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**Harmonization vs. the Precautionary Principle
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Switzerland Adopts Strict Limits for Cell Towers and Power Lines 10 mG Standard for New Sources of EMFs

The Swiss government has adopted stringent new standards for public exposures from power lines and from towers used for mobile communications and radio and TV broadcasting. The new rules, which took effect on February 1, are similar to those in Russia and in China and are among the toughest in the world.

Both new and existing mobile phone towers must meet a 4 $\mu\text{W}/\text{cm}^2$ standard at 900 MHz. Other sources of electromagnetic fields and radiation (EMF–EMR) are allowed considerable administrative discretion to meet their respective limits as long as specified steps are taken to reduce exposures.

The new limits are “oriented to the future,” the Federal Agency for Environment, Forests and Landscape (known as BUWAL) explains in a commentary accompanying the new rules. “Our task is to protect the public not only from agents that are known to be harmful, but also from agents that might prove to be harmful,” Dr. Stefan Joss told *Microwave News*. Joss is with BUWAL’s non-ionizing radiation unit in Bern.

Joss explained that the rules are an application of the precautionary principle. The Swiss Environmental Protection Law, he said, “gives a clear, prag-

(continued on p.6)

U.K. Childhood Cancer Study: New Controversy Over Power Lines Role of Pollutants and Electric Fields at Issue

When results from the U.K. Childhood Cancer Study (UKCCS) were released, the headline on the press release read, MAJOR STUDY FINDS NO LINK BETWEEN OVERHEAD POWER CABLES AND CHILDHOOD CANCER. But that soon became a point of controversy.

Scientists at the University of Bristol argue that the UKCCS shows exactly the opposite: While the study found no link between childhood leukemia and time-averaged 50 Hz magnetic fields below 4 mG, they contend that it did find evidence of a greater leukemia risk among children living near high-voltage power lines.

One table in the UKCCS paper on EMFs and childhood leukemia lists 31 cases and 17 controls who lived near power lines for which historical line-load data were available. Children with leukemia were almost twice as likely as controls to live near one of these lines—a statistically significant difference. The study was published in the December 4 issue of *The Lancet*.

(continued on p.10)

NCRP Cuts Scientific Staff: Impact on Non-Ionizing Radiation Reports Uncertain

The National Council on Radiation Protection and Measurements (NCRP) has laid off all three of its full-time staff scientists. One of the three, Dr. Tom Koval, was coordinating the work of two committees preparing reports on radiofrequency and microwave (RF/MW) exposure.

"It's too early to say what the changes might mean for our work," said Dr. Thomas Tenforde, the overall chair of the NCRP's Scientific Committee 89 (SC 89) on non-ionizing radiation (NIR). Tenforde, of Battelle Pacific Northwest Labs in Richland, WA, told *Microwave News* that most of the cuts would be directed "at the infrastructure of the NCRP, at their headquarters in Bethesda, MD."

Dr. William Beckner, the NCRP's executive director, said in an interview that the layoffs became necessary after sharp reductions in the NCRP's funding. "The main cutback was from the Nuclear Regulatory Commission," he explained. "We had a \$250,000 annual grant, which has now dwindled to \$50,000."

"I don't think this will have that big an effect on any of our programs," Beckner predicted. He said that the NCRP still had five part-time staff scientists, as well as a full-time postdoctoral student and a few consultants. "In essence," he said, "a full-time scientific staff is being replaced, as needed, with a part-time one." In particular, Beckner maintained, "The cutbacks should hardly affect the non-ionizing radiation work at all." Most of the NCRP's work in this area was not being done by its direct staff, he stated.

But it appears that the two RF/MW committees that Koval worked with may be left without staff support. Beckner said that these committees—SC 89-5, which is revising the NCRP's 1986 report on exposure limits for RF/MW radiation (see box), and SC 89-4, on the specific issue of modulation of RF fields—are now "unassigned" in terms of NCRP resources.

Koval told *Microwave News* that he has been asked to work as a consultant for two NCRP committees—on ionizing radiation. "I told them I would be willing to do that, and in fact I mentioned I'd be willing to do the same for the two non-ionizing radiation committees." Koval said, however, that there has been no response to this suggestion.

"Obviously, I would prefer to have Tom Koval around, but it was not my decision," said Dr. James Lin of the University of Illinois, Chicago, the chair of SC 89-5. "Bill Beckner and his staff will try to fill in." Lin said his committee would still be able to complete its work, though progress would probably be slower. Funding for meetings is being cut, he said, "and that may be important." Lin said that he still hopes to submit a draft report for review by the full council by the end of 2000, at which point the text would be posted on the Internet.

"I don't think they are a good move," the chair of SC 89-4, Dr. Om Gandhi of the University of Utah, Salt Lake City, said of the layoffs. "I think this is going to impact our work greatly, because Tom Koval has been very helpful in keeping our committee going," ensuring that members complete their assignments.

Gandhi said that his committee, on modulated RF/MW radiation, has done four or five drafts of its analysis, and that "We

are in the final stages of what we think is the final draft." He said that the committee hopes to have it ready for NCRP review by April "at the latest." Gandhi's committee is preparing a commentary, not a full report, and Tenforde said that since NCRP commentaries are not reviewed by the full council, the text will not be available until it is final.

The RF/MW modulation report was requested by the Environmental Protection Agency (EPA) and was supposed to be completed by 1997. "Because everything the NCRP does is essentially a volunteer effort," said Norbert Hankin of the EPA in Washington, "there isn't really much a funding agency can do to influence the progress of a report."

The EPA has also provided funding for a report on extremely low frequency (ELF) field health effects. SC 89-3 began work on that report in 1983, and was scheduled to complete it by early 1993 (see *MWN*, D83 and M/J92). The ELF report's draft conclusions have been the subject of controversy (see *MWN*, J/A95) and the report has been delayed repeatedly as it has undergone extensive review. Last year, NCRP President Dr. Charles Meinhold said that it would be issued by the end of 1999 (see *MWN*,

Changes in NCRP RF/MW Panel

As the NCRP's Scientific Committee 89-5 (SC 89-5) on Biological Effects and Exposure Criteria for RF Fields gets closer to completion of a draft report, there have been some changes in its membership. "I recommended restructuring the committee based on the kinds of expertise we need at this point," committee chair Dr. James Lin told *Microwave News*.

On epidemiology, SC 89-5 has recruited Dr. Faith Davis, who, like Lin, is at the University of Illinois, Chicago. On cell biology, Dr. Elizabeth Balcer-Kubiczek, a longtime collaborator of panel member Dr. George Harrison, has agreed to serve as a consultant. Both Balcer-Kubiczek and Harrison are at the University of Maryland, Baltimore.

Leaving the committee are Drs. Robert Liburdy and Jan Stolwijk. Lin said that Liburdy, formerly of Lawrence Berkeley National Lab in California, was required to step down as a result of the agreement he signed with the federal government last May, after investigators concluded that he had falsified research results (see *MWN*, J/A99). Stolwijk, an epidemiologist, recently retired from Yale University in New Haven, CT.

Dr. Patricia Buffler, an epidemiologist at the University of California, Berkeley, will no longer be a member of the committee but will still work with it as a consultant, said Lin.

In addition to Harrison, those continuing as committee members are vice chair Dr. C.K. Chou of Motorola in Plantation, FL, Dr. Eleanor Adair of Brooks Air Force Base, TX, and Dr. Gregory Lotz of the National Institute for Occupational Safety and Health in Cincinnati. SC 89-5 was formed in 1995 (see *MWN*, S/O95).

J/A99), but, in January, Tenforde said, "It's not quite there yet." Committee members, he said, "have been making progress in redrafting chapters and answering reviewers' comments, but they aren't quite where we hoped they'd be."

Alone among the NCRP's committees on NIR, the ELF panel still has specific staff support. Dr. Constantine Maletskos, an NCRP consultant based in Gloucester, MA, said that he hoped a draft would be submitted to the full council "soon." SC 89-3 has made "some significant progress in recent months," said the EPA's Dr. Joe Elder in Research Triangle Park, NC. "I remain optimistic that the report will be completed."

A fourth NCRP report on non-ionizing radiation "has been in limbo for a while," according to Tenforde. SC 89-1, on static (DC) magnetic fields, had been chaired by Dr. Dennis Mahlum

of the National Research Council in Washington, but Tenforde noted that Mahlum retired some time ago and that a new committee chair needs to be found. In 1992, the NCRP said that the static field report had been reviewed by the full council and was undergoing final editing (see *MWN*, M/J92)—but it has never been released. "It was put into the hands of Dr. Tenforde," said Beckner, "and he's not been able to get it completed."

The static field report has been "kind of on the back burner," Tenforde conceded. "It's a nice report, and wouldn't have to be updated much," he said.

Asked why so many NCRP reports have run so far behind schedule, Beckner responded, "There's no good answer to that question." He noted that much of the problem stems from the volunteer character of the NCRP's efforts.

« Wireless Notes »

Dr. **Henry Lai** has found that a single one-hour exposure to relatively low levels of microwave radiation can impair **long-term memory** in rats. The rats, exposed to pulsed microwaves with a whole-body specific absorption rate of 1.2 W/Kg, were slower than controls to learn the location of a submerged platform in a water maze. The study appears in the January issue of *Bioelectromagnetics* (21, pp.52-56, 2000). "The results indicate that the rats had trouble forming a map inside their head. In fact, the exposed rats used a different strategy to find the platform," Lai told *Microwave News* from his lab at the University of Washington, Seattle. "This is the first paper on the loss of long-term memory following microwave exposure," Lai said. "It could be a warning sign—we need to look into this further." After the university's news department issued a press release on the forthcoming paper at the end of November, Lai's results gathered a great deal of attention, including coverage by *CBS Evening News with Dan Rather* (December 2), the *New York Times* (December 14), *Scientific American* (February) and <drkoop.com> (December 6). The European press also picked up the story. The U.K.'s *Sunday Mirror* did not wait for the press release and ran an item on October 31, following a presentation by Lai at the NRPB.

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At a conference last summer, Dr. **Maria Feychting** raised questions about the methods used to identify cases and controls in Dr. **Lennart Hardell**'s epidemiological study of cell phones and brain cancer (see *MWN*, J/A99). Feychting and Dr. **Anders Ahlbom**, both of the Karolinska Institute in Stockholm, spell out their concerns in a letter that appears in the November *International Journal of Oncology* (15, p.1,045). On the one hand, Hardell reported an unusually high response rate, they write, but on the other hand, he appears to have missed hundreds of cases. In their reply, Hardell, of Sweden's Örebro Medical Center, and coworkers counter that there is nothing "unusual" about the response rate they had for their subjects. In fact, they point out that they achieved similar response rates in many of their previous case-control studies. No word about the possible missing cases.

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The **Australian Senate** has agreed to open an inquiry into the

health risks from mobile phones. The review will address both health research and exposure standards. "This will also be an opportunity for the Senate to scrutinize the expenditure of the Commonwealth's Aus\$4.5 million fund for research into and information on electromagnetic emissions," said Sen. Lyn Allison, the telecommunications spokesperson for the Australian Demo-



Kathleen MacInnes

HIGHLIGHTS

crats, who had pushed for the probe (see *MWN*, J/A98, S/O98 and M/J99). According to the *Sydney Morning Herald* (December 11), the Democrats want manufacturers to inform consumers of the radiation levels emitted by mobile phones.

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Rising public concern over the potential health effects of wireless technology does not seem to have had any impact on Consumers Union, the publisher of *Consumer Reports*. The February issue of the magazine features an eight-page evaluation of the leading cellular and cordless phones—but not a word about health risks or the radiation output of different phones. Based on criteria that included voice quality, battery life and ease of use, Motorola's StarTac was judged the best analog phone and the Ericsson DF688 the best digital phone; the Sanyo CLT 937A 900 MHz DSS was found to be the best cordless phone.

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It's no secret that the use of mobile phones is exploding. This is forcing service providers to find ways of **increasing capacity** on

their networks. The January 15 issue of *Wireless Review* offers the following advice: "**Downtilting antennas** is the easiest and most cost-effective way to increase capacity. A downtilted antenna essentially decreases the size of the cell. Instead of radiating the RF power horizontally, the downward adjustment increases the signal strength close to the site...."

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Dr. **Eleanor Adair** has accepted the challenge. After reading about a **German** activist group's (**Bürgerwelle**) offer of \$10,000 to anyone who would be willing to be exposed to mobile phone radiation below current ICNIRP standards for ten days (see *MWN*, N/D99), Adair contacted *Microwave News* and stated that, "I am willing to [volunteer] without compensation for as long as they wish and at levels well above the ICNIRP guidelines, if they so desire." She added fearlessly that, "I am certain that such irradiation is completely benign." Adair, who is at the Armstrong Lab at Brooks Air Force Base in San Antonio, said that she will be attending this year's BEMS meeting in Munich. The ball is now in Bürgerwelle's court. Stay tuned.

FCC Wins Round on Cell Phone Testing Position

Mobile phone manufacturers yielded to the Federal Communications Commission (FCC) after a disagreement about the positions in which phones should be tested. Manufacturers at first supported a test position that would produce lower exposure readings—but after the FCC held its ground, they gave in.

The Institute of Electrical and Electronics Engineers' (IEEE) Standards Coordinating Committee 34 (SCC-34), Subcommittee 2 (SC-2), has been working to develop a protocol for measuring RF/MW exposures of users of mobile phones. Testing position is one of the subcommittee's last major decisions as it nears the end of its work. A revised draft of the protocol is due to be completed by SC-2's next meeting, in March, and it would then be submitted for IEEE approval.

At its December 7 meeting in Washington, SC-2 decided that all phones should be tested in two positions. (See also p.5.) In the first, known as the "touch position," the phone is held against the ear with the bottom of the phone touching the chin; thus, the antenna is tilted away from the brain. In the second position, the phone is still held against the ear, but the bottom is held away from the chin at a certain angle. (As the angle increases, the antenna gets closer to the skull and exposure is greater.)

Dr. Robert Cleveland of the FCC in Washington proposed that this angle be set at 15 degrees, a motion that was seconded by Dr. Om Gandhi of the University of Utah, Salt Lake City. The motion failed for lack of a quorum because many manufacturers abstained. A rival proposal to set the angle at 10 degrees was put forward by Dr. Niels Kuster of ETH in Zurich and seconded by Dr. C.K. Chou of Motorola in Plantation, FL.

But after industry representatives caucused during a lunch break, their position had changed. The Kuster-Chou motion was withdrawn; Kuster made a new motion backing the 15-degree position, which was seconded by Ron Petersen of Lucent Tech-

nologies in Murray Hill, NJ.

This time, the 15-degree position passed decisively. What made the difference? "The FCC made it pretty clear that they considered 10 degrees to be unacceptable," said a participant in the meeting, who asked not to be named, "and industry decided they could live with 15 degrees."

Mobile phone equipment manufacturers represented at the meeting also included Ericsson, Mitsubishi, Nokia, Panasonic and Sony. As in the past, several companies sent more than one representative. (For instance, six of the 36 people on the attendance list were from Motorola.) A December 1 memo advised subcommittee members that under IEEE procedures, each corporation is allowed only one vote.

"This is all resolved now—everyone is in agreement," said Chou. He said that manufacturers at first favored the 10-degree angle because "it was a harmonization issue." The European standards group CENELEC had adopted the "touch plus 10 degrees" policy at its November meeting in Palermo, Italy, Chou said, and many people wanted the two to be consistent.

Speaking to *Microwave News* from the CENELEC meeting in Dublin, Ireland, on January 20, Chou reported that the European group has now decided to follow SCC-34/SC-2 and adopt the same 15-degree test position. (Chou attended the CENELEC meeting as an IEEE observer.)

Four of the seven draft chapters of SCC-34/SC-2's "recommended practice" for exposure testing were submitted by the deadline of January 24, according to Kwok Chan of the FCC lab in Columbia, MD. "Some took a little longer because of this ear issue," said Howard Bassen of the FDA in Rockville, MD, noting that several section editors also serve on the IEEE task force on SARs in the ear.

A conference call of chapter editors to iron out remaining differences was held on February 1. Final changes are scheduled to be made at an editorial meeting February 24-25 in Ft. Lauderdale, FL, before SC-2 next meets, March 13-14.

Cell Phone Signals Do Not Affect Tumor Growth in Brains of Rats

Cellular phone signals did not affect the growth and development of brain tumors in rats, according to a study by Dr. Joseph Roti Roti at Washington University in St. Louis.

Researchers drilled a small hole in the skull of each rat and injected brain cancer cells grown in the lab. Most animals developed brain cancer soon after, but their risk was not affected by exposure to either digital or analog mobile phone signals.

"Tumor cells are constantly formed at a low background rate," Roti Roti and colleagues write in the December issue of *Radiation Research* (152, pp.665-671, 1999). But the ability of these cells to establish tumors "is held in check due to factors such as host surveillance mechanisms." This experiment was designed to see whether mobile phone signals could affect either the establishment of brain tumors or their subsequent growth.

In 1990, Dr. Stephen Cleary of Virginia Commonwealth University in Richmond reported that RF/MW radiation could either promote or retard the proliferation of human brain cancer cells grown in culture, depending on the strength of the signal (see *MWN*, M/A90). Cleary's work has often been pointed to as ground for concern about mobile phones and brain cancer.

The new Washington University study is "directly relevant to Cleary's observations," Roti Roti told *Microwave News*. "In a way, that was why we did it," he said. "Of course, it's not an exact replication. But it could be considered more relevant to humans using cell phones."

In Roti Roti's experiment, rats were exposed to an 836 MHz analog phone signal or an 848 MHz CDMA digital signal, or they were sham-exposed, for four hours a day, five days a week. For both types of radiation, exposure was at a specific absorption rate (SAR) of about 0.75 W/Kg. Each rat was exposed in a small cylinder that kept it at a fixed distance from the antenna. (Cleary's study used frequencies of 27 and 2450 MHz, at SARs of 5 and 25 W/Kg.)

The rats were divided into three groups, based on how many cancer cells were injected, plus a control group injected only with a saline solution.

Exposure of the rats began four weeks before the tumor cells were injected. Roti Roti explained that this was done "in order to see if prior exposure in any way made the brain more susceptible to the establishment of a tumor." After the brain cancer cells were injected, the rats were exposed for another 150 days or until death.

Neither the digital nor the analog signal had any apparent effect on the number of rats with tumors, the average length of survival, the percentage of rats alive at the end of the experiment or the minimum number of cancer cells required to form a tumor. In some experimental groups, exposed rats fared slightly better, in others slightly worse, and in others the response was almost the same. None of these small differences is statistically significant.

There was also no clear difference in tumor size, though here there was one difference of borderline significance. Among rats injected with the most cancer cells, sham-exposed rats had some-

what smaller tumors than CDMA-exposed animals. But Roti Roti expressed doubt that this had much meaning: "It may be a statistically significant result," he said, "but I'm not sure it's biologically significant." He explained that the tumors in these CDMA-exposed animals were still about the same size as the tumors in every other experimental group. "The irregularity occurred in the sham-exposed animals," the paper notes, "not in the CDMA-exposed animals."

The study was funded by Motorola.

SAR Search

- Is it possible to measure SARs in the **outer ear** directly? With current technology, the answer is no, the IEEE's SCC-34/SC-2 decided in a December 7 vote. "Existing probes are too large to measure accurately," the panel concluded. The FDA's **Howard Bassen**, the chair of SCC-34/SC-2, told *Microwave News* that existing probes are 3 mm in diameter, and the outer ear is not much wider than that in many places. "You've got to have a certain amount of simulated tissue around the probe," Bassen explained, "or you'll get huge errors because you're measuring air instead of tissue." But Dr. **Om Gandhi** disagrees, citing data from his group at the University of Utah (see *MWN*, N/D99). Gandhi's model head avoids having an ear that is too thin by filling in the space between the back of the ear and the skull. "We compared measurements for ten phones to computational results, and they agreed to within $\pm 20\%$," Gandhi, a member of the subcommittee, said in an interview. But Gandhi was on the losing side of the issue, which was decided by a wide margin. The net result: A model head without ears. (See also p.4.)

- SCC-34/SC-2 favors a 6 mm **separation distance** between cell phones to be tested and the tissue-simulating fluid of the model head. The 6 mm total results from the model head's 2 mm shell and a 4 mm plastic spacer used to "simulat[e] a compressed ear." The 4 mm distance represents "the very worst case," according to Dr. **C.K. Chou** of Motorola. This should cover all mobile phone users, including children, he told *Microwave News*.

- Dr. **Niels Kuster** has founded a new institute in **Zurich**—the Foundation for Research on Information Technologies in Society, also known by its acronym, **IT²IS**. Kuster and the new institute will remain closely associated with ETH Zurich, the Swiss Federal Institute of Technology. He will continue his research on dosimetry, and the analysis of interactions in the near field. In addition, IT²IS will focus on new applications of wireless technology, including its use to support the disabled.

- A team from the **University of Singapore** presents a series of calculations on SAR distributions inside "multilayered prolate spheroidal" models of the human head from simulated mobile phone antennas at different distances, operating frequencies and inclination angles. The paper, by X.K. Kang and coauthors, appears in the January/February issue of *Radio Science* (35, pp.247-256, 2000).

matic framework for precautionary measures: Keep exposures as low as is technically feasible and economically sustainable.” The need for caution is prompted by “credible indications” that chronic, low-level exposures may be harmful.

The strict EMF and EMR limits apply in all “areas with sensitive uses”—that is, where people are likely to be for extended periods of time, including homes, schools, playgrounds and hospitals. In these locations, the ordinance requires, radiation from each individual source must be kept below a specified level.

In all publicly accessible areas not deemed to be “sensitive,” exposure limits are based on the guidelines of the International Commission on Non-Ionizing Radiation Protection (ICNIRP). But the ordinance restricts new construction of buildings in such areas if exposure levels exceed the lower, precautionary limits.

Magnetic fields from new power lines, substations or electric railway lines must not exceed 10 mG in places where people spend time. This is a level that is 100 times lower than that specified in most health standards, including ICNIRP’s.

There are no national power line standards in the U.S. But five years ago a committee on EMF health risks set up by the National Council on Radiation Protection and Measurements (NCRP) also recommended a 10 mG exposure guideline in a draft report (see p.2 and *MWN*, J/A95). The committee, chaired by Dr. Ross Adey, then of the Veterans Administration Hospital in Loma Linda, CA, and now at the University of California, Riverside, called for limits ranging from 2 mG to 10 mG for schools, hospitals, homes and offices.

“We felt it was a prudent approach to EMF health risks, especially given that the limits would have been subjected to rigorous periodic review,” Adey told *Microwave News*. Adey’s report was deemed very controversial and is still under review.

For 900 MHz mobile telephone base stations, the Swiss ordinance limits exposures from each site to 4.0 V/m, or 4.2 $\mu\text{W}/\text{cm}^2$. This level is also 100 times stricter than the 450 $\mu\text{W}/\text{cm}^2$ allowed by ICNIRP and 150 times less than allowed under the exposure guidelines adopted by ANSI/IEEE. Russia’s public exposure limit is 3.0 V/m, or 2.4 $\mu\text{W}/\text{cm}^2$, while China’s is 5.0 V/m, or 6.6 $\mu\text{W}/\text{cm}^2$.*

The maximum exposures are 3.0 V/m for radio and television transmitters, except for long- and middle-wave transmitters, for which the standard is 8.5 V/m, or 20 $\mu\text{W}/\text{cm}^2$.

Switzerland’s wireless industry had a mixed reaction to the new rules. In a December 23 statement, the trade group Protelec called it “an expensive Christmas gift.”

The Zurich-based carrier diAx looked on the positive side, stating that the ordinance “will at long last create legal certainty,” adding that it “hopes that applications for building permits for mobile phone transmitters will be processed more rapidly.” diAx and another carrier, Swisscom, both warned that the ordinance will make it necessary to build additional transmitters.

BUWAL’s Joss said that once the ordinance takes effect, tower opponents “will have little recourse, provided a base station complies with the law. Slight delays may be possible, but that’s about all.” He noted, however, that comments on a draft of the ordi-

*These limits are for ambient levels, rather than for exposures from individual sources, as in the Swiss ordinance.

The New Swiss Rules: A Vote Against Harmonization

Switzerland’s tough new limits are a major setback for the move toward uniform worldwide exposure standards.

There was an intensive lobbying campaign to try to persuade Swiss officials not to adopt the new limits, according to a number of close observers of recent European developments—all of whom asked not to be named. “The fear is that other countries will follow Switzerland’s lead,” said one source.

At a standards harmonization meeting in Erice, Sicily, a few weeks before the Swiss rules were announced, most attendees were opposed to the adoption of numerical limits stricter than those of ICNIRP, according to Dr. Mirjana Moser of the Swiss Federal Public Health Agency. Many of the participants at the November 27 meeting favored adapting to the precautionary principle, but not to the point of deviating from ICNIRP’s numbers.

The Erice meeting was convened by Dr. Michael Repacholi of the World Health Organization (WHO), who heads the WHO’s International EMF Project. Repacholi, formerly ICNIRP’s chair, has set the globalization of health standards as one of the main goals of the EMF project. He has been sharply critical of the Swiss decision.

“If countries feel that they need further protective measures while the science is gathering information on possible health effects, this should be in the form of *policy*,” Repacholi told *Microwave News* in January. As examples of policy changes, he cited public consultation on siting major EMF sources and requests for lower emissions from plants and equipment.

“Unfortunately, it seems as if the Swiss are undermining health-based standards with arbitrary reductions in EMF levels,” Repacholi stated.

But Dr. Stefan Joss of BUWAL defended the Swiss rule. “Each country must decide what is technically and economically feasible. That is what we have done,” he said in an interview.

Switzerland has now broken ranks with the rest of Europe, North America and Australia. Only Italy has such stringent limits for phone and broadcast towers (see box, p.7).

“It’s a step backwards for harmonization,” said Dr. Sheila Johnston, a consultant based in London, who attended the Erice meeting.

In most countries—with the exceptions of China and Russia (see *MWN*, S/O99 and N/D99)—the trend so far has been to favor the guidelines set by ICNIRP. For instance, last year, New Zealand moved to discourage local authorities from setting any limits stricter than ICNIRP’s (see *MWN*, S/O99).

nance indicated that, “The public wants even lower limits” (see *MWN*, M/A99).

Protelec estimated that it will cost the industry SFr1 billion (approximately US\$620 million) to comply with the new rules.

Joss questioned such predictions. He noted that, by administrative practice, strict limits for wireless base stations have already been in effect for more than a year. "During that time," said Joss, "about 2,000 new sites have been built in Switzerland, and not one site application has been denied because of radiation emissions."

Electric utilities, too, have expressed concern with the new rules, although less vocally than the wireless industry. The ordinance creates "substantial costs not only for utilities, but also for manufacturers, employers and consumers," a spokesperson for the Zurich Electricity Company, known as EKZ, told *Microwave News*.

The new limits are based on a literature review by an expert group that included university scientists as well as officials from BUWAL and the Federal Public Health Agency. "It isn't so much a matter of this or that piece of evidence tipping the balance," said Dr. Mirjana Moser of the health agency's Radiation Protection Office in Bern. "Rather, it is the degree of 'unknowledge.'

Italian Wireless Radiation Limits Enter Second Year

Italy led the way. A year before Switzerland tightened its RF/MW exposure rules, the Italian Ministry of the Environment set a 6 V/m standard (10 $\mu\text{W}/\text{cm}^2$) for broadcast and mobile phone towers.

The standard, which took effect on January 2, 1999, applies to exposures in homes, schools and hospitals, as well as at other locations where people spend four or more hours. It is designed to protect against possible long-term effects.

The 6 V/m limit covers *all* fixed antennas—old and new—used for wireless communications, as well as radio and TV broadcasters. Emissions from mobile phones are not covered under this rule.

For other RF/MW exposures, the limits are 100 $\mu\text{W}/\text{cm}^2$ for 3 MHz-3 GHz and 400 $\mu\text{W}/\text{cm}^2$ for 3-300 GHz, both of which are stricter than the ICNIRP and ANSI/IEEE standards.

The Italian rules, like those in Switzerland, were prompted by public concerns, but they may not be having the desired effect. "The regulations have increased, rather than reduced, public anxiety," said Dr. Paolo Vecchia, the head of the non-ionizing radiation section at the Physics Laboratory of the National Institute of Health in Rome.

"Opposition to base stations for mobile phones seems to be higher than before," Vecchia told *Microwave News*. "Whether this is a temporary effect is difficult to predict." He explained that the 6 V/m limit is interpreted by some members of the public as a threshold for a severe hazard rather than as a safe exposure level.

The full text of Decree No.381, dated September 10, 1998, is available on the Internet at <www.linnet.it/sre/foglio2.htm>. A very rough English translation is available by searching for "Decreto 10 settembre 1998 n.381" on AltaVista, <www.altavista.com>, and clicking on "Translate." The decree was originally published in *Gazzetta Ufficiale Della Repubblica Italiana* on November 3, 1998.

At this point, we don't know enough to say with confidence that weak non-ionizing radiation is safe," she said in an interview with *Microwave News*.

BUWAL, on the other hand, identified enough evidence to support the strict limits. "Although more scientific evidence is still needed," its commentary states, "the confirmed effects already warrant the consideration of precautionary measures." Among the effects cited are epidemiological studies showing increased cancer risks, as well as studies showing disruption of the immune, melatonin and calcium systems. The commentary also points to the U.S. National Institute of Environmental Health Sciences' Working Group report that classified EMFs as a "possible carcinogen" (see *MWN*, J/A98).

On nonthermal RF/MW effects, the commentary cites the Australian study showing a cancer-promoting effect of GSM mobile phone radiation (see *MWN*, M/J97) and a Swiss study which found that people living near the Schwarzenburg short-wave transmitter had more sleep disturbances (see *MWN*, S/O96).

The ordinance does not apply to occupational exposures or to mobile phones, household appliances or medical devices. In addition, the precautionary limits do not apply to private outdoor spaces, such as the backyards of homes.

The ordinance's reliance on specific numerical limits differs from the approach proposed in a draft that BUWAL released for public comment last spring (see *MWN*, M/A99). In the draft, exposures were to be reduced by requiring that EMF and RF/MW sources be kept at specified minimum distances from locations where people spend time.

According to Joss, BUWAL decided to switch to numerical limits in response to comments on the draft from regional and local officials, environmental groups and the public, as well as from affected industries. Many of those commenting faulted the minimum distances as difficult to interpret, hard to enforce and unclear about the levels to which the public would actually be exposed.

The use of numerical limits is "the best way for Switzerland to fulfill the precautionary principle," the health agency's Moser said, explaining that, "The limits are what is technically and economically feasible, and they are relatively simple to implement."

The 10 mG limit for power frequency sources is "slightly stricter" than the minimum-distance rules in the draft, according to Joss. The same is true for wireless antennas: Under the minimum-distance system, the effective limit for 900 MHz base stations would have been 4.5 $\mu\text{W}/\text{cm}^2$, compared to 4.2 $\mu\text{W}/\text{cm}^2$ as per the final ordinance.

Officials can allow some new sources, and many existing ones, to exceed the limits. New power lines, for example, may do so if phase configuration is optimized and if other "technically feasible and economically sustainable" measures, which may include relocation, shielding and underground placement, are taken.

The full text of the *Ordinance on Non-Ionizing Radiation Protection* is available in German and in French at BUWAL's Web site: <www.admin.ch/buwal>. An accompanying commentary and a summary of public comments on the draft ordinance can also be found there. An English translation of the ordinance is being prepared and is scheduled to be posted on the Internet in late March, according to Joss.

New York Suit Blames Landlord for Leukemia Death

In a lawsuit that may soon go to trial, the family of a New York City psychiatrist is claiming that his fatal leukemia was caused by workplace exposure to EMFs. The suit, which accuses the landlord of negligence, is moving forward in court after most other EMF-cancer litigation in the U.S. has ended (see *MWN*, N/D98).

For more than 20 years, Dr. Seymour Grossman saw patients in an office on the ground floor of a 14-story Manhattan apartment building. Power frequency magnetic fields of up to 13 mG were measured in the office last spring.

In July 1990, Grossman was diagnosed with acute lymphoblastic leukemia (ALL). He died a year later. Gloria Weisman, who worked in the office as Grossman's secretary from 1975 until 1990, also developed leukemia: She was diagnosed in 1991 and died the following year.

Representing Grossman's two children and his former wife, Anne-Renée Testa, Lester Tanner of the New York City law firm Tanner Propp filed suit in 1993. "If I can get just this case in front of a jury, I know I can win," Tanner told *Microwave News*. Following Grossman and Testa's divorce, she married Tanner in 1987.

Andrew Sapon of Bivona & Cohen in New York City is the attorney for the estate of Robert Olnick, who was an owner of the building when Grossman worked there. Sapon, who has twice moved to dismiss the case, said that he is "quite confident" the case will not go to trial.

In 1996, after Sapon's first motion for summary judgment, New York state Judge Emily Goodman dismissed several defendants from the case. But she refused to dismiss the case against Olnick, and ruled that a jury trial must take place. The lawsuit is currently on hold, however, pending Goodman's ruling on a second motion, which Sapon filed last spring.

In pretrial briefs, Sapon has contended that EMFs did not cause Grossman's cancer. In an interview, Sapon stressed that the case raises a larger issue: whether landlords can be held responsible for protecting tenants from EMFs. "Are you going to charge every landlord in New York City with a duty to bone up on EMFs and run around with a meter measuring 400 apartments?" At the time that Grossman's exposure would have occurred, he argued, relatively little about EMF health effects was known outside scientific circles.

Besides Sapon, the defense team includes James Orr of Sutherland, Asbill & Brennan in Atlanta. Orr defended Oglethorpe Power Co. in a 1991 suit in which Nancy Jordan alleged that EMFs from the utility's power line near her home caused her non-Hodgkin's lymphoma (see *MWN*, S/O93, M/J94 and J/F 96). Jordan withdrew the suit for health reasons in 1997 (see *MWN*, J/A97).

The intensity of the magnetic fields in Grossman's office is in dispute. In pretrial briefs, Tanner has maintained that the primary source of EMFs in the office was a portable air conditioner, but the unit had been removed after Grossman's death and initially could not be located.

Working on the Ground Floor: A Cancer Risk Factor?

Dr. Samuel Milham, an epidemiologist formerly at the Washington State Department of Social and Health Services, has long suspected that working on the ground floor of a large building can mean increased risks of cancer due to elevated EMF exposures.

A multistory building consumes large amounts of electricity, which typically is routed through power lines and transformers in the basement. As a result, offices on the first floor often have high EMF levels.

The possibility of a ground-floor effect suggested an explanation for an anomaly in the Washington state dataset that Milham had used to link work in jobs with elevated EMF exposures to leukemia and other cancers (see *MWN*, J/A82). "I had always been puzzled about the relatively high cancer mortality rates seen in bankers in my Washington state occupational mortality studies," said Milham, who is now retired and living in Olympia, WA.

Banks often occupy street-level—i.e., ground-floor—offices, which in many cities are in high-rise buildings. In Washington state, male bank workers ranked fifth among 219 job categories for total cancer mortality from 1950 through 1989, while female bank workers ranked fifth among 68.

Milham noted that the bankers in his study had elevated mortality from testicular and brain cancer, as well as from melanoma and leukemia. "I think it is no coincidence," he told *Microwave News*, "that many of these same cancer sites have been shown to have elevated mortality in electrical workers."

In 1996, Milham looked into a suspected cancer cluster in an Orange County, CA, high-rise. Eight employees of a real estate brokerage there had developed cancer. All worked on the ground floor, directly above three 12 kV transformers, and they were exposed to EMFs as high as 190 mG (see *MWN*, S/O96).

The New York City psychiatrist and his secretary whose cancers prompted two recent lawsuits (see story at left) also worked in a ground-floor office. Lou Vitale of VitaTech Engineering in Montclair, VA, who measured the fields in the psychiatrist's office, said that this is not an isolated case. "I know of another physician who worked on the ground floor of an office building, with exposures of 10-100 mG, and he also developed leukemia," he told *Microwave News*.

Efforts to reduce EMF levels in ground-floor offices have become increasingly common, often to ensure that computer equipment does not malfunction. These involve shielding electrical switching hardware and transformers, or designing a building so that such equipment is kept distant from occupied office spaces—the approach taken by the World Bank for its headquarters in Washington (see *MWN*, M/A93).

In early 1999, Sapon told Judge Goodman that he had found the air conditioner. Citing measurements by Michael Silva of Energetech Consultants in Campbell, CA—showing that the magnetic field from the air conditioner did not exceed 1 mG at a

distance of more than three feet—Sapon again moved to dismiss the suit. (Tanner insists that this unit was not the one that had been in Grossman's office.)

Silva's affidavit suggested, however, that the air conditioner had not been the main source of EMFs in Grossman's office. Noting that he made the measurements in an office next to Grossman's, Silva identified a "magnetic field source in [the] floor" that generated increasing EMF levels—up to 6mG—as he moved toward Grossman's office. Silva declined further comment.

This prompted Tanner to ask Lou Vitale of VitaTech Engineering in Montclair, VA, to measure the EMFs in the office itself. Vitale found that a plumbing pipe in the wall, which acts as a ground conductor for the building, produced EMF levels above 6 mG where Grossman sat, and above 10 mG nearby. A 1996 assessment performed for Sapon by GausScan Corp. in New Canaan, CT, on the other hand, found EMF levels in the office

to be generally below 1 mG.

Vitale believes that Grossman's exposure may in fact have been higher than 10 mG. "There could have been a significant ground current in the plumbing pipe from bad wiring or faulty electrical equipment," he said in an interview. If so, Grossman's office "could have had fields of 100 mG or more." Vitale added that he hopes to conduct on-site tests to check this possibility, but that to date he has been blocked from doing so.

If the case goes to trial, expert witnesses for the plaintiffs could include Vitale and Dr. Richard Clapp of Boston University. The defense's experts could include Silva, Dr. Patricia Buffler of the University of California, Berkeley, and Dr. Mark Weiss of Memorial Sloan-Kettering Cancer Center in New York City.

Gloria Weisman's husband, Morey, sued the building's owners in 1995. That suit, which is also being handled by Tanner, is on hold pending the outcome of the Grossman case.

« Power Line Talk »

With the close of the RAPID and DOE EMF programs, the only remaining source of dedicated funds for **EMF research** is **EPRI**. "We do plan to continue our program," Jackie Turner in EPRI's media office in Palo Alto, CA, told *Microwave News*. "It is a reduced program, but we feel it is a strong program." Turner declined to specify EPRI's EMF budget, citing a policy against such disclosures. In the early 1990s, when such information was made public, EPRI spent up to about \$10 million a year on power line health issues (see *MWN*, M/A89 and S/O91). Turner said that she did not know when the policy had changed. **Dr. Paul Zweigacker**, the acting director of environmental services at TXU, an electric utility in Dallas, and the chair of EPRI's EMF Assessment and Management Business Area Council, advised EPRI last year that the institute "needs to have a viable EMF program."

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In June, **EPRI** will host a workshop in **Brussels, Belgium**, on **EMF Exposure Guidelines**. "It's for those interested in the science that forms the basis of exposure guidelines," said EPRI's **Dr. Robert Kavet**, the meeting organizer. "We plan to review what we know now and what would be useful to do next," he said. The workshop will be held the week following the Bioelectromagnetics Society's conference in Munich, Germany (see the calendar on p.15 for details on both meetings). Kavet cautioned that attendance will be limited: "We have reserved 65 rooms and it may be difficult to find additional space because there will be a popular soccer game in town at the same time." The proceedings will be published in a peer-reviewed journal. The registration fee is \$300. For more information, contact Kavet at (650) 855-1061 or E-mail: <rkavet@epri.com>.

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A new **meta-analysis**—this one from **Italy**—of 15 epidemiological studies points to a consistent association between residential exposures and **childhood leukemia** for both direct measurements and for surrogate exposure indices such as wire codes.

This finding is in line with the conclusions of several other recent meta- and pooled analyses (see *MWN*, J/F99 and S/O99). Drs. I.F. Angelillo of the University Magna Graecia in Catanzaro and P. Villari of University Federico II in Naples argue that the size of any excess risk is "at present unknown," given the possibility of selection bias, exposure misclassification and confounding variables. Overall, they find, "Enough evidence exists to lead us to conclude that dismissing concerns about EMFs and childhood leukemia is unwarranted." The full text of their paper, which is published in the *Bulletin of the World Health Organization*, 77, pp.906-915, 1999, is available on the Internet at: <www.who.int/bulletin/tableofcontents/vol.77no.11.html>.

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A very different view comes from the Committee on Man and Radiation (**COMAR**) of the Institute of Electrical and Electronics Engineers (IEEE). "There is little cause for concern among most of the population" about power line EMFs and cancer, COMAR concludes in a newly released commentary. The full text of **Possible Health Hazards from Exposure to Power Frequency EMFs** appears in the January/February issue of the *IEEE Engineering in Medicine and Biology Magazine*. COMAR also contends that, "The scientific evidence does not support the existence of cancer or other health and safety hazards from exposure to power frequency fields that are encountered in normal residential or most occupational environments," which it defines as 24-hour average magnetic fields below 1 μ T [10 mG]. Such levels "characteriz[e] the exposure of more than 99.5% of the U.S. population." The statement was prepared by a subcommittee chaired by Ruth Miller of Kansas State University, Manhattan. The panel members were: Larry Anderson, Jerome Beers, John Bergeron, Janie Blanchard, Linda Erdreich, William Feero, Kenneth Foster, John Male, Charles Polk, Patrick Reilly, Russel Reiter, Carl Sutton and Jan Walleczek. Contributions were made by: Eleanor Adair, Robert Adair, Howard Bassen, C.K. Chou, Kjell Hansson Mild, John Moulder, John Osepchuk, Michael Repacholi and Mays Swicord.

All the extra leukemia cases are in the lowest exposure group, so the UKCCS team concludes that if this does reflect a real difference, it is not related to average magnetic field exposure.

Dr. Denis Henshaw of the University of Bristol thinks that these data support his own hypothesis, which suggests that exposure to aerosol pollutants such as traffic exhaust and radon decay products increases close to high-voltage power lines (see *MWN*, M/A96). If so, Henshaw says, it could explain the conclusions of the 1996 report by the U.S. National Academy of Sciences-National Research Council (NAS-NRC): that there is a consistent association between childhood leukemia and living near power lines, at the same time that there is no clear link to magnetic fields (see *MWN*, N/D96).

"Henshaw's interpretation is wrong," UKCCS study leader Dr. Nicholas Day told *Microwave News*. He explained that the table at issue does not include all children in the study living close to high-voltage power lines—only the 30% for which good line-load data were available. Its purpose, he stressed, is just to show that contemporary field measurements are "a reasonably accurate measure" of past exposure. "This table is...very incomplete and misleading in assessing risk in proximity to power cables," said Day, who is at the University of Cambridge.

Day added that his team is now analyzing proximity data on over 200 cases and controls, and plans to publish the findings.

"The publicity people for *The Lancet*, for Henshaw and for the UKCCS all made a hash of their respective press releases," said Day, "which is why we had a press conference to try to get across the correct message." Journalists in the U.K. tend to equate magnetic fields with overhead power cables, he said—"part of their offensive assumption that the U.K. public doesn't understand science and won't be bothered to make an effort." Day noted that his paper is specifically about "the magnetic component of EMFs." And for the average field strengths found in Britain, he said, it is "as definitive as one is likely to get."

What the UKCCS Found

The UKCCS shows no leukemia risk for average magnetic field exposures below 4 mG (see *MWN*, N/D99). As one part of the largest-ever study on possible causes of childhood cancer, careful efforts were made to assess the magnetic field exposures of 2,226 children with cancer and an equal number of controls. These included field measurements at home and school, questionnaires on proximity to power lines and appliance use in the home, plus data on the historic load on nearby power lines.

"We found no evidence that magnetic fields associated with the electricity supply increase risk of childhood leukemia, malignant brain...tumors or any other childhood cancer," Day and colleagues write in *The Lancet* (354, pp.1,925-1,932, 1999).

Sir Richard Doll, overall chair of the UKCCS and perhaps Britain's most respected epidemiologist, now thinks that there is no need for any further epidemiological studies on this subject in the U.K. "This major study provides firm evidence," said Doll, "that exposure to the levels of magnetic fields found in the U.K. does not augment risk for childhood cancer."

"These results cannot be confidently extrapolated to the United States or Canada," cautioned Ken Campbell of the U.K. Coordinating Committee on Cancer Research (UKCCCR) in London,

one of the main sponsors of the study. Only 83 children in the UKCCS (less than 4%) had exposures above 2 mG, compared to more than 11% of children in the U.S. and more than 15% of Canadian children. "Our study contributes little evidence" on exposures of 4 mG and above, the study team notes, given that only 17 children were in this category.

In a commentary in the same issue of *The Lancet*, Drs. Michael Repacholi of the World Health Organization in Geneva and Anders Ahlbom of the Karolinska Institute in Stockholm stress the need to study average exposures above 2 mG, as well as other factors such as high frequency transients (see *MWN*, N/D99).

Henshaw on Power Lines and Cancer

According to Henshaw, "The results of the UKCCS, the review by the NAS-NRC and the recent Bristol papers all point in the same direction, in confirming a link between proximity to power lines and childhood leukemia." His latest research is presented in two papers in the December issue of the *International Journal of Radiation Biology*, published just days before the UKCCS findings appeared (*IJRB*, 75, pp.1,505-1,521 and pp.1,523-1,531, 1999; see *MWN*, N/D99).

Power line electric fields, Henshaw contends, increase both the velocity of airborne pollutants and the number of such particles that are charged, making them more likely to be deposited on the skin and in the lungs of people nearby. "Thereafter," Henshaw told *Microwave News*, "the inhaled particles will pass into the bloodstream and around the body, including the bone marrow." He stated that, "This interaction of airborne pollution with high-voltage power lines is via the electric, not the magnetic, field." (The UKCCS has also collected data on electric field exposures, which will be published in the future.)

The UKCCS table cited by Henshaw is based on both overhead and buried cables, the UKCCCR's Campbell told *Microwave News*. Since the latter produce no appreciable electric field aboveground, they would be irrelevant to Henshaw's hypothesis. Day declined to provide details on the proportion of each type of cable in the disputed table, explaining that this information will not be available until the full set of proximity data is published.

Overall, Day is unconvinced by Henshaw's theory about aerosol pollutants. "Physicists disagree with his theory that the cancer-causing agents can be received within the internal organs," Day told the BBC on December 3.

The U.K. electric industry is also unimpressed. In a December 1 statement from Britain's Electricity Association (EA), EA Scientific Advisor Dr. John Swanson accused Henshaw of engaging in "speculation about health effects of power lines which is not supported by [his] data."

A paper in the same issue of the *IJRB*, by Dr. David Jeffers, a retired engineer for the U.K. electricity provider National Grid Co., concludes, on the basis of theoretical calculations, that electric fields increase the deposit of radon decay products on surfaces within a power line electric field, but that "the effect does not appear to be of epidemiological significance."

The U.K.'s National Radiological Protection Board (NRPB) responded to Henshaw's new papers on December 6. "The NRPB remains extremely skeptical about recent claims that a causal link between power lines and human health can be established,"

the board began. "There must be great doubt about the assertion" by Henshaw's group "that their findings can be extrapolated to real health effects," the NRPB emphasized.

On December 9 the NRPB issued a revised version of this statement. The first sentence was changed to a pledge that, "The NRPB will investigate recent claims" of a power line-cancer link. While "there is doubt" that Henshaw's work is relevant to human health, the NRPB stated, "nevertheless, the NRPB's Advisory Group on Non-Ionizing Radiation will review the work by [Henshaw's group], and the NRPB will take note of their advice." No explanation was given for the change.

When Henshaw first published his hypothesis in 1996, the NRPB called it "implausible" and "purely speculative." A letter to the *IJR* from Dr. John Stather, a senior NRPB official, and colleagues argued that increased deposit of aerosols such as radon decay products should actually lower their concentration in the surrounding atmosphere. They added that there was no convincing path by which inhaled particles could enter internal organs such as bone marrow in significant concentrations.

Henshaw countered that there is already epidemiological evidence linking traffic pollution to childhood leukemia, presumably from inhalation.

In support of his theory, Henshaw cited a small skin cancer

study by Dr. Alan Preece, also of Bristol University, which was presented at the 1996 U.S. Department of Energy contractors review meeting in San Antonio. "Preece found a statistically significant 1.6- to 2.0-fold increase among people living under high-voltage power lines in the counties of Devon and Cornwall, U.K.," Henshaw said. Preece told *Microwave News* that he recently started work on expanding this study, to make the results more statistically robust.

Henshaw's new research used radon decay product aerosols "as markers of general aerosol behavior," and found that they accumulate 1.4 to 3 times faster under power lines than on control samples 100 meters away. Henshaw thinks pollutant aerosols should behave similarly, and that, "In most cases, and certainly for childhood cancer, it is probably pollution that is the key."

Some critics have argued that power line electric fields would be too weak inside the lungs and nasal passages to have much effect. In their latest work, Henshaw and colleagues respond that the electric field around power lines "is often sufficient to ionize the air," creating a stream of charged particles known as corona ions. "Corona ions quickly attach themselves to pollutant aerosols and are then carried away by the wind," Henshaw explained. He contends that these charged particles are twice as likely to be deposited in the lungs.

FROM THE FIELD

Letter to the Editor

Chou Defends Standard-Setting For Cellular Phone Safety

January 19, 2000

To the Editor:

In your recent issue (N/D99), you assert that "industry is in the driver's seat" in revising the RF/MW exposure limit for the ear. I would like to express my opinion on this assertion and clarify the ear safety limit issue.

Standards are developed by committees. In the U.S., two major organizations develop RF/MW safety standards and criteria: IEEE SCC-28/SC-4 and NCRP SC-89. SCC-28/SC-4 is a large subcommittee, with about 100 national and international members representing academia, government and industry. All SCC-28 meetings and records are open to the public and all decisions are made by consensus. All members have equal rights in making decisions. Balanced membership is a key criterion for the committee and the subcommittees.

The ear issue was brought up during deliberations of SCC-34/SC-2 (subcommittee on SAR test procedures). The ICNIRP RF/MW safety guideline published in 1998, which was developed by an international group of experts (without representation from industry), adopted 10 g as the averaging mass for the local SAR limit. When the European CENELEC standardized the SAR measurement protocol, there was no issue with the ear because they accepted the ICNIRP guidelines. Due to the 1 g averaging recommended in the IEEE C95.1-1991 standard and adopted by the FCC, FDTD calculations in 1 g of ear tissue showed values in the pinna which could exceed 1.6 W/Kg. Due to the size of the electric field probe, it is impossible to measure the SAR in the ear. This created a technical issue for the SCC-34/SC-2 to resolve.

Prof. Veli Santomaa of Nokia first raised the ear issue during the

SCC-28/SC-4 meeting in Long Beach, CA, in June of 1999. The issue was listed on the SCC-28/SC-4 agenda for the October 17, 1999, Atlanta meeting (cochaired by Dr. John D'Andrea and me). During the meeting, Santomaa made a presentation explaining the reasons for the proposal. It was pointed out that the temperature rise of at least 3°C in the pinna during steady state was mainly due to conduction of heat from the phone and not due to the RF absorption in the ear. The pinna is an important but rugged organ like the hands and feet. The pinna experiences large environmental temperature changes (-40°C to 40°C). The main function of the pinna is to capture sound for hearing. With its efficient vasodilatation, the 4 W/Kg per 10 g SAR will not produce excessive heating in the pinna. After the presentation, Bob Curtis of OSHA made the motion to adopt 4 W/Kg averaged over 10 g of ear tissue, i.e., the same as for other extremities. The motion passed 28-0. I have made the detailed meeting record available to *Microwave News*. A formal ballot by SC-4 is now in process. If the proposal passes, a similar process by SCC-28 will follow. Dr. Om Gandhi, who raised the ear issue, also expressed his support of this proposal at the December 1999 SCC-34/SC-2 meeting.

The assertion that industry is controlling standard setting and keeping the public in the dark is unfounded and does not serve the readers in a positive manner.

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Hot New Papers

G.M.J. Van Leeuwen et al., "Calculation of Change in Brain Temperatures Due to Exposure to a Mobile Phone," *Physics in Medicine and Biology*, 44, pp.2,367-2,379, October 1999.

"We calculated a maximum rise in brain temperature of 0.11°C for an antenna with average emitted power of 0.25 W, the maximum value in common mobile phones. The power distributions causing this were characterized by a maximum averaged SAR over an arbitrarily shaped 10 g volume of approximately 1.6 W/Kg. Although these power distributions are not in compliance with proposed safety standards, absolute temperatures do not rise markedly over 37°C and the temperature rises are far below what is considered dangerous."

Kurtis Andrews and David Savitz, "Accuracy of Industry and Occupation on Death Certificates of Electric Utility Workers: Implications for Epidemiologic Studies of Magnetic Fields and Cancer," *Bioelectromagnetics*, 20, pp.512-518, December 1999.

"The limited quality of occupation and industry information on death certificates argues against relying on such information to evaluate modest associations with mortality."

Ulla Forssén, Maria Feychting, Lars Erik Rutqvist, Birgitta Floderus and Anders Ahlbom, "Occupational and Residential Magnetic Field Exposure and Breast Cancer in Females," *Epidemiology*, 11, pp.24-29, January 2000.

"Although the findings in our study are consistent with our previous results based on residential exposure, which showed an increased risk in the youngest age groups and for ER+ [estrogen-receptor-positive] breast cancer, the results are far from persuasive. The small number of subjects in our study resulted in unstable risk estimates. The elevated relative risks could be the result of chance and should also be viewed in light of the reductions in risk for women more than 50 years of age, which is not consistent with the melatonin hypothesis." (See *MWN*, S/O98.)

Frank Gustrau et al., "Simulation of Induced Current Densities in the Human Body at Industrial Induction Heating Frequencies," *IEEE Transactions on Electromagnetic Compatibility*, 41, pp.480-486, November 1999.

"At industrial workplaces in the vicinity of induction heating and melting devices workers are exposed to strong magnetic fields....This paper provides numerical [FDTD] investigations to clarify the ratio between external homogeneous magnetic fields and induced current densities inside the human body in the frequency range from 250 Hz up to 10 kHz....The magnitude of the external magnetic field equals the reference value for occupational exposure in the current guideline of the International Commission on Non-Ionizing Radiation Protection (ICNIRP). It was found that the calculated maximum current densities inside the body may exceed the basic restrictions of the ICNIRP guideline [by] at least up to a factor of two."

C. Harris et al., "Electromagnetic Field Strength Levels Surrounding Electronic Article Surveillance (EAS) Systems," *Health Physics*, 78, pp.21-27, January 2000.

"Field strength levels were measured around four types of EAS systems: audio frequency magnetic, pulsed magnetic resonant, radiofrequency and microwave. Field strengths from these EAS systems varied with magnetic fields as high as 1073.6 A/m (in close proximity to the audio frequency magnetic EAS system towers), and electric fields up to 23.8 V/m (in close proximity to the microwave EAS system towers). Medical devices are only required to withstand 3 V/m by the International Electrotechnical Commission's current medical device standards. The modulation scheme of the signal transmitted by some types of EAS systems (especially the pulsed magnetic resonant) has been shown to be more likely to cause EMI with electronic medical devices. ...The measurements recorded in this survey of EAS systems show that

EMFs and Childhood Leukemia: "Conservative Interpretations"

Anders Ahlbom and Maria Feychting, "A Bayesian Approach to Hazard Identification: The Case of Electromagnetic Fields and Cancer," in "Uncertainty in the Risk Assessment of Environmental and Occupational Hazards—an International Workshop," *Annals of the New York Academy of Sciences*, 895, pp.27-33, 1999.

"As an example of conservative interpretations, consider the latest [EMF] study from the U.S. [National Cancer Institute]....[T]he study is entirely negative for wire codes and leukemia risk. However, that is not at all the case for 24-hour measurements, and particularly not so for the higher exposure level. Despite this, the paper is accompanied by an editorial that has the following conclusion: 'In this issue of the *Journal*, Linet et al. report the results of a major study showing that the risk of [acute lymphoblastic leukemia] does not increase with increasing electromagnetic field levels in the children's homes.' That is, despite the risk elevations in the commented study and despite the previous literature, the editorial takes this opportunity to dismiss this hypothesis once and for all. The editorial even says: 'It is time to stop wasting our research resources.' As another example of conservative interpretation, we refer to a later publication from the same U.S. study that addresses the use of electrical appliances in relation to leukemia risk. [Some are] linked to increased relative risks. The pattern, however, is not fully consistent: For other electrical appliances there is no risk elevation, and there is some concern about the lack of dose response in some instances. Nevertheless, for the most important exposure source—electric blanket use—the relative risk is high, and there is a clear indication of dose response. The authors' conclusion, however, is careful: 'Although not impossible, we think that a causal relation between magnetic fields from the appliances and acute lymphoblastic leukemia is unlikely.'" (See *MWN*, J/A97, N/D97 and M/J98.)

the types of signals and their associated signal amplitudes are not easy to predict. The field strength levels measured are not only a result of the type of technology employed by the manufacturer, but also a function of the environment where the EAS is being used."

Thurman Wenzl, "Assessment of Magnetic Field Exposures for a Mortality Study at a Uranium Enrichment Plant," *American Industrial Hygiene Association Journal*, 60, pp.818-824, November/December 1999.

"A total of 252 workdays was measured with a personal monitor, and individual average magnetic field exposures ranged from 0.20 to 82.6 mG....Very high consumption of electrical power at this plant does not imply that a large fraction of the workers are highly exposed to magnetic fields. An initial hypothesis had been that since flowing current generates magnetic fields, and this plant uses as much electrical power as a large city (up to 1,750 MW daily), then many workers would have high exposures. More measured workers had average exposures above 3 mG than in the employed population in general (14% vs. 10%), but workers in these jobs represent only about 9% of the work time of the cohort. These high exposures were encountered by switchyard workers, welders and some electricians....Some common assumptions about

On the Internet

Think You Have a Brain Tumor?

A new Web site is using concern over mobile phones and cancer to sell cut-rate MRI exams. "Brainscans.com has no position on whether there is a link between cellular telephone usage and brain cancer," it states. "However, an MRI of the brain at \$169 will provide peace of mind to those who are concerned about the fact that the 'jury is still out' on this subject." The site features links to television news reports from ABC, the BBC and CNN, as well as the views of the FCC, FDA and the U.K.'s NRPB. Dr. Patrick Kelly, one of the founders of the Web site, said in an interview: "Some of these Wall Street types who're worried about their cell phones—hell, if I were them I'd get it." Kelly is chair of neurosurgery at New York University Medical Center. No medical organization currently supports screening the general public for brain cancer, said Joann Schellenbach of the American Cancer Society in New York City. "They would need a lot more scientific evidence that it would actually reduce mortality," she explained. Brainscans.com states that it is offering the low \$169 price "as a public service." Kelly conceded, however, that it is a profit-making enterprise. In a study published in the July 7, 1999, *Journal of the American Medical Association*, 18% of 1,000 healthy adults had "abnormal" results in MRI exams of their brains—but five out of six of these turned out to be "trivial problems such as sinusitis." According to Kelly, "Someone with an abnormality should probably get a diagnostic MRI," which he said normally costs \$1,200-\$1,500. <www.brainscans.com>

FDA Seeks Toxicity Testing of RF/MW Radiation

In our last issue, we noted that the Food and Drug Administration (FDA) had nominated RF/MW radiation from wireless communication devices for testing under the national toxicology program (NTP). The full text of FDA's nomination, dated May 19, 1999, appears on the NTP's Web site, run by the Na-

tional Institute of Environmental Health Sciences.

<ntp-server.niehs.nih.gov/htdocs/Chem_Background/ExecSumm/Cefuroxime.html#Wireless>

Promoting Nonlethal Weapons

In a new report, the Council on Foreign Relations criticizes the Pentagon for the "very slow" development and use of nonlethal weapons and spells out what needs to be done to speed things up. Among the various technologies cited in the report are: RF/MW zappers to "stop vehicles or disable electronics" and acoustic and directed-energy weapons "designed to interfere with local communications, to disorient, to set up buffer zones, to deny access or to repel mobs." One specific criticism is that the military's Joint Nonlethal Weapons Directorate, created in 1997, "has had little or no access to extensive programs in radiofrequency, high-power microwave and other directed-energy technologies that exist in the military services." Full texts of both this report and the council's previous report, issued in 1995, are available on the Web. (See also p.16.)

<www.cfr.org> or <www.foreignrelations.org/public/pubs/Non-ViolentTaskForce.html>

FDA CDRH:

Standards Liaison List and Annual Report

The FDA's Center for Devices and Radiological Health has posted a list of its current (as of February 8, 2000) representatives to various standard-setting organizations—such as AAMI, ANSI, IEC, IEEE and ISO.

For U.S. national groups:

<www.fda.gov/cdrh/national.pdf>

For international groups:

<www.fda.gov/cdrh/international.pdf>

And CDRH's 1999 Annual report is at:

<www.fda.gov/cdrh/annual/fy99rpt.pdf>

workplace chemical exposures do not apply to magnetic fields at this site. For example, large groups of professionals and office workers had higher magnetic field exposures than did production and maintenance workers....The weakness of job title alone in predicting exposures has also been suggested in other exposure investigations."

Kathy Ryan, John D'Andrea, James Jauchem and Patrick Mason, "Radiofrequency Radiation of Millimeter Wavelength: Potential Occupational Safety Issues Relating to Surface Heating," *Health Physics*, 78, pp.170-181, February 2000.

"As the use of MMWs [millimeter waves] increases, the possibility exists that personnel might be inadvertently exposed, perhaps leading to injury. Because of the shallow penetration depth of MMWs, thermal injury to the eye and skin are most likely. However, irradiation of both the eyes and the skin are, for the most part, self-limiting in that the exposure will be sensed and avoided before thermal injury is incurred. Low-level exposure of MMWs is not known to be carcinogenic; the majority of animal experiments performed to date have failed to demonstrate carcinogenic potential of microwaves at lower frequencies than MMWs. Finally, in the event of an accidental exposure to MMWs of sufficient power to produce thermal injury, there is an extremely low possibility that scars derived from such [an] exposure might later be-

come cancerous. With proper wound management, this possibility decreases even further...."

C. Graham, M. Cook, A. Sastre et al., "Multi-Night Exposure to 60 Hz Magnetic Fields: Effects on Melatonin and Its Enzymatic Metabolite," *Journal of Pineal Research*, 28, pp.1-8, January 2000.

"Thirty healthy young men were evaluated using a randomized, double-blind test protocol. Statistical analysis indicated that four consecutive nights of exposure to power frequency magnetic fields at occupational intensity (resultant flux density=28.3 μ T [283 mG]) had no differential effect on concentrations of melatonin or its major enzymatic metabolite (6-OHMS) in daily morning urine samples, compared to [controls]. The consistency of intra-individual urinary measurements over the four test nights also was quite high ($p<0.01$) in the sham control condition. In contrast, repeated nightly exposure to the magnetic field was associated with reduced consistency. Morning urinary measures obtained after exposure on night 4 differed ($p<0.01$) from similar measures obtained on after the second and third exposure night. Thus, while the overall results of this study do not support the melatonin hypothesis, there is some suggestion of a possible cumulative effect of magnetic field exposure on the stability of individual melatonin measurements over time."

Across the Spectrum

IT'S OFFICIAL. POWER LINES DON'T GIVE CHILDREN LEUKEMIA.

—Headline, editorial on the U.K. Childhood Cancer Study, *New Scientist* (U.K.), p.3, December 11, 1999 (see p.1 and *MWN*, N/D99)

Cultlike purification movements exist to purge our lives of chemicals, power lines or perfume.

—Dr. Peter Huber, *Manhattan Institute*, New York City, in "Insights: Wealth and Poverty," *Forbes*, p.110, December 27, 1999

"Given the results published up to this point, I personally feel that the implications of cellular telephone effects are not horrendous. But cellular telephones are a recent phenomenon. For the first time in our history, we are putting a microwave source right next to the head of millions and millions of people. So we need to get a consistent and dependable set of answers, and that will take time."

—Dr. James Lin, *University of Illinois*, Chicago, quoted by Tekla Perry in "Technology 2000: The Environment," *IEEE Spectrum*, p.85, January 2000

"The research keeps rolling in, but we haven't seen anything conclusive to demonstrate that cell phones are a health risk. We agree with the FDA and the scientific community that more research needs to be done. Our position could change with more definitive results."

—Norm Sandler, *director, global strategic issues, Motorola Inc.*, Schaumburg, IL, quoted by Phillip Browne in "Cell Phone Safety Weighed," *Daily News* (Los Angeles), p.20, December 3, 1999

"[It is a] really good study that will answer the question for once and for all."

—Dr. Elisabeth Cardis, *International Agency for Research on Cancer*, Lyon, France, on its multicountry study of mobile phone use and brain cancer, quoted by Eoin Licken in "Cell Phones: Are Cancer Risks Real?" *International Herald Tribune*, p.6, December 16, 1999 (see *MWN*, J/F98 and S/O98)

"[Go back to your rooms and] dream about the precautionary approach."

—Juan Mayr, *chair, conference on genetically modified food, to delegates from 140 countries near the close of a weeklong meeting in Montreal, Canada*, quoted by Andrew Pollack in "Talks on Biotech Food Turn on a Safety Principle," *New York Times*, p.A4, January 28, 2000

"[A]s of September, if we find sites out of compliance, we'll use the full measure of the FCC's power to get them in compliance, and if there are penalties to be given out, then that is what will happen."

—Jerry Ulcek, *FCC Office of Engineering and Technology*, Washington, quoted in "RF Regulations Create Exposure to Liability," *Telecom Land Management Law Report*, p.2, November 1999

"They were not intended to address the situation that the public is most concerned about, and that is chronic exposure. As a result, there's really uncertainty about how protective the current guidelines are."

—Norbert Hankin, *EPA Office of Radiation and Indoor Air*, Washington, on the FCC's public RF/MW exposure guidelines, quoted by Katie Dean in "Cell Towers Take Root on Farms," *Wired News*, <www.wired.com>, January 10, 2000 (see *MWN*, M/J97 and S/O97)

"There is no demonstrable health risk from using a cell phone that transmits at around a watt. So using a 1 milliwatt Bluetooth transmitter means there is a thousandth of no risk."

—Dr. Michael Clarke, *spokesperson, U.K.'s National Radiological Protection Board*, on Ericsson's introduction of a wireless headset for a mobile phone, quoted by Barry Fox in "Bluetooth Stops You Getting All Tangled Up," *New Scientist*, p.20, December 18, 1999

"This is the first time that the government is acknowledging that people got cancer from radiation exposures in [nuclear weapons] plants."

—Secretary of Energy Bill Richardson, quoted by Matthew Wald in "U.S. Acknowledges Radiation Killed Weapons Workers: Ends Decades of Denials," *New York Times*, p.A1, January 29, 2000

"MICROWAVE NEWS" FLASHBACK

Years 15 Ago

- RF radiation levels from broadcast antennas in Honolulu, HI, are the highest ever measured in an urban area, according to the EPA.
- After determining that power substation workers have an increased risk of chromosomal abnormalities, a team of Swedish researchers finds that electromagnetic pulses (spark discharges) cause breaks in chromosomes *in vitro*.
- The EPA plans to propose several options for limiting public exposure to RF radiation. A federal standard is expected to be in place within a year.

Years 10 Ago

- "Anyone who would believe that EMFs could promote cancer would believe in perpetual motion or cold fusion," says Dr. Robert Adair of Yale University.
- A series of Swedish and Canadian experiments with mouse and chicken embryos indicates greater vulnerability to pulsed magnetic

fields in the early stages of pregnancy.

- The U.S. Navy's submarine communications system, Project ELF, with antennas in Michigan and Wisconsin, is fully operational for the first time.

Years 5 Ago

- Drs. David Savitz and Dana Loomis of the University of North Carolina find an elevated mortality rate due to brain cancer among electric utility workers exposed to EMFs. The study does not support a link to leukemia.
- Trees within 50-150 meters of the U.S. Navy's Project ELF transmitters—with exposures of 1-7 mG—are growing up to 74% faster than unexposed trees, according to a Michigan Technological University study.
- Sweden's Ellemtel Telecommunication Systems Laboratories accommodates a group of employees suffering from EMF hypersensitivity, including an electrical engineer who must be confined to a specially shielded office.

2000 Conference Calendar (Part II)

Part I appeared in our last issue.

March 20-21: **Circadian Disruption as Endocrine Disruption in Breast Cancer/National Action Plan on Breast Cancer Workshop**, NIH Campus, Bethesda, MD. Contact: Cheryle Davis, ROW Sciences Inc., (301) 294-5455, E-mail: <cdavis@hq.row.com>. Space is limited.

April 26-28: **Transmission and Distribution World Expo 2000**, Convention Center, Cincinnati, OH. Contact: T&D World 2000, Intertec Exhibitions, 5680 Greenwood Plaza Blvd., Suite 100, Englewood, CO 80111, (800) 288-8606, Fax: (720) 489-3164, Web: <www.tdworldexpo.com>.

May 4-5: **Low Frequency EMFs, Visible Light, Melatonin and Cancer**, University of Cologne, Germany. Contact: Organizing Secretariat, Institute and Polyclinic for Occupational and Social Medicine, 50924 Cologne, Germany, (49+221) 478-5819, Fax: (49+221) 478-5119, E-mail: <tim.erren@uni-koeln.de>, Web: <www.uni-koeln.de/symposium2000>.

May 6-7: **COST 244bis Workshop on Bioeffects of Transient EMF Exposure**, Ramón y Cajal Hospital, Madrid, Spain. Contact: Dr. Jocelyne Leal, Dept. of Research, Ramón y Cajal Hospital, Ctra. de Colmenar, Km9, 28034 Madrid, Spain, (34+91) 358-1365, Fax: (34+91) 336-8171, E-mail: <jocelyne.leal@hrc.es>.

June 7-8: **International Conference on Cell Tower Siting**, Salzburg, Austria. Contact: Dr. Michael Kundi, Institute of Environmental Hygiene, University of Vienna, Kinderspitalgasse 15, A-1095 Vienna, Austria, (43+1) 4277-64726, E-mail: <michael.kundi@univie.ac.at>.

June 9-16: **22nd Annual Meeting of the Bioelectromagnetics Society (BEMS)**, Technical University, Munich, Germany. Contact: Dr. William Wisecup, 7519 Ridge Rd., Frederick, MD 21702, (301) 663-4252, Fax: (301) 371-8955, E-mail: <75230.1222@compuserve.com>, Web: <www.bioelectromagnetics.org>.

June 15-17: **33rd Annual Meeting of the Society for Epidemiological Research (SER)**, Seattle, WA. Contact: SER, 111 Market Pl., Suite 840, Baltimore, MD 21202, Web: <www.jhsph.edu/Publications/jepi>.

June 19-20: **EMF Exposure Guidelines Science Workshop**, Hotel Metropole, Brussels, Belgium. Contact: Gail Banerjee, EPRI, 3412 Hillview Ave., Palo Alto, CA 94304, (650) 855-7956, E-mail: <gbanerje@epri.com>.

June 25-29: **45th Annual Meeting of the Health Physics Society (HPS)**, Convention Center, Denver, CO. Contact: Lynne Fairbent, c/o HPS Secretariat, 1313 Dolley Madison Blvd., Suite 402, McLean, VA 22101, E-mail: <fairbent@ncrp.com>, Web: <www.webpanache.com/crmchps/hps2000.htm>.

June 27-30: **15th International Wrocław Symposium and Exhibition on Electromagnetic Compatibility**, Wrocław, Poland. Contact: W. Moron, EMC Symposium, Box 2141, 51-645 Wrocław 12, Poland, (48+71) 348-3051, Fax: (48+71) 372-8878, E-mail: <emc@il.wroc.pl>, Web: <www.emc.wroc.pl>.

July 5-14: **Progress in Electromagnetics Research Symposium (PIERS 2000)**, Royal Sonesta Hotel, Cambridge, MA. Contact: Dr. Hsiu Han, 391 Durham Center, Iowa State University, Ames, IA 50011, (515) 294-5320, E-mail: <hsiu@iastate.edu>.

July 16-20: **2000 IEEE PES Summer Meeting**, Seattle, WA. Contact: IEEE PES, 445 Hoes Lane, PO Box 1331, Piscataway, NJ 08855, (732) 562-3883, Fax: (732) 562-3881, E-mail: <peasm2000@ieee.org>, Web: <www.ieee.org/power>.

July 16-21: **2000 IEEE Antennas and Propagation Society International Symposium and USNC/URSI National Radio Science Meeting**, Doubletree Hotel, Salt Lake City, UT. Contact: Michael Jensen, Dept. of Electrical and Computer Engineering, 459 Clyde Building, Brigham Young University, Provo, UT 84602, E-mail: <tpc2000@ee.byu.edu>, Web: <www.caeme.elen.utah.edu/aps2000>.

July 17-19: **35th Annual Microwave Symposium**, Montreal, Canada. Contact: International Microwave Power Institute, 10210 Leatherleaf Ct., Manassas, VA 20111, (703) 257-1415, Fax: (703) 257-0213, E-mail: <info@impi.org>, Web: <www.impi.org>.

Meeting Notes

• A European tour in June: Meetings have now been scheduled for before and after the June 9-16 BEMS annual meeting in Munich. June 7-8, there will be a conference in Salzburg on the siting of cellular phone towers and, June 19-20, a workshop on EMF exposure guidelines will be held in Brussels. See the calendar for details on all three meetings and p.9 for more on the EMF workshop.

• The *1st Australasian Conference on Bioelectromagnetics*, which was to be held in New Zealand at the end of October, has been canceled for financial reasons. According to Dr. William Wisecup, the meeting organizer, there was practically no interest from potential corporate or institutional sponsors.

• On February 7, there will be a panel discussion in Toronto, Canada, on the siting of cell phone towers. Among the participants will be Dr. Henry Lai and Mary McBride. For more information, contact Ronald Macfarlane, (416) 392-1560, ext. 87012 or <rmafar3@city.toronto.on.ca>.

July 23-28: **World Congress on Medical Physics and Biomedical Engineering**, Navy Pier Convention Center, Chicago, IL. Contact: World Congress Chicago 2000, AAPM Headquarters, 1 Physics Ellipse, College Park, MD 20740, (301) 209-3350, Fax: (301) 209-0862, E-mail: <wc2000@aapm.org>, Web: <www.wc2000.org>. Includes **22nd Annual Conference of the IEEE-EMBS**. Contact: Dr. John Enderle, Dept. of Electrical and Systems Engineering, University of Connecticut, 260 Glenbrook Rd., U-157, Storrs, CT 06269, (860) 486-5521, Fax: (860) 486-2447, E-mail: <jenderle@bme.uconn.edu>, Web: <www.ieee.org/soc/embs>. Note: There will not be a fall EMBS Annual International Conference in 2000.

August 19-23: **12th Conference of the International Society for Environmental Epidemiology (ISEE 2000)**, Adam's Mark Hotel and Resort, Buffalo, NY. Contact: Jay Friedman, (716) 645-3705, Fax: (716) 645-3869, E-mail: <sumpter@buffalo.edu>, Web: <www.specialevents.buffalo.edu/ISEE2000>.

August 21-25: **IEEE International Symposium on Electromagnetic Compatibility**, Washington, DC. Contact: IEEE/EMC Washington 2000, 445 Hoes Lane, Piscataway, NJ 08855, Web: <www.dcemc2000.org>.

September 11-15: **4th European Symposium on Electromagnetic Compatibility (EMC Europe 2000)**, St. John Hospital, Brugge, Belgium. Contact: EMC 2000, Technologisch Instituut, Desguinlei 214, B-2018 Antwerp, Belgium, (32+3) 216-0996, Fax: (32+3) 216-0689, E-mail: <emc2000@conferences.ti.kviv.be>, Web: <www.ti.kviv.be/conf/emc2000.htm>.

September 17-21: **8th International Conference on Dielectric Materials, Measurements and Applications (DMMA 2000)**, Heriot Watt University, Edinburgh, U.K. Contact: DMMA 2000 Secretariat, IEE Conference Services, Savoy Pl., London WC2R 0BL, U.K., Fax: (44+171) 240-8830, E-mail: <dmma2000@iee.org.uk>.

October 8-12: **3rd International Conference on Bioelectromagnetism and 1st Slovenian-Croatian Meeting on Biomedical Engineering**, Bled, Slovenia. Contact: ICBEM Organizing Committee, Faculty of Electrical Engineering, University of Ljubljana, Trzaska 25, SI-1000 Ljubljana, Slovenia, (386+61) 1768-456, Fax: (386+61) 1264-658, E-mail: <3rdICBEM@svarun.fe.uni-lj.si>, Web: <lbk.fe.uni-lj.si/icbem>.

October 17-20: **Biological Effects of Electromagnetic Fields**, Crete, Greece. Contact: Dr. Panos Kostarakis, NCSR Demokritos, Institute of Informatics and Telecommunications, 15310 Agia Paraskevi, Greece, (30+1) 650-3208, Fax: (30+1) 653-2910, E-mail: <millenium@ariadne-t.gr>, Web: <ikaros.tsinet.gr>.

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ANIMAL MAGNETISM

Butterflies in the Field...The annual migration of monarch butterflies is one of the enduring mysteries of science. These tiny insects travel over 2,000 miles each fall from the northern U.S. and Canada to a specific area in the mountains of central Mexico, and scientists have long wondered how they are able to find their way. Now researchers at the University of Kansas, Lawrence, have demonstrated what many had long suspected: that one of the monarch's navigational tools is an ability to sense Earth's magnetic field directly. Migrating butterflies were put in a plastic column one meter wide, and their direction of flight was observed. Under normal conditions, the monarchs flew to the southwest. Inside a room of nickel-iron alloy, which blocked Earth's magnetic field, they did not fly in any consistent direction. And when coils were used to cancel out this field and create an equal field in the opposite direction, the butterflies flew to the northeast. Interestingly, when the Kansas researchers conducted the same tests with nonmigratory monarchs, the butterflies flew in random directions under all three magnetic field conditions. "The...changes that trigger migration and cause monarchs to respond to magnetic information have not been determined," Dr. Jason Etheredge and colleagues write in the November 23 *Proceedings of the National Academy of Sciences* (96, pp.13,845-13,846, 1999), noting that the butterflies do not navigate by magnetic sense alone. They suggest that, "The site of magnetoreception may be the thorax, which contains 65% of the magnetite" in a monarch's body. Magnetite, they explain, is "a magnetically active, biosynthesized mineral suspected to mediate orientation in organisms that respond to magnetic fields"; magnetite is also found in human brain tissue (see *MWN*, M/J92).

ELECTROMAGNETIC WEAPONS

"Disruption of Voluntary Muscle Control"...Researchers at Oak Ridge National Lab (ORNL), a Department of Energy (DOE) facility in Oak Ridge, TN, are exploring whether EMFs could be used to immobilize enemy personnel. In a funding proposal for FY99, Dr. Clay Easterly had asked for \$400,000 for "a proof-of-principle" experiment with mice or rats. Easterly was granted only \$100,000, however, and told *Microwave News* in January that, "We're just doing some computer modeling" as a result. "We're starting with a given waveform and seeing how it changes when it goes through the skull," he explained, "and how that might look at the cellular level." The proposal states that, "The active biophysical mechanism in the proposed work is *not heating*, but rather lowering the firing potential of neurons, triggering them to discharge, or inducing currents." Animal studies would try to demonstrate an effect and explore its parameters, laying the basis for "a prototype device for the disruption of voluntary muscle control." Other possible effects include interference with vision and short-term memory. The proposal notes that "high-strength fields have the theoretical potential to *incapacitate personnel*" (original emphasis), and envisions "a weapon system that could be used at close range or 100+ meters." The ORNL's Michael Maston said that if the computer model is successful, animal experiments might follow. "But we're probably two years away from that, even if the model works out," Maston said. Any

animal studies, he added, would likely be carried out with Dr. Karl Pribram of Radford University's Center for Brain Research in Radford, VA. Maston is ORNL's director for work under the DOE's Special Technologies Program (STP), which he defined as "a program that supports the special activities community." And what is that? "The special activities community is the intelligence community, special operations of the FBI, things in that area," Maston answered. "That's about all I can say on that." The STP has two tasks, Maston explained: "real-world operations support" and "limited support for emerging technologies" such as EMF weapons. Developing effective nonlethal weapons "is actually a rather benevolent goal," Maston emphasized (see also p.13). "The current pathway of all weapons is either death or pain, and if we can go beyond that, it would be a good thing." As for weapons based specifically on electromagnetic energy, Maston said, "People have the wrong idea about this—this is not mind control." He said that he had been deluged with Freedom of Information Act (FOIA) requests about research in this area: "You think, my God, we've answered this two or three times already, and the response is, 'Well, yes, but we didn't believe you.'" When the DOE was subpoenaed in a federal lawsuit (see, for example, *MWN*, M/J98), Maston said, he posed this question: "Do you think if I had mind control I would have let you file this FOIA?" He expressed frustration with the amount of time he has had to spend on such matters, and suggested that more might be involved than just frightened citizens: "Some of these FOIA requests may almost be state-sponsored," he asserted. "It would be a great way to gather intelligence."

PEOPLE

Dr. **Elizabeth Jacobson**, the deputy director for science at the FDA's Center for Devices and Radiological Health, has won the Presidential Rank Award, one of the highest awards in the federal civil service....**Ron Petersen** of Lucent Technologies in Murray Hill, NJ, has been elected a fellow of the IEEE "for outstanding contributions and leadership in development of standards for the safe use of electromagnetic energy across the spectrum from DC to light." Petersen plays a key role in two IEEE standard-setting committees: he is chair of SCC-34 and the secretary of SCC-28....**Dr. Jerry Phillips**, formerly a member of Dr. **Ross Adey's** research group at the VA Medical Center in Loma Linda, CA, has moved to Colorado Springs, CO, where he is now a staff biologist at the Biological Science Curriculum Study, an organization devoted to science education from kindergarten through the first two years of college. He is also opening a martial arts studio—Kung Fu San Soo—in town. Phillips plans to continue to consult on EMF and RF/MW health issues....**Norm Sandler**, Motorola spokesman and director of global strategic issues, is leaving Schaumburg, outside Chicago. He will continue in the same job, but will be based in Washington....**Hedy Lamarr**, the sultry screen star of the 1940s, died on January 19. She shared a patent on the development of spread spectrum techniques (used, for instance, in CDMA)....**Dr. Mary Ellen O'Connor** of the University of Tulsa, in Oklahoma, died on January 14 after a long battle with breast cancer. O'Connor, a former president of BEMS, was last the editor of the society's newsletter. The BEMS board is considering ways to honor her memory.

The Institute for Integrated Systems of the

Swiss Federal Institute of Technology (ETH) Zurich

is searching for

4-5 Doctoral Candidates and 1-2 Postdocs

with degrees in Computer Science, Electrical Engineering or Physics, for immediate placement or by arrangement.

Duties

The Institute for Integrated Systems (IIS) is expanding its activities together with the newly founded research institute, Information Technologies in Society (IT'IS), under the direction of Dr. N. Kuster. The main focus of interest is in the risk assessment of possible direct and indirect health hazards of current and future wireless technologies, as well as their beneficial use in life support and life improvement systems, with special emphasis on handicapped persons. Current projects include several risk assessment studies conducted in Europe, the U.S. and Asia, development of TCAD tools and experimental analysis technology for the electromagnetic near field, as well as novel applications of wireless technologies. The salary for PhD students is approximately SFr 60,000, and for postdocs approximately SFr 80,000.

Requirements

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VIDEO HISTORY

Antenna Farm Fight...A controversy has been raging for some time over a possible cancer cluster on Lookout Mountain, home to a dozen high-power TV and radio towers—as well as hundreds of other transmitters—serving Denver. Last year, a report from the Colorado Department of Public Health and Environment suggested that there may in fact be an excess incidence of brain cancer among those living close to the antenna farm (see *MWN*, M/A99, also J/A98). This possibility mobilized those living on Lookout Mountain to try and stop the siting of a new 860-foot tower that would broadcast digital TV signals. Len Aitken has produced an hour-long documentary, $\mu\text{W}/\text{cm}^2$ —*Broadcast Blues*, which tells the residents' story. The film ends with the Jefferson County Commissioners voting to reject the application for the new tower and the broadcasters' subsequent attempt to overturn this decision. A number of members of the EMF/RF community appear in the documentary, including: Dr. Robert Cleveland, Jules Cohen, Dr. Philip Cole, Bruce DeBoskey and Dr. Henry Lai. A copy of the video is available for \$32.00 (including shipping) from: Len Aitken Productions, 1053 Red Moon Rd., Golden, CO 80401, (303) 526-1896, E-mail: <LAitken@laproductions.com>.

CORRECTION

ICNIRP Standard...In the table comparing the Russian and ICNIRP public RF/MW exposure limits on p.9 of our last issue, we gave the wrong value for the ICNIRP limit in the 400-2,000 MHz frequency band. It should have been $f/2 \mu\text{W}/\text{cm}^2$, where f is frequency in MHz.

Keeping Current: Follow-Up on the News

◆ In a review of epidemiological studies, New Zealand's Dr. Mark Elwood concluded that there is no “consistent evidence linking RF/MW radiation to cancer” (see *MWN*, M/J99). Australia's Dr. Bruce Hocking now points out that at the time Elwood was preparing his paper, he was a consultant to Telecom NZ in a court case over the placement of a mobile phone tower next to a school. Hocking was a witness for the school. In response, Elwood cites the opinion of the presiding judge, who called his evidence “carefully constructed and balanced.” The exchange appears in the December issue of *Environmental Health Perspectives*, in which Elwood's review was originally published.

◆ *Wireless Week* reports in its January 24 issue that there are now some 70,000 mobile phone towers in the U.S., about seven times the number that were in place five years ago, according to Sheldon Moss, director of government relations at the Personal Communications Industry Association in Alexandria, VA.

◆ The International Electrotechnical Commission (IEC) is establishing Technical Committee 106, with the provisional title: *Testing Instrumentation and Methods for Measuring Electric and Magnetic Fields Associated with Human Exposure*. The committee is being set up “amid increasing public and scientific concerns over the effects of electromagnetic radiation on human and

animal health,” according to the IEC, which is based in Geneva.

◆ On January 27, the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) announced the membership of its RF/MW Radiation Working Group, which will develop a new exposure standard (see *MWN*, S/O99). The chair of the group is Dr. Colin Roy, the director of the non-ionizing branch of ARPANSA. The full membership is posted on the Internet at: <www.arpansa.gov.au/arp_news.htm#rf>.

◆ In mid-December, responding to pressure from local activists, the U.S. Air Force announced that it will prepare a detailed environmental impact statement for the PAVE PAWS radar on Cape Cod, MA. The last environmental review was completed in 1979. (See also *MWN*, M/J87, J/A98, N/D98 and N/D99.)

◆ On February 2, as we go to press, the European Commission (EC) has released a “Communication” that details how it plans to apply the precautionary principle in “cases where scientific evidence is insufficient, inconclusive or uncertain and preliminary scientific evaluation indicates that there are reasonable grounds for concern...” The full text of the communication, in the 11 EC languages, is available on the Internet at: <http://europa.eu.int/comm/off/com/index_en.htm>. (See also p.1 and p.19.)

Switzerland's Prudent Avoidance of Harmonization

Globalization has become a powerful force in almost every area of modern life. Its effects are felt in business, the environment, entertainment, language and more.

When it comes to non-ionizing radiation, globalization has meant "harmonization": the effort to get all countries around the world to adopt identical safety standards.

There are a lot of arguments in favor of harmonization. It is certainly more convenient for world travelers to be able to use the same mobile phone in different countries. And if a laptop with a wireless Internet link can be sold all over the world, it will generate more profits and presumably more jobs. But let's be clear: harmonization is essentially a commercial imperative.

This was starkly illustrated when the World Health Organization (WHO) led a harmonization delegation to China last year (see *MWN*, S/O99). Besides WHO and ICNIRP officials, it included representatives of Lucent, Motorola, Nokia and the U.S. Air Force. No comparable group of biologists and public health experts went on the trip.

In Switzerland, harmonization has come into conflict with the precautionary principle—the idea that exposures with unknown effects should be kept as low as is practical. Now included in many international agreements, this principle is similar to the policies of ALARA (as low as reasonably achievable) for ionizing radiation and prudent avoidance for EMFs.

The Swiss Environmental Protection Law is based on the precautionary principle, and the government has translated that general idea into what it believes is an appropriate set of numbers for EMF and RF/MW exposure limits. What the Swiss are saying is, "There's reason for concern, there's a lot that we don't know, and if we err it should be on the side of caution." Strictly from the vantage point of public health, we think it is hard to disagree.

Yes, Swiss wireless carriers are complaining that the rules will cost them money, but they also appear to be willing to pay this price to increase public acceptance of their antennas and gain some certainty in the siting process. (In the U.S., Congress tried—and failed—to impose the same certainty by law without making any concessions to public health concerns.)

History shows that exposure standards for radiation and chemicals have been tightened as research has found ill effects at lower and lower levels. The public has learned this lesson and is understandably suspicious when companies hide behind absolutes, and say that there is "no conclusive proof" of a cancer risk or other nonthermal health effects.

Some have argued that numerical limits should only be based on well-defined hazards (see p.6). Prudent avoidance, they say, should be limited to general statements of policy. But there is a simple reason why numbers are needed: Talk is cheap. Vague pledges to reduce exposures may not result in any real change, especially when industry makes all the final decisions. Health standards must be based on sound science—but that does not mean there is no way to take into account research results that are worrisome, if still unclear.

As long as there is uncertainty about health effects, the out-

Europe Sets the Agenda

At this time last year, we noted that the action had moved to Europe. That is even more true today.

Interesting meetings are being held all across the European continent. Policy debates on health standards are taking place in numerous European capitals. Whatever research will be done in the next few years is mostly being planned by the EU or by individual countries.

Meanwhile, the U.S. has its head firmly planted in the sand. Congress is apathetic about funding research. The Bioelectromagnetics Society is wondering how it will survive the money drought. And some members of the IEEE standards group on RF/MW radiation want to do away with its two-tier exposure standard, basically returning to the 1,000 $\mu\text{W}/\text{cm}^2$ limit of the 1980s. It does not inspire confidence.

But Europe has often led the way on environmental questions, while the U.S. played catch-up. We predict that before long the call for tougher, precautionary standards will get louder on this side of the Atlantic.

look for harmonization is cloudy at best. Different countries will want different standards, for the simple reason that every country's values are not the same. Such decisions depend heavily on social attitudes about risk, technology, the environment, commerce and public health.

If you want countries to adopt the same standard, there's one sure way to do it: Resolve the scientific uncertainty. Once the data are in, countries will adopt similar safety standards of their own accord. No one will need to force harmonization down their throats.

Unfortunately, funds for research on EMF and RF/MW health effects have dried up in the U.S. European funding, while not quite so miserly, is far short of what is needed.

And the push for harmonization actually undermines the case for more research. The idea that everyone must accept the same numbers exaggerates how much we already know.

There are a host of unanswered questions about non-ionizing radiation—and at the current pace of research, it will be a long time before they are resolved. Until then, harmonization will remain a goal that is driven by commerce, not public health.

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