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U.S. Wireless Industry Will Release SAR Numbers—Slowly

The Cellular Telecommunications Industry Association (CTIA) will require manufacturers to disclose the specific absorption rates (SARs) of microwave radiation from mobile phones.

But it will be months before the CTIA makes phone SARs available to consumers, and even longer before the SARs of two different models can be compared. Most CTIA-certified phones will be sold without SARs for close to a year.

Even so, the new policy represents an about-face for the mobile phone industry. In the past, manufacturers have refused to disclose SARs to the public. The industry came under pressure to change its stance in May when a British government panel, headed by Sir William Stewart, called for the SAR of each mobile phone to be printed on the box in which the phone is sold (see p.4 and *MWN*, M/J00).

In June, the Federal Communications Commission (FCC) began posting the SAR measurements for a number of models of phones on its Web site (see box, p.7).

Motorola spokesperson Norman Sandler pointed to these two developments as prompting the industry's new position on SARs. "Clearly the FCC is moving to make this information more available, and then the Stewart commission advocated making more information available to consumers," he said, when asked what led to the CTIA's change in policy.

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Efforts To Harmonize RF/MW Exposure Standards in Disarray All Parties Say Science Is on Their Side

Call it standards disharmonization.

Despite pressure from the World Health Organization's (WHO) EMF project for a consistent set of exposure standards for radiofrequency and microwave (RF/MW) radiation throughout the world, that goal seems as elusive as ever.

First a split emerged between countries that base their health standards only on heating and those, such as Italy and Switzerland, that want to take nonthermal effects into account (see *MWN*, M/J00).

Now there is division within the thermalist camp. The two leading standard-setting groups—the International Commission on Non-Ionizing Radiation Protection (ICNIRP) and the Institute of Electrical and Electronics Engineers (IEEE) Standards Coordinating Committee 28 (SCC-28)—are at odds

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At the Bioelectromagnetics Conference

More Evidence of EMF Genotoxicity

Two presentations on the first morning of the BEMS meeting* reached very similar conclusions: Low-frequency magnetic fields can lead to chromosomal abnormalities among occupationally exposed workers.

Researchers led by Dr. Ingrid Nordenson of Sweden's University of Umeå have been working on the genotoxicity of EMFs for more than 15 years (see *MWN*, J/F85). At the 1996 BEMS conference, the team reported that a pilot study of 18 male railroad engine drivers exposed to a complex EMF environment showed significantly more chromosomal breaks, compared to controls (see *MWN*, J/A96). This year, they announced that a larger study (30 engine drivers and 30 controls) pointed to a doubling of chromosomal aberrations among engine drivers.

Dr. Kjell Hansson Mild of the National Institute of Working Life in Umeå, who presented the new genetic results, closed his talk with the advice that, "As a precautionary measure, we should take steps to reduce EMF exposures" among engine drivers.

Mild cited the separate epidemiological studies by Drs. Lars Alfredsson and Birgitta Floderus, both of the Karolinska Institute in Stockholm, which have pointed to higher rates of leukemia among Swedish railway workers (see *MWN*, S/O92, M/J94, S/O95 and J/A96). In addition, four different labs—in India, Sweden and the U.S.—have shown that low-frequency EMFs can increase DNA breaks (see *MWN*, N/D98 and M/J00).

"We see DNA breaks, we see chromosomal abnormalities; there definitely seems to be something going on," Mild said in an interview. He pointed out, however, that Nordenson and the Swedes who worked on DNA breaks have retired. "It's not clear who will follow up this research," he said.

Dr. Rafi Korenstein of Israel's Tel-Aviv University in Israel followed Mild to the podium and reached a very similar conclu-

sion. "[EMF] occupationally exposed populations are at high risk to develop cancer over the long term," he said.

Korenstein found many more chromosomal abnormalities in the blood cells of 21 men who worked near high-voltage power lines and substations than in 25 controls ($p < 10^{-4}$). He then exposed these same blood samples to 50 Hz pulses with an average (rms) intensity of 320 mG and once again found evidence of genetic changes.

"The fact that I see the same effect in both *in vivo* and *in vitro* makes the evidence much stronger," Korenstein said.

New Focus on Plants

Three papers from Germany put the spotlight on the effects of RF/MW radiation on plants, a field that has been largely ignored in the past.

Pulsed 383 MHz and 900 MHz radiation caused a "remarkable acceleration" in the growth of corn seedlings, reported a group led by Dr. Daniela Lerchl of the University of Wuppertal. The effect, which Lerchl calls "robust," does not appear to be a thermal one, though the underlying mechanism remains mysterious.

In a second study, Lerchl found that pulsed 383 MHz radiation—mimicking signals from the European radio communications system TETRA—upset the development of pine and fir seedlings. There was a decline in the plants' photosynthetic system, which Lerchl believes "may be the first indication of a decline in the plant's overall status."

Dr. Günter Nimtz of the University of Cologne presented an elegant investigation of how microwaves can affect plants, which could help elucidate the nature of the interaction.

Nimtz applied a 1.87 GHz GSM signal to a mimosa plant and showed that it can change the voltage on the surface of the cell membrane. He observed the same effect with and without the modulation. "At this point we have no explanation for the mechanism," Nimtz said—but he emphasized that it is a highly reproducible nonthermal effect. A new edition of Nimtz's 1994 book *Elektrosmog* is expected soon.

Dr. Alexander Lerchl of the University of Karlsruhe, who also worked on the plant growth studies, told *Microwave News* that stress may be the explanation for the effects seen in all three experiments.

Serious Doubts About Magnet Therapy

Despite anecdotal reports touting the success of magnet therapy, Dr. Abe Liboff argues that it cannot work. "There is no credible physical mechanism that might explain how permanent magnets can reduce pain or have any other therapeutic value," he said.

Liboff, a physicist at Oakland University in Rochester, MI, is not a total skeptic about the biomedical applications of low-frequency EMFs. In fact, he has a number of patents on the use

*22nd Annual Meeting of the Bioelectromagnetics Society (BEMS), Munich, Germany, June 11-16, 2000.

Few Utilities Represented in Munich

You didn't need very many fingers to count the number of attendees from electric utilities at the BEMS meeting. Only a handful of countries were represented, with one utility person from each.

Dr. Kelly Gibney of BC Hydro was there for Canada. This was his 11th annual BEMS meeting, but perhaps his last. He said that he will be retiring next January.

Sweden's Rolf Lindgren of SwedPower, another veteran, came with an unusual outlook. He said that he would not be surprised if the EMF controversy resurfaced. "My bosses tell me to continue to cover this issue because it could come back," he told us during a coffee break. If so, Lindgren believes the emphasis will be on neurological effects, such as Alzheimer's disease, and other noncancer end points. "We may have been sidetracked by cancer," he said.

Kent Jaffa of PacifiCorp in Salt Lake City was the only U.S. utility staffer in Munich. Even EPRI, which has sent a contingent to BEMS in the past, left it to Dr. Robert Kavet to show its colors.

of cyclotron resonance to speed up cellular growth. But in his BEMS presentation, Liboff reviewed three types of physical interactions and in each case showed that the forces associated with 1,000 G permanent magnets are too small to have any observable effects.

“Whenever I’ve been approached by companies marketing magnet therapy, I have suggested research programs which in all cases have frightened them away,” Liboff told *Microwave News*. “They are afraid of research, and my theoretical calculations show that their fear is well grounded.”

Undeterred, Drs. Howard Wachtel and Frank Barnes advanced a model the very next day of how strong magnetic fields could have an analgesic effect. The two University of Colorado, Boulder, researchers suggested that the fields could alter ion channels in nerve fibers.

Dr. Robert Adair of Yale University in New Haven, CT, was not impressed. “I agree with Abe,” he said outside the lecture hall.

Wachtel has not shied away from controversy in the past. He has worked for years to show that air pollution, not EMFs, leads to childhood leukemia. For his part, Barnes, the new president of BEMS, seemed unwilling to bet too much on this new work. When asked to reconcile his model with Liboff’s calculations,

Barnes said, “We’re looking at the problem differently.”

Urban Electrosmog Increasing

RF/MW radiation levels in urban areas are approximately ten times higher than they were 20 years ago—and most of the increase is due to wireless communications, according to Dr. Yngve Hamnerius of Chalmers University of Technology in Göteborg, Sweden.

Hamnerius measured radiation levels in the 30 MHz-2 GHz frequency range at 26 sites across Sweden with varying levels of urbanization. In cities, the median power density was 0.05 $\mu\text{W}/\text{cm}^2$, with a 61% average contribution from GSM base stations.

In rural environments, the radiation levels were about 1,000 times lower with the largest contribution coming from television broadcasters, which account for 48% of the total.

Hamnerius contrasted his results with those of Richard Tell and Edwin Mantipli in the late 1970s, when both were at the U.S. Environmental Protection Agency in Las Vegas. Their survey of 12 large American cities showed that the median exposure of the population was 0.005 $\mu\text{W}/\text{cm}^2$ (see *Radio Science*, 17, pp.39S-47S, 1982).

EC Research Moves Forward; Funding for New Studies Found

\$27 million worth of mobile phone health research is getting under way in Europe.

Most of these projects will receive partial funding from the European Community (EC), including a set of large-scale animal studies proposed by the wireless industry known as PERFORM-A (see *MWN*, M/A00). But an industry-sponsored project that failed to win EC backing, PERFORM-B, has now secured enough funding to proceed on its own (see *MWN*, J/A99).

Dr. Bernard Veyret of France’s University of Bordeaux led the effort to secure funding for the PERFORM-B studies and will serve as their overall coordinator. “Each institution was willing to put up the seed money,” Veyret said in an interview. “We then went to the MMF for matching funds.”

Dr. Laurent Bontoux, a science officer with the European Commission’s research program on the environment and health in Brussels, told *Microwave News* that the EC is planning to sponsor another round of wireless health research next year. These grants will not focus on cancer but on other potential health issues such as neurological effects.

Veyret said that experimental work on the three PERFORM-B studies will begin in the fall. Research groups in Britain, France, Finland and Italy will try to replicate already-published findings of RF/MW effects on the growth enzyme ODC, human chromosomes, and learning and memory in rodents. Each of the three experiments will be repeated in two different labs.

As with the PERFORM-A research, industry funding for PERFORM-B is coming from both the Mobile Manufacturers Forum (MMF) and the GSM Association (see *MWN*, J/F99). Public funding is being provided by government agencies and research institutes in the countries where the work will be done.

Veyret said that PERFORM-B will cost about \$2.4 million, with industry paying a little more than half.

The EC will contribute about \$2 million of the roughly \$8 million cost of the PERFORM-A animal studies, according to Bontoux. Exposures in the first experiment are scheduled to start this November.

Bontoux said the EC will contribute about \$4 million toward the more than \$12 million cost of the multicountry epidemiological study by the International Agency for Research on Cancer (see *MWN*, J/F98 and S/O98). EC funding will help support work in seven countries in Europe, but will not cover any costs in the four other countries in the IARC study.

Markey Seeks Health Research, But Bill “Not Going Anywhere”

Rep. Edward Markey (D-MA) has proposed legislation that would allocate \$25 million for research on potential health effects of mobile phones. But Markey’s staff says that HR4610, introduced on June 8, will probably never come to a vote.

“It isn’t going anywhere in this session of Congress,” legislative assistant Colin Crowell told *Microwave News*. “Right now neither the congressional leadership nor the administration has any interest in this.” The bill is cosponsored by Rep. John Tierney (D-MA). A Senate bill that would fund research is also unlikely to pass (see *MWN*, S/O99).

Markey is the only member of Congress to hold hearings on mobile phone safety research (see *MWN*, J/F93). In mid-1998, he proposed spending \$10 million on cellular phone studies in an amendment to a telecom services bill. It won approval in committee, but the overall bill never reached the floor of the House (see also *MWN*, S/O99).

« Wireless Notes »

Mobile phones affect the inner ear in “perhaps 5% to 8%” of users, causing **headaches** and other symptoms, according to Drs. **Robin Cox** and **Linda Luxon** of the U.K. “Dizziness, disorientation, nausea, headache and transient confusion” among users “are being increasingly reported,” they write in a letter in the June issue of *Occupational and Environmental Medicine* (57, pp.431-432, 2000). Cox, a physician based in Fowlmere, near Cambridge, began looking into such headaches in 1995 when he was a consultant to the wireless industry (see *MWN*, N/D95). Cox told *Microwave News* that he has now collected approximately 30 case reports. In their letter, Cox and Luxon write that “there is good theoretical and clinical evidence” for an inner-ear effect. They suggest that the hair cells or fluid of the inner ear are affected by direct action of phone radiation or by heat from the phone. Cox and Luxon, who is a professor at the Institute of Laryngology and Otology in London, call for research to clarify this mechanism—in part “to emphasize that these symptoms do not indicate any greater risk of developing brain cancer.” There have been similar reports on headaches from Australia (see *MWN*, M/J97), Sweden and Norway (see *MWN*, M/J98) and, most recently, from Singapore (see p.15).

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The U.K. **Consumers’ Association** (CA) is doing new tests of radiation exposure from **hands-free headsets**. In April the CA warned that headsets can triple the radiation exposure from mobile phones, a claim that was met with widespread skepticism (*MWN*, M/J00). This time the tests will include SAR measurements. Antonia Chitty, a senior CA researcher in London, told *Microwave News* that the results should be available in the fall. She declined to say who is doing the measurements.

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The **FCC** has issued a guide to help **local officials** comply with federal RF/MW radiation rules in siting **mobile phone antennas**. The 34-page document presents selected portions of OET Bulletin 65, the more technical statement of the FCC’s RF/MW policy, in “a form accessible to officials and citizens alike.” In addition to detailing the limits themselves, the publication covers the types of sites that automatically receive FCC approval, the kind of information that local officials can use to check compliance and procedures for handling exposures that may exceed the limits. The FCC cautions local officials, however, that the guide is “only intended to help you distinguish sites that are unlikely to raise compliance concerns from those that may,” and

The Stewart Report: New Developments

As detailed on p.1, the report of the U.K. Independent Expert Group on Mobile Phones, chaired by Sir William Stewart, played a major role in the U.S. industry’s decision to release SARs. Here are some other developments that followed the May 11 release of the report (see *MWN*, M/J00):

- On June 13, the Stewart panel issued a “clarification”—at the request of Professor Liam Donaldson, the U.K. Department of Health’s (DOH) chief medical officer—advising that its recommendation that children be discouraged from using mobile phones applied to those who are less than 16 years old. With respect to adults, the panel stated that, “The expert group believes that, on the basis of the evidence currently available, there is no need for the general population to be worried about the use of mobile phones.” The full text of the panel’s clarification is on the Internet at <www.iegmp.org.uk/Queries.htm>.

- David Blunkett, the minister of education, has notified all British schools of the potential health risks for children from mobile phones, the U.K. press reported in late July. A leaflet discouraging the use of the phones by those under 16 will be distributed to retailers in August and may be included as an insert to phone company bills, according to the *Financial Times* (July 25).

- The health research program recommended by the expert panel will be formally launched by the U.K. DOH in September. “It’s going to be big,” Dr. Philip Chadwick of the DOH in London told *Microwave News*, “and it’s going to be independent.” A workshop is being planned to map out the research strategy and to indicate how to apply for funding.

- In a May 27 letter, Dr. Ross Adey of the University of California, Riverside, wrote to Stewart to express his “serious concerns” about the expert panel’s recommendations for future research. The panel, Adey stated, “studiously avoided discussions of urgently needed studies of biophysical and physiological mechanisms underlying nonthermal effects,” as well the impact of long-term exposures and the significance of modulation-dependent effects.

- The Swedish Radiation Protection Institute (SSI) in Stockholm has endorsed the recommendations of the Stewart panel. In a May 12 release, the SSI stated that it too favors public access to SAR information for different models of mobile phones. The SSI’s comments, which are available only in Swedish, are at <www.ssi.se/nyheter/Aktuellt/kommenBrittMobil.html>.

- On June 30, the National Radiological Protection Board (NRPB) released a report on *Exposure to Radio Waves near Mobile Phone Base Stations* (No.NRPB-R321). The Stewart panel had access to a draft when preparing its own report. The NRPB found that the maximum power density from a tower was 0.83 $\mu\text{W}/\text{cm}^2$, with typical readings in the 0.001-0.1 $\mu\text{W}/\text{cm}^2$ range. The report costs £16 (about US\$24) including postage; order from the NRPB: Fax: (44+1235) 822746, E-mail: <information@nrpb.org.uk>.

- The enormous amount of attention the U.K. media has devoted to potential health hazards has done nothing to stem the public’s appetite for mobile phones. On July 4, the *London Times* reported that 3.5 million people bought mobile phones between April and June of this year—85% more than over the same period last year.

should not be used "to identify sites that are out of compliance." Readers are also reminded at the outset that the 1996 Telecommunications Act bars states and towns from setting exposure rules stricter than the FCC's (see *MWN*, M/A96). A *Local Government Official's Guide to Transmitting Antenna RF Emission Safety: Rules, Procedures and Practical Guidance* was developed with the assistance of the commission's Local and State Government Advisory Committee. The full text of the guide is available on the Internet at: <www.fcc.gov/oet/rfsafety>.

FDA and CTIA Ink Research Pact; NTP Board Backs Animal Studies

For the first time, the U.S. government is moving to take a direct role in wireless phone health research. The Food and Drug Administration (FDA) has agreed to oversee a set of industry-funded experiments, and a federal panel has backed a separate FDA proposal for government-financed animal studies.

Representatives of the FDA and the Cellular Telecommunications Industry Association (CTIA) signed a Cooperative Research and Development Agreement (CRADA) on June 7, under which the FDA will provide advice on CTIA-sponsored research. At least initially, this work will focus on following up on two specific findings from the CTIA's Wireless Technology Research (WTR) program: an increased rate of a rare type of brain tumor and lab studies pointing to genetic damage.

But the FDA is not putting all its eggs in the CRADA basket: It wants the government to do its own research as well. Three years ago the agency had asked WTR to give lifetime animal studies the "highest priority." But WTR rejected this advice, and closed its doors without doing any work on chronic exposure. So in May 1999, the FDA asked the National Toxicology Program (NTP) to do this type of work (see *MWN*, M/A97 and N/D99).

On June 30 of this year, the NTP's executive board endorsed the FDA's request. Dr. Scott Masten, an NTP official at the National Institute of Environmental Health Sciences (NIEHS) in Research Triangle Park, NC, explained that NTP staff will now evaluate the feasibility of RF/MW animal studies and their priority relative to other possible experiments. While it is hard to predict how long this will take, Masten said, "six months is a reasonable time frame." The final decision on whether to go ahead will then be made by Dr. Kenneth Olden, head of both the NTP and the NIEHS.

Contrary to numerous press reports stating that the CRADA research will cost \$1 million, CTIA's Jo-Anne Basile told *Microwave News* that no firm budget has yet been set.

The first research under the CRADA will be *in vitro* tests on chromosome abnormalities. A WTR-sponsored study found that micronuclei formed at an increased rate after human blood cells were exposed to mobile phone signals (see *MWN*, M/A99), and the FDA has convened a group of experts to define what follow-up studies are needed. The RF Micronucleus Working Group will hold its first meeting August 1-2 in Rockville, MD.

This group will develop a "statement of work" within a few weeks, Dr. Russell Owen of the FDA's Center for Devices and

Kane Brain Tumor Lawsuit Against Motorola Is Dismissed

On May 12, the only remaining U.S. mobile phone-cancer lawsuit was thrown out of court. An appeal has been filed.

Robert Kane's lawsuit against Motorola was dismissed after the trial judge ruled that his expert witnesses were not qualified. A former Motorola engineer, Kane charged that his brain tumor was caused by use of a prototype cellular phone (see *MWN*, J/F94 and S/O97).

Judge Paddy McNamara of Cook County Circuit Court in Chicago found that Drs. Samuel Milham and Jan Leestma had "testified outside their specialties," and that their opinions failed the legal test of "general acceptance in the relevant scientific community." This follows a trend in both state and federal courts in which judges increasingly act as "gatekeepers" of scientific evidence, deciding whether or not it may be considered (see *MWN*, N/D95, J/F96 and M/J97).

"Dr. Milham is an occupational epidemiologist who would be appropriate...in a case involving the health histories of many people," the judge stated in her May 12 ruling. "He does not diagnose individual patients." While Leestma is a neuropathologist, Judge McNamara maintained that "no literature in his field supports his testimony." She emphasized that Kane's treating physicians had stated "that the cause of Mr. Kane's tumor is not known."

Formerly a Washington state health official, Milham is now a consultant based in Olympia, WA. He was the first epidemiologist to link workplace EMF exposures to leukemia (see *MWN*, J/A82) and has testified in lawsuits over cancer and power frequency EMFs (see *MWN*, J/F94 and S/O96). Leestma is chief of neuropathology at the Chicago Institute of Neurosurgery and Neuroresearch. In 1997 he testified for the defense in the Boston murder trial of British nanny Louise Woodward.

Kane's attorneys, the Chicago firm of Barnow & Goldberg, filed an appeal on July 24. Kane told *Microwave News* that he was "surprised" that Judge McNamara had disallowed his experts' testimony. "We expect that this judgment will be reversed on appeal," he said. (See also p.18.)

Radiological Health in Rockville said in an interview. That will serve as the basis for a request for proposals (RFP) to be issued by the CTIA. "Proposals will be submitted to us and we will forward them to the FDA for the working group to evaluate," Basile said.

While the CTIA is free to fund whatever proposals it chooses, Owen said, "My feeling is they're going to stick very closely to the recommendations we send them." After the labs are selected, the working group will oversee the conduct of the experiments and will evaluate their results. Basile said that the CTIA's budget for this work will be set after the proposals are received.

Epidemiological research will come next. "I think the epi group will be taking a broad look at the research issues, and won't be quite as tightly confined to direct follow-up" as the micronucleus working group, Owen said. While Basile did not disagree with this, she emphasized that "the driving force" behind

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the decision to do more epidemiological work was the WTR-sponsored study by Joshua Muscat “and the interpretation of it that has been publicized by George Carlo.” Muscat and Carlo have disagreed over whether the brain tumor study actually shows a cancer excess (see *MWN*, M/A99 and M/J00).

The epidemiology working group, Owen said, is not likely to be assembled until next year.

The third part of the CRADA will be an assessment of topics for possible future study. The document envisions meetings of international experts in the second year “to comprehensively review the ongoing global research and to identify and prioritize further research that is not being addressed.” In the third year of the three-year plan, the CTIA and the FDA will consider “topics...for future collaborative research, if any.”

Owen said that the work described in the CRADA “could end up taking five years rather than three.” On the other hand, both Owen and Basile said that decisions on further research need not wait until the very end. “It’s just that logistically, we won’t be able to get to the third part until we get the other two going,” Owen explained.

The two topics for initial research were selected by the CTIA, which then approached the FDA about working together. The industry group will also have the final say in choosing any topics for further study. “Since they’re the ones paying for it,” said Owen, “they have to decide what they want to pay for.”

The research itself will not be governed by the CRADA, but by separate contracts between the CTIA and individual labs. Many aspects of the CTIA–researcher relationship still remain to be defined.

“We won’t own the research,” emphasized Basile. “The research is owned by the researcher.” The CRADA specifies that results shall be made public “when the research is complete.” But Basile noted that, “While the research is going on, there’s appropriate confidentiality.”

Will researchers need the CTIA’s permission to present interim results at a scientific conference? Will they be required to show the CTIA a draft of their paper before submitting it for publication? Will the dollar amount of each research contract be kept secret? To each of these questions, Basile said she did not yet know the answer.

Medical Report Points to Hazards Of Work on Broadcast Towers

People who work on broadcast towers risk serious and lingering health problems, according to Dr. Chris Schilling, an occupational health consultant based in London. Schilling details six case histories of workers exposed to RF/MW radiation on two different towers in the January issue of *Occupational Medicine* (50, pp.49-56, 2000).

In 1995, a four-man crew serviced a tower near Glasgow, which was used for FM radio and UHF television. All four men became sick during the three-month job. Their symptoms included headaches—often severe—numbness, tingling or pain in the back or extremities, dizziness, diarrhea, nausea and fatigue.

Similar problems were reported in 1996 by two members of a six-man crew that spent 17 days installing a UHF antenna on a tower in Cornwall. The tower was also home to FM radio and mobile telephone antennas.

None of these men was able to return to tower work in less than two months. Those who had been closest to operating antennas (two men at each site) had still not recovered when Schilling conducted follow-up interviews in 1999.

Schilling suggested that whole-body resonances might have made the work more hazardous. Such resonances, he told *Microwave News*, “may result in a several-fold increase in exposure of certain organs and tissues.” He said that he is seeking government funding to study the phenomenon.

In surveys before the work began, some exposure levels were above the occupational limits set by the National Radiological Protection Board (NRPB), but most were below these limits, according to Schilling. Transmitter power levels were reduced at both locations when the men were on the tower, but the transmitters were not turned off.

“It is possible that NRPB [limits] do not give adequate protection,” Schilling said.

The NRPB RF/MW exposure limits are among the world’s most lenient. For example, at 100 MHz—a frequency band used by FM radio—the NRPB limit for workers is 2.7 mW/cm², compared to 1 mW/cm² as set by ICNIRP and the ANSI/IEEE.

U.S. Wireless Industry To Disclose SAR Data (continued from p.1)

The CTIA’s new requirement is part of its certification program, which includes most phones sold in North America. A new phone’s SAR value will have to be listed in the user manual or on a separate sheet, along with “a plain-English description of what SAR is and what it means,” CTIA’s Jo-Anne Basile told *Microwave News*.

The new rule applies only to phones certified after August. Since CTIA certification is granted for 18 months, it will take that long for all phones now on the market to be retested and their SARs disclosed. Therefore, while the first phones with SAR information

may be in stores later this year, it will be 2002 before every CTIA-certified phone will be sold with SAR information.

The CTIA will not require the phone’s SAR to be printed on the box. “On the outside of the box there will be a sticker that says the phone meets the FCC RF emission guidelines,” Basile explained. “It will give consumers the phone’s FCC identification number and the FCC’s Web site, so they can go

Product meets current FCC Radiofrequency Exposure Guidelines
FCC Equipment Authorization ID: xxxx-xxxx
Additional detail within and at <http://www.fcc.gov/oet/fccid>

CTIA’s Draft Language for the Label on Cell Phone Packaging

look up their phone” (see draft label above). SARs are not easy to find on the FCC Web site, however, and are not listed at all for many phones.

Dr. Stewart, chair of the U.K.'s Independent Expert Group on Mobile Phones, said that the CTIA had not gone far enough to help consumers. "We said that we wanted the SAR levels to be...readily available at the point of sale, with information on the box," Stewart told Scotland's *Sunday Herald* (July 23).

The CTIA and its members counter that consumers should not comparison-shop for wireless phones based on differences in SARs. "SAR values by themselves can be misleading," a CTIA statement declared on July 21. "Variations in SARs do not represent a variation in safety."

The industry is concerned about how the public might interpret SAR numbers. In the past it cited this as a reason to keep SARs secret. "The rankings lack any relevance to health," Sandler told *Microwave News* in 1997. "The way they have been presented may mislead or confuse consumers." All phones are equally safe to use, he contended then, "as long as they all meet recognized exposure standards" (see *MWN*, S/O97).

Sandler makes the same point today. "The challenge," Sandler said this July, "is how to put this out to consumers in a way that does not breed any misunderstanding." In a July 11 e-mail to industry insiders, Basile argued that putting SARs on the box would be a mistake. "Given the complexity of measurement and SARs," she wrote, "it is insufficient just to provide raw numbers to the public without any explanatory information that helps put it in context." Sandler agrees: "To present a single number in isolation—we'd have some problems with that."

Basile and Sandler both pointed out that the way phones are actually used, SARs will vary and will almost always be lower than the maximum values that are reported to the FCC. And Sand-

Test Protocols Near Completion

The SARs of two different phones are not comparable unless they are tested using the same procedure. Standard protocols are nearing completion, but it will take some time before all phones are tested in the same way.

An IEEE working group is now finalizing a test method (see *MWN*, J/F99 and M/J00). The subcommittee on mobile phones, SCC-34/SC-2, will vote on it by September 15. If approved, it will go to the IEEE for review. Dr. C.K. Chou of Motorola expects final approval by the end of the year. The FCC's Dr. Robert Cleveland said that the FCC plans to use the SCC-34/SC-2 protocol for compliance testing.

Meanwhile, the European standards group CENELEC is moving forward on its own protocol. A draft has been reviewed by committees from each member country, and in mid-May was approved by Technical Committee 211. It is also expected to be finalized by the end of the year.

ler noted that test results can vary because the industry still does not have a single "gold standard" for how to measure SARs—which means that two tests of the same phone may get different results. The IEEE and CENELEC are working to define standard testing protocols (see box above).

The CTIA's shift on SARs drew attention in print and electronic media around the world, especially in the financial press. "I'm a little surprised that this has aroused so much interest," Basile said. "We were not planning on issuing a press release on this at all."

"Prudential Securities analyst Chris Larsen said the industry should learn from cigarette manufacturers," reported CNNfn, the cable channel, on July 17. "Why not come out front and say... here is the information you need to make a decision," said Larsen. "We don't know if it's bad or not, but here's the information. We'll be as up front as possible, because apparently not being up front has hurt the tobacco companies."

In Australia, a government spokesperson told the *Sydney Morning Herald* (July 19), "There will be pressures for us to follow world trends." And on August 2, Australia's wireless industry agreed to adopt an SAR policy modeled on the CTIA's.

In theory, SAR numbers have been public information in the U.S. since 1996. Manufacturers are required to submit SAR test results to the FCC before a phone is approved for use, but in practice that information has been inaccessible to outsiders (see *MWN*, N/D99). Top officials at the FCC recently ordered agency staff to ensure that SAR data are available to the public, and the numbers began to appear on its Web site as a result (see box at left and *MWN*, S/O99, N/D99 and M/J00).

A majority of mobile phones sold in North America are CTIA-certified, said Tim Jeffries, manager of the CTIA's certification programs. This means they have shown compliance with a wide range of industry technical standards, as well as the FCC's exposure limits. Seventeen manufacturers take part in the program, including Audiovox, Ericsson, Motorola and Nokia.

Basile said that the new consumer language on SARs is not quite final. It is being worked out jointly with the Telecommunications Industry Association (TIA), a manufacturers' group.

Finding SARs on the Internet

The FCC's Web site now includes SAR test data for many cellular phones—but finding those numbers is not easy. Often it is impossible. The site includes SAR data only for phones approved since the records were computerized; it has no SARs for phones submitted before mid-to-late 1998.

The site, <www.fcc.gov/oet/fccid>, does not yet give SARs by the names under which the phones are sold, such as "StarTac 130" or "Nokia 8890." You need the FCC identification number, which is in the user manual and usually on the back of the phone or in the battery compartment.

After you enter the ID number you will get a lot of data, including the manufacturer's application, documents (exhibits) and the FCC's grant of approval. The exhibits can include several different SAR test reports, and a test report can present more than one SAR value. For example, a test report for one Motorola model (FCC ID# IHDT56ZF1) gives SARs that range from 0.54 W/Kg to 1.58 W/Kg, reflecting measurements in different modes of operation.

The FCC is working to make SAR data available in a more consumer-friendly format. For other details on how to look up SARs on the FCC Web site, see <www.fcc.gov/oet/rfsafety>.

A third-party site has already sprung up that gives SARs for popular phones: <www.SARdata.com>. It lists phones by their common model names and presents a single SAR value for each.

over who has the most rigorous approach. A key point at issue is the safety margins each group uses to set exposure limits.

A free-for-all has developed, with everyone claiming that the science is on their side.

The friction was evident at a *Forum on EMF Safety Standards and Science* sponsored by the U.S. Air Force (USAF), held in Munich on June 11, just prior to the BEMS annual meeting (see p.2). "The ICNIRP standard is based on science, science and nothing but science," maintained ICNIRP member Dr. David Sliney of the U.S. Army Center for Health Promotion and Preventive Medicine at the Aberdeen Proving Ground, MD.

This prompted Dr. John Osepchuk, the chair of SCC-28, to challenge the scientific basis for the safety factors used by ICNIRP. Osepchuk, formerly with Raytheon Co. and now a consultant based in Concord, MA, sees the ICNIRP standard as unduly restrictive.

Dr. Michael Murphy, of Brooks Air Force Base in San Antonio and a member of the executive committee of SCC-28, wore a button at the workshop which demanded **SHOW ME THE DATA**. "It's the experimentalist's mantra," he told *Microwave News*. Dr. John D'Andrea, who works for the U.S. Navy at Brooks, commented that, "It's a plea for good science."

Efforts are under way to soothe the tensions between SCC-28 and ICNIRP. The day after the USAF workshop, representatives from the two groups met in Munich. Few details of what transpired at the meeting are available as all those present were pledged to secrecy. A written statement, provided to *Microwave News*, resembled a diplomatic communiqué following a summit conference. It referred to "positive and constructive exchanges" and noted that the harmonization of non-ionizing radiation standards is a "prime objective of both organizations," but otherwise it revealed little.

One of those present said that most of the meeting consisted of descriptions of how the committees functioned. A second session is planned for next November at Brooks AFB, the same week the WHO will also hold an EMF standards harmonization meeting there (see p.18).

At the heart of both the ICNIRP and IEEE standards is the same threshold for thermal effects: a specific absorption rate (SAR) of 4 W/Kg. The similarities between the two standards left some observers wondering what the dispute is really about.

A number of those in Munich pointed to control of the standard-setting process. "It's a turf battle, pure and simple," said one observer. Like many others, he declined to be identified.

Some drew parallels between the ICNIRP-IEEE dispute and the lobbying campaign waged by the IEEE to convince the U.S. Federal Communications Commission (FCC) to adopt the IEEE standard over the limits set by the National Council on Radiation Protection and Measurements (NCRP) (see *MWN*, M/A96 and M/J96). Like the IEEE and ICNIRP, the NCRP standard is also based on a 4 W/Kg threshold for thermal effects.

The USAF plays a key role in both ICNIRP and the IEEE. Two members of the Brooks RF/MW team are on SCC-28's six-person Executive Committee (Murphy and Dr. Eleanor Adair). In addition, the USAF has been a major financial supporter of the meetings organized by the WHO and ICNIRP, and those who work at Brooks have been active participants at these meetings.

While ICNIRP is made up of health professionals, most of whom are associated with national radiation protection agencies, SCC-28 is largely composed of representatives from industry and the military. But the USAF's expanded involvement with ICNIRP and the WHO has clouded some of the distinctions between the two groups. In addition, SCC-28 is seeking to recruit European members to make itself more international.

The Department of Defense (DOD), including the USAF, has its own RF/MW standard which is similar to the IEEE limits.

Uncertainty and Safety Factors

Despite objections from SCC-28, Sliney maintains that the ICNIRP safety factors are necessary. "When you have large uncertainties in the data, you need larger safety factors," he told *Microwave News*.

In fact, this is the same argument used by those who want limits that are stricter than those of ICNIRP. "The ICNIRP standard is a heat-based standard with a safety factor that has no scientific basis," Dr. Michael Kundi of the University of Vienna said in an interview. "ICNIRP takes the position that studies showing nonthermal effects have errors or are bad science. I

1 g vs. 10g: IEEE & NCRP vs. ICNIRP

Although the IEEE RF/MW standard is in many ways looser than that of ICNIRP, this is not the case for SARs from mobile phones. The IEEE, like the NCRP, has a 1.6 W/Kg limit averaged over 1 g of tissue, compared to 2 W/Kg averaged over 10g for ICNIRP.

Averaging over a larger volume makes compliance easier because it smooths over radiation "hot spots." For example, a Motorola test report submitted to the FCC states that the maximum SAR of one of its StarTac phones is 0.92 W/Kg averaged over 1g, but only 0.49 W/Kg averaged over 10g.

If the two organizations succeed in harmonizing their standards and move away from the 1.6 W/Kg over 1g limit, would the U.S. FCC follow?

"I don't think the 10g averaging volume is scientifically defensible," Dr. James Lin, the chair of the NCRP committee revising the council's RF/MW standard, told *Microwave News* in Munich. He noted that he had expressed the same opinion at WHO/ICNIRP standards harmonization meetings held last year in Moscow and in Erice, Italy.

Lin did not comment on the difference between an SAR limit of 1.6 W/Kg and 2.0 W/Kg.

The NCRP's position is important because the FCC, on the advice of federal health agencies, favors the council's positions over those of the IEEE. The NCRP is chartered by the U.S. Congress.

The NCRP revision, which began approximately five years ago (see *MWN*, S/O95), is now at a standstill. "We are in a holding pattern," Lin said, explaining that one of the members of his committee, who he declined to name, has a potential conflict of interest. The matter has to be resolved.

Lin, who is at the University of Illinois, Chicago, said that there is at present no firm schedule for completing a draft of the report.

Salzburg's 0.1 $\mu\text{W}/\text{cm}^2$ Limit for RF/MW from Cell Towers Prompts Concern Across Europe

Salzburg's proposal for a 0.1 $\mu\text{W}/\text{cm}^2$ health standard for mobile phone towers is causing consternation in Vienna and all over Europe.

"Everyone in Switzerland is talking about the Salzburg limits," said Dr. Michael Burkhardt of diAx, a mobile phone service provider based in Zurich. Switzerland and Italy have their own strict limits for mobile phone towers, but Salzburg's are forty to a hundred times lower.

On June 7 and 8, Salzburg officials sponsored an *International Conference on Cell Tower Siting*, which showcased its draft limits. A few weeks later, on June 30, Paul Lannoye, a Belgian member of the European Parliament and a senior official of the Green Party, called for the adoption of the 0.1 $\mu\text{W}/\text{cm}^2$ limit across Europe. Lannoye had helped organize a conference on mobile phone radiation and health held at the parliament's offices in Brussels the previous day.

Salzburg officials began working on cell tower radiation in 1997 and over the next two years developed a "precautionary" proposal. "It's a classic issue for public health officials," said Dr. Gerd Oberfeld of Salzburg's Public Health Department at the opening session of the conference. Oberfeld and Dr. Michael Kundi of the University of Vienna cochaired the meeting.

Oberfeld explained that the 0.1 $\mu\text{W}/\text{cm}^2$ standard is based on a study of the effects of GSM signals on sleep by Drs. Klaus Mann and Joachim Rösche of Germany's University of Mainz (see *MWN*, M/J94 and M/J98). On March 29 of this year, Salzburg officially asked the federal government of Austria to adopt the limit nationwide.

This appears unlikely. At the conference, Johann-Klaus Hohenberg of the Austrian federal environmental ministry endorsed the ICNIRP standard. Just a few days before the meeting, his department had released a literature review by the Austrian Re-

search Center (ARC) in Seibersdorf which argued that the Italian and Swiss limits are based on "social and political developments and not on scientific considerations alone" (see p.1).

Those who support the WHO EMF project and favor the ICNIRP exposure standards were in the minority at the Salzburg meeting. Although WHO's Dr. Michael Repacholi and ICNIRP members were invited, none of them came.

"WHO is deaf in one ear and blind in one eye," said Dr. Christoph König of the Salzburg public health department. "How do they justify not coming?" he asked. "WHO is very industry-friendly," said Siegfried Zwerenz of Germany's Bürgerwelle (Citizens' Wave), a leading activist group (see *MWN*, N/D99).

At present, mobile phone operators can operate within the proposed standards. "In most, but not all places, the levels meet the Salzburg limits," said ARC's Georg Neubauer, who has recently completed a nationwide survey of base stations.

But some see trouble as wireless communications continues to grow and begins to transmit data. "I don't believe the activists realize that it is not profitable to build a network with the Salzburg limits when future capacity is taken into account," said Dr. Thomas Schüller of Mannesmann Mobilfunk, a service provider based in Düsseldorf, Germany. Schüller, who backs the ICNIRP limits, wants "the activists, the government and the operators to sit down and find a way to move forward."

Bernhard Eicher of Swisscom in Bern doubts that a consensus can be reached. "The new Salzburg standard does not help one bit," he told *Microwave News*. "The public wants more and it will never stop," he said.

Indeed, at the close of the Salzburg meeting, one member of the audience got up and demanded a standard at femtowatt levels—that is, 12 orders of magnitude tighter than the draft Salzburg limit.

disagree," he said.

Ronald Macfarlane, a consultant to the city of Toronto, echoed Kundi's concerns. "It is very clear that ICNIRP does not provide a very large margin of safety," he said in a talk at the Salzburg cell tower conference on June 8 (see box above). Toronto is weighing limits that are more than 100 times stricter than those of ICNIRP (see *MWN*, M/A00).

Macfarlane highlighted the 1997 lymphoma study by Dr. Michael Repacholi, the head of the WHO EMF project, as a major reason for a precautionary approach to setting exposure limits. Speaker after speaker at the Salzburg meeting pointed to the Repacholi study as the largest single source of uncertainty over the adequacy of current safety standards.

Salzburg is seeking a very strict standard: 0.1 $\mu\text{W}/\text{cm}^2$ for pulsed signals from mobile phone base stations—a level that is 40 times stricter than the standards adopted by Switzerland and 100 times stronger than those of Italy.

The Italian and Swiss standards are themselves much tougher than those of either ICNIRP or the IEEE (see *MWN*, J/F00). The two countries broke ranks with the rest of the EC, as well as the U.S., in adopting a precautionary approach to non-ionizing

radiation. They joined Russia and China, both of which have long favored tight exposure limits (see *MWN*, S/O99 and N/D99).

Officials from China and Russia were in both Salzburg and Munich and they offered no hint that they might be willing to relax their standards or to make them compatible with ICNIRP and the IEEE. "The 4 W/Kg threshold must be revised downward," said Dr. Huai Chiang of the Zhejiang University Medical College in Hangzhou, China, in her talk in Salzburg.

In a fact sheet released in June by the WHO EMF project, Dr. Michael Repacholi warned regulatory authorities who want to set precaution-based exposure guidelines that "they should not undermine the science base of the guidelines by incorporating arbitrary additional safety factors" (see also p.13). This advice, clearly aimed at Italy and Switzerland, parallels the arguments directed at ICNIRP by IEEE's SCC-28.

As the Salzburg conference came to a close, a number of participants suggested that those favoring precautionary limits should establish a new international advisory body, which was being called the "anti-ICNIRP"

Clearly, a consensus on what constitutes a "scientific" safety standard is a long way off.

« Power Line Talk »

A lawsuit blaming EMFs for a psychiatrist's leukemia has been dismissed. For more than 25 years, Dr. Seymour Grossman saw patients on the ground floor of a 14-story building in New York City. He was diagnosed with cancer in 1990 and died a year later. In 1993, his children and ex-wife sued the building's owners, accusing them of negligence for failing to protect Grossman from EMFs in his office (see *MWN*, J/F00). The source and levels of magnetic fields are in dispute, but New York state Judge Emily Goodman focused on whether the landlord could have known that EMFs were a potential hazard "at the time of the alleged exposure." She noted that an air conditioner cited by the plaintiffs as the main source of exposure was installed in Grossman's office in 1964, 15 years before "the first somewhat relevant, though inconclusive, EMF study"—Dr. Nancy Wertheimer and Ed Leeper's 1979 paper linking childhood cancer and power lines. "It cannot be said that the alleged harm was reasonably foreseeable to the defendants," Goodman argued in her ruling, which was dated February 28 but not officially issued until June 21. Defense attorney **Andrew Sapon** of Bivona & Cohen in New York City downplayed the case's significance for EMF litigation. "The judge didn't rule on the issue of whether EMFs caused Grossman's cancer," Sapon told *Microwave News*. Goodman rebuffed a recent request to reopen discovery by the plaintiffs' lawyer, **Lester Tanner** of Tanner Propp in New York City. Tanner had cited new measurements made in Grossman's office that pointed to a plumbing pipe in the wall as the main source of EMF exposures. Tanner and his clients were weighing an appeal, he told *Microwave News*, but were pessimistic about its chances.

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The U.S. **Department of Transportation** (DOT) will soon decide whether to proceed with an epidemiological study of cancer and EMFs from electrified railway lines. Dr. **William Bailey**, a consultant with Exponent Health Group in New York City, expects to complete a feasibility study in "a couple of months," he told *Microwave News*. If approved, the full-scale study would compare incidence of childhood leukemia near electrified and non-electrified portions of **Amtrak's** route in several northeastern states. The purpose of the preliminary analysis is "to determine if there are sufficient data on exposures and cases," Bailey said. The DOT awarded a \$100,000 contract for the preliminary study to Bailey Research Associates in 1998. "The project has been delayed," Dr. **Aviva Brecher**, who is overseeing the project for the DOT, explained in an interview. "It's very hard to get data from the state cancer registries." She said that the study was prompted by public concerns over Amtrak's move to complete electrification of its service between New York City and Boston. The federally subsidized passenger carrier began running electric trains over the entire length of the route in January, after installing overhead power cables on a 150-mile section between Boston and New Haven, CT. "There was a lot of opposition" to electrification, said Brecher, noting that the environmental impact statement for the Amtrak project had been challenged in federal court, but was upheld. The new power supply system carries 25 kV at 60 Hz and is designed to minimize EMFs, ac-

EPRI: Shock Theory on EMFs

The link between EMFs and childhood leukemia might be caused by electric shocks, according to a hypothesis proposed by a team from EPRI in Palo Alto, CA, and Enertech Consultants in Lee, MA.

U.S. wiring practices create "the possibility of a small voltage (up to a few tenths of a volt) on appliance surfaces.... [which] will cause 'contact current' to flow in a person who touches the appliance and completes an electrical circuit to ground," write EPRI's Dr. Robert Kavet, Enertech's Dr. Luciano Zaffanella and colleagues. Their paper will appear in *Bioelectromagnetics* later this year.

Their dosimetric model suggests that modest contact currents can cause significant induced electric fields in bone marrow and other tissue, and that this might increase childhood leukemia risk. But they concede that this may not apply to countries with different wiring practices, and would not explain elevated risks for children who live beneath overhead transmission lines.

cording to Brecher, who is based in Cambridge, MA. Between New Haven and Washington, Amtrak's trains operate at 12.5 kV and either 60 Hz or 25 Hz.

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Dr. **Chris Portier** is the new acting director of the **NIEHS'** Environmental Toxicology Program and the new acting associate director of the **National Toxicology Program**. He took over from Dr. **George Lucier**, who retired on July 1. Portier was the principal author of the NIEHS' report to Congress on the EMF **RAPID** research program (see *MWN*, J/A99). Before working on EMF issues, Portier used an electric blanket. But no more—it has been replaced with a comforter, he told *Microwave News*.

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It is "unlikely" that exposing chick embryos to weak EMFs before a heart attack helps them survive, according to the Food and Drug Administration (**FDA**). FDA's Dr. **Russell Owen** tried to verify claims by Dr. **Theodore Litovitz** that magnetic fields prompt the synthesis of **stress proteins**, thereby protecting heart tissue from damage (see *MWN*, N/D97 and M/J99). Litovitz has obtained a patent for treating patients with EMFs to activate stress proteins and the FDA anticipates being asked to approve a medical device for this use. Litovitz, of the Catholic University of America in Washington, has shown that genetic variability can play a key role in the effect, but Owen told *Microwave News* that FDA's tests were not designed to take this factor into account. This marks the second time that FDA researchers have failed to replicate results from Litovitz's lab. Previously, Owen was unable to show that EMFs could increase the activity of ornithine decarboxylase (ODC) in cell cultures. Owen's results have not been published or presented at a meeting, but are described in the most recent *Office of Science and Technology Annual Report*, available on the Web at <www.fda.gov/cdrh/ost/reports/fy99/>.

Add Dr. **Robert Ashley** to the growing number of people who think that too much emphasis has been placed on magnetic fields at the expense of **electric fields** (see *MWN*, N/D96 and M/J00). “I estimate, based on my measurements,” Ashley writes in the July issue of *IEEE Spectrum*, “that the peak value of the electric field is 10-20 times more likely to explain the link between intermediate and bulk power lines and childhood cancers than is the magnetic field.” Ashley also states: “When measuring electric fields above 3 kV/m, I now intend to wear a type of metallic mesh hot suit to protect myself.” Nor does he believe that a child’s transient exposure to a 1 kV/m field is safe (see p.13). A retired professor of electric engineering, Ashley is an unlikely EMF activist. In 1992, Ashley published a letter to another IEEE magazine which concluded, “The increased cancer risk associated with electromagnetic fields from power lines is about the same as the increased cancer risk associated with solar radiation exposure from engaging in nude moon bathing.” Asked to explain his change of outlook, Ashley replied that he was trying to make a “semantic point” about the differences between fields and radiation in the 1992 letter. “In any case,” he continued, “it was written before the Swedish study by Feychting and Ahlbom and that turned me around. If we do some better epidemiology, I would be totally surprised if we learned anything bad about magnetic fields. But I would not be very surprised if electric fields were found to present a cancer risk.”

Physicists: 60 Hz Magnetic Field Effects as Low as 10 mG

The gulf between the physicists and the biologists just got smaller. Dr. James Weaver of MIT in Cambridge, MA, who has been a leading skeptic of low-level EMF effects, now says that under certain conditions biological systems could be affected by magnetic fields on the order of a few milligauss.

“It is possible to design a specialized system—through evolutionary pressure—to have sensitivity down to 1 mG,” Weaver told *Microwave News*. He was referring to static magnetic fields. “For 50/60 Hz fields, you get less sensitivity,” Weaver said, “perhaps by an order of magnitude, that is, down to 10 mG.”

This marks a major change in Weaver’s outlook. At a workshop convened by the National Institute of Environmental Health Sciences (NIEHS) in March 1997, Weaver said that he had “a hard time understanding” how experimental data could point to power-frequency EMF interactions at levels below 1 G (see *MWN*, M/A97).

Based on Weaver’s opinions and those of other members of the physics community, the NIEHS concluded in its report to Congress in 1999 that, “The current biophysical theories for ELF EMFs would suggest little possibility for biological effects below exposures of 100 μ T” (1 G).

Asked about his new outlook, Weaver replied: “I have been remarkably consistent.” He explained that there are some ten different ways that electric and magnetic fields might couple to

Alternate Metrics Don’t Point to Leukemia Risk, Says NCI Team

“Peak exposures, threshold values, measures of short-term variability and spot measurements demonstrated little association with risk of childhood acute lymphoblastic leukemia” (ALL), according to a new “exploratory analysis” of data from the large-scale study of childhood leukemia and magnetic fields by the National Cancer Institute (NCI), originally published in 1997 (see *MWN*, J/A97).

Writing in the July 1 issue of the *American Journal of Epidemiology* (152, pp.20-31, 2000), NCI researchers conclude that future studies should focus on median exposure and similar measures.

They note, however, that the NCI study did not include data on electric fields, for which a strong threshold effect was recently reported for utility workers (see *MWN*, M/J00). Nor did it examine transients or harmonics.

When time-weighted average, mean and median exposures were analyzed as continuous variables, they all showed small increases in risk—from 7% to 14% per 10 mG—that were statistically significant, or nearly so.

But the article emphasizes that such findings “should be interpreted with caution because of the hypothesis-generating nature of the analysis and...the large number of...statistical tests performed.” It adds that none of the risks observed in this latest analysis call into question the NCI’s original assessment of its childhood leukemia data: “that there was little evidence of an association between high magnetic field levels and risk of childhood ALL.” That conclusion has been controversial (see *MWN*, N/D97).

Interestingly, the NCI team found that “risk estimates were slightly higher for the nighttime (10 pm-6 am) interval than for the corresponding 24-hour period,” and the article points out that measurements taken when children are in bed may be a more accurate reflection of their residential exposure than a 24-hour measure.

biochemical processes to cause an observable effect and that his 1997 comments were based on only one of these, the movement of ions through voltage-gated transmembrane channels for single cells.

The new model, based on radical pair recombination over a multicellular system, points to a sensitivity at much lower field levels. It is presented in a paper published in the June 8 issue of *Nature*. Weaver, Dr. Timothy Vaughan, also of MIT, and Dr. Dean Astumian of the University of Chicago write that their analysis “demonstrates quantitatively that an extremely sensitive, chemically based magnetic sense should be possible.”

Not all physicists are convinced, however. Dr. Robert Adair of Yale remains skeptical. “I have argued with Jim and Dean,” he told *Microwave News*. “Their hypothesis only really applies to very small molecules and any effects would be much smaller for more complex molecules.”

When told of Adair’s comments, Weaver countered: “Do any molecules found in nature have a significant sensitivity to mag-

netic fields? We don't know yet, but our model tells us what to look for."

In an interview, Astumian pointed out that, "Once you can detect the signal, physics has little to say about what the biological system does with it." He added that, "You can always beat electromagnetic noise by detecting over a long period of time or using a lot of receptors."

Indeed in 1998, Adair, Astumian and Weaver showed that the exquisite sensitivity of sharks could be explained by the voltage-gated membrane model when it is extended from a single cell to a multicellular system (*Chaos*, 8, pp.576-587, 1998).

But Adair pointed out that one cannot translate the sensitivity of sharks to humans because most of the body of the fish is part of the sensory organ.

Studies of sea turtles, which navigate over large areas of the ocean by sensing very small changes in the Earth's magnetic field, suggest that they can sense a static field of 1 mG. Detecting such a field, Weaver and Astumian estimate, would require a biological organ the size of a 2 mm cube. For 10 mG, the cube would only need sides of about 0.4 mm. "We are talking about an organ that is not bigger than a pineal gland," Astumian said.

Dr. Paul Gailey of Ohio University in Athens commented that, "It's good to see a detailed model that could explain how animals navigate with the geomagnetic field—clearly these results will force a rethinking of what kinds of low-level EMF effects are possible."

Is Electrosensitivity Real? Debate in Sweden Continues

In Sweden, more and more people are calling themselves "electrosensitive." They report a range of distressing symptoms when near devices that are powered by electricity. But are their maladies really caused by EMFs? After more than ten years of research, there is still no agreement.

Skin reactions are the most common complaint. More than 10% of heavy VDT users in Sweden report having facial skin discomfort or rashes, compared to 4% of non-users, according to a recent survey led by Drs. Nils Eriksson and Jonas Höög of the University of Umeå. Other health problems blamed on EMFs include fatigue, headache, dizziness and loss of concentration.

But most provocation studies have found that such patients cannot reliably tell whether or not they have in fact been exposed to EMFs. Most recently, Dr. Ulf Flodin of the Center for Public Health Sciences in Linköping, Sweden, asked subjects to make such a distinction and found that, "The patients were not able to make a more precise judgment than the controls or chance."

Dr. Monica Sandström of the National Institute for Working Life in Umeå, who worked on the Eriksson survey, is among the many who are skeptical of an EMF link. Sandström and NIWL's Dr. Kjell Hansson Mild have previously suggested that the electrosensitive have "hyperreactive" nervous systems, making them more susceptible to stress from sensory stimuli such as flickering light (see *MWN*, M/A97).

Sandström told *Microwave News* that she and Mild have new

results which "confirm our earlier findings" on nervous susceptibility while providing "no indication" that magnetic fields play a role in electrosensitivity. They have submitted one study for publication and expect to complete a second study soon.

One of the few researchers to report effects in provocation studies is Dr. Olle Johansson of the Karolinska Institute in Stockholm. Johansson has also reported seeing more mast cells—those involved in inflammatory and allergic reactions—in the skin of electrosensitive patients (see *MWN*, N/D94 and S/O95). But he has been unable to obtain funding to pursue these findings.

In a new paper, Johansson and Dr. Shabnam Gangi propose mechanisms by which EMFs could trigger mast cells to release histamine, a compound that causes pain, swelling and itching of the skin.

But other investigators have not seen any differences. For example, a team led by Dr. Solbritt Lonne-Rahm of the Karolinska Hospital in Stockholm reported in May that mast cells and histamine levels of patients with VDT-related symptoms "were not affected" by VDT exposures. Lonne-Rahm also found that EMF exposure did not alter the effects of a stress-inducing task in either the patient or the control group.

Dr. Bengt Arnetz, who worked with Lonne-Rahm, suggested in an interview that EMFs may play a role in triggering symptoms as part of the "total load" of stresses, but emphasized that, "EMFs alone don't appear to be the cause." Arnetz is now setting up a clinic at the University of Uppsala that will treat electrosensitive patients.

Some have suggested that the EMF exposures used in provocation tests do not accurately reflect the complexity of real-world EMFs. "Most of the studies have been performed in the laboratory and may not have been representative of normal living conditions," noted an editorial that accompanied the Flodin study. Flodin and collaborators attempted to approximate real-world exposures by testing patients in their own homes or workplaces, with sources they believed to cause their symptoms; they still found no link to EMFs.

Clas Tegenfeldt, who worked with Flodin, does not rule out EMFs as a factor in electrosensitivity. Tegenfeldt suggested that the provocation studies may be skewed toward a negative outcome by the stress inherent in a test situation.

Nils Eriksson, Jonas Höög, Kjell Hansson Mild, Monica Sandström and Berndt Stenberg, *Prevalence of Symptoms Similar to "Sick Building Syndrome" (SBS), Facial Skin Symptoms in VDT-Workers and "Electric Hypersensitivity" in the Swedish Population*, Working Life Report No.2000:5, Umeå: National Institute for Working Life, 2000. (Available in Swedish only.)

Shabnam Gangi and Olle Johansson, "A Theoretical Model Based Upon Mast Cells and Histamine To Explain the Recently Proclaimed Sensitivity to Electric and/or Magnetic Fields in Humans," *Medical Hypotheses*, 54, pp.663-671, April 2000.

Solbritt Lonne-Rahm, Bengt Arnetz, Mats Berg et al., "Provocation with Stress and Electricity of Patients with 'Sensitivity to Electricity'," *Journal of Occupational and Environmental Medicine*, 42, pp.512-516, May 2000.

Ulf Flodin, Agneta Seneby and Clas Tegenfeldt, "Provocation of Electric Hypersensitivity Under Everyday Conditions," *Scandinavian Journal of Work, Environment and Health*, 26, pp.93-98, April 2000.

Mikko Härmä, "Electric Hypersensitivity and Neurophysiological Effects of Cellular Phones—Facts or Needless Anxiety?" (editorial), *Scandinavian Journal of Work, Environment and Health*, 26, pp.85-86, April 2000.

Across the Spectrum

“Getting better scientific evidence on whether wireless phones are a risk is a high priority public-health concern for this country.”

—Dr. Christopher Portier, acting associate director, National Toxicology Program, Research Triangle Park, NC, quoted by Allyson Vaughan, “NTP Elects To Study RF Effects,” *Wireless Week*, p.10, July 17, 2000 (see p.5 and p.10)

SARs will likely be meaningless numbers to the public—like tar and nicotine measurements on cigarettes.

—Steven Milloy, publisher, *Junk Science Home Page*, “Science Can’t Help Cell Phone Makers,” *Fox News.com*, July 21, 2000, available at <www.junkscience.com>

I would be personally opposed to my grandchildren attending a school where, in getting to the school building, they would walk in an electric field above 1 kV/m.

—Dr. Robert Ashley, retired professor of electrical engineering and an active member of IEEE standards committee SCC-28, “Are Power Lines Unsafe? Years of Research Have Not Answered This Question in Terms of Magnetic Fields—But Perhaps Electric Fields Are the Danger,” *IEEE Spectrum*, p.23, July 2000 (see p.11)

“I don’t understand why he doesn’t correctly present the results obtained by the researchers whose work he supervised.”

—Dr. Bernard Veyret, University of Bordeaux, referring to Dr. George Carlo’s now-defunct Wireless Technology Research, speaking before the French National Assembly, quoted in “Mobile Phones: Responsible for Tumors or Rumors?” (in French), *Agence France Presse*, June 19, 2000

All established health effects of RF exposure are clearly related to heating. While RF energy can interact with body tissues at levels too low to cause any significant heating, no study has shown adverse health effects at exposure levels below international guideline limits.

—World Health Organization, Geneva, Switzerland, Fact Sheet No.193, *Electromagnetic Fields and Public Health: Mobile Telephones and Their Base Stations*, revised June 2000, available on the Internet at <www.who.int/inf-fs/en/fact193.html> (see also p.9)

Letter to the Editor

NEMA Not Backing Specific Limits

June 23, 2000

To the Editor:

The article on the European use of the precautionary principle [see *MWN*, M/J00] was well-balanced but I would like to point out your misstatement of the NEMA position as taken from the April 15, 2000, issue of the NEMA publication, *electroindustry*.

You stated that “NEMA has mounted its own ‘full-scale effort’ backing the ICNIRP limits.” This is completely untrue. In the *electroindustry* article, we wrote that “NEMA has mounted a full-scale effort on the EMF standards issue.” This in no way implies that NEMA supports the ICNIRP standards, or even much less that we agree with these standards. Our effort is solely aimed at keeping the doors open and unrestricted for the free worldwide trade of electrical products through harmonization of the most scientifically sound EMF exposure standards.

Douglas Bannerman, Consultant
National Electrical Manufacturers Association (NEMA)
1300 N. 17th St., Suite 1847
Rosslyn, VA 22209

Criminals may already have used microwave weapons....to disable bank security systems and to disrupt police communications.

—Dr. Robert Gardner, chair, Commission E on Electromagnetic Noise & Interference, International Union of Radio Science, cited by Ian Sample, “Just a Normal Town...,” p.24, *New Scientist* (U.K.), July 1, 2000

“Will that be cash or phone?”

—Shopkeeper in an ad that ran in Stockholm, quoted by Peter Lewis, “Wireless Valhalla: Hints of the Cellular Future,” *New York Times*, Circuits, p.G7, July 13, 2000

“MICROWAVE NEWS” FLASHBACK

Years 15 Ago

- The University of Utah’s Dr. Om Gandhi shows that weak RF (30-70 MHz) radiation can “induce currents with very large local SARs.” He calls the ANSI guidelines, which are keyed to whole-body SARs, “clearly too high for the general population.”
- The National Institute for Occupational Safety and Health proposes RF/MW exposure limits for workers based on an adverse effects threshold of 2 W/Kg—compared to 4 W/Kg in the ANSI standard.
- Radiation from AM radio stations in Honolulu, HI, is blamed for causing shocks among residents and interfering with electronic equipment in nearby high-rise condominiums.

Years 10 Ago

- Male telephone linemen, electricians and utility workers have a six times greater risk of developing breast cancer, according to a study by the Fred Hutchinson Cancer Research Center in Seattle.

- A cluster of ten cases of non-Hodgkin’s lymphoma among present and past employees of the University of Rochester, NY, who worked near the school’s 1,000 W FM radio antenna is under investigation.
- The IEEE’s SCC-28, which develops health limits for non-ionizing radiation, lacks expertise in biology and is dominated by the military, say critics—who include a senior IEEE official.

Years 5 Ago

- In a draft report, an NCRP committee endorses a 2 mG limit for EMF exposures at day care centers and schools, as well as for houses near new transmission lines.
- The American Medical Association reverses its support for prudent avoidance of EMFs, but no one seems to know who was responsible for this change in policy.
- Children whose mothers used sewing machines while pregnant are up to seven times more likely to develop leukemia, a McGill University study finds.

Hot New Papers

Maria Stuchly and Trevor Dawson, "Interaction of Low-Frequency Electric and Magnetic Fields with the Human Body," *Proceedings of the IEEE*, 88, pp.643-662, May 2000.

"One relatively straightforward but very important application of the recently available numerical dosimetric data is their proper introduction into the health protection guidelines. However, it needs to be emphasized that current density is not the proper measure to be used, but rather tissue-induced electrical field. This change requires reevaluation of some experimental data on tissue and cell stimulation."

Jukka Juutilainen, Richard Stevens, Larry Anderson et al., "Nocturnal 6-Hydroxymelatonin Sulfate [6-OHMS] Excretion in Female Workers Exposed to Magnetic Fields," *Journal of Pineal Research*, 28, pp.97-104, March 2000.

"The results of this study suggest that if MF exposure suppresses melatonin production, this effect may be chronic, with little recovery during the weekend. This might partially explain why it has been difficult to show effects on melatonin production in (short-term) experimental studies on human volunteers....Our study provides limited evidence that women employed in an inherently high MF-exposure occupational setting, a garment factory, had lower nocturnal melatonin production than did women in a much lower MF-exposure working environment, office workers. However, increasing magnetic flux density within the garment factory was not associated with decreasing urinary 6-OHMS, i.e., no monotonic dose-response was observed." (See *MWN*, M/A97.)

Paolo Bernardi et al., "Specific Absorption Rate and Temperature Increases in the Head of a Cellular Phone User," *IEEE Transactions on Microwave Theory and Techniques*, 48, pp.1118-1126, July 2000.

"The obtained results show, for a radiated power of 600 mW, maximum SAR values, averaged over 1 g, from 2.2 to 3.7 W/Kg depending on the considered phone. The maximum temperature increases are obtained in the ear and vary from 0.22°C to 0.43°C, while the maximum

First Paper on Scandinavian Mobile Phone-Headache Study

G. Oftedal, J. Wilén, M. Sandström and K.H. Mild, "Symptoms Experienced in Connection with Mobile Phone [MP] Use," *Occupational Medicine*, 50, pp.237-245, May 2000.

"Next to the sensations of warmth on the ear or behind/around the ear, burning sensations in the facial skin and headaches were most commonly experienced in connection with MP use. The warmth sensations were predominantly experienced during the MP call. Other symptoms, like headaches, most often began during or within half an hour after the call and usually lasted for up to 2 h. Although relatively many of the respondents reported MP-attributed symptoms, relatively few had consulted a physician or been on sick leave because of the symptoms. An awareness of the symptoms is suggested by the fact that nearly half of the respondents with an MP-attributed symptom had taken steps to reduce the symptom. Most commonly, they had reduced the calling time or started using hands-free equipment. Most people experienced a reduction of the symptom as a result of the reported steps. Various results are consistent with the observation that the symptoms were experienced predominantly in connection with long duration calls. The relatively high number of people reporting the symptoms, as well as other results obtained in this investigation, motivate the study of the reason behind the symptoms attributed to the MP." (See p.4, p.15 and *MWN*, M/J98.)

BBB Permeability In Vitro

A. Schirmacher et al., "Electromagnetic Fields (1.8 GHz) Increase the Permeability to Sucrose of the Blood-Brain Barrier [BBB] in Vitro," *Bioelectromagnetics*, 21, pp.338-345, May 2000.

"[T]he cell culture model we have established in this paper is suitable to study the influence of EMFs on the BBB....Our results show a significant increase in permeability under EMF exposure. Within four days, the permeability of exposed samples increased by a factor of three, whereas values of controls rose only slightly. This finding has already been suggested by preliminary experiments on 28 samples and 29 controls conducted by independent investigators in our laboratory. We exclude thermal effects as the mechanism of the observed changes in sample permeability, because exposure conditions are nonthermal. In conclusion, we report for the first time a definite and reproducible effect of microwave exposure on the physiological properties of the BBB *in vitro*. This is in line with the findings of Salford et al. in *in vivo* experiments. Since we have thoroughly checked the validity of our model of the BBB, and the exposure conditions resemble those used in mobile telecommunication, we emphasize the relevance of our findings to clinical medicine, as well as to basic research."

temperature increases in the brain lie from 0.08°C to 0.19°C....[T]he results evidence a maximum temperature increase in the external part of the brain from 0.10°C to 0.16°C for every 1W/Kg of SAR, averaged over 1 g of brain tissue....With reference to SAR values, the IEEE limit (1.6 W/Kg over 1 g) is exceeded in all the considered situations, while the CENELEC limit (2 W/Kg over 10 g) is always respected. It must be noted that these results refer to a portable phone radiating 600 mW in free space, which is typical of analog cellular phones. The new digital generation is characterized by a lower mean radiated power (250 mW). This means that the reported results should be decreased by a factor of 2.4, giving rise to SAR_{1MAX} values below the IEEE limit for all the considered phones."

A. Skedsmo and A. Vistnes, "Deflection of Cosmic Radiation Near Power Lines—A Theoretical Approach," *Health Physics*, 78, pp.679-686, June 2000.

"The present paper will hopefully serve as a definitive answer to the hypothesis raised by Hopwood in 1992. The hypothesis proposed that power lines focus cosmic radiation, and Hopwood claimed to have measured a doubling of background exposure slightly to the side of the power line. The hypothesis is neither supported by any experimental observations performed after the original finding, nor by our theoretical analyses. While in theory a small effect of electromagnetic field on the trajectories of cosmic particles can be demonstrated, our simulations show that the effect is far too small to be of any possible health significance. The actual increase in the total particle flux density is found to be within the order of 0.01%, an effect that is probably not measurable with currently available detector technology....The very small shift in particle flux demonstrated in this work will lead to an

insignificant change in the total radiation activity and should be of no importance at all in the debate concerning a possible health effect from residing close to power lines.”

P. Sarma Maruvada, “An Investigation To Identify Possible Sources of Electromagnetic Field Transients Responsible for Exposures Reported in Recent Epidemiological Studies,” *IEEE Transactions on Power Delivery*, 15, pp.266-271, January 2000.

“The possible link between occupational exposure to high frequency short-duration [EMF] transients and the health of utility workers has been discussed in two recent epidemiological studies. Questions have been raised, however, on the sources responsible for the exposures reported in these studies. A thorough investigation has therefore been carried out, in the laboratory as well as in the utility work environment. The results indicate that the instrument used in these epidemiological studies is typically responding to the use of hand-held walkie-talkies and mobile radio communication devices rather than power system switching operations.” (See *MWN*, N/D94.)

Edwin van Wijngaarden and David Savitz, “Occupational Sunlight Exposure in Relation to Suicide Among Electric Utility Workers,” *American Journal of Industrial Medicine*, 38, pp.149-154, August 2000.

“Mortality from suicide was not associated with estimates of recent and career occupational sunlight exposure, with adjusted odds ratios around unity. Occupational sunlight exposure was positively associated with nonviolent suicides, but no dose-response gradient was observed and risk estimates were notably imprecise.” (See also *MWN*, M/A00.)

Mark Hallett, “Transcranial Magnetic Stimulation [TMS] and the Human Brain,” *Nature*, 406, pp.147-150, July 13, 2000.

“TMS is rapidly developing as a powerful, noninvasive tool for studying the human brain. A pulsed magnetic field creates current flow in the brain and can temporarily excite or inhibit specific areas. TMS of motor cortex can produce a muscle twitch or block movement; TMS of occipital cortex can produce visual phosphenes or scotomas. TMS can also alter the functioning of the brain beyond the time of stimulation, offering potential for therapy.”

Electric Blankets: No Breast Cancer Association

Francine Laden et al., “Electric Blanket Use and Breast Cancer in the Nurses’ Health Study,” *American Journal of Epidemiology*, 152, pp.41-49, July 1, 2000.

“[O]ur findings did not support an important association between exposure to EMFs from lifetime electric blanket use and breast cancer. Our findings were generally null, although the confidence intervals around our risk estimates did not exclude the a small excess risk in those with the longest duration of exposure many years before diagnosis.”

Tongzhang Zheng et al., “Exposure to Electromagnetic Fields from Use of Electric Blankets and Other In-Home Electrical Appliances and Breast Cancer Risk,” *American Journal of Epidemiology*, 151, pp.1103-1111, June 1, 2000.

“A total of 608 incident breast cancer patients and 609...controls, 31-85 years old, were interviewed...to obtain information on lifetime use of various in-home electrical appliances. A total of 40% of the cases and 43% of the controls reported regular use of electric blankets in their lifetime, which gave an adjusted odds ratio of 0.9 [CI:0.7-1.1]. For those who reported using electric blankets continuously throughout the night, the adjusted odds ratio was 0.9 [CI:0.7-1.2] when compared with never users....This study does not support an association between risk of female breast cancer and exposure to EMFs in the range of 50-60 Hz from in-home electrical appliance use, including but not limited to electric blankets. The risk did not vary by menopausal status or by hormone receptor status.”

On the Internet

Mobile Phones Linked to Headaches Again

Users of cell phones in Singapore were more likely to have headaches and heavy users were the most affected, according to a letter posted on the *British Medical Journal's* (*BMJ*) Web site on May 12. Dr. Sin-Eng Chia of the National University of Singapore reports that 65% of those who used their mobile phones for more than an hour a day complained of getting headaches, compared to 54% of those whose daily phone use averaged less than two minutes. Chia found a statistically significant trend: the more phone use, the more headaches. He also notes that people who used hands-free sets complained less of having headaches. Chia’s team conducted interviews with 808 randomly selected individuals, 45% of whom used hand-held phones. Chia told *Microwave News* that he has submitted the results to a U.S. journal and that he plans to do a follow-up study if he can secure the necessary funding. His letter appeared in response to an editorial on the Stewart Report in the May 13 issue of the *BMJ* (see *MWN* M/J00). It can be found at: <www.bmj.com/cgi/eletters/320/7245/1288#EL1>. The Singapore findings support similar results from Australia (see *MWN*, M/J97 and N/D98), Norway and Sweden (see p.14 and *MWN*, M/J98), the U.K. (see p.4) and the U.S. (see *MWN*, N/D96).

German Symposium on EMFs, Light & Melatonin

There is “presently insufficient evidence” of an association between low frequency magnetic fields and cancer, but there are “strong experimental indications” of a link with visible light, according to Drs. Claus Piekarski and Thomas Erren of the University of Cologne. Their conclusion follows a symposium on *Low Frequency EMFs, Visible Light, Melatonin and Cancer*, which they hosted at the university, May 4-5. They advise that future epidemiological studies should focus on visible light and on electric fields, whose role “may have been underestimated.” Their comments, together with the abstracts of the papers presented at the meeting and overviews by Drs. D. Horrobin, C. Portier, R. Reiter and R. Stevens, are on the Internet at <www.uni-koeln.de/symposium2000>. Reiter comments that EMF-melatonin interactions have been “enigmatic” and that this whole area of research “has, on occasions, been exasperating.” For his part, Horrobin concludes that “serious areas of investigation” remain, which “should not be suppressed by a consensus of intellectual, commercial and state interest.” All this, which is in English except for the Piekarski-Erren assessment, which is in German, will soon be published in the *Zentralblatt für Arbeitsmedizin* (*Bulletin for Occupational Medicine*), according to Erren.

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EMI FROM MOBILE PHONES

Measurements Point to Avionics Hazard... Tests by the U.K.'s Civil Aviation Authority (CAA) show that radiation from a wireless phone is strong enough to potentially interfere with a commercial plane's electronic equipment. According to a CAA report issued on May 2, electromagnetic interference (EMI) from phones could cause false hazard warnings, noise in the flight crew's headphones or a failure to detect safety system malfunctions. "We carried out the tests to get scientific proof that there is a threat," CAA spokesperson Jonathan Nicholson told the *New Scientist* (May 27). "Until now, we've only had pretty strong anecdotal evidence" (see also *MWN*, S/O96 and S/O99). CAA technicians measured RF/MW levels above 1 V/m in the cockpits and avionics bays of a British Airways Boeing 737 and a Virgin Atlantic Boeing 747 when phone-like signals were generated in their passenger cabins. In the cockpit of the 737, a 900 MHz signal transmitted at 2 W produced a reading of 4.5 V/m. The planes' internal structures absorbed some radiation, the report explained, but also produced reflections that combined to create "hot spots." Digital and analog radiation produced similar peak levels. Before 1989, the U.K. only required aircraft electronics to be immune to EMI up to 1 V/m. No testing for immunity to 1800 MHz radiation was required. These rules were designed to prevent interference from external sources, but not from transmitters inside the plane—such as wireless phones. Because equipment introduced before 1989 can remain in production and can still be used or installed in aircraft, the CAA advises that the U.K. continue to prohibit phone use while the engines are running. The CAA plans to run additional tests to determine how strong mobile phone signals have to be in order to trigger actual malfunctions. *Interference Levels in Aircraft at Radiofrequencies Used by Portable Telephones* is available as a PDF file on the Web at <www.srg.caa.co.uk/srg/srg_news.asp>....Meanwhile, in the U.S. on July 20, the aviation subcommittee of the House Committee on Transportation and Infrastructure held a hearing on the use of electronic devices, including phones, on board airliners. Some who spoke at the hearing suggested that there is no proven EMI risk to justify current restrictions, but Paul McCarthy, air safety chief of the Air Line Pilots Association, testified that cell phones "definitely should not be used on an aircraft in flight."

MOBILE PHONES & THE BRAIN

Finns: Brain Workload May Be Key... Cellular phone signals caused no changes in the electroencephalogram (EEG) of resting volunteers, according to a study by Dr. Maila Hietanen of the Finnish Institute of Occupational Health and coworkers in Helsinki. Nineteen volunteers went through six half-hour test sessions in "a silent, half-darkened room...in a comfortable chair, keeping their eyes closed but staying awake." They did not use the phones for conversation. Five models were tested, all at maximum power: a GSM phone, an 1800 MHz digital PCN phone and three different analog phones using the Nordic Mobile Telephone standard. "The differences in the EEG...during the sham and actual exposures were extremely small," Hietanen reports in the April issue of the *Scandinavian Journal of Work, Environment and Health* (26, pp.87-92, 2000). Only one significant dif-

ference was observed out of 180 different comparisons, and she attributes it to chance. "This study suggest[s] that exposure to RF fields emitted by cellular phones has no abnormal effects on human EEG activity," Hietanen writes. Different results come from the latest experiment by Drs. Mika Koivisto, Christina Krause and colleagues at the Center for Cognitive Neuroscience in Turku, Finland. In the June 5 issue of *NeuroReport* (11, pp.1641-1643, 2000), they conclude that "RF fields may have measurable influences on human brain function and cognition." But the two studies may not be inconsistent. Koivisto and Krause note that digital 900 MHz phones "do not show any consistent effects" on EEG readings while people are at rest—but studies of task-related brain activity tell a different story. Previous research indicates that GSM phone signals "affect higher level cognitive functions requiring a certain level of attention, in contrast to simple motor execution" such as repeatedly lifting a finger. Thus, Koivisto and Krause write, "One could predict that the RF exposure would decrease reaction times when the cognitive load is heavy, whereas no effects would be observed" with less-demanding tasks. This is what happened in their latest experiment. When 48 volunteers were asked to perform a memory recall task that required remembering from one to three letters of the alphabet at a time, exposure to a GSM phone did affect reaction time—but only in relation to the three-letter task. They performed 36 msec faster, a statistically significant difference—but one that "probably has no practical implications for performance in daily life," Koivisto and Krause point out. This is their third study of mobile phones and brain activity published this year (see *MWN*, M/A00 and M/J00), and they conclude that, "All the available evidence point to the same direction: RF fields facilitate rather than disrupt performance."

PEOPLE

Dr. **Elizabeth Jacobson** has been appointed acting senior advisor for science in the office of the FDA Commissioner. **Lillian Gill** is taking over for Jacobson at the FDA's Center for Devices and Radiological Health and will serve as its acting deputy director for science. Jacobson will continue as the chair of FDA's CRADA Review Board, overseeing its various cooperative agreements with industry (see p.5)...The Bioelectromagnetics Society (BEMS) has a new president—it is Dr. **Frank Barnes** of the University of Colorado, Boulder, who stepped into the job a year early. Barnes won this year's election and was to be president-elect until next June but took over at the society's annual meeting in Munich, Germany, June 14. Dr. **Mats-Olof Mattsson** of Sweden's Örebro University was to have been president but he resigned immediately after he took over. Mattsson said that he was stepping down for "purely and strictly personal reasons."...At the May meeting of the International Commission on Non-Ionizing Radiation Protection (ICNIRP), held in Hiroshima, Japan, Dr. **Alastair McKinlay** of the U.K.'s NRPB took over as chair from Germany's Dr. **Jürgen Bernhardt**. Bernhardt is now vice chair, McKinlay's former role. The new members of the ICNIRP are Drs. **Anthony Swerdlow** of the U.K., **Bernard Veyret** of France and **Paolo Vecchia** of Italy. Vecchia is also the president of the European Bioelectromagnetics Association. Drs. **Martino Grandolfo** of Italy, **Laszlo Szabo** of Hungary and **Jan Stolwijk**

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of the U.S. have stepped down from ICNIRP. (For the other current members, see *MWN*, S/O96.)...After 24 years with the EPA, **Edwin Manti** has joined the FCC, where he will work with Dr. **Robert Cleveland** at the Office of Engineering and Technology in Washington. Manti was at EPA's National Air and Radiation Environmental Lab in Montgomery, AL....**Lucinda Grant**, the director of the Electrical Sensitivity Network in Prescott, AZ, and the publisher of *Electrical Sensitivity News*, has stopped both activities. In a June 14 letter to her subscribers, she stated she could no longer continue in the face of repeated harassing phone calls....Dr. **Motohisa Kanda** died on June 12 at the age of 56. Kanda had been on the staff of the National Institute of Standards and Technology (formerly the National Bureau of Standards) since 1971. For 13 years he was the editor of the *IEEE Transactions on EMC*.

RADIATION FROM MICROWAVE OVENS

Leaky Old Ovens...Older microwave ovens leak about twice as much radiation as new models, according to Canada's Radiation Protection Bureau (RPB) in Ottawa. A team led by Dr. Art Thansandote measured the 2450 MHz radiation 5 cm away from 60 new and 103 used ovens. In the May 2000 issue of *Microwave World*, a publication of the International Microwave Power Institute in Manassas, VA, they report that, on average, used ovens emitted 170 $\mu\text{W}/\text{cm}^2$ while heating water, compared to 80 $\mu\text{W}/\text{cm}^2$ for the new units. The bureau has a limit of 5 mW/cm² when the oven is empty and 1 mW/cm² when loaded. The average age of the used ovens was eight-and-a-half years. The U.S. has long had an emission standard of 1 mW/cm² at 5 cm for new ovens and 5 mW/cm² for old ovens. (See also *MWN*, S/O87.)

Conferences

September 3-8: **Gordon Research Conference on Bioelectrochemistry: New Aspects on Physiological and Experimental Variations of the Transmembrane Potential Difference: Cell and Tissue Electromanipulation, Sensing, Endogenous Electric Fields**, Queen's College, Oxford, U.K. Contact: Dr. Luis Mir, UMR 8532 CNRS-Institut Gustave-Roussy, 39 Rue Camille Desmoulins, F-94805 Villejuif, France, (33+42) 11 47 92, Fax: (33+42) 11 52 76, E-mail: <luismir@igr.fr>.

October 23-26: **2nd International EMF Seminar in China**, Xi'an, China. (Sponsored by the Chinese Ministry of Health, WHO and ICNIRP.) Contact: Dr. Wang Peng, Foreign Liaison Dept., China Preventive Medical Association, 154 Gulou Xidajie, Xicheng District, Beijing, China 100009, (86+10) 6401-4326, Fax: (86+10) 6401-2329, E-mail: <cpma@ht.rol.cn.net>, Web: <www.emfhealth.com/seminar/english/2000/2ndEMFseminar1.htm>.

November 6-8: **2000 IEEE Antennas and Propagation Society Conference on Antennas and Propagation for Wireless Communications**, Westin Hotel, Waltham, MA. Contact: Dr. Christos Christodoulou, Dept. of Electrical and Computer Engineering, University of New Mexico, Albuquerque, NM 87131, (505) 277-6580, Fax: (505) 277-1439, E-mail: <christos@ecece.unm.edu>, Web: <www.eece.unm.edu/apwc2000>.

November 13: **WHO Research Coordination Meeting**, and November 15: **WHO EMF Standards Harmonization Meeting**, Brooks Air Force Base (AFB), San Antonio, TX. Contact: Dr. Michael Repacholi, World Health Organization, Occupational and Environmental Health, Protection of the Human Environment, CH-1211 Geneva 27, Switzerland, (41+22) 791-3427, Fax: (41+22) 791-4123, E-mail: <repacholim@who.int>, or Dr. Michael Murphy, Brooks AFB, Radiofrequency Radiation Division, San Antonio, TX 78235, (210) 536-4838, Fax: (210) 536-3977, E-mail: <Michael.Murphy@he.brooks.af.mil>.

December 3-6: **2000 Asia-Pacific Microwave Conference (APMC 2000)**, Sydney Convention Center, Sydney, Australia. Contact: Dr. T.S. Bird, CSIRO Telecommunications and Industrial Physics, PO Box 76, Epping, NSW 1710, Australia, (61+2) 9372-4289, Fax: (61+2) 9372-4446, E-mail: <trevor.bird@tip.csiro.au>, Web: <www.tip.csiro.au/Events/apmc2000>.

Keeping Current: Follow-Up on the News

◆ The California Coastal Commission has decided not to sue the U.S. Navy over its plans to install more radars at its SWEF facility in Port Hueneme (see *MWN*, N/D99 and M/J00).

◆ ICNIRP has published *Effects of Electromagnetic Fields on the Living Environment*, proceedings of a conference held in Ismaning, Germany, last October. Copies of the 279-page volume are available from SMI (Distribution Services) Ltd. in the U.K.: Fax: (44+1438) 748-844, E-mail: <enquire@smibooks.com>.

◆ On July 14, two more employees of the National Security Agency (NSA) filed suit against Electro-Matic Products Co., a maker of degaussing equipment, alleging that magnetic fields caused them to develop brain tumors. There are now four NSA staffers who have claims pending (see *MWN*, M/A00).

◆ ABC News' TV magazine show, *20/20*, is preparing a follow-up of its report on the health risks of mobile phone use, which originally appeared last October (see *MWN*, N/D99) and was repeated in May. No word yet on when the new show will air.

◆ Dr. Bruce Hocking has extended his analysis of childhood leukemia near TV broadcast towers (see *MWN*, N/D95 and J/F97). In a paper presented at a medical meeting in Adelaide, Australia in May, Hocking and Dr. Ian Gordon report that children with

acute lymphatic leukemia living near such towers had a significantly shorter survival time.

◆ On July 20, an Illinois state judge ruled that the invasion-of-privacy lawsuit brought by Jerald Busse against Motorola and others may proceed as a class action (see *MWN*, J/F96 and M/A99). Busse filed an amended complaint after the suit was dismissed last year.

As We Go to Press

...Just as litigation over brain tumors alleged to be caused by cell phones appeared to be coming to an end (see p.5), a 41-year-old physician filed suit on August 1 against Motorola and other plaintiffs, claiming that his brain cancer resulted from use of a wireless phone between 1992 and 1999. The physician is represented by Joanne Suder of the Suder Law Firm in Baltimore.

...On July 31, *Medscape General Medicine*, an on-line journal, released Dr. George Carlo's assessment of the work of the WTR program on mobile phone safety, which he directed. He concludes that, "Absolute claims of safety [are] no longer supportable." See <www.medscape.com/Medscape/GeneralMedicine/journal/2000/v02.n04/mgm0731.carl/mgm0731.carl-1.html>.

Wireless Health Studies: Europe Gets It Right

In Europe, the first truly wide-ranging research effort on health effects of mobile phones is getting started. The Mobile Manufacturers Forum (MMF) deserves much of the credit.

The European Commission (EC) has given substantial funding to several well-designed projects. They include studies of RF effects on the immune system, on gene expression and on interactions with chemical carcinogens, as well as a large-scale epidemiological study (see p.3 and *MWN*, M/A00).

A project that deserves particular attention is the suite of animal studies known as PERFORM-A. It embodies an approach to research that has been needed for some time. It is all the more noteworthy for having been initiated, designed and organized largely by people in the wireless industry (see *MWN*, J/F99). While the MMF took the lead in this process, the GSM Association also deserves credit for stepping forward to help fund this much-needed work.

The strengths of PERFORM-A, and of another set of studies, PERFORM-B, can be seen in the contrast with past efforts.

In March 1997, the U.S. Food and Drug Administration (FDA) told Wireless Technology Research (WTR), the research group of the Cellular Telecommunications Industry Association (CTIA), where it should focus. First on the list was this: "Chronic (lifetime) animal studies should be given highest priority." Two months later, Dr. Michael Repacholi's lymphoma study underlined the importance of such research (see box at right).

Yet despite the FDA's advice, and despite Repacholi's startling results, WTR did no work at all on chronic exposures. In contrast, PERFORM-A includes six large chronic exposure studies — with rats and with mice, at 900 MHz and at 1800 MHz. One of them will attempt to replicate the Repacholi experiment.

Repeating past studies that have reported troubling results is a hallmark of the PERFORM research projects. A second MMF-funded project, PERFORM-B, will follow up on findings of chromosome damage, increased growth enzyme activity and impairment of learning and memory.

The PERFORM-B story highlights another important point about current European studies: what has to be described as a "can-do" approach. When the EC did not fund the PERFORM-B experiments, France's Dr. Bernard Veyret and his colleagues worked overtime to find the money elsewhere. Industry came through with its share, and laboratory work will begin this fall.

This sort of speed and initiative is often described as an American characteristic, but in this field it is more in evidence in Europe. Compared to European efforts, the FDA-CTIA research agreement (see p.5) is a shrunken shadow. Its likely result: four or five years of committees to form committees, reviews of reviews and plans to make plans, with some limited research on just two topics. It is not a serious approach to the problem. Of greater interest is possible NTP research on chronic exposures (see p.5). But that still does not have final approval, and is at least seven years overdue.

EC- and MMF-supported cellular phone research is also an improvement on the U.S. government's research project on EMFs, the RAPID program. It is more focused on answering specific

"Are Mobile Phones Safe?"

That is the title of a six-page article by Drs. Kenneth Foster and John Moulder in the August issue of *IEEE Spectrum*. How they address the question tells us a lot about why the cell phone debate is so polarized, and why many of the so-called experts have lost their credibility.

Foster and Moulder neglect to mention much of the research that is prompting concern: changes in brain function, blood pressure, sleep and frequency of headaches. But most startling is that they do not say a word about Dr. Michael Repacholi's study, in which the rate of lymphoma more than doubled among mice exposed to mobile phone radiation. Many consider this to be the most disturbing finding to date on wireless health effects.

This omission seems inexplicable. Moulder is an associate editor of *Radiation Research*, the journal which published the Repacholi study, and Foster is currently spending part of his sabbatical working with Repacholi in Geneva.

Repacholi himself sees his study as having broad significance. Speaking at a meeting convened by the European Parliament on June 29, Repacholi said that his results "seem to show that 900 MHz electromagnetic fields can exert a significant carcinogenic effect" (see p.9).

The public needs the whole story, not false reassurance. Foster and Moulder and the editors of *IEEE Spectrum* have done a disservice to the IEEE's 350,000 members, and to their own credibility.

questions. A number of experiments will be run in more than one lab, which should produce more confidence in the results.

The MMF effort is not perfect. We would feel more comfortable if the EC had heeded the advice of its own expert group, which recommended "a firewall" between corporate money and all decisions on research (see *MWN*, N/D95). That is not the case, and many questions about control of the data remain to be resolved. Decisions about when and how to discuss of results must be left completely to researchers. Industry must not have early, exclusive access to results or to drafts of research papers.

But overall, the PERFORM A and B projects are being professionally run by independent researchers. They should materially expand our understanding of wireless phones and human health, and we look forward to their results.

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