anxious to harmonize national and international guidelines (see *MWN*, M/J97; also M/A97). Repacholi, who himself favored the change, resigned from the TE/7 committee when he went to Geneva to run the World Health Organization's EMF project. He did not vote on the adoption of the interim standard.

According to the foreword to the new standard, the decision to retain limits often below the ICNIRP's was influenced by the

WHO's ongoing research on RF/MW health effects, as well as "public concerns about RF radiation, particularly from cell phone systems" (see *MWN*, J/A96).

The spectrum covered by the standard has been extended downward from 100 kHz to 3 kHz and the exposure limits for the range below 100 MHz have been lowered to protect against potentially hazardous induced currents. From 100 kHz to 100 MHz, currents induced by occupational exposures must not exceed 200 mA through both feet or 100 mA through either foot. Below 100 kHz, maximum induced currents decrease with frequency to 6.0 mA through both feet at 3 kHz.

In Japan, Digital Phones Did Not Promote Liver Cancer in Rats

Exposure to digital mobile phone radiation does not promote liver cancer in rats, according to a new study from Japan. The researchers did find, however, that the animals exposed to the pulsed 929 MHz signal had significant increases in their levels of the hormones melatonin, ACTH and corticosterone — although these effects may have been due in part to stress.

The cellular phone signal "does not show any significant effect on rat liver carcinogenesis," wrote Dr. Katsumi Imaida and coauthors in the February issue of *Carcinogenesis* (19, pp.311-314, 1998). Their research, sponsored by Japan's Association of Radio Industries and Business, used the rat liver medium-term bioassay, a well-established method for identifying carcinogens.

The team has conducted the same bioassay with animals exposed to 1.5 GHz radiation and is preparing to publish the results, Imaida told *Microwave News*. A follow-up to the 929 MHz study is planned.

Imaida, who is at the Nagoya City University Medical School, initiated two groups of six-week-old male F344 rats with single doses of the chemical carcinogen diethylnitrosamine. There were 48 animals in each group. Starting two weeks later, one group was exposed 90 minutes each day, five days a week, for six weeks. The second group served as controls.

Dr. Masao Taki of Tokyo Metropolitan University designed the exposure system. The 929 MHz radiation was pulsed at 50 Hz, using the Japanese standard for time division multiple access (TDMA) signals. Taki is a member of the ICNIRP.

Both the exposed and control animals were confined during the daily exposure periods in narrow plastic tubes placed 1 cm from a quarter-wavelength monopole antenna to maximize direct exposure of the animals' midsections. Average specific absorption rates (SARs) in the liver did not exceed 1.7-2.0 W/Kg, while whole-body average SARs were 0.58-0.80 W/Kg. To control for the effects of stress due to confinement, a third group of 24 animals was initiated with the carcinogen but was neither exposed to the signal nor confined in plastic tubes.

Six weeks after the exposures were begun, the animals were sacrificed and each rat's liver, spleen, thymus, kidney, testes and adrenal glands were examined for tumors. Imaida found no significant differences between the exposed and unexposed groups in either tumor incidence or tumor size.

Imaida noted that the liver bioassay technique can also iden-

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tify carcinogens for which the liver is not the primary target organ of cancer initiation or promotion. Its odds of detecting a carcinogen from this broader class are about one in four.

The Japanese researchers were surprised by the melatonin results. RF/MW exposure “was unexpectedly associated with a significant increase,” they wrote. “The reason for this remains to be clarified.” Levels of ACTH, corticosterone and melatonin were all significantly higher ($p < 0.01$) in the exposed animals

than in the controls.

The team speculated that confinement stress may explain some parts of the results. Levels of both ACTH and corticosterone, which are markers for stress, were significantly higher in the controls confined in plastic tubes than in those that were not.

Researchers at the University of Mainz in Germany report finding no change in melatonin levels in volunteers exposed to GSM digital signals while sleeping (see below).

Do German GSM–Sleep Studies Show a Dose-Response Trend?

In a new study by German scientists, digital wireless phone radiation appeared to have generally weaker and less significant effects on sleep than in a previous experiment. But the second study was conducted at a lower power density, and the researchers suggest that the effects may be dose-dependent.

“Preliminary results point to a biological window of power density that might influence the sleep profile,” Dr. Joachim Röschke of the University of Mainz Psychiatric Clinic told *Microwave News*. Röschke leads the research group, which includes Drs. Klaus Mann and Peter Wagner. The new results appear in *Bioelectromagnetics*.

Both studies were sponsored by Deutsche Telekom. A third study is under way with GSM radiation at a “much higher” power density to check for a dose-response trend, according to Röschke.

In its original study, published in *Neuropsychobiology* in 1996, the Mainz group found statistically significant changes in the length of time it took subjects to fall asleep (sleep latency) and in the duration of rapid eye movement (REM) sleep (see *MWN*, M/J94). On average, the 12 volunteers fell asleep about 3 minutes (22.4%) sooner while exposed to the GSM digital signal ($p < 0.005$) and had about 15 minutes (17.7%) less REM sleep ($p < 0.05$).

In the follow-up study, the 22 volunteers’ REM sleep was reduced by a smaller amount—about 5 minutes (5.5%). This change is just short of statistical significance ($p = 0.08$). Sleep latency was only slightly shorter—half a minute (3.8%)—with GSM exposure.

The radiation exposures in the follow-up were less than half those in the original study. The second study used a new exposure system, with a measured incident power density of $20 \mu\text{W}/\text{cm}^2$, as compared to an estimated $50 \mu\text{W}/\text{cm}^2$ in the first study.

Not all the results fit a dose-response pattern, however. In the original study, subjects entered REM sleep about 8 minutes (9.7%) later while exposed to the GSM signal. In the new study, subjects took some 15 minutes (25.4%) longer to enter REM sleep while exposed. This new result is also just short of statistical significance ($p = 0.07$).

Röschke explains in the paper that he abandoned the original exposure system because it did not allow for direct measurement of the applied power density. In addition, the new system generates a more uniform field.

Rather than using a phone with a standard stick antenna, as in the first study, Röschke used a phone connected to a circular antenna 40 cm in diameter, which produces circularly polarized radiation. In contrast, the stick antenna produces a linearly po-

larized signal. Volunteers slept in a room specially designed by Deutsche Telekom and lined with radiation-absorbing material.

“We chose the circular antenna because we could generate a homogeneous field,” Röschke told *Microwave News*. Because the two antennas were different and because the antenna in the second study is not actually used in any cellular phone, the paper notes, the new findings “cannot be generalized to cellular phone technologies.” Röschke also said that it is “absolutely necessary” to confirm the stick antenna results.

In both studies, male volunteers were exposed for eight hours on one of three overnight stays at the Mainz lab. The 900 MHz signal was GSM-modulated (217 Hz with a pulse width of 577 μsec). The subjects served as their own controls. They were unaware when the antenna was switched on. Subjects’ ages ranged from 21 to 34 in the first study and from 18 to 37 in the second.

During the second study, the Mainz group also monitored the volunteers’ neuroendocrine function. Writing in *Neuroendocrinology*, Röschke reports that exposure to GSM radiation was not associated with any statistically significant changes in overall nocturnal levels of growth hormone, cortisol, luteinizing hormone or melatonin.

Immediately after the onset of GSM exposure, however, the level of cortisol increased and remained elevated for one hour. This statistically significant increase ($p = 0.017$) was followed by a second increase in the final hour of exposure ($p = 0.046$). Cortisol, also known as hydrocortisone, is a hormone secreted by the adrenal glands.

Röschke writes that the changes in cortisol levels are non-thermal effects of pulsed radiofrequency radiation. While noting that, in themselves, the cortisol effects are not clinically significant, he stresses that it would be a mistake to conclude that such radiation has no further effects on neuroendocrine function: “Our results are strictly limited to the given experimental conditions.” Other nonthermal effects “might be dose-related and thus might become visible only under exposure to fields of higher intensity.”

A Swiss-American team led by Dr. Boris Pasche previously found that nonthermal levels of RF/MW radiation are effective in treating insomnia (see *MWN*, M/J96).

Peter Wagner et al., “Human Sleep Under the Influence of Pulsed Radiofrequency Electromagnetic Fields,” *Bioelectromagnetics*, 19, pp.199-202, 1998.

Klaus Mann et al., “Effects of Pulsed High Frequency Electromagnetic Fields on the Neuroendocrine System,” *Neuroendocrinology*, 67, pp.139-144, 1998.

Klaus Mann and Joachim Röschke, “Effects of Pulsed High Frequency Electromagnetic Fields on Human Sleep,” *Neuropsychobiology*, 33, pp.41-47, 1996.

minutes of calling time, tripled for those with 15-60 minutes and went up sixfold for those who used their phones for over an hour a day. An increase was also seen in Sweden, with the observed risk roughly tripling among the hour-plus users (see table at right).

For the sensation of warmth behind the ear, Swedes with 2-15 minutes of daily use saw the odds rise three- to fourfold, users with 15-60 minutes had about a tenfold increase and those using cellular phones over an hour per day were 20-30 times more likely to feel heat in these areas. In Norway, the numbers showed a 15- to 20-fold increase for the heaviest users.

The study was prompted by complaints from cellular phone users in Australia, Sweden and the U.K. in 1995 (see *MWN*, N/D95 and N/D96). In Sweden, such anecdotal reports came most often from users of digital GSM phones, which use pulsed signals. The Swedish-Norwegian study was designed to test the hypothesis that GSM users would have a higher rate of symptoms than users of analog phones.

This did not prove to be the case. In fact, there were no significant differences between the two systems, except that users of NMT (Nordic Mobile Telephone) analog phones were *more* likely to feel warmth behind or on the ear—the opposite of what was predicted.

In what Mild and colleagues describe as “side findings,” they report dose-response trends for a range of symptoms with respect to both calling time and number of calls per day. Their abstract calls for more studies “to explore the role of various physical factors” that could explain these associations. It notes that “bias might to a certain extent be responsible” for some findings.

The Swedish-Norwegian results will be presented at the *Annual Meeting of the Bioelectromagnetics Society* in St. Petersburg Beach, FL, June 7-11. They have not yet been submitted for publication.

A second part of the study will analyze the timing of symptoms and examine reported difficulties in concentration, but Mild does not expect this to be completed before the end of the year.

“We’re very interested in this study,” said Dr. Gregory Lotz of the National Institute for Occupational Safety and Health (NIOSH) in Cincinnati. “NIOSH thinks it’s important, and we’re going to look at it closely.” Lotz belongs to an advisory committee for the study, which also includes Drs. George Carlo of Wireless Technology Research in Washington, Nancy Dreyer of Epidemiology Resources Inc. in Newton Lower Falls, MA, Trevor Hughes of the U.K.’s Oxford University, who is a consultant to Motorola, and Michael Repacholi of the World Health Organization in Geneva, Switzerland.

“The data on headache and fatigue were interesting, but could be due to any number of things,” commented Dreyer. “It could be the phones themselves, or the more stressful circumstances in which you tend to use one—on the street, or while doing other business.” Both Dreyer and Mild pointed out that static or signal loss during wireless phone conversations may also increase stress.

“Now we must go on and find out what really causes the problems,” Mild told the Swedish magazine *Ny Teknik* (May 22).

The Swedish-Norwegian study caused a stir in the European press, but has been essentially ignored in the U.S. In the U.K., the May 15 *Express* featured it on the front page, with the head-

Headaches and Cell Phone Calling Time

Relative Risk*
(95% Confidence Interval)

Phone Use	NMT (Analog)		GSM (Digital)	
	Sweden	Norway	Sweden	Norway
2-15 min.	1.81 (1.22-2.69)	1.81 (0.82-3.98)	1.49 (1.02-2.19)	1.94 (0.90-4.20)
15-60 min.	3.24 (2.12-4.95)	3.31 (1.53-7.18)	2.50 (1.66-3.75)	2.69 (1.24-5.88)
>60 min.	3.40 (1.43-8.12)	6.36 (2.57-15.8)	2.83 (1.37-5.85)	6.31 (2.35-17.0)

*Relative to those who used mobile phones less than 2 minutes a day. Relative risks that are statistically significant appear in bold. The study had 16,992 participants—5,000 in Norway and 11,992 in Sweden.

line, WARNING ON MOBILE CALLS—HEALTH DANGER ‘STARTS AT JUST TWO MINUTES.’ The next day *The Express*’ lead editorial insisted that, “The industry has a responsibility beyond making a fast buck. It should not be casually dismissing well-founded fears about the safety of its products.”

Sweden’s *Aftonbladet* (May 15) warned readers that frequent use of a mobile phone “is a threat to your health.” Swedes have nicknamed mobile phones the “yuppie teddy bear,” and *Aftonbladet* declared the symptoms reported by Mild to be “the new teddy bear disease.”

In an internal memo to its members on how to respond to media inquiries about the Scandinavian study, the Australian Mobile Telecommunications Association (AMTA) insisted that “the heating sensation...is a normal response to holding a warm object against the cheek and is not due to the very low radio signals used by the phone.” The Canberra-based AMTA declared that, “Warm or cold, cellular phones can be used with confidence.”

Mild and colleagues do note that “heating from the current drawn from the battery” might contribute to symptoms—but they do not rule out possible effects of microwave exposure. In the 1960s, Dr. Allan Frey of Randomline in Potomac, MD, stopped his studies of auditory sensations from microwaves after volunteers complained of headaches (see *MWN*, M/A97). Frey details these experiments and discusses the headache issue in the March 1998 *Environmental Health Perspectives* (106, pp.101-103).

The AMTA also contends that, “Wireless users have [no] greater incidence of headaches than the general population.” Mild confirmed that Swedish mobile phone users as a whole had “about the same percentage of complaints about headache as found in earlier studies.” But he explained that this did not contradict the findings linking heavier mobile phone use to headaches: “In the group that used mobile phones the most, we have only 65 people. Even if their risk of headache is increased threefold, this does not make a lot of difference to the total.”

The study was funded by the Swedish Mobile Telecommunications Association, the Norwegian Industries Organization, Telefon (Norway’s recently privatized phone company) and Norway’s state telecommunications agency. A summary of the study in English is on the Internet at: <www.niwl.se/niwl.htm>.

Appliances with Significant Risks of Childhood Leukemia

Appliance & Use	Cases/Controls (640/640)	Relative Risk (95% Confidence Interval)
Curling iron		
No use	176/183	1.00
Some use	93/78	1.74 (0.91-3.31)
<1 yr	21/16	1.50 (0.53-4.23)
1-2 yrs	41/39	1.47 (0.68-3.15)
≥3 yrs	31/23	3.56 (1.05-12.12)
Electric blanket/mattress pad		
No use	593/619	1.00
Some use	45/19	2.75 (1.52-4.98)
<1 yr	10/3	5.45 (1.14-26.06)
1-2 yrs	18/9	2.19 (0.95-5.05)
≥3 yrs	17/7	2.63 (1.05-6.59)
Hair dryer		
No use	374/416	1.00
Some use	266/221	1.55 (1.18-2.05)
<1 yr	33/16	2.50 (1.28-4.87)
1-2 yrs	127/110	1.41 (1.02-1.96)
≥3 yrs	106/95	1.54 (1.02-2.30)
Microwave oven		
No use	198/220	1.00
Some use	374/335	1.33 (0.99-1.79)
<1 yr	24/25	0.85 (0.43-1.66)
1-2 yrs	152/108	1.59 (1.10-2.31)
≥3 yrs	197/201	1.30 (0.92-1.83)
Sound system with headset		
No use	407/412	1.00
Some use	164/143	1.34 (0.97-1.84)
<1 yr	44/48	0.94 (0.58-1.53)
1-2 yrs	82/76	1.40 (0.94-2.09)
≥3 yrs	37/19	3.04 (1.48-6.26)
Video games (arcade)		
No use	215/230	1.00
Some use	251/213	1.66 (1.18-2.33)
<1 yr	42/51	1.10 (0.66-1.82)
1-2 yrs	115/101	1.70 (1.14-2.54)
≥3 yrs	92/60	2.78 (1.64-4.72)
Video games (television)		
No use	215/261	1.00
Some use	253/203	1.91 (1.36-2.68)
<1 yr	35/39	1.31 (0.73-2.35)
1-2 yrs	154/113	2.04 (1.40-2.98)
≥3 yrs	64/50	2.36 (1.31-4.25)
Television		
<i>viewing time</i>		
<2 hrs/day	84/108	1.00
≥2 and <4 hrs/day	202/257	0.98 (0.65-1.46)
≥4 and <6 hrs/day	171/163	1.38 (0.89-2.14)
≥6 hrs/day	178/109	2.39 (1.50-3.80)
<i>distance from set</i>		
>6 ft	90/125	1.00
≥4 ft and ≤6 ft	363/348	1.71 (1.20-2.44)
<4 ft	166/142	1.60 (1.08-2.37)

Listed above are appliances for which the NCI study found any statistically significant association between childhood use and the risk of ALL. Those relative risks that are significant appear in bold. No significant associations were found for **air conditioners, bedside electric clocks, electric heat, electric stoves, humidifiers, night lights, personal computers, stereo systems without headsets or water beds.** The NCI researchers did not assess number of years of television use because nearly all children watched television from an early age.

NCI in Rockville, MD, told *Microwave News*. “Also, childhood leukemia rates have not increased, despite a huge change in the level of appliance use—especially TV viewing, which just exploded between 1950 and 1970.”

Writing in the May 1998 issue of *Epidemiology* (9, pp.234-245), Hatch, Dr. Martha Linet and colleagues also argue that their results on appliance use must be interpreted in the context of “the lack of an effect for measured 60 Hz magnetic fields or wire codes in our companion study.”

Last summer, the NCI reported that its power line study had found no evidence of a health risk for EMFs, but that interpretation was challenged by other researchers (see *MWN*, J/A97 and box at right).

The appliance study has provoked a new round of controversy. Many observers have pointed to the large number of appliances for which a significant risk was observed, and have criticized the NCI for being too quick to discount its own findings. “I don’t understand it,” said Dr. Imre Gyuk, EMF program manager at the Department of Energy in Washington. “Why did they bother to do the study if they don’t believe the results?”

Norbert Hankin of the Environmental Protection Agency’s Office of Radiation and Indoor Air in Washington told *Microwave News*, “The conclusions don’t seem to follow from the results.”

A senior federal health official, who asked not to be identified, said that on some points “there’s an improper interpretation of their own data.” The official added, “I think there’s some evidence here that these fields are causing the disease—mostly from the electric blanket data, both for pregnancy and children’s use.”

All of the 25 significant associations observed for children’s use of appliances indicated an increased risk of leukemia. Of the six significant links found for appliance use during pregnancy, four showed an increase in risk and two showed a decrease. Hatch said that while some of the increases in risk may be due to chance, she certainly does not think that all of them are. Others, she suggested, may reflect various kinds of bias.

The paper states that the mother of a child with leukemia may be more likely to remember or overestimate past use of various appliances, “as she tries to identify some specific action that led to the illness.” Hatch said that, “This might especially be a factor for something like electric blankets, since they have been mentioned a lot in the media” as having high EMF levels.

More recent patterns of children’s behavior may bias parents’ reporting of past activities, the paper adds. If children watch more TV after they develop ALL, the NCI team speculates, this might bias reports of how much they watched before diagnosis.

In an editorial in the same issue of *Epidemiology*, Drs. Anders Ahlbom, Maria Feychting and David Savitz agree that this is possible. “The use of electric blankets, however, seems unlikely to have increased after diagnosis,” they write (see also box at right).

Hatch argues that some of the data in the NCI appliance study contradict the idea that EMF exposure leads to leukemia. For example, she said, children of mothers who used sewing machines during pregnancy were only three-quarters as likely as other children to develop ALL, a significant reduction in risk. The paper notes that this is “inconsistent with a causal effect of magnetic fields, since sewing machines have rather high mag-

Ahlbom, Feychting and Savitz Dispute NCI on Power Line Study

Three leading epidemiologists have taken issue with the NCI's conclusion that its 1997 study of childhood leukemia found no evidence of a risk from power line EMFs (see *MWN*, J/A97).

In an editorial in the May 1998 *Epidemiology*, Drs. Maria Feychting and Anders Ahlbom of the Karolinska Institute in Stockholm, Sweden, and Dr. David Savitz of the University of North Carolina, Chapel Hill, criticize the NCI for "a tendency to judge a finding as either entirely negative or positive, instead of viewing it quantitatively and integrating it with the results of other research."

The editorial notes that the power line study's findings on measured EMFs did show some elevation in risk, "as well as a dose-response gradient." It concludes that, "The cumulative results still lend some support for a weak association between childhood ALL and [EMF] exposure."

In fact, the authors state, the NCI found "exactly the same" relative risk as two previous studies of EMFs and childhood leukemia that used 24-hour measurements: a 1991 study by Drs. Stephanie London, John Peters and colleagues at the University of Southern California in Los Angeles (see *MWN*, J/F91, M/A 91 and S/O91), and a 1997 study by Drs. Jörg Michaelis, Joachim Schüz and colleagues at the University of Mainz in Germany (see *MWN*, J/A 97 and S/O97). Feychting, Ahlbom and Savitz state that pooling the data from all three studies points to a significant 50% increase in risk.

The three scientists also write that, "The wire-code result in [the NCI's] companion study was indeed negative, but it also differed from most previous studies." While this is "intriguing"

and will weaken "the combined estimate of the wire-code association from all published studies," they argue, it does not by itself render all other studies invalid.

NCI's Dr. Elizabeth Hatch said that perhaps more could have been done to put the NCI's conclusions in the context of other power line studies. "But our study is the largest to date and the others, even the Swedish study, basically only deal with very small numbers of cases." The NCI study had 640 cases of leukemia, compared to 232 for London-Peters, 176 for Michaelis-Schüz and 39 for Feychting-Ahlbom (see *MWN*, S/O92).

The editorial marks the first formal comment by Feychting, Ahlbom and Savitz—all of whom have conducted landmark studies on EMFs and childhood cancer—on the NCI's power line study since it was released last year. Several letters published in the *New England Journal of Medicine* argued that the NCI's own data in fact supported a link between measured EMFs and ALL (see *MWN*, N/D97; also S/O97).

Others have criticized the NCI's power line study for downplaying a statistically significant 72% increase in risk for exposures over 3 mG. "Testing your *a priori* hypothesis is the main thing," responded Hatch. "The other findings have to be considered more exploratory than anything else." The *a priori* hypothesis of the NCI power line study focused on exposures over 2 mG, for which a small, nonsignificant increase was observed.

"Even if it's eventually shown that there is a small increase in risk at high levels," Hatch said, "the number of additional cases that could be attributed to this exposure would be very small."

netic field levels, and the user's abdomen would usually be quite close to the motor."

To detect potential biases, NCI researchers included several "red herrings," appliances with negligible EMF exposures—ceiling fans, night-lights and stereos without headphones. None of these appliances showed an increased risk, for either children's use or exposure during pregnancy, and they concede that this could argue against recall bias as a major factor.

No EMF measurements were taken from the actual appliances in each home. Dr. William Kaune, a physicist and a coauthor of both NCI papers, has reported that in a recent U.K. residential study, he and his collaborator, Dr. Alan Preece of the U.K.'s Bristol University, found that questionnaire data did not accurately predict time-weighted averages of EMF exposures. They suspect that participants tended to overestimate how much time they spent near appliances.

"This reduces the likelihood that the observed associations are due to appliances' contributions to time-weighted averages," Kaune told *Microwave News*. If the links are actually caused by EMFs, he said, it would more likely be a result of another aspect of the fields, such as peak exposure. Kaune is with EM Factors in Richland, WA.

"We do not wish to dismiss the associations observed for certain electrical appliances out of hand," the NCI paper in *Epidemiology* concludes, "and accordingly, we are studying whether some aspects of measured magnetic fields associated with [certain] appliances could explain the elevated ALL risks of the mag-

nitude reported." Hatch explained that this study will involve appliances used by about 50 families, including TV sets (with and without video games), audio headphones, sewing machines and hair dryers. NCI researchers will look at EMFs over a range of frequencies, Hatch said, but they will not examine high frequency transients.

In their editorial, Ahlbom, Feychting and Savitz call the NCI's evaluation of its appliance data "overly narrow." While agreeing that the appliance findings must be viewed with caution, the editorial argues that Hatch and colleagues would have provided a more useful analysis if they had viewed their study more "quantitatively, and integrat[ed] it with results from other studies."

"It's difficult to do that with the appliance study," responded Hatch. "There are only two other studies of children's appliance use and leukemia. One, the London study, only reported regular use and didn't appear to be able to investigate dose-response trends. And the Savitz study (see *MWN*, M/J90) was incredibly small—with only 59 cases of ALL. It's hard to look for trends in that kind of data."

The 1991 study by Drs. Stephanie London, John Peters and colleagues at the University of Southern California in Los Angeles found that children's use of electric hair dryers almost tripled the risk of leukemia, a significant increase. For use of black-and-white TVs, there was a significant 49% increase, though no risk was found for color TVs. Electric blanket use was linked to a sixfold increase in risk, but this involved a small number of cases and was not significant (see *MWN*, S/O91; also J/F91, M/

A91 and N/D91).

“Ours is really the first comprehensive study of appliance use among children,” stated Hatch. “That in itself is a reason why its results have to be taken with such caution.”

The NCI team did extra analysis of children’s use of both television and video games connected to a TV. Here, every comparison revealed a significant increase in risk. Heavy, moderate and light users of video games all showed about an 80% increase in the risk of ALL, as compared to nonplayers. As time spent on TV and video games combined went up, so did the chance of developing ALL. Finally, children sitting closer than six feet from the TV had a significantly higher risk than those who sat farther away.

But Hatch was skeptical that this showed any real EMF ef-

fect, pointing out that children who reportedly sat four to six feet from the TV had a slightly higher risk (1.71) than did those who sat closer (1.60). “You could look on TV as partially a red-herring variable,” she commented, “since past three or four feet there’s virtually no field.” The paper states that the observed effect “was similar regardless of the distance from the television, implying that magnetic fields are unlikely to be a causal factor.”

Hatch said that another planned follow-up study might shed some light on the question of bias in responses: “We’ll try to interview mothers very soon after diagnosis and then a year later to see if there’s a difference in how they recall their children’s appliance use.” She expressed hope that, “Eventually, all this will get sorted out, and these methodological studies should help with that.”

FROM THE FIELD

Electromagnetic Interference with Medical Devices at Both ELF and RF/MW Frequencies

Letter to the Editor

May 11, 1998

To the Editor:

Increasingly, the normal operation of delicate electronic circuitry is being disrupted by power or radiofrequency fields. Often these are annoying or unpleasant problems—as in the case of electromagnetic interference (EMI) with computers. But sometimes they can be life-threatening.

A large manufacturing company in Atlanta recently complained of interference patterns playing havoc with a group of computer-assisted design (CAD) terminals. Floor-level extremely low frequency (ELF) magnetic fields in the vicinity of the CAD terminals were found to be greater than 100 mG over an area of several hundred square feet.

Company managers were about to shield the terminals with our “JitterBoxes” when the problem became much more critical: the failure of an automatic insulin delivery system used by an executive visiting the high-field area.

The system, which is worn on the ankle, senses the user’s blood insulin levels and delivers insulin as needed. Medical experts concluded that the elevated fields caused a circuit failure in the delivery system.

The cause of the high fields was traced to frayed insulation in the electrical wiring embedded in the base of the modular walls of an office cubicle. Once identified, the problem was corrected with a small section of electrical tape. The insulin delivery system, with new circuitry, now functions normally again.

This incident is not unique. Industry representatives cited a similar incident at the April 28-29 Department of Energy’s *EMF Engineering Review Symposium* in Charleston, SC.

It should be stressed that in this case the elevated fields were suspected because of the disruption of the computer monitors. Without such interference, the cause would have been much more difficult to diagnose.

Michael Hiles
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Report Excerpt

Reprinted below are the conclusions of a report from the Institute of Electrical and Electronics Engineers’ (IEEE) Committee on Man and Radiation (COMAR), “Radiofrequency Interference with Medical Devices—A Technical Information Statement.” The report, written by Howard Bassen of the Food and Drug Administration’s (FDA) Center for Devices and Radiological Health in Rockville, MD, with contributions by other COMAR members, appears in the May/June issue of IEEE Engineering in Medicine and Biology Magazine (17, pp.111-114, 1998). The report will also be posted on COMAR’s web site: <<http://homepage.seas.upenn.edu/~kfoster/comar.htm>>. For more information, contact Bassen at: FDA, HFZ-133, 12725 Twinbrook Parkway, Rockville, MD 20852, E-mail: <hib@cdrh.fda.gov>.

Today, many medical devices that are tested for susceptibility to RFI [radiofrequency interference] cannot meet the 3 V/m minimum immunity requirements of the current International Electrotechnical Commission Standard 60601-1-2. Hand-held cellular telephones produce field strengths greater than 3 V/m at distances of up to 1 meter, while higher-power transceivers produce 3 V/m at distances of up to 2.6 meters. This situation may be responsible for serious failures of life-sustaining medical devices. It is imperative that immunity to RFI be designed into new medical devices. Because mobile transceivers can generate field strengths of hundreds of volts per meter at close range, fail-safe mechanisms should be designed into medical devices that cannot be made immune to such high RF field strengths.

The field strength to which a medical device may be exposed depends on many conditions that are beyond the control of the designer or manufacturer. Therefore, administrative controls should be implemented that include education of the user, both in the clinic and at home. The possibility of incomplete RF compatibility between RF transceivers and medical devices must be recognized and dealt with. In healthcare facilities, mobile transceivers should be restricted to distances that have been determined to be safe, especially in areas where critical devices are operated. By developing both short- and long-term solutions like those suggested above, electromagnetic compatibility between mobile RF sources and medical devices can be maximized.

Clippings from All Over

Presently, there is no consistent experimental data that prove that EMFs have any detrimental effects on living organisms.

—Office of Cancer Communications, National Cancer Institute, Bethesda, MD, in a press backgrounder, *Questions and Answers About the National Cancer Institute/Children's Cancer Group Study of the Magnetic Fields Associated with Electrical Appliances and the Risk of Childhood Acute Lymphoblastic Leukemia*, April 20, 1998 (see p.1)

Once again, the U.S. National Cancer Institute (NCI)—one of those RICH health bureaucracies—has done a study examining the possible connection between EMF and childhood cancer. Once again, their study weakly corroborates that such a connection DOES EXIST!!! But they just can't bring themselves to admit what their own data reveal. You will recall...that was the same problem they had with the results of their earlier power line study.

—Posted on the Internet by Roy Beavers, also known as the "EMF Guru," April 22, 1998, archived on the Internet at: <www.feb.se/EMF-L/EMF-L.html> (see p.1, p.13 and p.19)

"The safety of human exposure to an ever-increasing number and diversity of EMF sources both at work and at home has clearly become a public health issue. In 1995, the Russian government declared this issue a social problem....EMF technology does not stay still, and research into their possible adverse health effects should continue. But like in many other fields, the problem in Russia today is the lack of funds and coordination of such research."

—Dr. Nikolai Izmerov, Director, Institute of Occupational Health, Russian Academy of Medical Sciences (RAMS), Moscow, quoted in a May 20 World Health Organization (WHO) press release, "Scientists Meet in Moscow To Discuss Adverse Health Effects of Electromagnetic Fields," reporting on a seminar organized by the RAMS and the WHO International EMF Project, in Moscow, Russia, May 18-22, 1998 (see *MWN*, N/D97); the press release is available at: <www.who.ch>

[T]he average scientist is exposed to religious and political views at his mother's knee, long before he is exposed to science. Such views

have a way of occupying whatever gaps are present in scientific understanding.

—Dr. Robert Park, American Physical Society, Washington, DC, in an op-ed article, "Scientists and Their Political Passions," *New York Times*, p.A15, May 2, 1998

"There is no possibility that mobile phones are involved in a cancer scenario because the power output of phones is just too low. We are talking about devices that can be powered on four double-A batteries, not 600-watt microwave ovens."

—Dr. Ken Joyner, director, EME strategy & regulatory affairs Asia/Pacific, Motorola, Scoresby, Victoria, Australia, quoted by Stan Beer in "Phoney Research, Says Expert," *Australian Financial Review*, p.24, April 1, 1998

"People ask, 'Isn't there someone out there looking after us?' The answer is no. There is no scientific or professional group evaluating this problem."

—Dr. John Goldsmith, Ben-Gurion University of the Negev, Beer Sheva, Israel, on possible health hazards of mobile phone radiation, quoted by Ruth Mason in "Punching In a Cell Phone Warning," *Jewish Week*, p.48, May 8, 1998

There is a small but real danger in using a mobile phone at a petrol filling station. The batteries that are used in the phone can deliver enough power to ignite petrol.

—Allan Gibson, responding to another reader's question on a mobile phone company's warning to switch off the phone when in a gas station, in the column "The Last Word," *New Scientist* (U.K.), p.105, May 9, 1998

The lack of frequency coordination symbolizes the commission's long-lived practice of ignoring engineering expertise in favor of attorney stupidity.

—Brad Dick, editor, in an editorial, "Screw the Laws of Physics, We're the FCC," *Broadcast Engineering*, p.10, April 1998 (on EMI with medical telemetry devices from WFAA's DTV transmitter in Dallas, TX; see *MWN*, M/A98)

"MICROWAVE NEWS" FLASHBACK

Years 15 Ago

- Epidemiologist Dr. Annemarie Crocetti reports to the New York State Power Lines Project that the Wertheimer-Leeper findings linking power lines to cancer are probably not due to research design flaws and recommends that their work be repeated.
- Concerned about emissions from the Raytheon naval weapons test center, the town of Wayland, MA, adopts a 5.0 $\mu\text{W}/\text{cm}^2$ exposure limit for microwave radiation on private property.
- Writing in *Science*, a team led by Dr. Sol Michaelson relates that it found no effect on white blood cells from continuous RF/MW radiation at 4.0 W/Kg and concludes that ANSI's 4.0 W/Kg threshold is protective. Left open are questions raised by Polish studies showing effects of low-level pulsed radiation.

Years 10 Ago

- Using a video display terminal for 20 hours or more each week during early pregnancy more than doubles the risk of miscarriage, according to epidemiologists at Kaiser Permanente in Oakland, CA.

- The U.S. Army and Navy agree to turn off—or reduce the operating power of—their electromagnetic pulse (EMP) simulators while they assess their environmental impacts.
- Beaming 20 kHz-1.8 MHz radiation into the upper atmosphere to disrupt communications, and possibly the weather, could pose a serious environmental threat, warns physicist Dr. Richard Williams.

Years 5 Ago

- A jury finds San Diego Gas & Electric Co. was not negligent in failing to warn customers about potential health effects of EMFs. Ted and Michelle Zuidema's suit blamed their daughter's kidney cancer on the utility's power lines.
- Taking issue with EPRI, Dr. Genevieve Matanoski of Johns Hopkins University says her EPRI-sponsored study of telephone linemen shows an EMF-leukemia link. But she is unable to secure funding for a replication of the study.
- Following reports in *Florida Today*, Rep. Jim Bacchus (D-FL) calls for a federal investigation of a cluster of eight cases of Lou Gehrig's disease near an air traffic radar in South Patrick Shores.

REQUEST FOR PRE-PROPOSALS

The Johns Hopkins University Center for VDT & Health Research announces a request for research pre-proposals focusing on musculoskeletal disorders associated with computer use in various work settings (office, home, remote office, etc.). Proposals should be for studies costing up to \$100,000 total cost per year (including a maximum of 15% indirect costs) for up to two years, focusing on the following subject areas:

1. Development or application of methods for the diagnosis of musculoskeletal disorders of the upper extremity, including shoulder and neck, suitable for application in a variety of work settings, using non-invasive and inexpensive procedures for epidemiologic studies.
2. Measurement of psychosocial and work organization stressors, and stress responses, associated with health outcomes and work related outcomes such as productivity.
3. Application and comparison of multiple methods for comprehensive measurement of ergonomic stressors in a variety of work settings. Such measures should include metrics of force, posture and time, and should be non-invasive, low cost and feasible for large epidemiologic studies.

Priority will be given to proposals that integrate exposure measures of both psychosocial and ergonomic stressors, particularly if these can be linked to health or work outcomes, mechanisms, or pathways. Projects nested within existing prospective or intervention studies, or secondary analysis of existing data sets will also be given priority if they are cost effective. Cross-sectional or case-control studies of specific populations with contrasting exposures will also be considered.

Applications for pre-proposals can be obtained by written request from Ms. Maria Zanella, Program Administrator, Johns Hopkins University School of Hygiene and Public Health, 615 N. Wolfe St., Room 4030, Baltimore, MD 21205 (Fax 410-955-0792). All pre-proposals must be received by September 1, 1998. After review by the Center's Scientific Advisory Board, successful applicants will be invited to submit full proposals by December 1, 1998 for final review. The Center has conducted two workshops, one on diagnosis of musculoskeletal disorders and the other on exposure assessment, which review and summarize the status of research in these areas. These reports will be made available on request.

CELLULAR PHONE EMI

Pacemakers: What's the Safe Distance?...In a recent laboratory study, no case of interference between cellular phones and implantable cardiac pacemakers was observed beyond a distance of three inches. The Center for the Study of Wireless Electromagnetic Compatibility (EMC) at the University of Oklahoma in Norman tested five types of cellular technology and six pacemaker models known to be vulnerable to EMI. The pacemakers were submerged in a saline solution to simulate the electrical characteristics of the chest. The headline of the EMC Center's April 20 press release declared, **SAFE SEPARATION DISTANCE...MUCH LESS THAN PREVIOUSLY RECOMMENDED**, and the statement emphasized that, "This is half the distance previously given by [pacemaker industry] recommended labeling." But no one, including the EMC Center, is proposing any changes to the six-inch separation distance supported by the FDA, Wireless Technology Research (WTR) and the pacemaker industry (see *MWN*, N/D96). "Nothing in the data from Oklahoma is inconsistent with the information we considered previously," Don Witters of the FDA's Center for Devices and Radiological Health in Rockville, MD, said in an interview. "I don't think it would alter our recommendations." WTR chair Dr. George Carlo told *Microwave News* that, "The Oklahoma data are corroborative but add nothing new." A 1996 review of clinical data for WTR by Dr. Roger Carrillo of Mt. Sinai Medical Center in Miami found that "effects that could pose a major risk to the patient all occurred within a range of three inches," but that less severe EMI can also occur beyond this range (see *MWN*, N/D96). Carlo emphasized that WTR's recommendations were based on extensive clinical tests with people who actually have implanted pacemakers, not just simulations in the lab, and he argued that, "Clinical data should always supersede *in vitro* data...in making public policy decisions." Bernard Liebler of the Health Industry Manufacturers Association commented, "None of my companies have a problem with the current recommendation. A study like this should create a level of comfort with it." This May, the Oklahoma EMC Center's director, Dr. Hank Grant, told *Microwave News* that the center is not in fact calling for any change in the six-inch rule. "The center really tries to stay out of influencing that kind of decision," Grant said. "We just report the facts and let the standard-setting bodies draw their own conclusions."

CHILDHOOD CANCER

Auto Pollution Increases Risk...Air pollutants from motor vehicles increase the risk of childhood cancer, according to a recent study by Dr. Maria Feychting, Daniel Svensson and Dr. Anders Ahlbom of the Karolinska Institute in Stockholm, Sweden. Published in the *Scandinavian Journal of Work and Environmental Health* (24, pp.8-11, 1998), the study analyzed 142 cases and 550 controls drawn from the Feychting-Ahlbom study of power line EMFs (see *MWN*, S/O92). Children with the highest exposure to auto exhaust had almost four times the rate of cancer of those with low or moderate exposure, a statistically significant finding. Risks for leukemia and brain cancer were also elevated, but the estimates were imprecise because of the smaller numbers of cases for individual cancers. The Karolinska team notes that only two other epidemiological studies have exam-

ined childhood cancer and auto pollution: Dr. David Savitz (see *MWN*, N/D87) and Dr. Nancy Wertheimer each found significantly increased risks. Interestingly, all three studies used data sets originally developed in studies of childhood cancer and EMFs. These studies have had to control for the effects of other potential factors, such as motor vehicle exhaust.

DNA BREAKS

Sensitivity of Comet Assays...Drs. Robert Malyapa, Joseph Roti Roti and coworkers at Washington University in St. Louis have published new data to back up their claim that they can detect DNA damage at low doses of ionizing radiation, using the comet assay developed by Dr. Peggy Olive of the British Columbia Cancer Research Center in Vancouver, Canada. The Olive method's sensitivity had been challenged by Drs. N.P. Singh and Henry Lai of the University of Washington, Seattle, who have used Singh's version of the comet assay (see *MWN*, J/F98). The controversy is part of the debate over whether microwave radiation, specifically cellular phone signals, can increase the frequency of DNA breaks. Writing in the April issue of *Radiation Research* (149, pp.396-400, 1998), Malyapa and Roti Roti affirm that they can reliably measure DNA damage below 1 cGy. They say that prior to their recent series of experiments there had been no previous "sustained effort" to determine the lower sensitivity limit of the Olive method. They conclude that the sensitivities of the Olive and Singh methods are "similar and comparable." In an interview, Singh commented that he was "surprised by the consistency and sensitivity" of the Malyapa-Roti Roti results.

MEETINGS

All About Risk...Last October 22-23, scientists and policymakers met in Vienna, Austria, to discuss public perceptions of EMF health risks. The International Commission on Non-Ionizing Radiation Protection (ICNIRP), a cosponsor of the seminar, has now published the proceedings, *Risk Perception, Risk Communication and Its Application to EMF Exposure*. Many people "seem much more alarmed than the scientific community" about potential EMF health hazards, write the volume's editors, Dr. Jürgen Bernhardt and Rüdiger Matthes, ICNIRP chairman and scientific secretary, respectively, both of the German Radiation Protection Office, and Dr. Michael Repacholi, director of the WHO International EMF Project in Geneva, Switzerland. To reduce this "gap," they continue, it is necessary "for government, scientists and industrial organizations to understand and apply the knowledge from the risk perception and risk communication sciences." Among the papers presented were "Risk Communication: The Focus in the NIEHS RAPID Program's Review of EMF Health Hazards," by Drs. Christopher Portier and Mary Wolfe of the NIEHS in Research Triangle Park, NC; "Mental Models and EMF Risk Perceptions of the U.S. General Public," by Dr. Gordon Hester of EPRI in Palo Alto, CA; and "Scientists as Communicators: Addressing the Media and the Public," by Matthew Gaines, now retired from the U.K.'s NRPB. Copies of the 369-page volume are available for \$50.00 plus shipping from Matthes at: ICNIRP, Institut für Strahlenhygiene, Ingolstädter Landstraße 1, D-85764 Oberschleißheim, Germany, Fax: (49+89) 31603 289, e-mail: <matthes@bfs.de>.

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Lawsuit Charges Illegal Experiments... On April 15, the International Committee on Offensive Microwave Weapons charged in federal court in Washington that the Department of Defense and the CIA have conducted "classified research on human subjects without their informed consent," in efforts to develop weapons using EMFs, lasers, microwaves and sound waves. The lawsuit cites an article by retired Lt. Col. Timothy Thomas in the Spring 1998 issue of *Parameters*, the journal of the U.S. Army War College. The article, "The Mind Has No Firewall," appears in a section on "Future Land Warfare." The committee, headed by Harlan Girard of Philadelphia, asks for an injunction to end the alleged illegal experiments.

NAS-NRC

RAPID Review Committee... The Board on Radiation Effects Research of the National Academy of Sciences-National Research Council (NAS-NRC) has made some changes to its committee charged with reviewing the research carried out under the EMF RAPID program. Dr. James Hoburg, an engineer at Carnegie Mellon University in Pittsburgh, has replaced Fred Dietrich of Electric Research and Management, also in Pittsburgh. Dr. Maria Stuchly of Canada's University of Victoria was set to join the committee but dropped out due to other commitments. The board has nominated Dr. Edwin Carstensen of the University of Rochester, NY, to fill the gap. In addition, Dr. Rick Jostes has replaced Dr. Steven Simon as the study director. (See also *MWN*, M/J97.) Dr. Maurice Fox of MIT in Cambridge, MA, a committee member as well as a member of the academy, told *Microwave News* that the RAPID program has been an exercise in looking at very small effects—"if they exist at all," adding that, "The money would probably have been better spent somewhere else." The committee, which completed an interim report on RAPID at the end of 1995 (see *MWN*, N/D95), has begun evaluating approximately 60 RAPID project summaries. Jostes said that the committee's report would not be completed until 1999.

PEOPLE

Drs. **C.K. Chou** of Motorola in Plantation, FL, and **Keith Florig** of Carnegie Mellon University in Pittsburgh have been elected to the National Council on Radiation Protection and Measurements (NCRP), based in Bethesda, MD. Dr. **David Sliney** of the U.S. Army's Aberdeen Proving Ground in Maryland has been reelected. Dr. **Bill Guy**, professor emeritus at the University of Washington, Seattle, has been named an honorary member of the NCRP.... Dr. **Jukka Juutilainen** of Finland's University of Kuopio has been appointed an associate editor of *Bioelectromagnetics*. Juutilainen takes the place of Germany's Dr. **Peter Semm**. In addition, Dr. **Richard Luben** of the University of California, Riverside, and **Janie Blanchard** of Bechtel Corp. in San Francisco have joined the journal's editorial board, replacing Drs. **Tom Tenforde** of the Battelle Pacific Northwest Labs in Richland, WA, and **Carl Blackman** of the EPA in Research Triangle Park, NC.... **Edward Aslan** of Narda Microwave in Hauppauge, NY, has been elected a fellow of the IEEE for his work on the measurement of electromagnetic fields and radiation.

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VIEWS ON THE NEWS

The Deep Roots of Public Skepticism

Public fears of EMFs and RF/MW radiation are groundless, according to so many official statements that we've lost count. Yet the public refuses to be reassured. If we look at how government and industry handle these issues, we get some idea why.

* * *

Many people had similar reactions to the NCI study on appliances and childhood leukemia (see p.1), but DOE's Dr. Imre Gyuk put it best. "I don't understand it," he said. "Why did they bother to do the study if they don't believe the results?"

When 29 out of 31 statistically significant findings show an increase in risk, and only two show a decrease, most scientists would at least say, "Hmmm. Perhaps there's something there."

But the NCI responded to its own data with a one-sided dismissal. Its press release described the study as "concluding that it is unlikely that magnetic fields from household electrical appliances increase a child's chances of developing...leukemia."

Later in the press release, there is a revealing shift of language: "The authors were unable to draw a clear conclusion from the data....The scientists *speculate* that the magnetic fields from electrical appliances are unlikely to increase the risk of ALL" (emphasis added).

And so a speculation is palmed off as a scientific conclusion. In fact, the NCI's report is full of speculations. It is not that any one of these is inherently unreasonable, but why are the NCI researchers so intent on explaining away their findings? Apparently, the data are telling them something they don't want to hear.

In last year's study of power lines and childhood leukemia, the NCI took a strong position, which has proved controversial. The institute is not about to back down now, even if the price of consistency is discounting the results of the appliance study.

Three prominent epidemiologists have questioned the NCI's rush to judgment (see p.13). Harsh comments about the institute have cropped up on the Internet (see p.15). The NCI's credibility has suffered in the eyes of both its colleagues and the public, and the institute has only itself to blame.

* * *

Is the Norwegian navy covering up evidence of a link between RF/MW radiation and birth defects? We don't know—but the fact that the navy wouldn't give us a copy of its report doesn't exactly inspire confidence (see p.6).

Once we obtained a copy from a Norwegian journalist, the report turned out to be astonishingly vague. Although it states that over 120 measurements were made on board the *Kvikk*, a torpedo boat with powerful transmitters, the report contains no data on power densities anywhere on the vessel. The presentation of the epidemiological results is also poor.

The whole affair reminds us of a cluster of birth defects observed among children of U.S. helicopter pilots at Fort Rucker, AL, in 1971. After an investigation by an independent researcher suggested a link to radar exposure, the U.S. military blocked further research by denying access to the necessary records.

The authors of the *Kvikk* report say they had access to plenty of information. But what it comes down to is that the Norwegian military investigated itself, and the results are not so different

from those obtained 27 years ago in Alabama.

* * *

EPRI has started responding to normal journalistic inquiries as if it were a public relations firm, not a research institute. Routine requests from *Microwave News* are being answered with, "That's confidential" (see p.2 and p.5).

In the past, EPRI has given us generous access to its documents and has been quick to answer questions. We're not sure why this has changed. Maybe it's related to cutbacks in funding from electric utilities, who are feeling the financial pinch of deregulation. If utilities see EPRI as a potential source of bad news, are they less likely to contribute? Whatever the answer, you cannot get away from the role of money in the EMF controversy.

Wagons are also circling at Britain's NRPB. Its September meeting on dosimetry and epidemiological studies will be closed to the press and the public (see p.7).

We don't accept that the only way to have a frank discussion is to keep the public out. Maybe that's true for a public relations firm discussing how to spin unpleasant news—but not for scientists who are planning to spend taxpayers' money on research.

It is troublesome to see the public excluded from a publicly funded meeting. In the U.S., such a conference would be required by law to be open. This open-meeting legislation has a nice nickname: the "sunshine laws." The NRPB ought to let a little more sun shine on its internal workings.

* * *

Many officials and experts are frustrated that the public is still worried about EMF and RF/MW health effects (see p.17). Polls show many people in the U.S. will not buy a home next to a power line, and local opposition to cellular phone towers is giving the wireless industry headaches.

Officials often seem to think that the public is worried because the public is stupid. But in fact people are worried because they know they are not being told a straight story. The only way to inspire public confidence is to make decisions out in the open. If you act like you've got something to hide, people will think that you probably do.

If important facts are not yet known, then scientists need to have the intellectual honesty to say so. In our experience, citizens are usually better than officials at dealing with uncertainty.

If we want the public to have more respect for scientific authority, spin and secrecy are the wrong way to go.

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