apolis saw no conflict between the two assessments, because the NAS committee had based its decision on the absence of "conclusive and consistent evidence" of a cancer risk (see *MWN,* N/D96). The NIEHS panel agreed that the available evidence did not support that type of definitive statement.

Luben noted that the working group had reached essentially the same conclusion as had the Environmental Protection Agency (EPA) nearly ten years ago (see *MWN,* M/J90; more recently, the EPA reaffirmed this finding, see *MWN,* J/F98). "I think it's time to look to the future," commented Luben.

Votes on the Epidemiological Evidence

Earlier this spring, the NIEHS had commissioned 13 review chapters, some on the possible health impacts of EMFs and others on theoretical and engineering issues (see *MWN,* M/A98). The health effects were not limited to cancer—they included miscarriages, Alzheimer's disease, ALS, depression and heart disease, among other effects.

In Minneapolis, members of the working group were assigned to one of five small groups to review and edit the chapters. The revised chapters were then reedited, line by line, by the full working group and a number of NIEHS staff members.

Each small group voted to categorize the evidence it had reviewed using the IARC cancer criteria. The votes were then repeated by the full working group meeting in plenary session.

IARC has four categories for classifying associations between EMFs and cancer: "1: sufficient," "2: limited," "3: inadequate" and 4: evidence of "lack" of carcinogenicity (see p.7). The "limited" evidence category is divided into two subcategories: "2A: probable" and "2B: possible" evidence of carcinogenicity, a distinction that the NIEHS working group used in its final summary vote.

The epidemiology small groups were unanimous that there was "limited" evidence of an association between residential magnetic field exposures and childhood leukemia. In plenary session, the vote was 22 to 4, with 2 abstentions and 1 member absent.* (Fred Dietrich and Drs. James Felton, Steven Miller and Paul Zweiacker found the evidence to be "inadequate"; Williams and Dr. Martin Misakian abstained.) There was near unanimity that there was "inadequate" evidence to judge the carcinogenicity of adult residential exposures. (Only Zweiacker favored the "lack" of evidence designation.)

Dr. Maria Feychting, who chaired the small group on childhood epidemiology, noted that its decision was not based on a meta-analysis, but rather on an evaluation of the individual studies. "We see trends," she said. Addressing the NCI's recent childhood leukemia study, she noted that, "It's a very good study, but it's not superior to the others" (see *MWN,* J/A97). She added that the childhood study by Dr. David Savitz also has its merits (see *MWN,* N/D86) and pointed to the specific problem of low participation rates in the NCI study, especially for the wire code populations.

The link between EMFs and occupational cancers was deemed to be more uncertain. The panel voted 14 to 11, with 2 abstentions and 2 members absent, that there was "limited" evidence of a link to chronic lymphocytic leukemia (CLL). This finding was based to a large degree on the persuasive epidemiological study by Sweden's Dr. Birgitta Floderus, now at the Karolinska Institute in Stockholm (see *MWN,* S/O92 and M/J94).

In the working group vote, Dr. Leeka Kheifets agreed with the majority that there was "limited" evidence of a link to childhood cancer, but sided with the minority with respect to the possible link to CLL among EMF-exposed workers. "For me, the consistency is not there" across occupational studies, she said (see also *MWN,* N/D97).

For acute myeloid leukemia, brain tumors and breast cancer (both female and male) among workers, the panel voted by an overwhelming majority that there was "inadequate" support for an association with EMFs.

The EMF animal studies provoked some of the working

*In a later vote on slightly stronger language, the working group voted 20 to 6 that there is "limited" evidence that EMFs are "carcinogenic to children." This time, Drs. Jean Harry and Walter Rogers joined the minority.

NIEHS EMF Working Group Members: How They Voted

The final vote to classify EMFs as possible human carcinogens was 19 in favor and 9 against, with 1 abstention. Listed below are the members of the working group divided into their small groups. Those who voted against are listed in italics.

Adult Epidemiology: Drs. Joseph Bowman, National Institute for Occupational Safety and Health, Cincinnati; Elisabeth Cardis,†‡ International Agency for Research on Cancer (IARC), Lyon, France; Charles Graham, Midwest Research Institute (MRI), Kansas City, MO; *Leeka Kheifets, Electric Power Research Institute (EPRI), Palo Alto, CA*; Richard Stevens, Battelle Pacific Northwest Labs (PNL), Richland, WA.

Childhood Epidemiology: Drs. Maria Feychting,† Karolinska Institute, Stockholm, Sweden; Antonio Sastre, MRI; Claire Sherman, University of California, Davis; Louis Slesin, "Microwave News," New York City; Daniel Wartenberg, University of Medicine and Dentistry of New Jersey (UMDNJ), Piscataway.

Exposure Assessment: *Fred Dietrich, Electric Research and Management, Pittsburgh*; Drs. Martin Misakian,* National Institute of Standards and Technology, Gaithersburg, MD; Michael Yost,† University of Washington, Seattle.

In Vivo: Drs. Larry Anderson, Battelle PNL; *Arnold Brown,† University of Wisconsin, Madison (emeritus)*; *James Felton, Lawrence Livermore National Lab, Livermore, CA*; *Jean Harry, NIEHS*; *Walter Rogers, consultant, San Antonio*; Lorenzo Tomatis, Istituto per l'Infanzia, Trieste, Italy; *Paul Zweiacker, TU Services, Dallas*.

In Vitro: Drs. Margarita Dubocovich, Northwestern University, Evanston, IL; Paul Gailey, Oak Ridge National Lab, Oak Ridge, TN; Richard Luben, University of California, Riverside; Mats-Olof Mattsson, Umeå University, Umeå, Sweden; Kenneth McLeod,† State University of New York, Stony Brook; *Steven Miller, SRI International, Menlo Park, CA*; Charles Polk, University of Rhode Island, Kingston; *Jerry Williams, Johns Hopkins University, Baltimore*; Hiroshi Yamasaki, IARC.

Chairman: Dr. Michael Gallo,§ UMDNJ; ***Coordinator:*** Dr. Christopher Portier,¶ NIEHS.

†Chair of small group. ‡Chair of adult and childhood combined small group. *Abstained from voting. §Would have voted in the event of a tie. ¶Nonvoting.

group's most heated exchanges. In the *in vivo* small group vote, six members favored the "lack" of evidence classification for EMF-induced animal carcinogenicity. (Only Anderson and Tomatis dissented; the NIEHS' Dr. Gary Boorman was a member of this small group, but did not vote in the plenary session.)

The full working group disagreed with the small group and instead voted that the animal evidence was "inadequate" to reach any conclusion. (The vote was 19 to 8, with 1 member abstaining and 1 member absent.)

Williams then announced that he would file a minority opinion. When drafted the following day, it stated in part that the German studies by Drs. Wolfgang Löscher and Meike Mevissen indicating an EMF–breast cancer risk are "fundamentally flawed" and that the bulk of the other animal results are "completely negative" (see also p.15 and *MWN,* M/A98 and M/J98).

None of the panel members argued that the animal data actually supported an EMF–cancer risk, but many were not convinced that the available data provided a complete picture of the problem. Gailey pointed out that the complex electromagnetic environments encountered in daily life bear little resemblence to the 50 Hz or 60 Hz sine waves used in laboratory studies of EMFs. He compared such studies to trying to assess drinking water toxicity by testing only two out of dozens of possible contaminants. In addition, he said, "History tells us that we don't always pick the right animal model."

The working group was in general agreement in its evaluation of the laboratory studies. There was consensus that effects above 1 G were possible, or even probable, but less likely at lower magnetic field levels.

Specifically, the working group unanimously agreed (with one abstention) that:

> A limited number of well-performed studies provide moderate evidence for mechanistically plausible effects of ELF EMFs *in vitro* at intensities greater than 100 ∝T [1 G] on end points generally regarded as reflecting the action of toxic agents.

For exposures below 100 ∝T, the panel agreed unanimously in a separate vote to replace the word "moderate" with "weak."

While the cellular studies were not evaluated in terms of the IARC criteria, Dr. Hiroshi Yamasaki, who works at IARC, noted that, "There was weak or moderate evidence" from the *in vitro* work in support of carcinogenicity."

There were many other votes on the level of evidence implicating EMFs in other, noncancer, disease end points. There was, in general, overwhelming agreement that the data were inadequate to reach any conclusion—using modified IARC criteria.

Early in the meeting, a sharp disagreement emerged as to whether the working group's votes would be by secret or open ballot. Some participants on both sides even threatened to leave if they did not get their way. In the end, all the votes were open and no one walked out.

How To Order and Comment on the Working Group Report

The working group report, *Assessment of Health Effects from Exposure to Power Line Frequency Electric and Magnetic Fields,* is available free, both in print and on CD-ROM. The full text of the report is also posted on the Internet at: <www.niehs.nih.gov/emfrapid/home.htm>.

Written comments on the report can be submitted to the NIEHS by mail, fax or E-mail. The deadline is October 9, 1998. The public will also have an opportunity to make comments in person at meetings in Tucson, AZ (September 14-15), Washington (September 28), San Francisco (October 1) and Chicago (October 5). Tucson is the site of this year's Department of Energy EMF research review (see *MWN,* M/A98).

To order the report, to register for the meetings or for more information, contact: EMF RAPID Program/LCBRA NIEHS, PO Box 12233, MD EC-16, Research Triangle Park, NC 27709, Fax: (919) 541-0144, E-mail: <emf-rapid@niehs.nih.gov>.

IARC Classifications for Evidence of Carcinogenicity

1: Sufficient	2A: Limited—Probable	2B: Limited—Possible	3: Inadequate	4: Lack
Sufficient evidence of carcinogenicity. Exceptionally: less than sufficient evidence in humans, but sufficient evidence in experimental animals and strong human evidence that the agent acts through a relevant mechanism.	*Limited evidence in humans and sufficient evidence in experimental animals.* Also: inadequate evidence in humans and sufficient evidence in experimental animals, and strong evidence that the mechanism also operates in humans. Exceptionally: only on the basis of limited evidence in humans.	*Limited evidence in humans and less than sufficient evidence in animals.* Also: inadequate evidence in humans, but sufficient evidence in experimental animals. Sometimes: inadequate evidence in humans, but limited evidence in experimental animals, with supporting evidence from other relevant data.	*Inadequate evidence in humans and inadequate or limited evidence in experimental animals.* Exceptionally: inadequate evidence in humans, but sufficient evidence in experimental animals, with strong evidence that the mechanism in experimental animals does not operate in humans.	*Evidence suggesting lack of carcinogenicity in humans and in experimental animals.* Sometimes: inadequate evidence in humans, but evidence suggesting lack of carcinogenicity in experimental animals, consistently and strongly supported by a broad range of other relevant data.
Examples: asbestos, benzene, dioxin, hepatitis C virus, radon, vinyl chloride. Total number of agents: 75.	*Examples:* benzo[a]pyrene, formaldehyde, PCBs, ultraviolet (A, B & C) radiation. Total number of agents: 59.	*Examples:* carbon tetrachloride, chloroform, DDT, lead, PBBs, saccharin. Total number of agents: 225.	*Examples:* coal dust, fluorescent lighting, mercury, parathion, phenol, xylene. Total number of agents: 474.	*Only example:* caprolactam.

Sources: for IARC evaluation criteria: <http://193.51.164.11/monoeval/eval.html>; for lists of agents in each category: <http://193.51.164.11/monoeval/crthall.html>. For information on IARC, see: <www.iarc.fr>.

« Wireless Notes »

On July 14, **Australia's health minister, Michael Wooldridge**, announced three grants totaling Aus$215,000 (approximately US$133,000) for research projects on mobile phone safety. In late 1996, the Australian government committed Aus$4 million (US$2.5 million) to wireless safety research (see *MWN,* N/D96). The three grants are the first, and so far only, funding announced under the initiative. The largest grant, about Aus$90,000, will go to Dr. **Bruce Armstrong** of the **New South Wales Cancer Council** for a pilot epidemiological study of mobile phones and tumors of the brain, salivary gland or auditory nerve. Dr. **Pamela Sykes** of **Flinders University** in South Australia will get about Aus$75,000 to study the effects of RF/MW radiation on DNA, while Dr. **Con Stough** of the **Swinburne Institute of Technology** in Victoria will receive Aus$50,000 to investigate whether mobile phones affect users' memory, concentration or problem-solving abilities. "The overwhelming weight of scientific evidence says there's actually not a problem," Wooldridge said on Australian television, "but as health minister I've got to be vigilant."

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Dr. **Joseph Brain** of the **Harvard School of Public Health** in Boston has asked the **National Academy of Sciences-National Research Council** (NAS–NRC) to examine the possible effects of RF/MW radiation on human health, with a focus on cellular phone towers. In a March 19 letter to the council's Commission on Life Sciences, Brain noted that the NAS–NRC had "already deliberated on EMF[s] and ELF" (see *MWN,* N/D96), and suggested that an NAS–NRC report on wireless radiation would be helpful. "These towers are being scattered across urban and suburban areas throughout the U.S.," wrote Brain. "As chair of the Department of Environmental Health at Harvard, I am repeatedly asked for my advice. I would like to point to an authoritative study [by] the NAS–NRC to give individuals and communities guidance." In a May 18 reply, Dr. Evan Douple, director of the NRC's Board on Radiation Effects Research, agreed that the subject is important and noted that both the **FDA** and Rep. **Edward Markey** (D-MA) want to see more research on cellular phone safety (see *MWN,* N/D97). This summer, Douple wrote, his board will discuss a proposal for a study of wireless safety and explore whether industry, government agencies or Congress is interested in supporting it.

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As they prepare to square off in court against the **FCC** over federal preemption of antenna siting and the commission's RF/MW rules, two citizens groups are at odds with each other. At issue is Washington telecom lawyer **James Hobson**, who is handling the FCC suit for the **Ad Hoc Association** (AHA) of Parties Concerned About the FCC's RF Health and Safety Rules, based in Olympia, WA. In a June 28 letter, **Arthur Firstenberg**, president of the **Cellular Phone Taskforce** (CPT) in Brooklyn, NY, argued that Hobson has a conflict of interest and cannot effectively represent cell tower opponents while doing other work for the wireless industry—for instance, the Telecommunications Industry Association. The AHA's **David Fichtenberg** and **Libby Kelley** disagree. In a July 6 response, they expressed confidence in Hobson, noting that his background qualifies him "to address the complex and demanding issues we are placing before the court." Hobson, of Donelan, Cleary, Wood & Maser, has not stepped aside. (He declined to comment on the dispute.) In separate briefs submitted to the U.S. Court of Appeals in New York City in May, the AHA and the CPT charge that the FCC's RF/MW rules are inadequate (see also *MWN,* N/D97). Oral arguments had been scheduled for August but were postponed. A new date has not yet been set. Meanwhile, Firstenberg told *Microwave News* that he has now "made peace" with Hobson. The AHA and Firstenberg's relationship has remained cool, however. He "is not communicating with us," the AHA's Kelley said in an interview in mid-July.

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It may not be the Nobel Prize, but those looking for a bit of extra cash might want to respond to the challenge laid down by **James Kaplan** of **EDX Engineering Inc.** in Eugene, OR. In a letter appearing in the July 20 issue of the trade magazine *Wireless Week,* Kaplan contends that regulating RF/MW exposures is "an absurdity." He is offering "a month's pay" (his, presumably) to anyone who can present human or animal evidence of a nonthermal health hazard of RF/MW radiation. Kaplan can be contacted by E-mail at: <jamesk@edx.com>.

George Carlo vs. Q. Balzano: Two Views of WTR's Record

"I stand by what we have done," Dr. George Carlo, the chair of Wireless Technology Research (WTR) in Washington, told *Microwave News.* Carlo was reacting to criticism that his research program, sponsored by the Cellular Telecommunications Industry Association (CTIA), has failed to produce any biological results over the last five years.

When asked to contrast his record with that of Motorola, which has completed many cellular phone safety experiments over the same time period, Carlo responded: "The Motorola program is different, and I don't want to comment on it."

Motorola's Dr. Quirino Balzano was not so reticent. Addressing WTR's record in an interview with *Microwave News,* Balzano said, "We have lost five critical years, and money can't buy those five years back." In breaking his long official silence on the WTR program, Balzano, the director of the company's Electromagnetics Research Laboratory in Fort Lauderdale, FL, stressed that he was speaking for himself and not for Motorola.

Carlo has long argued that he could not have begun his biological studies until he had developed the right exposure systems. But Balzano counters that that should have taken only a year: "For a good experiment, dosimetry was there for anyone who wanted it."

Carlo and Balzano were interviewed in St. Pete Beach, FL, the site of this year's *Annual Meeting of the Bioelectromagnetics Society,* June 7-11.

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It's been a bad summer for mobile phones in England. The **British press** has been blaming them for everything from hypertension to miscarriages—often with sensational headlines. **Do Mobile Phones Fry Your Brains or Just Eggs?** (July 13), wondered the tabloid *Evening Standard,* while the *Independent* sought to appeal to its more upscale readers: Why Mobiles Could Be the Rolls Royce of Disease (June 9). Every major paper in the U.K. covered the blood pressure story from Germany in mid-June (see below). A week later, the *Daily Telegraph* followed up with word of a French study under the headline Mobile Phones 'Put Pregnant Women at Risk' (June 29). Interference from cell phones may also be putting the London subways at risk, warned the *Daily Mail* on June 24 in a story headlined Mobile Phones Linked to Rail Signals Chaos. Some of the stories featured campaigner Roger Coghill—Why I Believe That All These Items Should Carry a Health Warning, *Daily Mail* (July 17)—while others hawked devices that promised some degree of protection: Health Scares Ring Out ran in the *Telegraph* on July 9. When word filtered out about military experiments showing loss of cognitive function, the *Mail* ran the story on its front page in large bold type: Mobile Phones in New Health Warning (July 16). Even the generally more cautious BBC chimed in with Mobile Phones in Brain Scare in its Internet edition (July 16). The phones have not been doing too well in other parts of Europe, either. On the front page of the tabloid *Aftonbladet,* two Swedes blamed cell phones for their loss of vision (Cell Phones Made Us Blind, We Are Sure, July 2).

Digital Mobile Phone Radiation Causes Rise in Blood Pressure

Short-term exposure to digital cellular phone signals significantly increased the blood pressure of participants in a new German study, according to researchers at the University of Freiburg and at Deutsche Telekom.

Dr. Stefan Braune of the University Neurological Clinic in Freiburg told *Microwave News* that the increase in resting blood pressure was not due to stress. "There is accumulating evidence that these high frequency signals may influence the sympathetic nervous system," he said.

In a research letter published in the June 20 issue of the *Lancet (351,* pp.1,857-1,858, 1998), Braune and colleagues at Deutsche Telekom in Darmstadt report that they also observed a significant increase in constriction of the blood vessels, which may in turn have been responsible for the increase in blood pressure.

Braune noted that electrical stimulation of an area in the right side of the brain (the right side of the insula) produces a rise in blood pressure. Since the phones in this experiment were mounted on the right side of the head, Braune wants to investigate whether the insula is involved in the observed effects.

The researchers exposed ten healthy volunteers between 26 and 36 years old to GSM mobile phone radiation, which was on or off for 35 minutes at a time. The increase in blood pressure was 5-10 mm Hg (millimeters of mercury), which is not considered large.

"In general, an increase like that would not be clinically significant," said Dr. Richard Stein, spokesperson for the American Heart Association in New York City. "People normally vary by that much in the course of a day."

The *Lancet,* one of the world's leading medical journals, stated in its press release that, "Such an increase could have adverse effects on people with high blood pressure." But Braune himself is not urging people with high pressure to avoid mobile phones. "At present, we don't have a clue as to what effect cellular phones would have on these patients," he explained. "Their blood pressure might even decrease." He said it would be premature to give advice to mobile phone users.

The U.S. Cellular Telecommunications Industry Association (CTIA) discounted Braune's results as inconclusive. The CTIA argued that stress, noise and heat from the telephones' circuitry were more likely causes of the reported rise in pressure. "In a 35-minute test, a normal cellular phone will increase in temperature by 4-5°C," CTIA spokesperson Tim Ayers said in an interview. "It's possible that this could result in increased blood pressure." But Ayers conceded that, "This is all speculation." The main point, he said, is that the study was too small to serve as the basis for any definite conclusions.

"Stress is certainly not the cause," Braune responded in a telephone interview, pointing out that heart rate showed a decrease, not an increase. He noted that the volunteers "were in a comfortable, supine position" and that there was "no evidence for the idea" that they experienced stress.

"As for noise—I don't know where they get this from," said Braune. "There was no noise." As the research letter and the *Lancet* press release both explained, the experiment was designed to expose the subjects to a radio signal without producing any sound from the phones. No phone conversations took place, and the volunteers did not know when the signal was being transmitted.

Heating also could not have been the cause, Braune contended. He noted that there was a 2.5 cm distance between the phone and the skin, "so we have no reason to believe that any heating of the skin would occur." In any case, he said, such heating would not cause blood pressure to rise: "What you'd expect would be just the opposite. If the skin gets hotter, you have a dilation of the blood vessels in response, which would tend to *decrease* blood pressure."

Braune said that the small number of subjects did not in itself cast doubt on his results. "If you have a high inter-individual variation, then you need a big group to see the effect; but our results were very consistent from one individual to another," he explained. "And the effect is strong enough that it shows up clearly even with a small number of people."

These results were observed in a pilot study designed to detect changes in the bowel reflex, which is also controlled by the sympathetic nervous system. No such changes occurred, but the consistency of the changes in blood pressure was striking and the researchers felt that the results should be published.

"Now we know better what to look at," Braune said. "In the pilot study, we had only electrophysiological evidence of the rise in blood pressure. In our ongoing research, we are looking at several biochemical markers as well."

A German Dairy Farmer's Complaints Prompt Major Health Study of Cows near Cell Phone Towers

The Bavarian state government in Germany will investigate whether mobile phone antennas cause health problems in dairy cattle, announced Bavaria's Minister for Land Development and the Environment, Dr. Thomas Goppel, at a June 29 press briefing in Munich. The study will encompass 30 farms at a cost of nearly 650,000 marks (approximately $360,000), according to the ministry.

The impetus for the research effort came from a preliminary inquiry that pointed to RF/MW radiation from a mobile phone base station as the cause of reduced milk yields, abnormal behavior and other ailments among cattle on a Bavarian farm.

The evidence suggests that RF/MW radiation is "the sole cause" of the health problems on the farm in Traunstein, Bavaria, concluded Dr. J. Schmid, a local veterinarian, in an internal report to the Bavarian government. But a follow-up investigation ordered by Goppel rejected Schmid's findings.

The farmer first suspected something was wrong with his herd of some 30 cows in the fall of 1995, soon after a mobile phone base station was installed on a 500-foot communications tower about 300 yards from his farm. The intensity of the resulting RF/MW radiation is very low, however, especially in comparison to the levels of the television signals being broadcast from the same tower.

The cattle's RF/MW exposure is more than 1,000 times below the limits set by the International Commission on Non-Ionizing Radiation Protection (ICNIRP), Rüdiger Matthes of the Federal Office of Radiation Protection in Oberschleißheim told *Microwave News*. Matthes, who is also ICNIRP's scientific secretary, joined Goppel at the June 29 press conference.

Dr. Wolfgang Löscher of the School of Veterinary Medicine in Hannover, who has investigated the complaints of the Traunstein farmer, is skeptical that radiation from the base station could be harming the cows. "I cannot believe that these weak fields could have caused these effects," he said in an interview.

But Dr. Theodore Litovitz of the Catholic University of America in Washington believes that the mobile phone signals could be to blame, because they are digital. "I am absolutely *not* surprised" by the observed effects in the cows, Litovitz told *Microwave News*. "They are predicted by our ODC work at RF frequencies." Last year, Litovitz reported that while analog cellular phone radiation did not affect ornithine decarboxylase (ODC) activity in cell cultures, digital signals did do so. These results appeared in *Bioelectromagnetics (18,* pp.132-141, 1997).

The animals began to behave abnormally in the spring of 1996, Schmid reported, and have continued to do so. Several animals turn their heads away from the tower. Some cattle constantly shift from side to side and lift their feet as if in pain and one cow swings her head constantly.

Löscher characterized the observed health and behavioral effects as "typical of cows under stress." In addition to lower milk yields, there have been five miscarriages with no known cause over a 15-month period and severe weight loss in two cows.

The farmer and his family also began having unexplained health problems when the mobile phone antennas were activated. Goppel also discounted the possibility that RF/MW radiation could be harming the health of the farmer and his family.

After details of the case became public earlier this year, Löscher noted, several other farmers complained of similar problems in other locations near communications towers.

In his report, Schmid cautioned that he was unable to establish a "definitive cause" of the herd's problems, although he had eliminated alternative explanations such as improper feeding or inadequate care. Especially compelling, he wrote, was the fact that when two of the cows with behavioral abnormalities were moved to a farm some 12 miles away, their symptoms disappeared within a few days. When they were brought back to the farm, the symptoms returned.

The farmer angrily denied suggestions that his herd's poor health is due to improper care: "I have run this operation for over 20 years. I had above-average milk yields with the highest quality. Now I have to listen to people saying I am too stupid to keep cows and milk them," he declared in the July 4 *Bayrisches Landwirtschaftliches Wochenblatt,* a leading agricultural newspaper.

Both Dr. Günter Käs, a radar electronics engineer formerly with the Federal Military University in Munich, and technicians from the Federal Office of Post and Telecommunications measured the power levels of RF/MW radiation on the property. Their findings are similar to those of Elekluft GmbH, which made new measurements at Goppel's request.

In a room on the upper floor of the farmhouse, with the window closed, Käs measured 0.3 $\propto W/m^2$ and 0.5 $\propto W/m^2$ for the 464 MHz analog and the 935 MHz digital telephone signals, respectively. At the same location, the power densities of the 512 MHz and 734 MHz TV signals were 0.44 mW/m^2 and 0.4 mW/m^2, respectively. Outside the farmhouse, the levels were as high as 7 mW/m^2, at 512 MHz.

Before announcing the 30-farm study, Bavarian officials had sought to avoid publicity about the Traunstein farmer's concerns. Schmid launched his investigation in November 1996 and submitted his report in April 1997, but state officials did not publicly acknowledge them until Germany's Green Party and the national news media, including the magazine *Der Spiegel,* began asking questions later last year.

Löscher told *Microwave News* that Bavarian officials asked him and Käs not to publish a paper documenting the Traunstein herd's problems until the government had completed its inquiry. They later approved its publication on condition that the farm could not be identified as being in Bavaria. The paper, "Striking Behavioral Disturbances in Cows in Proximity to Transmission Stations," appears in the April issue of the veterinary journal *Der Praktische Tierarzt (79,* pp.437-444, 1998).

The case has generated intense interest among anti-tower activists in Germany, the U.S. and elsewhere. An English translation of Schmid's report is posted on the Internet at: <www.reach.net/~scherer/p/vetrepde.htm>. Information in German on the multi-farm study is at: <www.bayern.de/stmlu>.

Testicular & Skin Cancer Findings Put Spotlight on Police Radar

Elevated rates of testicular cancer and melanoma have been found in a study of police officers in Ontario, Canada.

These cancers have been a focus of concern over the possible effects of police radar, Dr. Murray Finkelstein writes in the August issue of the *American Journal of Industrial Medicine (34,* pp.157-162, 1998). "The important thing to emphasize, though," he said in an interview, "is that at the moment we have no information on exposure. So we can't draw any conclusions about causes."

Although the increase in melanoma was statistically significant, Finkelstein said that it may turn out to be a chance finding. He is currently reviewing pathology reports to determine where the melanomas were located. "The question is, which of these might plausibly be located in the beam from a traffic radar device," he said. "If it's on the back of the leg, that's different than if it's on the thigh."

Finkelstein is with the Ontario Ministry of Labor in Toronto, which conducted the research in response to a request from a police health and safety group. The study drew on employment records for 22,197 officers, from 83 out of the 91 police departments in the province, and on data from the Ontario Cancer Registry. Finkelstein found that the incidence of testicular cancer

Hot New Papers

Deborah Barnes and Lisa Bero, "Why Review Articles on the Health Effects of Passive Smoking Reach Different Conclusions," *Journal of the American Medical Association, 279,* pp.1,566-1,570, May 20, 1998.

"The odds that a review article with tobacco industry-affiliated authors would conclude that passive smoking is not harmful were 88.4 times higher than the odds for a review article with non-tobacco-affiliated authors, when controlling for article quality, peer review status, article topic, and year of publication (95% CI, 16.4-476.5; $p<0.001$)."

Maria Feychting et al., "Magnetic Fields and Breast Cancer in Swedish Adults Residing near High Voltage Power Lines," *Epidemiology, 9,* pp.392-397, July 1998.

"Our results indicated a higher relative risk for cases with ER-positive breast cancer, especially for younger women, but the number of cases in these analyses was small." (See *MWN,* N/D97.)

C.M. Furse and O.P. Gandhi, "Calculation of Electric Fields and Currents Induced in a Millimeter-Resolution Human Model at 60 Hz Using the FDTD Method," *Bioelectromagnetics, 19,* pp.293-299, 1998.

"Proposed safety guidelines would allow external electric fields of 10 kV/m and 25 kV/m for exposure to 60 Hz fields of the general public and workers, respectively. For this external electric field exposure of 10 kV/m, local induced current densities as high as 20 mA/m^2 are found in the head and trunk with even higher values (above 150 mA/m^2) in the legs. These currents are considerably higher than the 4 or even 10 mA/m^2 that have been suggested in the various safety guidelines."

S. Kwee and P. Raskmark, "Changes in Cell Proliferation Due to Environmental Non-Ionizing Radiation: Microwave Radiation," *Bioelectrochemistry and Bioenergetics, 44,* pp.251-255, 1998.

"Contrary to popular assumptions, our results showed that there can be an effect at very low SAR values." (See *MWN,* J/A97.)

Adam Lacy-Hulbert, James Metcalfe and Robin Hesketh, "Biological Responses to Electromagnetic Fields," *FASEB Journal, 12,* pp.395-420, 1998.

"The absence of an identified mechanism whereby ELF EMFs can exert biological effects clearly constitutes a problem in that experimental protocols are devised and measurements are made on the basis of complete ignorance about the suceptibility of biological systems. The recurring theme of this review has been the overriding need to demonstrate a single, unequivocal ELF EMF-induced response that will be consistently reproducible in independent laboratories. Only then will the normal process of scientific development of the field become possible. Until this is achieved, the topic of biological responses to ELF EMFs will continue to be regarded with great skepticism by the scientific community at large." (See also p.3 and *MWN,* M/J95)

Russell Owen, "*MYC* mRNA Abundance Is Unchanged in Subcultures of HL60 Cells Exposed to Power Line Frequency Magnetic Fields," *Radiation Research, 150,* pp.23-30, July 1998.

"Using either cells from a commercial source or cells supplied by the original investigators, no evidence was obtained to support the hypothesis that EMF exposure could induce *MYC* expression."

Jerry Phillips et al., "DNA Damage in Molt-4 T-Lymphoblastoid Cells Exposed to Cellular Telephone Radiofrequency Fields in Vitro," *Bioelectrochemistry and Bioenergetics, 45,* pp.103-110, 1998.

"It was found that: 1) exposure of cells to the iDEN® signal at an SAR of 2.4 ∝W/g for 2 hours or 21 hours significantly decreased DNA damage; 2) exposure of cells to the TDMA signal at an SAR of 2.6 ∝W/g for 2 hours and 21 hours significantly decreased DNA damage; 3) exposure of cells to the iDEN® signal at an SAR of 24 ∝W/g for 2 hours and 21 hours significantly increased DNA damage; 4) exposure of cells to the TDMA signal at an SAR of 26 ∝W/g for 2 hours significantly decreased DNA damage. The data indicate a need to study the effects of exposure to RF signals on direct DNA damage and on the rate at which DNA damage is repaired." (See *MWN,* J/F98.)

David Savitz, Harvey Checkoway and Dana Loomis, "Magnetic Field Exposure and Neurodegenerative Disease Mortality Among Electric Utility Workers," *Epidemiology, 9,* pp.398-404, July 1998.

"The accumulation in the literature of sporadic indications of an association between Alzheimer's disease and occupational magnetic field exposure may have reached a threshold for warranting a more rigorous study, but it does not provide a coherent body of research to suggest that an association is present." (See p.4 and *MWN*, M/J97.)

Robert Tarone et al., "Residential Wire Codes: Reproducibility and Relation with Measured Magnetic Fields," *Occupational and Environmental Medicine, 55,* pp.333-339, 1998.

"Wire codes provide a proxy measure of exposure to residential magnetic fields. If magnetic fields were a risk factor for leukemia, however, there would be some attenuation of risk estimates based on wire codes because of misclassification of exposure to magnetic fields at both extremes of the wire code range. The lack of an association between high categories of wire code and risk of leukemia cannot be explained by a failure of the wire code classification schemes to estimate exposure to magnetic fields in the study area." (A follow-up paper on the NCI EMF study; see *MWN,* J/A97.)

Roger Yew-Siow Tay, Quirino Balzano and Niels Kuster, "Dipole Configurations with Strongly Improved Radiation Efficiency for Hand-Held Transceivers," *IEEE Transactions on Antennas and Propagation, 46,* pp.798-806, June 1998.

"This paper demonstrates that reduction of the magnetic field strength at the surface of the user's head is the key parameter to improve the efficiency of the transmitter."

was 30% higher than in the province as a whole, and that of melanoma was 45% higher.

These two elevated rates occurred even though the overall cancer rate among the police officers was lower than the provincial average, which Finkelstein cites as an example of the "healthy worker effect" (the tendency for those who are employed to have better-than-average health, since those who are ill often cannot hold a job).

Testicular cancer, leukemia and cancers of the brain, eye and skin were identified as the sites of greatest concern in a 1995 feasibility study on police radar health research by the U.S. National Institute for Occupational Safety and Health (NIOSH; see *MWN,* J/A95). The new Canadian study found no increases in leukemia or brain cancer, and only one case of ocular cancer among the officers.

The 1995 NIOSH report came in response to a 1992 Congressional inquiry (see *MWN,* S/O92). The report proposed a large cohort study that would broadly examine police officers' occupational health. "If disorders for which police appear to be at higher risk (e.g., testicular cancer) are identified," the report explained, studies of specific diseases could then follow. But no such study, either broad or narrow, was ever carried out.

"It was a matter of priorities," said Dr. Gregory Lotz, chief of NIOSH's Physical Agents Effects Branch in Cincinnati. "NIOSH has a small staff and wide responsibilities. Non-ionizing radiation continues to be a topic that we're interested in, but at the same time it's not a really high priority." Lotz said that people who worked on the 1995 report had hoped Congress might respond by allocating the funds for a police health study, but this did not occur.

In 1995, NIOSH put the cost of a cohort study of 10,000-30,000 officers at US$1.4-$2.6 million. Finkelstein said that his 22,000-person study had cost only C$3,000 (about US$2,000). Asked about the sharp discrepancy between the two cost figures, Lotz said that having a centralized cancer registry, like the one in Ontario, can make research less expensive. He also noted that NIOSH often hires outside contractors to gather data for large-scale studies, and this can be costly. This was especially true in this case, said Lotz, because interviews with cohort members would be needed to get information on radar usage.

Finkelstein plans to use interviews for exposure assessment in a smaller, nested case-control study that would follow up on his testicular cancer and melanoma findings. He has asked the U.S. National Institutes of Health for funding, and estimates that such a study would cost US$80,000-$100,000.

"If he can do it for $100,000, that's still a significant cost difference," Lotz conceded. He said he did not think that the Canadian study's lower costs had compromised its quality in any way, and commented, "I'm encouraged that someone else was able to make some progress on this."

Magnetic Fields Seen as Possible Treatment for Malaria: In the Lab, EMFs Can Be Toxic to Parasites

Researchers at the University of Washington, Seattle, believe that EMFs may prove to be an effective and low-cost treatment for malaria.

In preliminary experiments, a low frequency magnetic field had a potent antimalaria effect—comparable to that of chloroquine, the drug most often used to fight the disease. The oscillating field makes the iron in human blood vibrate, which ultimately kills the malaria parasite.

"It's a promising approach," Dr. Henry Lai told *Microwave News*. "With most drugs the parasite eventually develops resistance, but we don't think that will be the case for magnetic fields."

According to the World Health Organization, 300 million people are currently infected with the disease. Malaria kills more than one million people a year, and drug-resistant strains are becoming widespread.

Malaria parasites feed on human blood. They split the hemoglobin molecule into protein (the globin) and an iron compound (the heme). The parasites break down the protein so they can consume its amino acids, but they find free heme to be highly toxic. To eliminate this danger, they turn the soluble heme molecules into hemozoin, an insoluble polymer formed by linking the iron of one heme molecule to the oxygen in the next.

"This arrangement makes the hemozoin molecule highly magnetic," said Lai. "It behaves like a small bar magnet." He pointed out that magnetic fields have been used to separate malaria-infected red blood cells and isolate hemozoin particles. "We proposed the use of an oscillating magnetic field to shake the hemozoin in the parasites," Lai explained. The hypothesis was that this would disturb the process of polymerizing heme into hemozoin, resulting in an accumulation of free heme molecules that would poison the parasite.

Lai said that preliminary results show promise. In his first experiment, observations by microscope confirmed that the hemozoin particles can be made to oscillate according to the frequency of an applied magnetic field. In a second experiment, malaria parasites cultured in human blood were subjected to a 5 Hz, 15 G magnetic field for 48 hours, after which the percentage of blood cells infected with malaria was about half as great as in a non-EMF-exposed control.

The second experiment has been repeated by Dr. Jean Feagin, also of the University of Washington. In addition to examining the percentage of infected cells, Feagin measured the synthesis of a protein made by the malaria parasite. This was reduced by about the same proportion, further confirming the initial results.

"This antimalaria potency is equivalent to 1 micromolar of chloroquine in culture," Lai observed, "which suggests a rather potent effect of the magnetic fields."

Chloroquine is also thought to interfere with the parasite's processing of iron by inhibiting the enzyme heme polymerase. "But since EMFs act directly on the hemozoin," Lai said, "and not on an enzyme or other gene products, it is unlikely that the parasites could develop resistance to magnetic fields."

Although malaria is on the rise worldwide, research on the disease is not well-funded—in part because it is most virulent in

very poor countries. More effective treatments are costly to develop, and do not offer much opportunity for profit. But if EMFs can be used as effective treatment for humans, Lai said it could be very cost-effective.

"It is relatively easy and inexpensive to generate oscillating magnetic fields over a large area," he noted. "Several patients could be exposed at one time."

Lai and Feagin now plan to try EMFs at different frequencies and intensities, with support from a $15,000 grant from the Fetzer Institute in Kalamazoo, MI. "We want to see if we can find a more efficient exposure combination," said Lai. "If this is promising, then we'll try to get money to do animal studies."

WTR Gives Spending Summary, Specifics Still Hazy

This June, Wireless Technology Research (WTR) released a summary of its spending over the last five years. As of March 1998, WTR had spent about $23.5 million of the $28 million pledged by the Cellular Telecommunications Industry Association (CTIA). Both WTR and the CTIA are based in Washington.

WTR Chair Dr. George Carlo revealed the five-year spending summary in a poster presentation at the *20th Annual Meeting of the Bioelectromagnetics Society* in St. Pete Beach, FL, in June. While the figures are broken down into 16 categories (see below), the amount of money that went to research grants remains a mystery. WTR has consistently refused to disclose this information (see *MWN,* M/J96, M/J97 and N/D97).

Dr. Donald McRee, who heads WTR's program of extramural research, explained that the "clinical" category consists of WTR's pacemaker research, while "certification" refers to testing emissions from different models of phones (later taken over by the CTIA). "Scientific community," "government" and "industry" refer to WTR's coordination with these groups, while "scientific outreach" includes such activities as travel to its 1995 Rome conference on wireless safety research (see *MWN,* S/O95).

WTR did not provide breakdowns of spending within each category, and only partial information was available from other sources. For example, two organizations are carrying out epidemiological studies for WTR: the American Health Foundation (AHF) in New York City and Epidemiology Resources Inc. (ERI) in Newton Lower Falls, MA. The head of the AHF project, Joshua Muscat, said in an interview that the AHF had received a total of $469,000 from WTR, while ERI's Dr. Nancy Dreyer told *Microwave News* that her group had received "well under $2 million." This leaves more than $1.2 million in WTR's epidemiology budget that has been spent elsewhere.

All of WTR's clinical research has been devoted to the question of interference with implanted cardiac pacemakers, and total spending for this category is listed at about $2 million. A total of $353,000 in grants went to the Mayo Clinic in Rochester, MN, the New England Medical Center in Boston and the University of Oklahoma in Norman, which jointly carried out the WTR pacemaker study. Cost figures have never been released for other aspects of WTR's pacemaker work, such as the development of research protocols and recommendations for pacemaker users.

Where the Money Went: History of Spending at WTR

	1993	1994	1995	1996	1997*	1998*†	Totals	%
Ongoing Surveillance	$46,000	$269,171	$294,251	$157,028	$69,852	$18,004	$854,307	3.63
Dosimetry	126,000	489,130	1,085,064	671,867	711,960	159,450	3,243,471	13.78
Toxicology	180,000	813,989	1,266,756	248,504	599,396	259,801	3,368,446	14.32
Epidemiology	149,000	637,139	1,284,827	641,134	754,617	273,784	3,740,501	15.90
Clinical	54,000	95,782	897,833	946,832	0	0	1,994,447	8.48
Base Stations	0	0	114,737	3,446	0	0	118,183	0.50
Certification	24,000	160,453	216,008	179,057	0	0	579,518	2.46
RMR‡ Other	0	0	12,191	198,192	38,544	4,033	252,960	1.08
Scientific Community	26,631	73,609	1,002,182	538,091	186,515	43,215	1,870,244	7.95
Government	52,439	144,942	430,745	287,281	144,742	37,727	1,092,876	4.64
Industry	15,241	42,125	148,350	129,026	143,167	29,265	507,174	2.16
Other Scientific Outreach	39,689	109,699	304,816	258,541	291,181	44,584	1,048,510	4.46
Program Management	56,000	73,935	793,702	1,014,748	1,341,475	277,791	3,557,651	15.12
Litigation	0	0	395,596	200,616	170,676	33,517	800,406	3.40
Audit Committee	0	0	4,355	44,091	33,054	550	82,051	0.35
PRB§	16,000	29,000	123,672	122,300	66,857	61,920	419,749	1.78
Totals	$785,000	$2,938,974	$8,375,087	$5,640,756	$4,552,036	$1,238,641	$23,530,494	100%

*Not audited. †As of March 1998. ‡RMR=Risk Management Research. §PRB=Peer Review Board, based at the Harvard Center for Risk Analysis, Boston.
Source: WTR, June 1998.

Memo from Moscow: East Meets West

Dr. Ben Greenebaum, a professor of physics at the University of Wisconsin-Parkside in Kenosha and the editor of Bioelectromagnetics, *recently returned to the university after spending a sabbatical year with the World Health Organization's (WHO) International EMF Project in Geneva, Switzerland. He filed this report after attending* Bioelectromagnetic Research and Hygienic Standards in Eastern Europe *in Moscow, May 18-22 (see* MWN, *N/D97 and M/J98). The meeting was hosted by the Russian Academy of Medical Sciences' (RAMS) Institute of Occupational Health (IOH) and jointly sponsored by the institute and the WHO project. The Russian Academy of Sciences' (RAS) Institute of Biophysics in Moscow, the International Commission on Non-Ionizing Radiation Protection (ICNIRP) and the U.S. Air Force's (USAF) Armstrong Laboratory in San Antonio also helped arrange the meeting. Greenebaum may be reached on E-mail at: <greeneba@uwp.edu>.*

Research into the biological effects of electromagnetic fields (EMFs) by scientists in Russia and other parts of the former Soviet Union began in the late 1950s, predating many of the Western efforts. Since most of these results were published in Russian, however, they have not been easily accessible to scientists in other parts of the world. A major purpose of the meeting was to review this science and, by publishing the full proceedings in both English and Russian, to make this information more widely available.

Additional goals were to discuss the scientific basis for, and the procedural background of, the Russian exposure standards—as well as those in other parts of the world—and to facilitate international exchanges and collaborations for scientists from Eastern Europe, including the countries of the former Soviet Union.

Approximately 90 people from 17 countries, including about 25 from outside Eastern Europe, participated in four days of discussion, with interpreters providing simultaneous translation between Russian and English. Papers were presented by 20 Russian scientists, as well as three from the U.S., two from Germany and one from Bulgaria. There were an additional 25 poster presentations. One day was devoted to a visit to the RAS' Institute of Biophysics in Puschino.

The formal papers were a mixture of broad surveys of the work of an institute or a research group and detailed discussions of recent findings by individuals or teams of scientists. While the surveys were short on experimental details, the references in the published proceedings should fill these gaps. The posters presented more specifics, though many were in one language only; translations are planned for the proceedings.

Lively discussions ranged from dosimetry and other aspects of research design to the relationship between biological effects and hazards. (More often than not, the closest questioning came from one Russian colleague to another.) Although many Russian-language papers omit details on dosimetry, it was clear that this issue has long been a concern within this community.

At times, it was apparent that Eastern and Western scientists were laboring under different paradigms. Some of the health-related pathways identified by the Russians as being affected by EMFs were unfamiliar to the Western attendees. And ideas were sometimes invoked that were foreign to Western medicine, though they appeared to be related to those used in some types of "alternative medicine"—for example, the need to balance internal energies or fields within the human body.

One group presented experimental effects due to shielding of the Earth's magnetic field and argued that exposure standards should include a minimum level below which DC magnetic fields should not fall.

The latter part of the meeting focused on exposure standards. In Russia, standards are drafted by the IOH. The biological literature is examined for evidence of a threshold at which health-related effects begin to appear. Appropriate extrapolations and safety factors are then applied. Drafts are circulated for comment.

The Ministry of Health then formulates formal rules that are considered for adoption by the Russian government. The health ministry is also responsible for monitoring and enforcing compliance. The current severe economic difficulties in Russia have jeopardized these efforts, however. The adequacy of its monitoring equipment was also questioned.

Dr. Martin Meltz of the University of Texas Health Science Center in San Antonio and Dr. Jürgen Bernhardt, chair of ICNIRP, talked about how standards are set in the West. The USAF's Armstrong Laboratory's Dr. Michael Murphy described its initiative for collaboration with Eastern European institutions.

As part of the concluding panel discussion—which featured significant audience participation—Dr. Michael Repacholi of the WHO compared the current Russian and ICNIRP exposure standards, expressing both in terms of both incident power and specific absorption rates (SARs). At RF/MW frequencies, the Russians rely on incident power densities, while ICNIRP emphasizes SARs.

The Russian standards call for integrating the amount of incident energy over a day (e.g., occupational ELF exposures of 5 kV/m for 8 hours or proportionately more for shorter time periods up to an absolute maximum of 25 kV/m). This approach was contrasted to the ICNIRP guidelines, which essentially only consider power absorbed over a short time. Reduced to the same practical situation, the Russian and ICNIRP limits are similar, except at the higher RF/MW frequencies.

There was some support for a single worldwide standard, which is one of the objectives of the International EMF Project. A number of members of the Russian standards community noted that, for both scientific and political reasons, the time was ripe for a reassessment of their current exposure standards.

Many times, Russian participants challenged the Western standards' emphasis on thermal impacts to the exclusion of other types of effects. While several speakers stated that the Western process is open to nonthermal effects, they concluded that, for practical purposes, the available evidence only allows standards to be based on short-term thermal effects—at least above 10-100 MHz. Everyone agreed that there had been little research into the health effects of long-term, low-level exposures.

In the end, the Russian researchers gained more appreciation of the need for giving a more prominent role to methodology in their reports, and the Western scientists were more aware of those issues that concerned their Russian colleagues. Those present agreed on the following recommendations for further action:

1. A Russian Commission on Non-Ionizing Radiation Protection with an interdisciplinary membership, as existed in the days of the Soviet Union, should be established. It would address the need for further research into possible EMF health effects, particularly with reference to the WHO project's research agenda.
2. That commission should help the WHO project develop internationally acceptable exposure guidelines and produce a glossary of EMF terminology, based on existing international usage.
3. Russian and Western collaboration should increase, in part to help complete the WHO research agenda. This would build on existing relationships between the WHO, the Armstrong Laboratory and the RAS' Institute of Biophysics in Moscow and take advantage of the new USAF collaboration initiative.

The scientific program was organized by Dr. Nikolai Izmerov, the head of the IOH, Dr. Yuri Grigoriev of the RAS' Institute of Biophysics in Moscow and the WHO's Repacholi. The IOH's Dr. Nina Rubtsova made all the necessary arrangements. All the Russians, scientists and administrative staff alike, gave their out-of-town visitors a most gracious welcome in the finest tradition of Russian hospitality.

Clippings from All Over

"In Italy, each person has more of them. They keep three. One for the family calls, one for business. And the other one, well, that's for the girlfriends."

—An unidentified young man on his friends' fondness for cellular phones, quoted by Monique Yazigi in "The Party Line: 'What's Your Cell?'," *New York Times,* Sunday Styles, p.2, July 19, 1998

Since many research papers on the safety of mobile phones are conducted on behalf of the mobile phone companies, and not objective bodies, it is important to press the Government to run independent studies that take into consideration that the use of mobiles is a moving target. What was safe yesterday is not necessarily going to extrapolate for our mobile phone use of today.

—Eva Pascoe, columnist, in "Is Your Mobile Giving You a Real Ear-Bashing?" *Independent* (U.K.), Monday Review, p.11, July 27, 1998

"It's huge! It will scare people. If we had a campaign that featured our product, we'd lose."

—John Windolph, executive director of marketing communications, Iridium LLC, reacting last fall to the new Iridium hand-held phones, with which users will be able to place and receive calls anywhere in the world, quoted by Quentin Hardy in "Iridium's Orbit," *Wall Street Journal,* p.A1, June 4, 1998

"You have a well-known American corporation that is renting space within one of the church's most sacred symbols. The cross is a symbol of God's life for the world and that's exactly what we are trying to use the cross to do."

—Rev. Ross Goodman, pastor, St. Paul Evangelical Lutheran Church, Arlington, MA, on the church's contract with AT&T Wireless and Omnipoint to install cellular antennas on the 20-foot cross atop its steeple, quoted by Jennifer Babson in "Cell Phone Firms Target Higher Power," *Boston Globe,* p.A1, June 8, 1998

Although research on this speculative hypothesis continues, our judgment is that this potential hazard is best regarded as a "phantom risk."

—Dr. John Graham, Harvard Center for Risk Analysis, Boston, on possible health hazards of power line EMFs, in "Ranking Risks in the Home," *Risk in Perspective* (the center's newsletter), p.4, April 1998 (Graham's EMF-related work is sponsored by the Electric Power Research Institute in Palo Alto, CA, and by the Edison Electric Institute in Washington.)

Yet despite an enormous number of studies conducted over the past three decades examining many possible putative relationships between environmental factors and cancer, few correlations have been found. From electromagnetic fields and pesticides to microwaves and smog, credible studies have shown little evidence of links between environment and cancer risk.

—Drs. Brian Henderson and Susan Preston-Martin, University of Southern California School of Medicine, Los Angeles, in an op-ed piece, "Real Risks of Cancer Are Not in Environment But in Ourselves," *Los Angeles Times,* p.B5, June 8, 1998

"It was not a matter of replicating our experiments; rather, they were only similar experiments."

—Dr. Wolfgang Löscher, Hannover School of Veterinary Medicine, Germany, on the differences between his animal studies on the promotion of breast cancer with 50 Hz magnetic fields and those led by Dr. Larry Anderson of the Battelle Pacific Northwest Labs in Richland, WA, quoted in "Replication of the Löscher Studies in the U.S.," *Elektrosmog-Report* (Germany), p.7, June 1998 (translated from German; see below and *MWN,* M/A98 and M/J98)

"I pop melatonin like Tic-Tacs."

—Michael Kors, head designer for Celine, the French fashion house, whose recent travels have "taken him to Japan, Paris, Milan, Dallas, Paris again," quoted by William Norwich in "Style Diary," *New York Observer,* p.28, July 20, 1998

"MICROWAVE NEWS" FLASHBACK

Years 15 Ago

• A team led by Henry Kues of JHU–APL reports that pulsed 2450 MHz radiation damages tissue in the cornea at 10 mW/cm^2, but that the effects first appear 24-72 hours after exposure.

• The state of Wisconsin sues the U.S. Navy to block its extremely low frequency submarine communications system, Project ELF, until the Navy updates its 1977 environmental impact statement.

• Dr. Herman Schwan, chair of the panel that wrote ANSI's 1966 exposure standard (10 mW/cm^2) for RF/MW radiation, rejects charges that the panel was tilted toward industry and the military.

Years 10 Ago

• In a class action suit against Boeing, where he worked for 27 years, electronics technician Robert Strom charges that the company failed to inform its workers of the hazards of electromagnetic pulse (EMP) radiation, which he believes caused his leukemia.

• Dr. David Lange finds that 2450 MHz radiation at specific absorption rates of 2 W/Kg causes significant leakage through the blood-brain barrier. The finding parallels Henry Kues's work showing similar leakage from blood vessels in the eyes.

• The U.S. Air Force considers relocating its high-power PAVE PAWS radar in Georgia, because its main beam may detonate munitions aboard aircraft approaching Robins Air Force Base.

Years 5 Ago

• The CTIA abandons its proposal to have the FDA lead the industry's cell phone research program. The agency's Dr. Elizabeth Jacobson criticizes the wireless industry for "unwarranted confidence" in the safety of cellular phones.

• Drs. Wolfgang Löscher and Meike Mevissen in Hannover, Germany, report on a series of experiments showing that 50 Hz magnetic fields promote breast cancer in rats. In one experiment, the exposed animals also had decreased melatonin levels.

• People should be wary when phrases such as "no scientific proof" or "no objective evidence" are used to sum up the epidemiological evidence of an EMF–cancer connection, advises Canadian epidemiologist Dr. David Bates.

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UPDATES

BROADCAST RADIATION

Report on Cancer near Denver Antenna Farm... The cancer rate in the census tract around the Lookout Mountain antenna farm outside of Denver is not significantly higher than in the rest of the metropolitan area, according to a study released on June 15 by the Colorado Department of Public Health and Environment (CDPHE). Between 1985 and 1995 the rate of brain and central nervous system cancers was about 50% higher than expected—but due to the small number of cases, this finding was far from statistically significant. For all other cancers, the risk ratios were lower than expected, sometimes significantly so. The report concluded that if it is possible to collect more precise exposure data, further study might be warranted. The CDPHE inquiry had been requested in April by a citizens group called Canyon Area Residents for the Environment (CARE), which includes 25 neighborhood groups in the Denver suburbs near the antenna farm. In a June 18 press release, CARE stressed that, because of the uneven terrain around the site, residents' exposures may vary widely. "Are these [brain cancers] clustered in areas receiving certain doses of electromagnetic radiation?" CARE asked. "We do not know but would like to find out." Dr. John Reif of Colorado State University in Fort Collins, who helped prepare the report, told *Microwave News* that he would be collecting additional exposure data along with Dr. Frank Barnes of the University of Colorado, Boulder. Reif said he would like to carry out some additional pilot studies, but these would require new funding. CARE called on the CDPHE and county officials to support such research and "fill the funding void left at the national level." Lookout Mountain is home to a dozen high-power radio and TV broadcast towers and to 400-500 other antennas, with another half-dozen large towers planned for the introduction of digital TV. About 10,000 people live in the surrounding area. "From what I know about antenna farms elsewhere in the world, it's a rather unique situation," said Reif. *Cancer Incidence in Residents Adjacent to the Lookout Mountain Antenna Farm* is available from the CDPHE's Executive Director, Dr. Richard Hoffman, in Denver at: (303) 692-2662, Fax: (303) 691-7702.

ELECTRICAL APPLIANCES

U.K. Review of Field Levels... Research on EMFs from home appliances is reviewed in a new report from the British government. *A Review of EMFs Associated with Motorized Appliances* (CRR No.172), prepared by the National Radiological Protection Board for the Health and Safety Executive (HSE), is based mostly on U.S. studies and, to a lesser extent, on European and U.K. research. The report states that, "Lower field levels can generally be expected in European appliances, where the supply current is about half" that in the U.S. Data on the relationship between EMF levels and distance are provided for a range of appliances. Priced at £15 (approximately $25), the report is available from: HSE Books, PO Box 1999, Sudbury, Suffolk CO10 6FS, U.K., (44+1787) 881165, Fax: (44+1787) 313995.

EMI AND RADIO ASTRONOMY

Iridium's Negotiations with Radio Astronomers... Iridium, whose satellite-based mobile phone system is scheduled to be-

gin operation this fall, announced that it is on the verge of agreements to limit its interference with radio astronomy in Europe and India. Iridium reached an "agreement in principle" on July 7 with the European Science Foundation's Committee for Radio Astronomy Frequencies and government regulators from France, Germany, Holland, Norway and the U.K., according to spokesperson Michelle Lyle. The details of agreements with individual European observatories have yet to be worked out, Lyle told *Microwave News,* but she does not expect these negotiations to be difficult. On May 19, a tentative pact was reached with India's National Center for Radio Astrophysics, which operates a radio telescope in Pune, and Iridium expects this to be finalized by early August. At issue is the part of the spectrum between 1610.6 MHz and 1613.8 MHz, the emission frequency of the hydroxyl molecule. Since this is one of the most common interstellar molecules, radio astronomers rely heavily on observations in this band. Iridium satellites do not broadcast below 1621.35 MHz, but their powerful signals are expected to "bleed" into neighboring frequencies, drowning out the faint signals from stars that are light-years away. In March Iridium completed negotiations with the world's largest radio observatory, in Arecibo, Puerto Rico, promising to limit interference with the giant antenna for eight hours a day. Arecibo had held out for a longer quiet period than was granted to other U.S. radio telescopes, and it was the last one in North America to settle with Iridium. But this agreement does not guarantee Arecibo a complete elimination of static—only that it will be reduced by a factor of 30, according to *Science* (March 27). As a result, observations will take longer than in the past. Astronomers in other countries have taken a harder line than their U.S. colleagues (see *MWN,* J/A96), and the wireless trade paper *RCR* reports that some have accused the Americans of "dancing with the devil" (April 13). With more and more satellite-based wireless technologies expected in the future, the stakes are high. Tomas Gergely, in charge of spectrum management issues at the U.S. National Science Foundation, told *Nature* (March 26), "We must be very vigilant, so that radio astronomy as a discipline survives."

The Future of Spectrum Management...*Radio Astronomy Spectrum Planning Options,* a report released in April by the U.S. National Telecommunications and Information Administration (NTIA) in Washington, examines the conflict between science and commerce in spectrum allocation. The report calls for increased sharing of different parts of the radio spectrum, through time-sharing agreements, better filtering of unwanted signals and "geographic and topographic isolation of sensitive receivers." Other options described in the report include increased use of fiber-optic cable and other wireline technologies, shifting existing users to other frequencies and commercial use of the spectrum above 20 GHz. The report can be found on the NTIA's Web site at: <www.ntia.doc.gov>. Printed copies can be requested from the NTIA's Mary Wallach at (202) 482-3999.

ICNIRP

Exposure Limits Updated... The International Commission on Non-Ionizing Radiation Protection's (ICNIRP) exposure guidelines are only designed to protect against "known adverse health

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impacts," according to Dr. Jürgen Bernhardt, ICNIRP's chairman. Bernhardt reviewed the updated limits, which cover the spectrum from 1 Hz to 300 GHz, in a presentation at the *20th Annual Meeting of the Bioelectromagnetics Society* in St. Pete Beach, FL, on June 10. The limits protect against "short-term, immediate health effects" such as nerve stimulation, contact shocks and thermal insults, according to the guidelines, which appear in the April issue of *Health Physics (74,* pp.494-522, 1998). Despite "suggestive" evidence that power frequency magnetic fields can be carcinogenic, ICNIRP has concluded that this and other nonthermal health effects have not been "established." ICNIRP has long followed this approach to standard-setting (see *MWN,* Mr84, M/A87, J/F88, M/J88, M/J89 and J/F90). In his talk, Bernhardt noted that the guidelines include "no consideration regarding prudent avoidance" for health effects for which evidence is less than conclusive. The exposure limits are expressed in two ways: as basic restrictions and as more readily measured reference levels. For example, ICNIRP's basic restriction for public exposures to 50 Hz magnetic fields is a maximum induced current of 2 mA/m^2 in the head and trunk, and its reference level is 1 G. (At 60 Hz, the level is 833 mG.) "Compliance with the reference level will ensure compliance with the relevant basic restriction," ICNIRP states. For radiation in the 10 MHz-10 GHz range, ICNIRP specifies its basic restriction in terms of specific absorption rates (SARs). For the general public, the maximum allowable whole-body SAR is 0.08 W/Kg. For workers, the maximum SAR is 0.4 W/Kg. The reference level for public exposures is 200 $\propto W/cm^2$ from 10 MHz to 400 MHz. Above 400 MHz, it increases with frequency to a maximum of 1 mW/cm^2 at 2 GHz. To clarify aspects of the guidelines, ICNIRP has prepared a paper in a question-and-answer format, which will appear in the October issue of *Health Physics.*

INTERNATIONAL STANDARDS

Proposed EC Rules Follow ICNIRP... The European Commission (EC) has drafted new guidelines for the general public's exposure to non-ionizing radiation (NIR). The proposal is intended to replace the current patchwork of national and European regulations with a single coherent framework, but must still be voted on by the ministerial council of the European Union (EU). The draft rules "are based on the best scientific advice, notably from the International Commission on Non-Ionizing Radiation Protection (ICNIRP)," according to a June 22 press release from the EC in Brussels, Belgium. The EC noted that the proposed standard does not address "the so-called 'athermal' effects of NIR, such as cancer, for which there is no conclusive scientific evidence." Specific regulations to enforce the guidelines would be left to individual governments. EC Employment and Social Affairs Commissioner Padraig Flynn said that the rules are needed because, "The absence of requirements or guidelines at the EU level in this area is having a negative effect on the attitudes of consumers with regard to equipment emitting NIR." The EU had been urged to develop "a wider international consensus" on public exposure to NIR in a 1996 report from the EC's directorate for employment, industrial relations and social affairs (see *MWN,* S/O97; also S/O96). The new proposal has been endorsed by the EC's Scientific Steering Committee.

That Gallo was giving advice on EMFs was in itself surprising. He is new to the EMF debate, as he often remarked over the ten days of meetings. "I am agnostic" on this issue, he said.

Nor did Gallo learn much about risk during the working sessions—because risk was never discussed in Minneapolis. The panel was told to ignore risk and concentrate on the science. (Translated into jargon, the assigned task was "hazard identification," not "risk characterization." The idea is that you must first identify what risks, if any, exist, before you can judge their size.)

"We don't care what the outcome is," Dr. Kenneth Olden, the director of the NIEHS, instructed the working group on the opening evening of the meeting. "We just want it to be based on good science." Risk analysis would come later.

But, evidently, Gallo and NIEHS' senior managers felt they had to offer their risk assessment without the benefit of the formal risk analysis that Dr. Christopher Portier is preparing for them.

Why was the NIEHS trying to downplay public concern over EMFs? It is puzzling, especially given that the most likely result of the panel's decision would be to prompt more health research, which, after all, is the NIEHS' raison d'être. Why not accept the recommendation of its panel and ask Congress to keep funding EMF studies?

Part of the answer has to do with the current climate for environmental research. The RAPID program is coming to an end, and Congress is not in any rush to renew it. So any future EMF studies would be at the expense of other NIEHS projects.

But there's more than money involved. NIEHS managers long ago decided that EMFs are not worth their attention. In the press release, Gallo did recommend more "hypothesis-driven, focused research," but, in a telling omission, there was no endorsement from the NIEHS. Not from Dr. Gary Boorman, the head of the institute's EMF studies; not from Dr. George Lucier, the director of its Environmental Toxicology Program, who flew in for the concluding sessions of the meeting; nor from institute director Olden himself. The NIEHS does not want to make any commitments to EMFs.

The NIEHS' ambivalence over EMFs is not new. Three years ago, when the institute's long-term animal studies were just getting under way, Boorman said on national public television that, in all probability, it would soon be obvious that "there's really nothing there" (see *MWN,* J/A95).

Boorman's comments were remarkable. Here was a government scientist who had just committed some $10 million of NIEHS (*not* RAPID) funds for a set of animal studies—and he thought there was little evidence of any real risk. For Boorman, it appeared as if their real value was to quell what he perceives to be the public's groundless fears.

As it turned out, the animal studies were not as clearly negative as Boorman had predicted. Earlier this year, the National Toxicology Program found that they showed an "equivocal" cancer risk in male rats (see *MWN,* M/A98).

The $10 million animal data did not play a major role in the NIEHS working group's decision. The epidemiology was the dominant basis for listing EMFs as possible carcinogens. It had to be: There are simply too many high-quality childhood and worker studies to ignore. It makes sense that studies of *human beings* in *real* EMF environments should be given more weight than experiments on animals exposed to idealized magnetic fields.

In the real world, people rarely encounter the type of EMFs to which Boorman's animals were exposed—pure 60 Hz sine waves. In retrospect, it was probably a gross mistake to bet the whole $10 million on one artificial type of EMFs.

Which brings us back to the question of risk. How much of a threat do EMFs really pose? Do they pose only a small health risk, as Gallo and the NIEHS would have us all believe?

When asked to put his quote in context, Gallo explained that he was comparing EMFs to AIDS and TB. But we did not need a multimillion-dollar research project to tell us that EMFs are not the cause of a global plague. No one has ever argued that.

The idea that EMFs pose a small risk (at worst) comes largely from industry propaganda (see p.15). It has been repeated so many times that it is now accepted as dogma.

Even those who should be more skeptical are buying into the low-risk assumption. Jocelyn Kaiser's report on the NIEHS meeting for *Science* (July 3) included this sentence: "Experts are quick to point out that any cancer risk from EMFs is slight." She treated the statement as so self-evident that she did not even bother to name any of the experts.

The risks may indeed turn out to be small, but, at this point, that is still very much an assumption. No one will know the true dimensions of the EMF problem until the active biological agent has been identified. It could be high frequency transients, but that too is a guess.

We are all exposed to EMFs all the time. This means that epidemiological studies give at best a minimal estimate of the real risks, because it is impossible to find a truly unexposed group to serve as controls. EMF studies may be the equivalent of comparing two-pack-a-day smokers with those who smoke three packs a day.

As Dr. Raymond Neutra of the California Department of Health Services pointed out at the BEMS conference this June, "EMF risks could be large compared to lifetime theoretical risks for most regulated chemicals." Neutra argued that, "If you are not willing to do EMF research, you should not be doing any environmental research."

Anyone who has grappled with the inexact science of estimating risk knows that the numbers are easily manipulated to fit a desired objective—especially with agents like EMFs, for which there are large holes in the data. When the NIEHS releases Portier's risk analysis, his assumptions should be examined closely. After all, his superiors have already made clear how it should turn out: not much risk, not much need for research.

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NIEHS Finds "Weak" Evidence That EMFs Pose Health Risks

Prudent Avoidance Endorsed

The National Institute of Environmental Health Sciences (NIEHS) has concluded that the scientific evidence that exposures to power line electromagnetic fields (EMFs) pose a health risk is "weak."

The NIEHS stopped short of saying that EMFs are entirely safe, pointing to a "fairly consistent pattern" of a small increase in leukemia risk with increasing exposure—a pattern observed in epidemiological studies of both children exposed at home and workers exposed on the job. At the same time, the NIEHS noted that animal and mechanistic experiments tend not to support a cancer link.

These findings are contained in NIEHS Director Dr. Kenneth Olden's report to the U.S. Congress on the six-year RAPID research program on power line health effects, which was released on June 15.

Olden recommended a "continued emphasis" on educating the public and reducing EMF exposures because "virtually everyone in the U.S. uses electricity and therefore is routinely exposed." But he advised against "aggressive regulatory actions."

Olden's advice has been widely interpreted as an endorsement of a policy of "prudent avoidance," or taking simple and inexpensive steps to limit exposures. The policy was first put forward ten years ago in a report by the Congressional Office of Technology Assessment (see *MWN,* J/A89). The government of Sweden backed prudent avoidance of power frequency health risks four years ago (see *MWN,* N/D95).

(continued on p.9)

Finding of Scientific Misconduct Against Robert Liburdy

He Stands by EMF–Calcium Results

On June 18, the federal Office of Research Integrity (ORI) declared that Dr. Robert Liburdy had committed scientific misconduct. ORI charged Liburdy with "intentionally falsifying and fabricating data" in two papers about EMF effects on calcium changes in rat blood cells.

In a voluntary settlement with ORI, Liburdy agreed to retract three graphs: two in one paper and one in another. In addition, Liburdy agreed not to receive any federal grant money for the next three years.

"I admit no scientific wrongdoing," Liburdy stated in a letter published in *Science* (July 16), arguing that "the crux of the charges" center on his graphing techniques. "The raw data for my two calcium studies are valid. Thus, these papers are not being retracted, and my scientific conclusions stand as pub-

(continued on p.7)

HIGHLIGHTS

European Union To Adopt ICNIRP-Based Guidelines; Italy Protests That Decision Ignores Long-Term Effects

On June 8, the Council of Ministers of the European Union (EU) agreed on guidelines for public exposure to electromagnetic fields and radiation (EMF–EMR). Italy opposed the measure, arguing that it did not protect against possible long-term effects.

The recommended guidelines, based on those of the International Commission on Non-Ionizing Radiation Protection (ICNIRP), will provide "a high level of protection [against] established health effects," the Council of Ministers declared. The council noted that, "Concerns have been raised about possible health effects, primarily cancer," from low-level, long-term exposure. But it argued that, "There is no convincing scientific evidence of EMFs causing cancer."

German Health Minister Andrea Fischer called the council's action "an important step towards ensuring better protection of the public," according to a June 8 Reuters dispatch. Fischer chaired the meeting of EU health ministers, which was held in Luxembourg.

The council's report noted that Italy had "expressed firm objections against the general approach" of the EC proposal, and had argued unsuccessfully for a policy based on "the precautionary principle." Defeated Italian amendments called for efforts to reduce exposure, especially in "areas intended for children and health facilities."

Italy also complained that the council decision did not take the full range of scientific studies into account. Its amendments would have explicitly stated that, "The induction of cancer from long-term effects cannot be ruled out," and would have deleted both of the recommendation's references to ICNIRP as an authoritative body. Italy did not, however, try to change the proposal's ICNIRP-based numbers.

"The council's recommendation has no legal force—but it does have moral force," Ireland's Dr. Tom McManus said at an IEEE meeting in Long Beach, CA, in June. He predicted that smaller countries such as Denmark and Ireland would translate the guidelines directly into national laws, while larger nations would probably modify them in light of their existing regulations. McManus is the chief technical adviser to Ireland's Department of Public Enterprise, which deals with communications, energy and transportation policy.

The Council of Ministers approved the proposal advanced by the European Commission (EC) in June 1998 without major changes (see *MWN,* J/A98), The council rejected most of the amendments proposed by the European Parliament last March, which would have put more emphasis on a precautionary approach (see *MWN,* J/F99 and M/A99).

The European Parliament's proposed amendments to the EC proposal had little influence on the council's decisions. Though the council's report stated that "nine of the 17 amendments proposed by the European Parliament have, completely or partially, been taken into account," in many cases the council adopted only the weakest elements of a given amendment; the stronger provisions were often ignored.

Italian Who Won Euro Parliament Support for ALARA Loses Seat

In elections on June 13, Gianni Tamino of Italy's Green Party lost his seat in the European Parliament. Tamino led the recent parliamentary effort to press for reductions in EMF–EMR exposure.

Last year the parliament's committee on the environment asked Tamino, a biology professor at the University of Padova, to review public exposure guidelines proposed by the EC (see *MWN,* J/F99). Tamino's report proposed extremely strict numerical limits, but these were rejected by the full parliament in March (see *MWN,* M/A99). But the parliament did support Tamino's call for a precautionary approach, known as ALARA, to possible long-term health effects.

The Italian Green Party saw its support drop by half in the European elections. With only 1.8% of the vote, it was entitled to send only two representatives to the EU's parliament, and Tamino was not ranked high enough within his party to retain his seat.

The member of the European Parliament most likely to take the lead on EMF–EMR issues in the future is Paul Lannoye of the Belgian Greens. Lannoye is the author of a resolution which the European Parliament passed in 1994, *On Combating the Harmful Effects of Non-Ionizing Radiation* (see *MWN,* J/A94).

The council rejected the parliament's support for a precautionary approach based on the "ALARA principle"—the idea that public exposure should be kept "as low as reasonably achievable." It turned down a set of parliamentary amendments, supported by Italy, that would have required the EC to develop a system of regular scrutiny of devices that generate EMFs and EMR, to label such devices with information on field strengths at various distances and to revise the exposure guidelines by 2001 with an eye to possible long-term effects.

The council did, however, instruct the EC to keep the issue "under review," including "possible effects which are currently the object of research," and to prepare a report within five years. The council also supported research on health effects, and specified that this should be part of the EU's "Fifth Framework Program" for scientific research (see p.4 and *MWN,* J/F99).

Though the council accepted ICNIRP's numbers, McManus stressed that it had adopted the ICNIRP standard "in a modified way." The council urged that regulations focus on places "where members of the public spend significant time," and it stressed that limits on EMF–EMR exposure "should consider both the risks and benefits" of the technology concerned. These points responded to concerns raised by industry, which had argued that a strict application of the ICNIRP limits would be too expensive. For example, the U.K.'s electric power industry warned that it could be forced to spend up to $1 billion to reduce short-

term exposures of "a small number of agricultural workers, or ramblers on moorland" from high-tension lines (see *MWN,* J/F 99 and M/A99).

The limits recommended by the council do not apply to workers, or to patient exposure while undergoing medical treatment. They are also not intended to prevent EMI to medical devices.

The June 8 meeting of the council came to political agreement on its EMF–EMR recommendation, but did not formally approve it. That will happen at a future meeting, after the recommendation has been translated into all of the EU's official languages. Once the recommendation is officially approved it will be published in the *Official Journal of the European Communities,* available on the Web at: <europa.eu.int/eur-lex>. The European Parliament's suggested amendments to the EC proposal, approved in March, were published in the June 21 issue of the *Journal*.

French and German Studies on RF/MW Cancer Promotion: Widespread Interest, Inconclusive Results

When the Mobile Manufacturers' Forum (MMF) released a list of planned health studies in January, one topic sparked some curiosity: whether mobile phone radiation promotes the growth of cancer caused by the chemical DMBA.

The MMF said this animal study was needed "to address previous findings"—but most scientists familiar with cellular phone research did not know that such experiments had ever been conducted. What were these "previous findings"? MMF officials would not say.

So in June when results from one of the studies were slated for presentation at the annual meeting of the Bioelectromagnetics Society (BEMS), there was considerable interest. "This paper has attracted a lot of attention before the meeting, and I am expecting a controversial reaction," said Switzerland's Dr. Niels Kuster, the chair of that session, in his introductory remarks.

But results described by Dr. Rachid Anane, on behalf of Dr. Bernard Veyret's group at the University of Bordeaux in France, were ambiguous. In the first of two experiments, rats were exposed to 1.4 W/Kg and above and there appeared to be some increase in cancer. But in a second experiment at lower exposures, the number of malignant tumors went down.

Motorola's Dr. Mays Swicord, based in Plantation, FL, was skeptical about whether these apparent effects were real. "The question is whether these are statistical variations," Swicord said in an interview. "It is difficult for me to believe that these systems are bimodal. I would be more comfortable if the data went one way or the other."

"There is no doubt that the differences between the first and second experiments are statistical fluctuations," commented Dr. Alexander Lerchl of Germany's University of Münster. Lerchl argued that more animals and a lower dose of DMBA would be needed to clarify any possible RF/MW effects. Veyret countered that while the number of animals in his study was small, it should be enough to detect a difference of 40% or more between groups.

Another DMBA study on cellular phone radiation, by Drs. Christian and Hella Bartsch of the University of Tübingen in Germany, has not yet been released. Several scientists at the BEMS meeting told *Microwave News* that the Bartsches had at least some positive findings—but others said the data could be interpreted in various ways.

The German researchers have declined to discuss their experiments until the study is accepted for publication. "We plan to submit our results...in the next month or so," Christian Bartsch told *Microwave News*. "The final statistical analysis has not yet been completed."

Nonetheless, wireless industry representatives agreed that this initial work deserves further attention. Dr. Torsten Gailus of Deutsche Telekom, which funded the Bartsches' research, told *Microwave News* that both of the DMBA studies are "very interesting work." He added that he is "not concerned by their results."

"My personal opinion is that the Veyret study is a good study, and that it looks very important," said Gerd Friedrich of FGF, the German wireless industry research group based in Bonn. In an interview, he noted that Veyret's experiments were small and "still at an early stage." Neither Gailus nor Friedrich would comment specifically on the Bartsches' findings.

The MMF has selected Dr. Robert Hruby of the Austrian Research Center in Seibersdorf to try to replicate the DMBA studies (see p.4). Hruby is expected to use 100 animals per group, and thus achieve a statistically stronger result.

In both of his experiments, Veyret gave the rats one 10 mg dose of DMBA, which induces mammary tumors. Starting ten days later, the rats were exposed to 900 MHz GSM mobile phone radiation for two hours a day, five days a week, for nine weeks.

In the first experiment, three groups of 16 rats were exposed to 1.4 W/Kg, 2.2 W/Kg or 3.5 W/Kg. Another group of 16 was sham-exposed, while eight rats served as cage controls. Overall, exposed groups showed "a slight increase in the number of tumors, but it was not significant," said Anane.

The second experiment was conducted at lower exposures: 0.1 W/Kg, 0.7 W/Kg and 1.4 W/Kg. In this case, the number of tumors per animal decreased as exposure went up, and in two out of three groups the decline was statistically significant. This experiment also used 16 rats per group.

Gailus, who heads Deutsche Telekom's research group on RF/MW bioeffects in Darmstadt, said that Christian and Hella Bartsch used a different exposure system than did Veyret. While both labs used whole-body, far-field exposures, in the German study the cages held several animals each with enough space for them to move about freely. In the French experiments, the rats were confined to individual compartments just large enough for a single animal.

The use of confined spaces in Veyret's exposure system was criticized by Lerchl. He pointed out that in both experiments,

the cage controls had consistently higher body weights than all other groups of animals. "The animals are stressed when they are constrained," Lerchl told *Microwave News*. Since both exposed and sham-exposed animals are stressed, he contended, "You will not see an effect [of RF/MW exposure] unless it is very strong." Lerchl believes that, "This is a guaranteed way not to see any results."

Anane stressed that no firm conclusions could be drawn from his group's study alone. Veyret's lab is also planning further DMBA work, with a larger number of animals. Funded by the French service provider Bouygues Telecom, this study will use 1800 MHz exposures.

Another initiation/promotion study by Veyret's group, this one using benzo(a)pyrene instead of DMBA, found no effects at all from RF/MW radiation. This study, which used much lower level GSM exposures—0.075 W/Kg and 0.27 W/Kg—has been accepted for publication by the *International Journal of Radiation Biology.*

Wireless Industry Picks Studies for European Research Program

The Mobile Manufacturers Forum (MMF) is supporting the proposals listed below for funding from the European Union (EU) under its Fifth Framework Program for Research and Technological Development, known as FP5 (see *MWN,* J/F99). Under FP5 rules, the EU will cover only 50% of the cost of projects done outside of universities. The MMF will pay half the costs of its projects which are chosen by the European Commission (EC).

Research labs submitted applications early this year in response to a request for proposals issued by the MMF that detailed a number of research needs (see *MWN,* J/F99). The applications were evaluated by two panels specially convened by the WHO EMF Project in Zurich, May 8-9. Both panels were chaired by Dr. Chrisopher Portier of the U.S. NIEHS.

A list of labs that were judged capable of doing the research was presented to the MMF, which then matched the labs with specific research projects. Three consortiums, each of which included labs from several different countries, were assembled to do animal, cellular and human research (see below).

Applications for FP5 funding were due on June 8 and are now under review by the EC's Directorate 12, on science, in Brussels. The EC's selections are expected in the fall.

The chair of the MMF is Peter Harrison of Nokia in Camberley, U.K. Its secretary is Matthias Meier of Motorola in Kassel, Germany. Dr. Mays Swicord, Motorola's director of biological research in Plantation, FL, is also playing an active role in this MMF initiative.

***In Vivo* Studies**	**Country**	**Principal Investigator and Affiliation**
Two-year bioassays in rats with 900 MHz & 1800 MHz digital radiation	Switzerland	Dr. Antonio Dotti, RCC Ltd., Itingen
Two-year bioassays in mice with 900 MHz & 1800 MHz digital radiation	Germany	Dr. Clemens Dasenbrock, Fraunhofer Institute, Hannover
Replication of DMBA-initiated breast cancer in rats with 900 MHz digital radiation	Austria	Dr. Robert Hruby, Austrian Research Center, Seibersdorf
Replication of *Pim1* transgenic mouse study	Italy	Dr. Germano Oberto, RBM Bioscience, Colleretto Giacosa
Radial arm and water maze ability in rats and mice	U.K. France	Dr. Rick Saunders, NRPB, Chilton Dr. Jean-Christophe Cassel, Louis Pasteur University, Strasbourg
***In Vitro* Studies**		
Ornithine decarboxylase (ODC) expression using 900 & 1800 MHz digital radiation	France Finland	Drs. Bernard Billaudel & Bernard Veyret, University of Bordeaux Drs. Jonne Naarala & Jukka Juutilainen, University of Kuopio
Genotoxicity and chromosome aberrations using 900 & 1800 MHz digital radiation	Italy U.K.	Dr. Carmela Marino, ENEA, Rome Dr. David Lloyd, NRPB, Chilton
Human Studies		
Hearing and inner ear pathology	Sweden Finland	Dr. Ilmari Pyykkö, Karolinska Institute, Stockholm Dr. Jukka Starck, Institute of Occupational Health, Vantaa
Skin hypersensitivity, headaches and blood pressure	Sweden	Drs. Bengt Arnetz & Lena Hillert, Karolinska Institute, Stockholm
Sleep and EEG recordings	Sweden	Dr. Torbjörn Åkerstedt, Karolinska Institute, Stockholm
Working memory	U.K.	Dr. Adrian Owen, University of Cambridge
Exposure and Dosimetry Support		
Drs. Niels Kuster, Swiss Federal Institute of Technology, Zurich; John Sahalos, University of Thessaloniki, Greece; Philippe Leveque, University of Limoges, France; and Kari Jokela, Center for Radiation and Nuclear Safety, Helsinki, Finland.		

The Talk of Long Beach: Motorola Takes Center Stage as Carlo Makes His Exit

On walking into the BEMS meeting* it seemed as if someone had waved a magic wand and turned all the power line people into cell phone types—and got most of them jobs with Motorola.

Motorola was everywhere. Motorola scientists, engineers, consultants and administrators came to Long Beach from three continents. To keep order, the company sent a lawyer and a PR man. In all, there were about a dozen Motorola staffers at BEMS, not counting those actually doing Motorola-funded research.

Motorola has the largest mobile phone health research program in the world. In fact, it has the *only* research program. In contrast to Wireless Technology Research's (WTR) $25 million effort for the cell phone industry, which never got off the ground, Motorola is actually getting something done.

This was most apparent at WTR's own two-day symposium† held immediately before the BEMS conference. WTR's meeting was designed to showcase WTR results, but it had funded so few studies that Motorola researchers had to be brought in to fill out the program. At WTR's own meeting, there was more science from Motorola than from WTR.

The symposium did feature some WTR research: findings that Dr. George Carlo, WTR's chair, had previously released to the media with much fanfare. Carlo argued strongly that Joshua Muscat's epidemiological study (see *MWN,* M/J99) and Dr. Ray Tice's genetic toxicological experiments (see *MWN,* M/A99) suggested a possible cell phone-cancer link.

Muscat did not say what he thinks about his own findings—perhaps to keep them fresh so that he can publish them somewhere prestigious like the *New England Journal of Medicine*.

Sweden's Dr. Lennart Hardell did not come to Long Beach, but his collaborator Dr. Kjell Hansson Mild presented their recent epidemiological results, which show that users of mobile phones were more likely to develop brain cancer on the side of the head where they held the phone (see p.6 and *MWN,* M/J99).

While many of those in the audience were skeptical that any of these new pieces of the cell phone health puzzle represented a breakthrough, Carlo clearly thought so. He called for an "immediate and comprehensive review" of RF/MW health standards.

"There is something going on that does not involve heating," Carlo told us. Carlo's "deathbed" conversion to the nonthermalist camp may have prompted France's Dr. René de Seze, who does research for Motorola, to reassure the audience at the end of the meeting that there is no health problem. And Norm Sandler, Motorola's spokesman, observed that the reviews of safety standards that Carlo is calling for "are being done all the time."

"It is clear to me that consumers are not being protected," Carlo warned. He predicted that the health controversy is not over: "I am not anticipating an end to this anytime soon," he said.

Carlo now believes that the cell phone industry has a duty to monitor consumer complaints, to do public health studies of phone users and to continue biological research. This is "an ongoing cost of doing business," he said. "Nothing less will protect the consumer." In the past, Carlo has suggested that WTR would be well-suited to run just such a surveillance effort, according to a proposal for a second five-year research plan which Carlo has been circulating.

The Cellular Telecommunications Industry Association (CTIA), which sponsored the WTR program, quickly distributed a press release stating that there are no cell phone health risks.

To no one's surprise, there was visible tension between WTR and the CTIA. Carlo could be seen in heated arguments with CTIA Vice President Jo-Anne Basile in the hall outside the meeting room. "You have caused us a few sleepless nights," Basile said from the floor as the WTR meeting closed.

Carlo told *Microwave News* that the CTIA had informed him last winter that it would no longer support WTR—although it had previously promised him a role in following up the epidemiological and genotoxic findings.

In fact, as far as the CTIA is concerned, Carlo is gone for good. It is a "final goodbye," reported *Wireless Week,* which can be counted on to reflect the industry's position. CTIA's board has made a new commitment to sponsor health research, though it has not been specific as to who will do it and who will run it.

But Motorola is not waiting around. It has taken a central role in coordinating responses to the new European research effort (see p.4). In addition to its ongoing U.S. and European research efforts, Motorola is helping with the exposure system for the replication of a key animal experiment in Australia.

There was a fair amount of discontent among European scientists with Motorola's role in the EC project: "How come some guy from America is telling us how to spend our money?" one commented.

Dr. Mays Swicord, Motorola's director of biological research in Plantation, FL, defended the company's initiative: "If we had not acted, there is a risk the high priority items would not have been addressed." He attributed some of the ill will to hurt feelings because "some people got left out of the process."

Carlo is telling people that Motorola has a nearly unlimited budget when it comes to microwave research. He claimed that the company had given the World Health Organization (WHO) EMF project $10 million. "That's absolutely untrue," countered Dr. Michael Repacholi, the head of the project. He said that the WHO cannot accept direct industry support, but that Motorola has "at times picked up the costs of some meetings." For instance, Motorola paid for NIEHS' Dr. Christopher Portier's trip to Europe to evaluate the proposals for the EC program (see p.4).

Motorola's Sandler said that Motorola has contributed approximately $50,000 a year for the last three years for general support of WHO's RF work, explaining that Motorola gives the money to Australia's Royal Adelaide Hospital, which forwards it to the WHO. Repacholi worked at the hospital before joining the WHO.

Few people seem to be shedding any tears over Carlo's exit from the cell phone scene. "George is having difficulty bowing out gracefully," Repacholi told us as he left Long Beach.

**21st Annual Meeting of the Bioelectromagnetics Society* (BEMS), Long Beach, CA, June 20-24, 1999.

†*2nd State of the Science Colloquium on the Public Health Impact of Wireless Technology,* Long Beach, CA, June 19-20, 1999.

« Wireless Notes »

At the **WTR** symposium in Long Beach (see p.5), Dr. **Maria Feychting** of the Karolinska Institute in Stockholm raised a question about Dr. **Lennart Hardell**'s study of brain cancer and mobile phone use. From a central tumor registry, Hardell identified 270 cases in the study area between 1994 and 1996. Feychting, however, identified 862. While some of the difference is due to the fact that Hardell used only cases who were still alive, she noted that about two-thirds should still be alive a year after diagnosis. "We need to investigate the selection procedure to evaluate possible selection bias," said Feychting, who is working on the International Agency for Research on Cancer's mobile phone study (see *MWN,* S/O98). "It's strange that he does not explain why he identified only 30% of the cases," she told *Microwave News.*

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"**Neil Whitehouse**, stubborn and arrogant airline passenger, was jailed for a year." That was the caption on a photo of Whitehouse in the July 22 *Daily Telegraph* (U.K.), after he was sentenced for repeatedly refusing to switch off his mobile phone on a flight from Madrid to Manchester. While the plane was airborne, flight attendants and the captain warned that the phone could interfere with the aircraft's sensitive navigational systems. "So what?" Whitehouse replied. "Are we going to get lost?" Britain's **Civil Aviation Authority** welcomed the verdict and emphasized that, "Use of mobile phones on any aircraft is a definite safety risk." The sentence was intended "to act as a warning to others," stated **Judge Anthony Ensor**. "Proliferation of ownership of mobile phones and an increasing number of reports from pilots of electromagnetic interference makes this a priority."

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WTR's Dr. **George Carlo** has made peace with Drs. **Henry Lai** and **N.P. Singh** of the University of Washington, Seattle. In May, Carlo wrote to Dr. **Richard McCormick**, the president of the university, charging that they had written a "libelous" letter about WTR which was published in *Microwave News* (see *MWN,* M/A 99 and M/J99). Carlo requested a meeting so that the matter could be resolved "outside the courts." But by mid-June, Carlo had decided not to pursue the matter. "George told me 'Let's forget about it,' in Long Beach," Lai said (see p. 5). Carlo confirmed this to *Microwave News.* Then, on July 9, Dr. **Steven Olswang**, the vice provost of the university, responded to Carlo on behalf of McCormick, stating that, while Carlo's concerns "present legitimate differences of viewpoints about a topic of considerable academic importance," they "do not present investigatable issues of scientific integrity." Olswang added that, "The University of Washington encourages legitimate academic discourse, and as such, we are not prepared to intervene."

Could a Cell Phone Call Spark a Gas Station Explosion?

Is there a small but real danger that a cellular phone could spark a fuel explosion in a gas station? Or is this just "the latest urban legend," as the *Wall Street Journal* suggests?

This question got a burst of attention in the U.S. in June, after Exxon stations posted signs telling customers to turn off mobile phones before filling up. The signs are mandatory in company-owned stations, and "strongly encouraged" at independent Exxon dealers, CNN Financial Network reported on June 28.

BP Amoco has banned cellular phone use in its filling stations in Australia and the U.K., and will extend this policy to the U.S. in the next few months, according to the trade paper *RCR* (June 28). For several months, Japanese gas stations affiliated with Exxon and Shell have prohibited the use of wireless phones.

The wireless industry blames the fuss on an old British government rule requiring manufacturers of all electronic devices to warn customers to switch them off near potentially explosive atmospheres. Motorola's Norm Sandler told the *Wall Street Journal* (July 9) that the regulation was obsolete, and that cellular phone manufacturers may drop the warning from their manuals.

A recent Motorola patent application in the U.K., however, states that wireless phones can pose a danger of explosion in gas stations. It describes a Motorola system that would shut down all mobile phones within a given area. Sandler told *Microwave News* that this text does not reflect company policy, and was written by an individual engineer. He called the wording "unfortunate," and added that Motorola and oil industry experts are currently conferring "to clarify whether these precautions have any technical basis whatsoever."

An unconfirmed report from Indonesia of a gas station fire caused by a mobile phone is currently circulating on the Internet. But it is unclear whether such a fire or explosion has ever occurred, in Indonesia or anywhere else.

Dr. James Stuart, head of Franklin Applied Physics in Oaks, PA, told *Microwave News,* "I don't see any way you could get a spark out of a cell phone. They're designed *not* to cause sparks." Stuart, an expert on accidental discharge of the electro-explosive devices (EEDs) used in construction, noted that, "A two-way radio transmission can cause an EED to explode. But the only way to make an explosive vapor explode is with a spark."

An engineer for a major wireless technology firm, who asked not to be named, concurred. "Even if a wire to the battery breaks, the chances of that producing a spark, in the presence of enough gasoline vapors to matter—well, you'd be more likely to get hit by a meteorite," he said.

"The idea is kind of hard to believe," commented Dr. Motohisa Kanda of the National Institute of Standards and Technology in Boulder, CO. "Now, if you're using one of these pumps where you put in your credit card, the outgoing RF signal could maybe cause some kind of electromagnetic interference with the pump's computer chip and affect the billing," Kanda mused. "That *could* happen. So you might change your bill with a cell phone, but I don't think you can blow yourself up."

Exxon, however, is not taking any chances. In the company's refineries, using a mobile phone is banned in the same areas where using a welding torch would be restricted, spokesperson Crawford Bunkley in Houston told *Microwave News.*

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Carlo is currently in the midst of several suits and countersuits in a bitter divorce case. According to the trade publication *RCR,* his wife and former business partner **Patricia Carlo** has charged that he looted the assets of their consulting firm, **Health and Environmental Sciences Group** Ltd. (HES), by funneling its money to **WTR**. She has accused the head of the WTR audit committee, **Ronald Cavill** of Cavill & Co. of approving "false and fraudulent invoices" that were then submitted to HES, adding that WTR, HES, and Cavill's company all shared the same Washington address. "Patricia Carlo alleges George Carlo improperly spent HES money on close friends and associates for travel, vacations, pleasure boats, country club dues and sporting events," *RCR*'s Jeff Silva reported on July 19. George Carlo denies the charges, characterizing them as pressure tactics designed to get a better deal in the divorce.

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On June 15, **U.K. Members of Parliament** (MPs) heard from critics of tower siting policies and current RF/MW exposure guidelines. "There is widespread support for changing a system which does not protect the interests of the public," said Graeme McAlister of **Friends of the Earth Scotland**, which organized the briefing along with Northern Ireland Families Against Telecommunication Transmitter Siting (**NIFATT**). Margaret Dean of NIFATT called for buffer zones "between masts and homes, schools and hospitals" as a precautionary measure, echoing a proposal of the Swiss environmental agency (see *MWN,* M/A99). U.S. activist **Libby Kelley** described the ongoing legal challenge to the FCC's RF/MW exposure limits (see *MWN,* N/D97, N/D 98 and J/F99). The scientific basis for current RF/MW exposure standards was addressed by Drs. **Gerard Hyland** of the U.K.'s University of Warwick, **Michael Kundi** of Austria's University of Vienna and **Henry Lai** of the University of Washington, Seattle, in the U.S. All three focused on the limits' failure to protect against possible nonthermal effects. To defend its guidelines, the U.K.'s National Radiological Protection Board (**NRPB**) in Chilton sent Sir **Richard Doll** of Oxford University, who chairs NRPB's Advisory Group on Non-Ionizing Radiation, and Dr. **Zenon Sienkiewicz**, who argued that nonthermal effects lack the "established and consistent scientific data" on which exposure limits must be based. The meeting was sponsored by **Phil Willis**, a Liberal Democrat MP from northern England. "There is a lot of cross-party concern and a significant number of MPs are interested" in the tower siting issue, Willis told the BBC. Willis said that MPs from several parties are forming a parliamentary group on tower siting questions and wireless phone safety.

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The **U.K. government** is looking into the placement of mobile telephone base stations on schools. In June, **Education Secretary David Blunkett** announced that he had requested an inquiry into such siting policies and their possible health implications. "This is an issue for the entire country and we need to examine it urgently," said Blunkett, according to the *Daily Mail* (June 28). The *Mail* reported that the inquiry will be directed by the Department of Health. The announcement came as grassroots groups campaigned to ban cell towers on or near schools (see above) and as some local authorities—for example, in Edinburgh, Scotland—adopted precautionary measures restricting tower siting on public property. Dr. **Michael Clark** of the **NRPB** downplayed the risks posed by phone antennas on schools: "Invariably, checks taken in the school playground show that mobile phone transmitters give out far less power than nearby television and FM radio masts," Clark told the *Sunday Telegraph* (June 27). "So if people were being logical, they would want those masts taken down as well." Meanwhile, in another planned U.K. government inquiry, Sir **William Stewart** has been named the chair of an expert panel on mobile phone safety. Previously, Stewart was a chief scientific adviser to the government. **Tessa Jowell**, the minister for public health, promised a "definitive and rigorous assessment" of the health debate last April in response to a University of Bristol study showing faster response times among volunteers exposed to microwave radiation (see *MWN,* M/A99). The other members of the panel have yet to be named.

Finding of Misconduct Against Robert Liburdy *(continued from p.1)*

lished." He explained that he agreed to the settlement because he could not afford "a protracted legal battle with ORI."

The acting director of ORI, Chris Pascal, told *Microwave News,* "There's nothing in the voluntary agreement that says his conclusions were found to be invalid. We think scientists in the field are going to have to decide for themselves if his conclusions still hold up." But, Pascal added, "We did find that there was falsification and fabrication in the three figures, and they were retracted—not corrected, but retracted."

"It is unjustified to attempt to ruin a career over this," Liburdy told *Microwave News.* "ORI could not force me to retract any of the conclusions of my papers, despite being scrutinized for years. How many research findings have been reviewed at that level of hostile scrutiny and found to be accurate?"

By late July the Liburdy story had sparked a minor media frenzy, with prominent coverage in the *New York Times, San Francisco Chronicle,* and many other papers coast-to-coast. Most news stories described the three graphs of calcium data as central to the argument that there is a link between EMFs and cancer (see p.8). But researchers in the bioelectromagnetics community said that Liburdy's disputed data is only tangentially related to the cancer debate, and one small piece of the overall work on EMFs and calcium.

Liburdy and ORI have conflicting views of nearly every issue in the dispute. For example, ORI staff contend that in two of the graphs,* Liburdy's "unreported algebraic manipulations" of his raw data exaggerated calcium responses by a factor of ten and

*Figures 6 and 7 in "Calcium Signaling in Lymphocytes and ELF Fields," *FEBS Letters (301,* pp.53-59, 1992). The third graph is Figure 12 in "Biological Interactions of Cellular Systems with Time-Varying Magnetic Fields," *Annals of the New York Academy of Sciences (649,* pp.74-95, 1992; see box, p.9).

"created an experimental difference...that did not exist in the original data." But Liburdy insists that he simply applied accepted methods of normalization and baseline correction to his data—though he now concedes he should have described these procedures in the text. He plans to republish all three graphs, with a full explanation.

ORI staff accuse Liburdy of "a sustained pattern of deception over a period of several years," while Liburdy maintains that, "All it should have taken to settle this dispute is a revised figure legend giving more details about graphing the data."

ORI's investigation of Liburdy was preceded by a 1995 investigation by Lawrence Berkeley National Laboratory (LBL), where he worked until this March. A complaint was filed against Liburdy by someone whose name has not been released, but who Liburdy characterizes as "a disgruntled employee." An LBL committee accused Liburdy of "disrespect for the integrity of scientific data," and found that he "has published data in a manner which exaggerates their statistical significance and scientific validity."

After LBL completed its investigation in July 1995, internal review and appeals continued for two more years. ORI's investigation began in the fall of 1997, after LBL notified ORI that it had found Liburdy guilty of misconduct.

During LBL's proceedings, Liburdy chose three experts to review different aspects of his data: Drs. Carl Blackman of the Environmental Protection Agency, Richard Nuccitelli of the University of California, Davis, and James Putney of the National Institutes of Health. Liburdy's July 16 letter to *Science* states that while each "constructively criticized" him on various points, all believe "there was no intent to deceive [and] the data supports the conclusions."

ORI staff allege that Liburdy did not supply his own experts with all relevant data, a charge which he denies. Both Liburdy and ORI quote from the experts' letters in support of their positions, but at press time neither had provided *Microwave News* with the complete text of the letters.

ORI declared that, "Liburdy's claims were potentially very important when published in 1992 because they purported to link EMFs and calcium," which plays an key role in many cellular processes. But such a link was in fact first reported fifteen years earlier, and has been the subject of many studies since.

"The critical observations on calcium were made decades ago," Dr. Ross Adey of the University of California, Riverside, said in an interview. Adey noted that in his lab in the late 1960s, Dr. Suzanne Bawin observed that calcium in tissue was sensitive to modulated RF fields. This was a pioneering report of a nonthermal biological effect of non-ionizing radiation. Bawin followed this with work on calcium and extremely low frequency (ELF) EMFs, which was published in the mid-1970s and replicated by Blackman in 1979.

A report from a March 1997 NIEHS symposium on *in vitro* EMF bioeffects research lists 27 papers on EMFs and cellular calcium. Of the two Liburdy studies with data challenged by ORI, only one—the *FEBS Letters* paper—was considered important enough to be part of this list.

Liburdy's best-known research is not his calcium studies, but his experiments on the effects of EMFs on the growth of breast cancer cells. Liburdy has reported that in one line of human breast cancer cells, EMFs can block the anticancer effects of the hormone melatonin. This finding has now been replicated in four other labs, most recently by Drs. Masami Ishido and Michinori Kabuto of Japan's National Institute for Environmental Studies in Ibaraki, who reported their results at this year's BEMS meeting (on the other three labs, see *MWN,* J/A98). Liburdy also found that EMFs can neutralize the anti-breast cancer action of tamoxifen, and he told *Microwave News* that this work has been replicated by three labs in the U.S.

None of Liburdy's cancer studies were at issue in the ORI investigation.

Media Storm Over Liburdy Affair

For over a month after ORI announced its misconduct finding against Dr. Robert Liburdy, the most prominent press coverage was a short piece in the July 2 issue of *Science*. But the story caught fire after an article appeared in the *San Francisco Chronicle* on July 23. In what soon became a theme throughout the media, the *Chronicle* asserted that the two calcium studies "were considered tantalizing evidence that [EMFs] could cause cancer."

The next day a front-page story appeared in the *New York Times,* with the headline, DATA TYING CANCER TO ELECTRIC POWER WERE FAKED, U.S. SAYS. The graphs that ORI forced Liburdy to retract "had been considered crucial evidence of a tie between electric power lines and cancer," wrote reporter William Broad. "If he hadn't gotten these results, nobody would have paid any attention," an anonymous government investigator was quoted as saying. According to the *Times,* Dr. Robert Park, a lobbyist for the American Physical Society, "said Dr. Liburdy's deception was probably typical for the field."

The *Times* article was picked up by many other papers across the country, often appearing on the front page. An Associated Press story ran in the *Wall Street Journal,* the *Washington Post,* and elsewhere.

The next week opinion pieces began to appear. In the *Wall Street Journal* (July 27), Dr. Elizabeth Whelan of the American Council on Science and Health, based in New York City, wrote that in the disputed studies, Liburdy "claimed to have identified a possible mechanism by which EMFs caused cancer" and called this "a new low in the annals of junk science." On July 26, *Times* columnist William Safire complained that Liburdy "avoids prosecution by not contesting these [government] findings, though he admits nothing."

On July 28, Liburdy and Park appeared together on a public radio talk show on New York's WNYC. Responding to the media frenzy, Liburdy noted that his calcium experiments were not cancer studies. "He's absolutely correct on that," commented Park.

In a July 31 letter to the editor of the *Times,* Dr. Daniel Wartenberg of the Environmental and Occupational Health Sciences Institute in Piscataway, NJ, pointed out that concern over EMFs and cancer "is primarily a result of epidemiological studies that show an association between childhood cancer and power lines, not cell biology research."

Opposing Views of a Contested Liburdy Graph

ORI's case against Dr. Robert Liburdy is complex and not easily summarized. Below is a review of key arguments that have raged over one of the three graphs that Liburdy has agreed to retract (Figure 12 of his 1992 paper in *Annals of the New York Academy of Sciences)*. The graph shows changes in calcium within blood cells exposed to EMFs.

An analysis by ORI lawyers, obtained by *Microwave News* under the Freedom of Information Act, contends that in Figure 12: a) Liburdy selected data that supported his hypothesis and discarded the rest; and b) He fabricated parts of the curves. The document claims that this created an EMF–calcium effect not supported by the data. Liburdy vehemently denies these charges.

"Liburdy simply chose data points to express his desired experimental outcome," according to the analysis. It stresses that Liburdy graphed "less than 7.1% of his full data set."

"I could not graph hundreds of calcium data points since I did not have the software to do this in 1991," Liburdy told *Microwave News*. He added that he used more like 15% of the data. While Liburdy said that he sampled "at about 33-second intervals," ORI's analysis contends that he did not sample "systematically, uniformly or even randomly." It states that his selected data were "often clumped in groups of two and three," citing examples separated by 4, 11 and 15 seconds.

"I sampled at shorter intervals where the data were changing rapidly—for example, after the addition of Con A" (which induces cell division), responded Liburdy. This was simply "good experimental design," he said. Liburdy insisted that there was "no overall intent to 'clump' data to distort the findings."

ORI staff further assert that when the full data set is graphed, the variation, or scatter, is larger than any calcium response. They allege that by picking and choosing the data he wanted, Liburdy "manufactured" a calcium response.

Liburdy does not deny that the scatter in his full data set may be larger than any calcium response, or that this is not reflected in the graph. But he rejects the accusation that this was intentional. "The data sampling took place without knowing what the curves would look like, and was done only once," Liburdy said. "ORI analyzed my large data set with 1998-1999 software they knew was not available to me in 1991."

ORI staff also claim that, for one curve, there is physical evidence that Liburdy "rejected and erased data that contradicted the desired results."

"Like any normal person, I made some errors in plotting data points onto a graph with multiple axes," said Liburdy. "Occasionally I erased errors and replotted data. It is appalling to try to attach some other significance to this normal behavior."

Liburdy and the ORI analysis do agree that parts of the curves are not based on actual measurements, but disagree over what this means. The curves show a series of small jagged spikes, with peaks and valleys at intervals of 2-3 seconds—although the data points sampled by Liburdy are on average over 30 seconds apart. This "noise" was hand-drawn by Liburdy.

ORI's analysis says simply that, "Dr. Liburdy falsified the fluctuations in the traces shown in Figure 12," and stresses that the actual "noise" in Liburdy's full data set is much larger.

The 1995 LBL investigation also looked at this issue, concluding, "Liburdy's fabrication of the data noise is not a case of merely processing the results for better readability, but is at the level of tampering with the results in order to mislead the reader."

Liburdy maintains that the size of the fluctuations he drew was based on the observed level of noise. He said that one of the experts whom he had asked to review his data, Dr. Carl Blackman of the EPA, said that while Liburdy should have graphed the individual data points, his "line wiggles" do in fact match the extent of the scatter that Liburdy observed.

Liburdy's overriding defense is that his conclusions are supported not only by Figure 12, but also by a second assay, using calcium-45. "This calcium-45 data has not been challenged and it fully supports my scientific conclusions," he said.

The LBL investigation found that there had been no misconduct after it examined one of the calcium-45 graphs in Liburdy's 1992 paper in *FEBS Letters*. "We generally agree with his average values," LBL concluded. The ORI report does not challenge any of Liburdy's calcium-45 work.

NIEHS EMF RAPID Report to Congress *(continued from p.1)*

The NIEHS report was greeted with widespread approval as an evenhanded summary of the existing state of knowledge. "It's a good report," said Dr. Maria Feychting of the Karolinska Institute in Stockholm, Sweden. Dr. Antonio Sastre of the Midwest Research Institute in Kansas City, MO, called it "fair and balanced." Both Feychting and Sastre were on the 30-member working group assembled by the NIEHS last summer to review the EMF literature, which concluded that extremely low frequency (ELF) EMFs should be classified as "possible human carcinogens" (see *MWN,* J/A98).

The Environmental Protection Agency (EPA) reached a conclusion similar to that of the working group in 1990 (see *MWN,* M/J90). But Dr. Robert McGaughy, who drafted the EPA analysis, said "I would not have used the word 'weak'." He told *Microwave News* that, "I would have emphasized the consistency of the epidemiology, as is pointed out in the report."

On the other hand, the National Electrical Manufacturers Association (NEMA), based in Rosslyn, VA, questioned why EMFs should be regarded as possible carcinogens based only on limited epidemiological evidence.

How To Order the NIEHS Report

A copy of the NIEHS report, *Health Effects from Exposure to Power Line Frequency Electric and Magnetic Fields* (Publication No.99-4493), is available on the Internet at: <www.niehs.nih.gov/emfrapid>. Printed copies are available from: EMF RAPID Program, NIEHS, PO Box 12233, Research Triangle Park, NC 27709, (919) 541-7534, Fax: (919) 541-0144, E-mail: <emf-rapid@niehs.nih.gov>.

The NIEHS report comes at the end of the RAPID six-year research program mandated by Congress in 1992 (see *MWN,* S/O 92). The institute received $30 million from the federal government and industry for RAPID health research and public education. The institute also contributed approximately $14 million of its own funds for EMF research. RAPID had originally been designed to be a $65 million program.

Some observers were pleasantly surprised by the report's conclusions. Last December, a group of institute staffers circulated a draft summary of federally funded EMF research, which dismissed the possibility of EMF health risks. This was seen as an indication of what would be in Olden's report to Congress (see *MWN,* J/F99). Shirley Linde, the chair of the National EMF Advisory Committee set up by Congress to monitor the RAPID program, said that she was "pleased, surprised and even amazed" by Olden's report. Linde lives in Los Angeles.

The report that was sent to Congress is seen as a compromise within the NIEHS between those who put the most emphasis on the animal studies, which have been largely negative, and those who argued that the human studies cannot be discounted.

The evidence linking EMFs to childhood leukemia and occupational chronic lymphocytic leukemia "cannot be dismissed as random," said Dr. Christopher Portier, the associate director of NIEHS' Environmental Toxicology Program and the principal author of the NIEHS report. (See also p.11.)

The report's endorsement of a national policy of prudent avoidance also received broad support. "The call for prudent avoidance without excessive regulation is appropriate," Dr. David Carpenter of the State University of New York's School of Public Health in Albany told *Microwave News.* Carpenter was the director of the New York Power Line Project in the 1980s.

"It's good customer relations," commented Robert McCourt, the EMF issue manager at Public Service Electric and Gas Co. in Newark, NJ. McCourt added, however, that prudent avoidance is sometimes "hard to define" and that is why the utility "does not formally embrace it."

"The more sophisticated utilities have been practicing prudent avoidance for many years—since 1989, shortly after the OTA report was released," said Thomas Watson of Watson & Renner, a Washington law firm. Watson represents the Utility Health Sciences Group, which includes over 100 companies in the U.S., Australia, Canada and the U.K.

The NIEHS report specifically encourages "manufacturers of household and office appliances to consider alternatives that reduce magnetic fields at a minimal cost." NEMA's Douglas Bannerman told *Microwave News* that, "We are examining what that means for our products."

With the end of the RAPID program and the shutdown of the Department of Energy's EMF research program, the federal government, including the NIEHS, will no longer set aside any money specifically for EMF research.

The NIEHS stated, however, that it "will continue to support research in this area" through "carefully designed, hypothesis-driven studies." It cited a number of specific areas that warrant attention, including possible EMF links to cardiovascular and neurodegenerative diseases, as well as studies, first performed by Dr. Robert Liburdy (see also p.1), showing that EMFs can offset the beneficial effects of melatonin and tamoxifen.

In addition, the NIEHS concluded that, "More remains to be learned about the physics of magnetic field interactions with biological systems."

EMF researchers were disappointed that directed research will not continue. "Because we do not understand the basic mechanisms of interaction, it is very difficult to make any type of judgment on risk," Dr. Mats-Olof Mattsson of Sweden's Örebro University told *Microwave News*. Mattson, president-elect of BEMS (see p.17), said that he would have liked to have seen "money specifically targeted for hypothesis-driven EMF research."

The only remaining directed research effort is that of the electric utility industry, through EPRI, which is based in Palo Alto, CA. Dr. Leeka Kheifets, the manager of EPRI's EMF program, declined to comment on the NIEHS report.

One more report on the RAPID program is required by Congress. The Interagency Advisory Committee will issue its evaluation of the NIEHS report. Dr. Michael Marron of the Office of Naval Research in Arlington, VA, said that he is planning to have a draft of the committee's report completed by early September and to release the full report by the end of the year.

Last spring, the National Academy of Sciences issued a critical report on the RAPID program which argued that there is no need for a new EMF health effects program (see *MWN,* M/J99).

Excerpts from the Report

"The lack of connection between the human data and the experimental data (animal and mechanistic) severely complicates the interpretation of these results. The human data are in the 'right' species, are tied to 'real life' exposures and show some consistency that is difficult to ignore. This assessment is tempered by the observation that given the weak magnitude of these increased risks, some other factor or common source of error could explain these findings. However, no consistent explanation other than exposure to ELF–EMF has been identified...."

"The NIEHS concludes that ELF–EMF exposure cannot be recognized at this time as entirely safe because of weak scientific evidence that exposure may pose a leukemia hazard. In our opinion, this finding is insufficient to warrant aggressive regulatory concern. However, because virtually everyone in the United States uses electricity and therefore is routinely exposed to ELF–EMF, passive regulatory action is warranted...."

NIEHS: Recommended Actions

- The power industry should continue the practice of siting power lines to reduce exposures and continue to explore ways to reduce the creation of magnetic fields around transmission and distribution lines without creating new hazards.
- U.S. electric utility companies should continue the practice of measuring EMFs in their customers' homes and of helping them identify sources of high fields.
- Manufacturers of household and office appliances should consider alternatives that reduce magnetic fields at a minimal cost.
- NIOSH and OSHA should evaluate whether EMF exposure standards for workers are adequate.

NIEHS' Dr. Christopher Portier Talks with Microwave News

In July, Microwave News *chatted with NIEHS' Dr. Christopher Portier, the principal author of the RAPID report to Congress.*

MWN: The NIEHS report concludes that there is only weak evidence of an EMF health risk. Can you put EMFs in the context of other environmental health risks?

CP: There is widespread public exposure to ELF EMFs, which is also true of dioxins and fine particulate air pollutants. But the strength of evidence for a hazard from ELF EMFs is much weaker than that for dioxin, where there is both animal and human evidence. It is similar to that for Atrazine, the most widely used herbicide in the U.S. and the world, for which there is only limited evidence for carcinogenicity in humans and an ongoing controversy over the interpretation of the animal data.

MWN: The Mary McBride childhood leukemia epidemiological study, showing no EMF–cancer link, was published on May 1, as the NIEHS was completing its report. Did it influence your final conclusions?

CP: We made some changes after the release of the McBride study. Initially, we were going to weaken our conclusions because of her 48-hour exposure results. But then we asked McBride for the unpublished analysis of her 24-hour data and we saw that her results were not inconsistent with previous findings. The 24-hour data show nonsignificant adjusted odds ratios of 1.18 in the 75th to 90th percentile exposure group and 1.27 in the top 10% exposure group. So we decided to leave our overall conclusions intact.

MWN: And then on the same day that your report was released, Canada's Dr. Lois Green announced that she had found the highest EMF–leukemia risks ever reported. For children who were less than six years old, the odds ratio was 5.7. Were you surprised by her results?

CP: No. Dr. Green had kindly given me a copy of her results a week before the release of our report. They were interesting, but she used a unique way of looking at the data which does not allow direct comparison with previous studies. The analysis of all the children was not remarkably different from what has been reported in the past for 24-hour field measurements, but was very different from what McBride saw with 48-hour measurements. Basically, besides the one analysis for the under six-year-old group, this study was consistent with the associations we have been seeing. I hope this analysis for young children will be repeated by the authors of the other childhood leukemia studies.

MWN: You have said that the association between EMF exposure and childhood and occupational leukemias "cannot be dismissed as random." What kind of data would it take to convince you otherwise?

CP: At the least, it would take a better understanding of the risk factors for these leukemias—especially those which might have misled us into concluding that EMFs can lead to leukemia. In other words, we would need to find specific confounders in the existing studies that could explain away the link to EMFs. But I should add that many people have looked for such missing confounders and have failed. A new study that is similar to existing ones would be unlikely to alter the current view.

MWN: On the other hand, which would do more to convince you that there is definitely an EMF cancer risk: stronger epidemiological evidence or confirmation from animal studies?

CP: Clearly, confirmation from animal studies would carry the greater weight. These studies would be free of many of the problems that have clouded the epidemiological studies. With an animal model, we could plan in-depth, mechanistic studies on the role ELF EMFs may be playing in the development of disease.

MWN: In the cover letter to his report, Dr. Olden makes the point that the human data "are tied to 'real-world' exposures." Is it possible that the reason many of the human and animal studies have been inconsistent is that the electromagnetic environment in the real world is more complex than simple 60 Hz EMFs?

CP: This is always a possibility. The debate over whether to use real-world or simpler laboratory exposures has raged for many years on both chemical and physical environmental agents. The very few studies that have used real-world or mixed-field ELF EMF exposures have had similar contradictory results. If I had to choose a reason for the discrepancy, this would not be my choice.

MWN: What would be your top pick?

CP: There is no single top pick. There are two possibilities. The epidemiology is wrong or, alternatively, the laboratory data are wrong. If I had to choose one reason why the epidemiology data might be wrong, it is that we do not yet understand leukemia very well. As for the animal data, the inconsistencies may be due to genetic variations in strains and/or species. There are of course other possibilities.

MWN: As you know, there is a near infinite variety of EMFs in the real world. Could the epi findings be due to particular types of EMFs, such as high frequency transients "contaminating" power line fields in the real world, but to which experimental animals are not exposed?

CP: I do not have any data to support such a contention. It is true, however, that there are many examples of confounders misleading the epidemiology. For instance, aflatoxin appears to be a powerful liver carcinogen, but when you take into account the action of hepatitis-B virus, the aflatoxin effect gets much weaker. Also, in animal studies the type of species exposed can determine the result you see. Take arsenic for example: We knew for a long time that it is a human carcinogen, but all the animal studies were negative. Then someone tried a transgenic strain of mice and confirmed that arsenic is also an animal carcinogen. Later, another team saw the cancer effects in a second mouse strain.

MWN: Another aspect of high frequency transients is that the amount of EMF delivered varies over time, with some intermittent high levels.

CP: This could conceivably be a problem. One of the major flaws with the way we do toxicological testing is that we usually use continuous, lifetime exposures and seldom study peaks or other types of doses.

MWN: The report points to two potentially important noncancer EMF health areas: Alzheimer's and heart disease. Which of these (or any others) would you most like to see addressed in future studies?

CP: My choice would be Alzheimer's disease. While the theoretical basis for a possible link to heart disease is a bit more solid, a better understanding of Alzheimer's is a priority for the NIH and we could learn a lot by simply adding on to existing studies.

MWN: Most of the attention has been on general public exposures to EMFs. Do you think there should be more concern over occupational exposures, which are usually higher?

CP: The focus of the NIEHS is on general environmental exposures and our concern is for the general public. While occupational exposures were of interest in our analysis since they can provide dose-response data, this question is better answered by the experts at NIOSH.

MWN: The RAPID program is now over and there are no funds set aside for EMF research. The NIEHS states in its report that the institute "will continue to support research in this area" but it is also clear that this field will have to compete with all other environmental agents for a piece of the research pie. Wouldn't it be wise to earmark some money for EMF research so that we do not lose the expertise we have developed over the last six years on an agent to which we are *all* exposed?

CP: Most scientists are in favor of more money for research in every field; this one is no different. The NIEHS has no special program for UV radiation, dioxins, arsenic, fine particulates, low-level ozone and many other environmental agents with similar widespread exposure.

New Canadian Epi Study Points To Risk Among Young Children

Young children's exposures to power frequency EMFs are associated with significantly elevated risks of leukemia in a new study from Canada. The increases are the largest to date for magnetic fields and childhood cancer, using personal measurements. There was no increased risk based on wire codes.

"As exposure assessment is refined, the possible role of magnetic fields in the etiology of childhood leukemia becomes more evident," concludes Dr. Lois Green of the University of Toronto, writing in the June issue of *Cancer Causes and Control (10,* pp. 233-243, 1999). Ontario Hydro funded the study.

Led by Green, a team at the university and at the Hospital for Sick Children in Toronto had 88 children with cancer and 133 controls wear Positron meters for two days to monitor their EMF exposures. The leukemia risk of children in the highest exposure group was 4.5 times higher, after adjusting for possible confounders, than that of children in the least-exposed group—a statistically significant difference.

One of the study's most striking findings was the difference in risk between younger and older children. For children less than six years old at the time of diagnosis and with average exposures over 1.4 mG, the risk was 5.7 times higher than for those with exposures of less than 0.3 mG, a statistically significant difference. The corresponding risk ratio among older children was a nonsignificant 1.6.

Green and coworkers suggest that the greater risk in younger children may reflect a greater susceptibility to EMFs. But they also note that younger children in the study had spent more of their lives in one residence than had older children. As a result, they write, measurements for younger children may be "a better representation of the exposure received during the relevant etiologic time period."

For 201 children with cancer and 406 controls, the team estimated current and past residential EMF levels with spot measurements. In a second paper, which appears in the *International Journal of Cancer (82,* pp.161-170, 1999), they report finding a nonsignificant, 50% risk increase for the most-exposed of these children, compared to the least-exposed.

The team found no increase in risk associated with proximity to high-current wiring as identified by each of three methods: the Wertheimer-Leeper codes, the Savitz-Kaune codes and a modified version of the Wertheimer-Leeper scheme. "We know from our study that wire code is not a good estimator of exposure," Green told *Microwave News.*

The new study follows the release, last spring, of a similar study of EMFs and childhood cancer in other parts of Canada, which found little or no evidence of increased risk (see *MWN,* M/J99). In an interview, Mary McBride of the British Columbia Cancer Agency in Vancouver, the study's leader, said she was "a little surprised" by the new findings.

As a possible explanation for the two studies' divergent results, McBride noted that her group identified cases as they were diagnosed, while the Toronto team drew on cases reported to the children's cancer registry of the Hospital for Sick Children from 1985 through 1993, and was prospective only for the last two years of this period. As a result, the average time between diagnosis and exposure assessment was nearly two years shorter for the 399 children with cancer and 399 controls in the McBride study.

Green and coworkers assigned the cases and controls to four exposure groups, drawing the cutpoints between exposure levels so that the controls were divided into quartiles. The lowest exposure group comprised children with personal readings of less than 0.3 mG, and the highest had exposures of 1.4 mG and above.

Green maintains that the cutpoints used in previous studies result in smaller high exposure groups, which are more prone to error: "The potential for exposure misclassification is greatest at the highest levels," she noted.

Long Delayed, NCRP ELF Report Due at the End of the Year

The National Council on Radiation Protection and Measurements (NCRP) will release a draft of its long-awaited report on the potential health effects of extremely low frequency (ELF) EMFs by the end of the year, according to Dr. Charles Meinhold, the president of the council. The report was submitted for review to the council in June 1995 and the NCRP has had little to say about its status since then.

"We are making rapid progress in resolving the review process," Meinhold said in a talk at the annual meeting of the Bioelectromagnetics Society in Long Beach, CA, on June 22. He explained that the sticking point was "how to handle the recommendations in the report."

The committee that wrote the report endorsed a 2 mG exposure limit, which would take immediate effect for new day care centers, schools and playgrounds, as well as new transmission lines near existing housing (see *MWN,* J/A95). For existing electrical facilities, the committee recommended that restrictions be phased in over time.

The NCRP never released the committee's draft, which was completed in 1995. A copy was obtained by *Microwave News,* which published its conclusions (see *MWN,* J/A95). The committee's recommendations were widely reported by the popular media.

This July, the committee was still working on its revised draft. "We agreed that we would not discuss recommendations until the report is completed," the chair of the committee, Dr. Ross Adey told *Microwave News*. Adey, who is now at the University of California, Riverside, said that his committee would consider the most recent published papers in its latest revision.

Dr. Thomas Tenforde of the Battelle Pacific Northwest Labs in Richland, WA, who is an NCRP scientific vice president on non-ionizing radiation, explained in an interview that an initial review of the draft by 25 experts was completed in 1995. Adey noted that the panel had incorporated the suggestions from these reviewers in subsequent drafts.

The Environmental Protection Agency first requested the ELF report from the council 16 years ago (see *MWN,* N/D83).

U.S. Government Group Identifies 14 Issues To Be Addressed in Revision of ANSI/IEEE RF/MW Exposure Standard

On June 17, 1999, Dr. Gregory Lotz of the National Institute for Occupational Safety and Health (NIOSH) wrote to Richard Tell, the chair of the Institute of Electrical and Electronics Engineers' (IEEE) SCC-28 Subcommittee 4 Risk Assessment Work Group, to identify "certain issues that we believe need to be addressed to provide a strong and credible rationale to support RF exposure guidelines." Lotz, the chief of the Physical Agents Effects Branch at NIOSH in Cincinnati, was writing on behalf of the federal government's Radiofrequency Interagency Work Group (RFIAWG).

SCC-28 is developing a complete revision of the C95.1 exposure standard, which was approved by the IEEE in 1991 and by the American National Standards Institute (ANSI) in 1992 (see MWN, *N/D91 and N/D92). The guidelines were updated earlier this year (see* MWN, *M/J99). Tell's working group has been asked to "assess and characterize the potential risks to human health and safety" from exposure to EMFs of less than 300 GHz. Tell is a consultant based in Las Vegas.*

In addition to Lotz, the other members of the RFIAWG are: Dr. Robert Cleveland, Federal Communications Commission, Washington; Robert Curtis, Occupational Safety and Health Administration, Salt Lake City; Dr. Joseph Elder, Environmental Protection Agency (EPA), Research Triangle Park, NC; Janet Healer, National Telecommunication and Information Administration, Washington; Norbert Hankin, EPA, Washington; Dr. Russell Owen, Food and Drug Administration, Rockville, MD. Lotz noted that, "No particular priority is ascribed to the order in which the issues are listed" and that, "The views expressed...are those of the members of the RFIAWG and do not represent the official policy or position of the respective agencies."

Reprinted below are extended excerpts of the RFIAWG's RF Guidelines Statement.

Biological Basis for Local SAR Limit

The C95.1 partial body (local) exposure limits are based on an assumed ratio of peak to whole body SAR; that is, they are dosimetrically, rather than biologically based. Instead of applying a dosimetric factor to the whole body SAR to obtain the local limits, an effort should be made to base local SAR limits on the differential sensitivity of tissues to electric fields and temperature increases. For example, it seems intuitive that the local limits for the brain and bone marrow should be lower than those for muscle, fat and fascia; this is not the case with the current limits which implicitly assume that all tissues are equally sensitive (except for eye and testicle)....

Selection of an Adverse Effect Level

Should the thermal basis for exposure limits be reconsidered, or can the basis for an unacceptable/adverse effect still be defined in the same manner used for the 1991 IEEE guidelines? Since the adverse effect level for the 1991 guidelines was based on acute exposures, does the same approach apply for effects caused by chronic exposure to RF radiation, including exposures having a range of carrier frequencies, modulation characteristics, peak intensities, exposure duration, etc., that does not elevate tissue temperature on a macroscopic scale?...

Acute and Chronic Exposures

There is a need to discuss and differentiate the criteria for guidelines for acute and chronic exposure conditions. The past approach of basing the exposure limits on acute effects data with an extrapolation to unlimited chronic exposure durations is problematic. There is an extensive data base on acute effects....For lower level ("nonthermal"), chronic exposures, the effects of concern may be very different from those for acute exposure (e.g., epigenetic effects, tumor development, neurologic symptoms)....If the chronic exposure data are not helpful in determining a recommended exposure level, then a separate rationale for extrapolating the results of acute exposure data may be needed....[A] clear rationale needs to be developed to support the exposure guideline for chronic as well as acute exposure.

One-Tier vs. Two-Tier Guidelines

A one-tier guideline must incorporate all exposure conditions and subject possibilities (e.g., acute or chronic exposure, healthy workers, chronically ill members of the general public, etc.). A two-tier guideline, as now exists, has the potential to provide higher limits for a specific, defined population (e.g., healthy workers) and exposure conditions subject to controls, while providing a second limit that addresses greater uncertainties in the data available (about chronic exposure effects, about variations in the health of the subject population, etc.)....

Controlled vs. Uncontrolled (Applicability of 2 IEEE Exposure Tiers)

The current "controlled" and "uncontrolled" definitions are problematic, at least in the civilian sector, particularly since there are no procedures defined in the document to implement the "controlled" condition. The new guidelines should offer direction for the range of controls to be implemented and the training required for those who knowingly will be exposed (e.g., workers), along the lines of the existing ANSI laser safety standards.... [I]f it is determined that certain populations (due to their health status or age) are more susceptible to RF exposures, then a multitiered standard, applicable only to those specific populations, may be considered....

Uncertainty Factors

The uncertainties in the data used to develop the guideline should be addressed. An accepted practice in establishing human exposure levels for agents that produce undesirable effects is the application of factors representing each area of uncertainty inherent in the available data that was used to identify the unacceptable effect level. Standard areas of uncertainty used in deriving acceptable human dose for agents that may produce adverse (but noncancer) effects include: 1) extrapolation of acute effects data to chronic exposure conditions; 2) uncertainty in extrapolating animal data to humans in prolonged exposure situations; 3) variation in the susceptibility (response/sensitivity) among individuals; 4) incomplete data bases; 5) uncertainty in the selection of the effects basis, inability of any single study to adequately address all possible adverse outcomes. If guidelines are intended to address nonthermal chronic exposures to intensity modulated RF radiation, then how could uncertainty factors be used; how would this use differ from the historical use of uncertainty factors in establishing RF radiation guidelines to limit exposure to acute or sub-chronic RF radiation to prevent heat-related effects? There is a need to provide a clear rationale for the use of uncertainty factors.

Pulsed (Intensity) or Frequency-Modulated RF Radiation

Studies continue to be published describing biological responses to nonthermal ELF-modulated and pulse-modulated RF radiation exposures that are not produced by CW (unmodulated) RF radiation. These studies have resulted in concern that exposure guidelines based on thermal effects, and using information and concepts (time-averaged dosimetry, uncertainty factors) that mask any differences between intensity-modulated RF radiation exposure and CW exposure, do not directly address public exposures, and therefore may not adequately protect the public. The parameter used to describe dose/dose rate and used as the basis for exposure limits is time-averaged SAR; time-averaging erases the unique characteristics of an intensity-modulated RF radiation that may be responsible for producing an effect. Are the results of research reporting biological effects caused by intensity-modulated, but not CW exposure to RF radiation sufficient to influence the development of RF exposure guidelines? If so, then how could this information be used in developing those guidelines?...

Time Averaging

Time averaging of exposures is essential in dealing with variable or intermittent exposure, e.g., that arising from being in a fixed location of a rotating antenna, or from moving through a fixed RF field. The 0.1 h approach

historically used should be reassessed, but may serve this purpose adequately. Time averaging for other features of RF exposure is not necessarily desirable, however, and should be reevaluated specifically as it deals with modulation of the signal, contact and induced current limits, and prolonged, or chronic exposure....If prolonged and chronic exposures are considered to be important, then there should be a reconsideration of the time-averaging practices that are incorporated into existing exposure guidelines and used primarily to control exposure and energy deposition rates in acute/subchronic exposure situations.

Lack of Peak (or Ceiling) Limits for Induced and Contact Current

A recent change in the IEEE guidelines allows for 6-minute, rather than 1-second, time-weighted-averaging for induced current limits. This change increases the concern about the lack of a peak limit for induced and contact currents....

Criteria for Preventing Hazards Caused by Transient Discharges

The existing IEEE recommendation states that there were insufficient data to establish measurable criteria to prevent RF hazards caused by transient discharges. If specific quantitative criteria are still not available, can qualitative requirements be included in the standard to control this hazard (e.g., metal objects will be sufficiently insulated and/or grounded, and/or persons will utilize sufficient insulating protection, such as gloves, to prevent undesirable transient discharge)?

Limits for Exposure at Microwave Frequencies

Concerns have been expressed over the relaxation of limits for continuous exposures at microwave frequencies above 1500 MHz. The rationale provided in the current guideline references the fact that penetration depths at frequencies above 30 GHz are similar to those at visible and near infrared wavelengths and that the literature for skin burn thresholds for optical radiation "is expected to be applicable." The rationale then implies that the MPE limits at these high frequencies are consistent with the MPE limits specified in ANSI Z136.1-1986 for 300 GHz exposures. This is apparently the rationale for "ramping up" to the MPE limits for continuous exposure of 10 mW/cm^2 at frequencies above 3 GHz (controlled) or 15 GHz (uncontrolled). The rationale should be given as to why this ramp function has been established at relatively low microwave frequencies (i.e., 1500 MHz and above), rather than being implemented at higher frequencies that are truly quasi-optical....

Replication/Validation

Published peer-reviewed studies that have been independently replicated/validated should be used to establish the adverse effects level from which exposure guidelines are derived. The definition of "replicated/validated" should not be so restrictive to disallow the use of a set of reports that are scientifically valid but are not an exact replication/validation of specific experimental procedures and results. Peer-reviewed, published studies that may not be considered to be replicated/validated, but are well done and show potentially important health impacts provide important information...

Important Health Effects Literature Areas

Documentation should be provided that the literature review process included a comprehensive review of the following three areas: 1) long-term, low-level exposure studies...; 2) neurological/behavioral effects...; 3) micronucleus assay studies (because of their relevance to carcinogenesis).

Compatibility of RFR Guidelines

Compatibility of national and international RFR guidelines remains a concern. It is important for the IEEE Committee to address this issue by identifying and discussing similarities and differences in a revised IEEE guideline and other RFR guidelines....

Hot New Papers

Jolanta Kliukiene, Tore Tynes, Jan Martinsen, Karl Blaasaas and Aage Andersen, "Incidence of Breast Cancer in a Norwegian Cohort of Women with Potential Workplace Exposure to 50 Hz Magnetic Fields," ***American Journal of Industrial Medicine, 36,*** **pp.147-154, July 1999.**

"The main finding in our study is the increased risk shown for breast cancer among women potentially exposed to EMFs at the workplace, and also after adjustment for age at first birth....The present large population-based study, which does not contain selection or information bias, gives some support to the hypothesis that exposure to 50 Hz magnetic fields may increase the risk of breast cancer. However, since we had no direct information on exposures, the results should be interpreted with caution."

Torbjörn Åkerstedt, Bengt Arnetz, Gianluca Ficca, Lars-Erik Paulsson and Anders Kallner, "A 50 Hz Magnetic Field Impairs Sleep," ***Journal of Sleep Research, 8,*** **pp.77-81, March 1999.**

"Clearly, sleep was affected by the low frequency [1 ∝T (10 mG)] EMF. The reductions of [total sleep time] and sleep efficiency suggest a slight disturbance....Considering that the present experiment is the first of its kind and that the issue of EMF effects is sensitive, one needs to carefully consider possible confounders....We feel confident in concluding that the effects must have been caused by the EMF influences on the sleep process. It should be emphasized that, even if significant effects were observed, the absolute levels are still within the range of normal sleep values, and far from clinical significance. Conversely, the present study used healthy subjects, only one night of exposure and rather moderate intensity. However, patient groups might be more sensitive and it is conceivable that increased intensity of the field or of duration of exposure might yield larger effects. This remains to be demonstrated."

Charles Graham and Mary Cook, "Human Sleep in 60 Hz Magnetic Fields," ***Bioelectromagnetics, 20,*** **pp.277-283, 1999.**

"Human volunteers exposed during night sleep to an intermittent, circularly polarized magnetic field (60 Hz, 28.3 ∝T [283 mG]) exhibited statistically significant alterations in traditional EEG sleep parameters (less total sleep time, reduced sleep efficiency, increased time in Stage II sleep and decreased REM sleep). Volunteers in the intermittent exposure group also reported sleeping less well and feeling less rested in the morning. These effects were not found in the group continuously exposed to the same magnetic field or in the sham exposure control group....Little is known about possible biological mechanisms that could provide the necessary link between exposure to ELF fields and sleep regulatory systems in the brain. A biophysically plausible hypothesis is that the electric field induced in the brain by the 60 Hz magnetic field is able to modulate the activity of cortical neurons....In other words, exposure to a 60 Hz magnetic field at the flux density used in the present study could induce a unique electric field 'signal' in the brain, one not easily confused with the endogenous fields....A second possible mechanism can be derived from the 'melatonin hypothesis' developed by [Dr. Richard] Stevens." (See also *MWN,* N/D97.)

Paul Héroux, "The ELF Health Effects Olympics" (invited editorial), ***Annals of Occupational Hygiene, 43,*** **pp.217-219, 1999.**

"I was working in a power utility research facility in 1972 when our managers returned from the CIGRÉ [International Conference on Large High Voltage Electric Systems] in London, where the Soviets had first reported neurological disturbances in workers exposed to high-intensity electric fields. Statements were made that these reports were an attempt by the Soviets to slow the development of Western technol-

EMF Bioassays: No Effects

Gary Boorman, David McCormick et al., "Chronic Toxicity/Oncogenicity Evaluation of 60 Hz (Power Frequency) Magnetic Fields in F344/N Rats," ***Toxicologic Pathology, 27,*** **pp.267-278, May-June 1999.**

"Long-term animal studies are expensive, time-consuming and may be relatively insensitive as a mechanism to identify weak carcinogens. However, when considered together, long-term exposure of rodents to power frequency magnetic fields that are 5,000- to 10,000-fold (the present study), 10,000- to 20,000-fold [Mandeville et al., 1997] and 50,000- to 100,000-fold [Yasui et al., 1997] higher than field levels that are routinely encountered in residential environments has demonstrated no pattern of increased cancer risk. These data, when considered as a whole, provide little or no evidence that exposure to pure 60 Hz linear magnetic fields at up to 10 G field intensities for up to 2 yr can affect neoplastic development in the F344/N rat."

David McCormick, Gary Boorman et al., "Chronic Toxicity/Oncogenicity Evaluation of 60 Hz (Power Frequency) Magnetic Fields in B6C3F$_1$ Mice," ***Toxicologic Pathology, 27,*** **pp.279-285, May-June 1999.**

"The results of this study provide no evidence of increased cancer incidence in male and female B6C3F$_1$ mice exposed (for 2 yr) continuously to pure, linearly polarized 60 Hz magnetic field strengths of 20 mG, 2 G or 10 G, or intermittently to the same 10 G fields. The mouse results are similar to the results of our parallel study in rats [see above], to the results of a Canadian study in which female rats were exposed to 60 Hz magnetic fields at up to 20 G [Mandeville et al., 1997] and to results of a Japanese study in which rats were exposed to 50 Hz magnetic field intensities of up to 50 G [Yasui et al., 1997]. When considered together, these long-term animal studies provide no evidence to support the hypothesis that magnetic field exposure is a significant risk factor for human cancer."

For more on the Mandeville and Yasui studies, see MWN, *J/F98. For more on the two two-year bioassays, see* MWN, *M/A98.*

ogy!...When the Soviet reports appeared, electrical engineers rapidly polarized into two groups: skeptics and believers....It was amazing how early the lines were drawn and how unyielding both sides remained."

Martha Linet et al., "Cancer Surveillance Series: Recent Trends in Childhood Cancer Incidence and Mortality in the United States," ***Journal of the National Cancer Institute, 91,*** **pp.1,051-1,058, June 16, 1999.**

"In summary, there were no consistent large increases or decreases in incidence for the major categories of cancer among children aged 0-14 years during 1975 through 1995, based on data from the nine long-standing registries in the SEER [Surveillance, Epidemiology and End Results] program. The modest increases for childhood CNS cancers, leukemias and infant neuroblastomas were confined to short intervals in the mid-1980s. This pattern suggests that the increase likely reflected reporting or diagnostic changes rather than effects of environmental influences. The short-term jump in CNS tumors in the geographic areas covered by the SEER program registries has been ascribed to preceding developments in diagnostic technology, new neurosurgical procedures and classification changes. However, it is not apparent what specific diagnostic, reporting or classification changes account for the abrupt jump from 1983 to 1984 in leukemia rates or the increase during the mid-1980s for adrenal neuroblastomas."

Werner Irnich and Rolf Tobisch, "Mobile Phones in Hospitals," ***Biomedical Instrumentation and Technology,*** **pp.28-34, January-February 1999.**

"Four devices (two apnea monitors, two respirators) of 224 investigated devices proved to experience interference caused by mobile phones at distances of more than 1 m....Although the walkie-talkie proved to cause the most interference at distances more than 10 m, dangerous situations are normally rare because its use is restricted to short times.... Walkie-talkies in hospitals and in emergency situations should be handled with care, because they are more powerful than hand-held phones. A safety distance from life-saving or life-supporting devices of 1.5 m is sufficient." (See also Irnich and Tobisch's book, *Mobilfunk im Krankenhaus: Einfluß von Mobiltelefonen auf Lebensrettende und Lebenserhaltende Medizintechnik* (Mobile Communications in the Hospital: Influence of Mobile Phones on Life-Saving and Life-Support Medical Technology) Berlin: Schiele und Schön, 1999. Drs. Irnich and Tobisch are with the Institute for Medical Technology at the University of Gießen in Germany.)

"MICROWAVE NEWS" FLASHBACK

Years 15 Ago

• Researchers at the University of Washington report on a five-year study led by Dr. Bill Guy, in which rats exposed to pulsed 2450 MHz radiation at a maximum specific absorption rate (SAR) of 0.4 W/Kg had significantly more malignant tumors than did controls—primarily in their endocrine systems. An independent assessment of the study for the U.S. Air Force calls the findings "provocative."

• For a "very substantial" sum, Stanley Burgis, a former U.S. Army radar technician, settles his suit against Western Electric, which alleged that radiation from its M-33 military radar ruined his vision.

Years 10 Ago

• A report by the congressional Office of Technology Assessment (OTA) concludes that there are "legitimate reasons for concern" about EMF exposures as a possible health hazard, and proposes that risks could be addressed with a policy of "prudent avoidance."

• In response to the OTA's report, an editorial in *Science* by Philip Abelson, the magazine's deputy editor, calls for increased support of research on health effects of EMFs.

• The Soviet Union says that high frequency radio waves beamed at its embassy in London may have caused the deaths of two Soviet citizens. The U.K. government denies the charge.

Years 5 Ago

• Implanted cardiac pacemakers are vulnerable to electromagnetic interference from mobile phones, researchers in Switzerland and in Italy report at a conference in Copenhagen.

• The EMF exposure standard adopted in 1990 by IRPA (now ICNIRP) is "unethical," says Dr. Indira Nair of Carnegie Mellon University, because it is "the truth, but not the whole truth."

• Dr. Eugene Sobel of the University of Southern California links "medium" and "high" workplace EMF exposures to an increased risk of Alzheimer's disease.

Across the Spectrum

At Motorola's strategic-issues department, director Norm Sandler requests that we all please *relax*. "At the power levels and frequencies of existing cellular phones, there is no established evidence of any biological effects, much less any health effects." [Dr. Ross] Adey [of the University of California, Riverside]: "That is simply not true. Over and over, cell phone fields have produced effects. Industry is lying and lying and lying."

—David Kirkpatrick, "Static? Or Frying Brain Cells?" *Fortune,* p.40, July 5, 1999

#9: Cell phones may be hazardous to your health.

—Michael Kaplan, "Ten Things Your Cell Phone Company Won't Tell You," *Smart Money,* p.138, July 1999

The telecommunications industry poured money into research. Results have been all over the map. Some studies have hinted there might be unhealthful effects. Others are inconclusive. Still others have found no effects....But this is all too familiar. The Beef Industry Council funds research into red meat. "Igor, look! Our experiments! They show T-bone steaks LOWER cholesterol AND make you a hunk, a hunk of burning love! The Nobel is ours!"

—Kevin Maney, "Cell Phones and Cancer: Denial Isn't Just a River in Egypt," *USA Today,* p.3B, July 14, 1999

TEENAGERS AND CELL PHONES: A MATCH MADE IN GAB HEAVEN

—Headline, *New York Times,* p.A1, August 2, 1999

During the past year, several new issues have been raised in the scientific community regarding the link between EMF and health effects. Two results in particular merit closer examination: an epidemiologic study that suggests electrical workers exposed to magnetic fields might have increased risk of acute heart disease and laboratory studies of breast cancer cells that show antagonism to the potential beneficial effects of Tamoxifen and melatonin with exposure to EMF....Plainly, these findings need to be replicated and fully understood. A strongly focused, high-quality research program, similar to EPRI's earlier EMF efforts, should be mounted to address these issues.

—Stephen Peck, vice president, environment division, EPRI, in a letter "To Our Readers" inserted in *EPRI Environment Newsletter,* May 1999

"There is no way to actually protect your children from exposure."

—Dr. Mark Greenberg, Hospital for Sick Children, Toronto, Canada, quoted by Carolyn Abraham in "Scientists Link Magnetic Fields to Leukemia," *Globe and Mail* (Canada), p.A3, June 16, 1999 (see p.12)

"As long as you don't touch the wire, it's okay."

—Ken Hall, Edison Electric Institute, quoted by Bob Pool in "Neighbors Object to Development Below Power Lines," *Los Angeles Times*, p.B5, July 29, 1999

"Get plenty of sleep, use thick blinds to block out stray light and if you need to get up in the middle of the night for any reason, don't turn on a bright light."

—Dr. Russel Reiter, University of Texas Health Science Center, San Antonio, quoted by Kathleen McAuliffe in "Researchers Shine a Night Light on a Possible Link to Cancer," *New York Times,* Special Section on Women's Health, p.22, June 13, 1999

Iridium is looking more like Icarus with each passing day.

—Christian Hill and David Hamilton, "After Lofty Hopes, Iridium Is Falling to Earth," *Wall Street Journal,* p.B1, July 15, 1999

Nancy Wertheimer: You Must Remember This

In studying environmental magnetic field exposures, the exposure assessment problems are formidable. Too often we forget this, and proceed to think of whatever metric a study chooses as if that metric were indeed an accurate reflection of the true historic exposure of interest. That confusion of intent with fact has led some to conclude that risks from magnetic field exposure, "if real, are very small." But this should be understood as a leap of faith.

We need to remember:

- First, that we don't know exactly what to measure;
- Second, that even at best our exposure assessment probably includes considerable random misassignment of exposure, which will null our estimates of any true risk that exists;
- Third, that our hypothetically "unexposed" referent group is, in fact, *always* exposed to a number of unexamined sources of magnetic field, thus further nulling evidence of real risks; and
- Fourth, that magnetic fields may well act only in conjunction with specific cofactors, as some laboratory work has suggested. If so, then only the part of the study population having those cofactors will be at risk from magnetic fields at any given time—still further nulling evidence of any real risk.

Thus in interpreting epidemiologic studies we must stay aware that, while associations based on systematic bias are always possible, and must be guarded against, bias toward a null result is *always* likely in *all* studies. So if the modestly elevated risk ratios that have been repeatedly reported can't be attributed to systematic bias—and so far they haven't been—they are very likely to be *underestimates* of a substantial risk.

—Dr. Nancy Wertheimer, Boulder, CO, in an address on receiving the Bioelectromagnetic Society's d'Arsonval award for "extraordinary accomplishments" at the society's 21st annual meeting, in Long Beach, CA, June 21, 1999 (the full text of her talk will be published in a future issue of *Bioelectromagnetics,* the society's bimonthly journal)

59%: Proportion of Americans who say they would rather visit a dentist than sit next to anyone using a cell phone.

—"Numbers," *Time,* p.19, August 9, 1999

The *New Yorker* can now be counted on to champion the infallibility of U.S. products such as electromagnetic radiation, breast implants and psychoactive drugs.

—Cynthia Cotts, "Press Clips: Spin the Coke Bottle," *Village Voice* (NY), p.40, July 20, 1999

"Don't lean, don't linger, don't worry."

—Dr. Douglas Zipes, Indiana University School of Medicine, Indianapolis, on EMI to implanted defibrillators, quoted by Merritt McKinney, Medical Tribune News Service, in "Anti-Theft Devices No Shock to Heart," posted on *MSNBC* (<www.msnbc.com/news>), July 26, 1999 (see *MWN,* N/D98)

MICROWAVE WEAPONS

Ready, But Still Under Wraps... In the near future, the U.S. will be ready to use high-power microwave (HPM) weapons in the field, military officials say. "There's real stuff happening, both in high-energy lasers and in microwave systems," Earl Good of the U.S. Air Force told *Aviation Week* (July 5). "We're delivering products, and there are lots of demonstrations. It's not just 'viewgraph' technology." Good is the head of the Air Force Research Laboratory's Directed Energy Directorate, which has a yearly budget of about $100 million and is based at Phillips Laboratory in New Mexico. U.S. forces were rumored to have used an electromagnetic pulse (EMP) bomb, one type of HPM weapon, in the NATO air campaign against Serbia earlier this year, according to *Jane's Defence Weekly* (April 7). But Pentagon officials told *Aviation Week* (June 7) that although the U.S. had an EMP weapon ready, it probably would not use it in the Balkan conflict because the military did not want to reveal its capabilities. When detonated, an EMP device emits an intense pulse of electromagnetic energy that can disable sensitive electronics such as computers and communications equipment. Although the weapon is designed to simulate the EMP generated by an atomic bomb, the military claims that this and other HPM devices will not cause the extensive physical damage and loss of life associated with traditional weapons. HPMs are "what this country is looking for to fill the gaps between diplomacy and blowing things up," Good said. (See also *MWN,* J/F97 and M/A98.)

PEOPLE

Dr. **Mats-Olof Mattsson** of Sweden's Örebro University is the new president-elect of the Bioelectromagnetics Society (BEMS). He takes over as president next June. Two other Swedes have also been named to the BEMS board: Dr. **Maria Feychting** of the Karolinska Institute in Stockholm and **Monica Sandström** of the National Institute for Working Life in Umeå....Dr. **William Wisecup** of W/L Associates in Frederick, MD, the executive director of BEMS and organizer of the DOE annual reviews, has announced that he will retire at the end of 2000. He plans to spend more time on photography and will continue to show Border collies and corgis....Dr. **Paul Gailey** is leaving Oak Ridge National Lab to join the physics department at Ohio University in Athens, where he will start a new interdisciplinary program in biology, mathematics and physics....Dr. **Richard Stevens**, long of Battelle Pacific Northwest Labs in Richland, WA, is now on the faculty at the University of Connecticut Health Center in Farmington, where he is teaching and doing cancer research....Dr. **Charles Rafferty** has left EPRI. He is consulting out of Menlo Park, CA....NIEHS' Dr. **Michael Galvin**, who was a member of the RAPID team, has joined NIOSH in Atlanta....Formerly a member of Dr. **Ross Adey's** lab in Loma Linda, CA, Dr. **Christopher Cain** has helped start Phytoanalytics in nearby Riverside. The company offers quality-control testing of vitamins and herbal supplements as well as assays of pesticide residues....**Katja Pokovic** of Dr. **Niels Kuster**'s lab at the ETH in Zurich, Switzerland, won the best student paper award at the BEMS meeting in June. This is two in a row for Kuster: last year (now Dr.) **Michael Burkhardt** of his lab won the prize.

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—Fortune *magazine, July 5, 1999*

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More 1999 Conferences & Courses

August 11: **Avian Mortality at Communications Towers (in conjunction with the 117th Meeting of the American Ornithologists' Union),** Statler Hotel, Ithaca, NY. Contact: Dr. Albert Manville, Office of Migratory Bird Management, U.S. Fish and Wildlife Service, 4401 N. Fairfax Dr., Arlington, VA 22301, E-mail: <Albert_Manville@fws.gov>, Web: <www.fws.gov/r9mbmo/homepg.html>.

September 13-16: **Directed Energy Weapons** (short course), Alexandria, VA. Contact: Association of Old Crows, 1000 N. Payne St., Alexandria, VA 22314, (703) 549-1600, Fax: (703) 549-2589, Web: <www.aochq.org>. (Optional final day is classified.)

September 20-22: **Safety Issues and Requirements for PCS and Wireless Communications Devices** (short course), George Washington University, Washington. Contact: P.J. Mondin, (202) 496-8449, E-mail: <pj@ceep.vpaa.gwu.edu>.

September 28-30: **Power Distribution System Grounding and Transients** (short course), Georgia Institute of Technology, Atlanta. Contact: Georgia Institute of Technology, Continuing Education, PO Box 93686, Atlanta, GA 30377, (404) 894-2400, Fax: (404) 894-8925, E-mail: <register@conted.swann.gatech.edu>, Web: <www.conted.gatech.edu>.

November 15-16: **Potential Therapeutic Applications of Magnetic Fields,** Vanderbilt University Medical Center, Nashville, TN. Contact: PTAMF 99, Symposium Secretariat, PO Box 5940, Buena Park, CA 90622, (714) 562-7530, Fax: (714) 736-7605, E-mail: <PTAMF99@ mindspring.com>.

November 19-21: **4th European Bioelectromagnetics Association Congress,** University of Zagreb, Croatia. Contact: Congress Secretariat, (385+1) 6129 606, Fax: (385+1) 6129 717, E-mail: <4thebea@fer.hr>, Web: <www.ebea.org/EBEA/generalinfo.htm>.

December 5-8: **Society for Risk Analysis (SRA) Annual Meeting,** Marriott Marquis Hotel, Atlanta. Contact: SRA, 1313 Dolley Madison Blvd., McLean, VA 22101, (703) 790-1745, Fax: (703) 790-2672, E-mail: <SRA@BurkInc.com>, Web: <www.sra.org>.

Keeping Current: Follow-Up on the News

◆ Sony announced in July that it is leaving the North American wireless handset market. Last December, Sony recalled 60,000 of its phones that violated radiation standards (see *MWN,* J/F99).

◆ A paper on personal EMF measurements taken in the Mary McBride childhood leukemia study has been delayed and is now slated to appear in the August issue of the *Scandinavian Journal of Work, Environment & Health.* The corrected McBride table we ran in our last issue has been published in the July 15 *American Journal of Epidemiology* (see p.12 and *MWN,* M/J99).

◆ TVB Pearl, a Hong Kong TV station, decided not to air a Canadian documentary on potential cell phone health risks (see *MWN,* J/F99). The *South China Morning Post* (July 7) pointed to a surge in mobile phone advertising. "We are worried the viewers will be misled because the information in the program hasn't been confirmed as accurate," a TVB spokeswoman said.

◆ Rep. George Brown (D-CA) died on July 16 at age 79. As chair of the House science committee, Brown was instrumental in allocating federal funds for research on EMF health effects, including the RAPID program (see *MWN,* J/F92). *Nature* (July 22) called Brown "science's best friend in Congress."

◆ Dr. Lennart Hardell and coworkers' paper on mobile phone use and brain cancer is now in print: *International Journal of Radiation Oncology, 15,* pp.113-116, July 1999 (see *MWN,* M/J99).

◆ The town of Brooklyn, OH, is the first in the U.S. to outlaw using a mobile phone while driving. In 1966, Brooklyn, with a current population of 11,000, was the first in the nation to require the use of seat belts (see also *MWN,* J/F98).

◆ Crossing the Rubicon into the Internet Age: In a June 10 advisory, the CTIA noted that, in an earlier statement, "due to an editorial error, Rubicon was misspelled as Rubicom."

◆ Construction of a digital TV broadcast tower at the antenna farm on Lookout Mountain, outside Denver, was blocked on July 13 by a 3-0 vote of the Jefferson County, CO, commissioners, after months of protest by local residents concerned about RF cancer risks (see *MWN,* J/A98 and M/A99).

◆ New Zealand's health and environment ministers have asked for public comment on a discussion document on RF/MW health effects, *Towards National Guidelines for Managing the Effects of RF Transmitters.* The deadline for submitting comments is September 30. For more information, contact Sally Gilbert at the Ministry of Health in Wellington, (64+4) 496-2000, Fax: (64+4) 496-2340.

Something Is Terribly Wrong

In June 1999, these three events happen in just three days:
• The NIEHS issues its report to Congress, which concludes that the evidence that EMFs pose a cancer risk cannot be dismissed. Though this evidence is weak, the NIEHS says, it is reason enough for prudent avoidance (see p.1).
• EMFs are linked to as much as a sixfold increase in the risk of leukemia among young children, in a new study released by the University of Toronto (see p.12).
• Dr. Robert Liburdy agrees to withdraw three graphs in seven-year-old papers on EMF effects on cellular calcium (see p.1).

Which of these stories makes page-one headlines across the country? The Liburdy affair. And what is the lesson that the *New York Times* draws from the Liburdy business? That "electric power is safe."

Liburdy's calcium experiments were not cancer studies and had only the most speculative relationship to cancer biology. When they were published in 1992, anyone who had said, "This shows that EMFs cause cancer" would have been laughed out of the room. It would have been a ridiculous thing to say, and no one ever did.

Yet now these three Liburdy graphs seem to become more powerful each time they are mentioned in the media. The Associated Press (July 23) claimed that Liburdy's calcium work "was thought to be the first plausible biological explanation" of an EMF–cancer connection. Not one cancer researcher, biologist or biophysicist was quoted in support of this assertion, perhaps because it is not true.

The AP conceded that concerns about EMFs "had been raised well before Liburdy's study," but the *New York Times* (July 24) wasted no space on such qualifications. In the *Times*' hands, Liburdy's graphs became "crucial evidence of a tie between electric power lines and cancer"—which had been "faked." Soon the Cleveland *Plain Dealer* (July 30) was writing that Liburdy "managed to scare the bejabbers out of a lot of people by spinning a yarn about electrical transmission lines causing cancer," and applauded government fraud-busters for exposing this "hoax."

The power of the Liburdy graphs continued to grow. It was in fact "Liburdy's deception" which "sparked a campaign of 'prudent avoidance'," according to Dr. Elizabeth Whelan of the pro-industry American Council on Science and Health, writing in the *Wall Street Journal* (July 27). "We now know" that the EMF issue "is a phony health risk," added Whelan. Ken Hall of the Edison Electric Institute seems to agree: "As long as you don't touch the wire, it's okay," Hall told the *Los Angeles Times* (July 29), in a story about commercial development directly beneath high-voltage power lines. The paper estimated that EMFs in the proposed development would average about 60 mG.

What's ironic is that of the three June events, only two have much to do with EMFs and cancer: the NIEHS report and the Canadian study. Yet those were precisely the two that the media ignored.

There is a serious double standard at work here. The stories on the Liburdy affair are full of false statements—which are repeated so often, without rebuttal, that they are already accepted as fact. Where are the moderating voices of public health, of epidemiologists, of consumer advocates?

We don't believe in conspiracies. But at times the influence of corporate power in both science and the media is so overwhelming that it starts to resemble one. Industries worth hundreds of billions of dollars defend their interests, and they do so in many ways.

Recently, a leading epidemiologist at a world-famous medical institution wrote to us on the Liburdy media blitz. He said, "One reason I left this field was that I saw it was virtually impossible to get decent science funded or done without interference in the face of such massive commercial interest." But we can't tell you who he is. His next sentence was, "Don't quote me."

Memo to Motorola: The Burden of Leadership

The take-home lesson of the recent WTR and BEMS meetings is that Motorola is taking control of worldwide wireless research (see p.5).

On the one hand, we want to give the company credit for developing and funding its own research plan, when it could have simply left it to WTR. Motorola money has produced scientific results.

But we must also note that Motorola can be slow to make information public and does not always tolerate the type of open exchange that normally settles scientific controversies, which are endemic in the wireless world. (Lawyers and nondisclosure agreements, for example, don't mix well with public health.)

Motorola's support of research is of course not totally altruistic. The company has bet its future on wireless technology, and funding safety research is insurance against suffering the fate of the asbestos industry. And it also buys Motorola's PR team a first look at the latest findings.

To those who complain about Motorola's dominant role, the company answers, "If we don't do this work, no one else will." Unfortunately, at this point that is often true. Public health agencies have largely dropped the ball on wireless safety.

But leadership has its responsibilities. To have credibility, the company must be more open—even with its critics.

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Europe Sets the Agenda

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 $\mu W/cm^2$ 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 staff 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-

The Far Field



"Dr. Lai?...I'm supposed to be at the lab? ...Oh, I'm sorry. I completely forgot...."

Kathleen MacInnes

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 Technologies 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 somewhat 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 ±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, **IT'IS**. 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, IT'IS 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 μW/cm^2. This level is also 100 times stricter than the 450 μW/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 μW/cm^2, while China's is 5.0 V/m, or 6.6 μW/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 μW/cm^2.

Switzerland's wireless industry had a mixed reaction to the new rules. In a December 23 statement, the trade group Protelecom 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 ordinance indicated that, "The public wants even lower limits" (see *MWN,* M/A99).

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

*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).

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.' 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 shortwave 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 $\mu W/cm^2$, compared to 4.2 $\mu W/cm^2$ 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.

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 $\mu W/cm^2$) 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 $\mu W/cm^2$ for 3 MHz-3 GHz and 400 $\mu W/cm^2$ 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.linet.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.

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.

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

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).

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 6 mG — 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 Zweiacker**, 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>.

«« »»

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>.

«« »»

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 μT [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 *IJRB* 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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Dr. Chou is the chair of SCC-34/SC-2's Ear Task Force, the vice chair of NCRP's SC 89-5 on Biological Effects and Exposure Criteria for Radiofrequency Fields and the cochair of IEEE's SCC-28/SC-4 on Safety Levels with Respect to Human Exposure, 3 kHz to 300 GHz.

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 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

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.)

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 National 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 become 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 μT [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 Policlinic 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 Fairobent, c/o HPS Secretariat, 1313 Dolley Madison Blvd., Suite 402, McLean, VA 22101, E-mail: <fairoben@ncrp.com>, Web: <www.webpanache.com/crmchps/hps2000.htm>.

June 27-30: **15th International Wroclaw Symposium and Exhibition on Electromagnetic Compatibility,** Wroclaw, Poland. Contact: W. Moron, EMC Symposium, Box 2141, 51-645 Wroclaw 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: <pessm2000@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 <rmacfar3@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 Institut, 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 OBL, 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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UPDATES

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.

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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, *$\mu W/cm^2$—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 $\mu W/cm^2$, 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.)

VIEWS ON THE NEWS

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 outlook 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.

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 $\mu W/cm^2$ 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.

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Consumers Betrayed and Abandoned

Revision of RF/MW Standard Stalls As IEEE Panel Is Split on Key Issues

Disagreements within the IEEE's International Committee on Electromagnetic Safety (ICES) have stalled progress on updating its standard for human exposures to radiofrequency and microwave (RF/MW) radiation.

On one side, representatives of federal agencies have made it clear that they will not support a proposal to substantially relax key sections of the existing standard. On the other side, many members of the committee — especially those working for, or allied with, the Department of Defense — still favor looser limits.

"Everything is open," Dr. Eleanor Adair, the chair of ICES, better known as SCC-28, told *Microwave News*. Adair recently returned to New Haven, CT, after serving as a senior scientist at Brooks Air Force Base in San Antonio.

Last September, the Revision Working Group, a panel within subcommittee 4 (SC-4) of SCC-28, circulated a draft proposal for a more lenient exposure standard (see *MWN,* S/O01). But when the revision group met in Fort Lauderdale, FL, January 10-11, it repudiated many of the central elements of the draft. Then, a week later, SC-4 met in San Antonio and it, in turn, rejected some of the decisions made by its working group.

"It's pretty divided," said Richard Tell, a consultant based in Las Vegas who led the effort to draft the September proposal.

For instance, Tell's September draft stipulates that a single set of standards should cover workers and the general public. In Fort Lauderdale, there was a

(continued on p.7)

Epidemiologists at Odds Over Meaning Of New EMF Exposure Index

Do you have to be exposed to a magnetic field above some threshold level before it can cause a miscarriage? And if so, for how long?

Some leading epidemiologists are asking these questions in one of the liveliest debates on electromagnetic field (EMF) health effects in years.

International standards for power-frequency EMFs allow a pregnant woman to be exposed to as much as 1,000 mG, but in a paper published in the January issue of *Epidemiology,* a team led by Dr. De-Kun Li of Kaiser Permanente in Oakland, CA, shows that exposures to 16 mG or higher can result in significantly elevated rates of miscarriage (see *MWN,* M/J01).

"We don't know the mechanism, but there could be a switch that is activated above a certain threshold," Li told *Microwave News*. "If that is the case, I think that it makes more sense to look at the maximum rather than the average field exposures."

(continued on p.3)

« Power Line Talk »

In 1994, researchers on both sides of the Atlantic found strong power-frequency magnetic fields in hospital **incubators** used to nurture premature babies. **Gert Anger** of the Swedish Radiation Protection Authority in Stockholm reported levels as high as 48 mG, while in the U.S. the late Dr. **Charles Polk** of the University of Rhode Island, Kingston, found a peak reading of 289 mG using a different measurement protocol (see *MWN,* M/A94). These relatively brief and intense exposures do not appear to increase the risk of **childhood leukemia**, according to a new epidemiological study led by Dr. **Maria Feychting** of the Karolinska Institute in Stockholm, which appears in the January issue of ***Epidemiology*** *(13,* pp.45-49, 2002). Feychting's team, which includes Anger and Karin Söderberg, a doctoral candidate at the Karolinska, used hospital records of 619 Swedish children with leukemia and an equal number of controls, together with measurement data, to estimate EMF exposures. There were 53 children with leukemia and 57 controls who had been in incubators (some hospital records for other children were missing). The time spent in an incubator was "often less than 24 hours," according to the paper, but some stays were much longer — up to 28 days, Feychting told *Microwave News*. Measured fields were consistent with those Anger had found in 1994: The highest was 44 mG, with an average of 11 mG. Factoring in the time in an incubator, the Swedish researchers estimated that the maximum cumulative exposure was 6,136 mG-hours. Not only was leukemia risk no higher among the children who had been in incubators, there was also no increased risk for the high-exposure groups — that is, above either 6 mG or 10 mG — or those with cumulative exposures above 100 mG-hours. The new study did find elevated risks for acute lymphoblastic leukemia among those diagnosed between the ages of five and nine and for acute myeloid leukemia, the less common type, in all children, but these two estimates are based on small numbers of cases and are not statistically significant. Feychting believes that they are probably chance findings. She cautions, however, that there is no contradiction between these new results and previous studies (including her own) pointing to a link between childhood leukemia and residential EMF exposures. "Incubator exposures are profoundly different from those in the home," she said.

«« »»

ICNIRP has concluded that EMFs may be a risk factor for childhood leukemia. This is not too surprising since the chair of ICNIRP's epidemiology subcommittee is Dr. **Anders Ahlbom** of the Karolinska Institute in Stockholm, who also led the meta-analysis which persuaded the IARC EMF panel to designate EMFs as possible human carcinogens last summer (see *MWN,* S/O00 and J/A01). A doubling of the risk among children with average exposures above 4 mG is "unlikely to be due to chance," Ahlbom's subcommittee writes in a detailed review of the entire body of the EMF epidemiological literature — it appears in ***Environmental Health Perspectives*** *(109,* Supplement 6, pp.911-933, December 2001). Evidence linking EMF exposures to cancer in adults — specifically, brain tumors or leukemia — is "weak" according to the subcommittee, which also includes Drs. **Elisabeth Cardis** of IARC, **Martha Linet** of the U.S. NCI, **David Savitz** (see p.3) and **Anthony Swerdlow** (see p.10). For ALS, however, they write that the data are "intriguing and point toward a possible risk increase," especially among workers in electrical occupations, while noting that the association could also be due to electric shocks (see p.12, also *MWN,* N/D01).

Utility Industry Speaks Loudly On California Risk Analysis

The California EMF Program received 75 sets of comments on the draft assessment of EMF health risks, released last July. Those offering assessments — a veritable *Who's Who* of the EMF world — include many whose comments were solicited by the electric utility industry.

In their draft, Drs. Raymond Neutra, Vincent DelPizzo and Geraldine Lee of the EMF program concluded that EMFs are more likely than not to cause childhood leukemia, adult brain cancer, ALS and miscarriages (see *MWN,* J/A01).

The industry-sponsored submissions are for the most part quite critical. "Most scientists today would probably not agree" with the report's conclusions, wrote Dr. Abdelmonem Afifi of the University of California, Los Angeles (UCLA). Afifi, a long-time consultant to EPRI, was hired by Southern California Edison, Pacific Gas & Electric and four other utilities. These same utilities also paid for comments by Drs. Sander Greenland of UCLA and consultants Drs. Jack Sahl and Peter Valberg. They also sponsored a review by Dr. Lisa Croen of Kaiser Permanente — she agreed with the report's conclusion on miscarriages.

Attorney Tom Watson of Watson & Renner in Washington, DC, who represents the Utility Health Sciences Group, assembled a team featuring Drs. John Boice of the International Epidemiology Institute, Mark Israel of Dartmouth Medical School and Robert Tarone of the National Cancer Institute, each of whom filed separate critical comments.

The Edison Electric Institute in Washington turned to the Exponent Health Group, which points to the "strong possibility that there is no risk at all" (see also p.8). EPRI's Dr. Rob Kavet wrote his own comments.

Many others, however, filed positive comments. Dr. Herbert Needleman of the University of Pittsburgh called the report an "extremely valuable and sound analysis." Dr. Anders Ahlbom (see below) congratulated the authors for their "most comprehensive and ambitious risk evaluation." Among the others who supported the report are: EPA's Dr. Carl Blackman, NIOSH's Joseph Bowman, Dr. David Savitz (see p.3) and Dr. Gilles Thériault of McGill University.

All the comments, along with the EMF program's responses, will be posted on the Internet in late February. Print copies are also available from the City Copy Center in Oakland; call (510) 763-0193 for price information.

Health Canada Review: Transport EMFs Present Little Hazard

The prospect of a significant health threat from the EMFs generated by electrical transportation systems is "rather speculative and remote," according to a new report prepared for Health Canada by Dr. Tony Muc of Radiation Health and Safety Consulting in Toronto. He notes, however, that exposures over 1G are common and that "relatively little scientific investigation of transportation system EMFs has been carried out to date."

Muc analyzed EMF exposures of the public and workers associated with a number of currently used or projected technologies, including high-speed rail, Maglev, electrified railways, subways, trolleys and electric cars. In his view, the complexity and variability of transportation EMF exposures "far exceed the complexity addressed by present standards and guidelines."

Dr. Aviva Brecher of the U.S. Department of Transportation in Cambridge, MA, told *Microwave News* that the report "reinforces our conclusion that transportation EMF exposures are unique in their high degree of variability." Much of the data on EMF exposures presented by Muc is adapted from measurement surveys initiated by Brecher some years ago (see *MWN*, J/A93 and M/J99).

Muc also includes information from ongoing projects and yet-to-be-published research. For instance, measurements inside Washington Metro subway cars found fields ranging from 100 G to 1,000 G at floor level, generated by currents of up to 600 A.

Muc closes on a quirky note. He quotes, with approval, the view, written in Italian, of two obscure researchers that there are no demonstrable health risks. Their paper, presented at the 1996 annual meeting of the Automobile Club of Italy, "can hardly be claimed" to have been peer reviewed, Muc acknowledges.

The report was submitted to Health Canada last May. Muc only recently posted it on his Web site, <www.rhsc.ca>. Print copies can be purchased from RHSC for C$60 (US$40) each by writing to TransEMF, 64 Donlea Dr., Toronto, ON M4G 2M4, Canada, or faxing (416) 425-4233.

Debate Over Miscarriages and Exposure Index *(continued from p.1)*

Dr. Raymond Neutra of the California Department of Health Services in Oakland, whose EMF Program helped sponsor Li's study, uses an analogy to noise pollution to explain the significance of what Li calls maximum magnetic field (MMF) exposure. "One is not really interested in the cumulative amount of noise," he said in an interview, "but rather in the loud noise that wakes you up at night."

Dr. David Savitz is skeptical that Li's new exposure index has much meaning. In an editorial accompanying Li's paper, Savitz argues that the MMF index is probably little more than a random indicator.

In his prospective study, Li found no increased risk of miscarriage for time-weighted average (TWA) magnetic field exposures, but the risk of a spontaneous abortion almost doubled for those women who were exposed to a magnetic field of 16 mG or more for at least ten seconds. For those women exposed to 16 mG or more who said that the 24-hour magnetic field measurements were taken on a "typical day," the risk was three times that expected and close to six times higher for those women who had a miscarriage less than ten weeks into their pregnancies (see table at right for Li's results). "Our results are very coherent and provide strong evidence of a miscarriage risk," Li said.

"It's very comforting to me that, after our study found the association with MMFs, Raymond Neutra and Gerri Lee went back and looked at their own data and found a similar link," Li said. The Lee and Neutra miscarriage study appears in the same issue of *Epidemiology*.

"We are not saying that a single short exposure during the whole pregnancy is enough to lead to miscarriage," Li said. "We are saying that, if the measurement was taken on a typical day, then a woman was probably exposed to 16 mG almost every day. Our study could not answer how long or how often a woman had to be exposed to affect the pregnancy."

Nor did Li's study shed much light on the sources of the women's magnetic field exposures, though he notes that fields above 16 mG are routinely found near electrical appliances in the home and electrical equipment in the workplace, on electrically powered transit systems (see story above) and under some power lines.

Savitz, who is at the University of North Carolina, Chapel Hill, ascribes the different MMF exposures to behavioral differences between those who are and those who are not pregnant. He writes that Li's results really show that pregnant women limit their mobility due to bouts of nausea or to their increased girth. "Women who have lost or will soon lose their pregnancies are less likely to be nauseated and more likely to be mobile and thus will tend to have higher peaks and more variability in exposure," according to Savitz.

Not so, respond Li and Neutra in a letter that will appear in the March issue of *Epidemiology*. "We tested 30 different poten-

MMF and Risk of Miscarriage

Women Exposed ≥16 mG	Risk Ratio*	95% CI
All miscarriage	1.8	1.2-2.7
Early miscarriage†	2.2	1.2-4.0
Susceptible women‡	3.1	1.3-7.7
Measurement on typical day	2.9	1.6-5.3
Typical day/susceptible women‡	4.0	1.4-11.5
Typical day/early miscarriage†	5.7	2.1-15.7

* MMF≥16 mG vs. MMF<16 mG.
† Less than ten weeks of gestation.
‡ With multiple prior fetal losses or subfertility.

De-Kun Li et al., "A Population-Based Prospective Cohort Study of Personal Exposure to Magnetic Fields During Pregnancy and the Risk of Miscarriage," *Epidemiology, 13,* pp.9-20, January 2002.

tial confounders, including nausea, and none of them made the EMF association go away," Li said.

"I am not totally convinced," Savitz told *Microwave News*. He has written a second response to the journal, which prompted a further reply from Li and Neutra. (See box below for excerpts from their exchange.)

Other epidemiologists who are watching from the sidelines approve of the public debate, which spans three issues of the journal.

"The dialogue is healthy," said Dr. Kenneth Rothman of Boston University. "I am sure Li's findings will make a lot of people uncomfortable." He added: "By delving into other methodological explanations, Savitz is making a very important contribution." Rothman is the former editor of *Epidemiology*.

Similarly, Dr. Anders Ahlbom of the Karolinska Institute in Stockholm said that Savitz's commentary is an "excellent demonstration on how to write a good editorial."

Dr. Nancy Wertheimer in Boulder, CO, commented that she was pleased that Li had looked beyond TWAs, but, she noted, "I would like to know more about what these exposures above 16 mG indicate. The question is whether going over 16 mG points to some other aspect of electromagnetic exposures which could be responsible for the miscarriages."

Savitz said that Li's study is much better than the past EMF–miscarriage studies. He stressed that, putting aside the question of the MMF index, "The lack of an association with TWAs in Li's study is striking and that should not be ignored."

Despite all his skepticism, Savitz concludes his first commentary by stating that the new exposure index "deserves further scrutiny and is likely to get it." But, like Wertheimer, Savitz believes money would be best spent understanding the sources of 16 mG exposures.

What Does Maximum Magnetic Field (MMF) Mean? Li & Neutra and Savitz on Nausea, Mobility and Random Motion

"...Perhaps the investigators have pinpointed biologically important indices, as they suggest. But it seems even more plausible that the results are based on behavioral differences between women with healthy pregnancies and women who either experienced a miscarriage or were destined to have one....All other things being equal, a woman experiencing nausea will be less likely to move around her home or workplace or community, and therefore less likely to experience the diverse magnetic field sources in those places. As a result, she is less likely to encounter high magnetic field peaks and less likely to have substantial magnetic field variability over time. At its extreme, nausea can keep a woman in bed or at least in her home for much of the day. Thus, nausea (a marker of low risk of miscarriage) will be associated with lower peaks and variability in magnetic fields. Women who have lost or will soon lose their pregnancies are less likely to be nauseated and more likely to be mobile and thus will tend to have higher peaks and more variability in exposure. Thus, nausea may explain the association between magnetic field peaks and miscarriage...."

David Savitz, "Magnetic Fields and Miscarriage" (Commentary), *Epidemiology, 13,* pp.1-3, January 2002.

"...[Li] evaluate[d] this hypothesis directly, [with] information [collected in the in-person interviews] on nausea and related symptoms such as vomiting...As expected, nausea and vomiting themselves were associated with a reduced risk of spontaneous abortion (hazard ratio (HR)=0.3, 95% confidence interval (CI)=0.2-0.4 and HR=0.3, 95%CI=0.2-0.4, respectively). However, the frequency of nausea or vomiting was very similar for women exposed to maximum MF>16 mG (exposed) and to maximum MF<16 mG (unexposed)...After adding the nausea and vomiting variables to [our] model, the hazard ratio for the association of MMF with risk of spontaneous abortion remained essentially the same, if not strengthened...These results do not support the suggestion by Savitz that nausea or vomiting could influence MMF exposure or that adjusting for them might modify the measure of association between MMF exposure and the risk of spontaneous abortion...."

De-Kun Li and Raymond Neutra, Reply to Savitz, *Epidemiology,* March 2002 (in press).

"...[My original] rationale is that we are surrounded by magnetic field sources, ranging from pencil sharpeners to sewing machines to photocopiers, and that the only difference between someone who encounters such an exposure and someone who does not is the extent of random movement through their otherwise similar environments. If, indeed, moving around were the issue, then there are reasons to believe that nausea of early pregnancy or advanced size of later pregnancy would inhibit such Brownian motion....[T]he virtual lack of correlation between early and late pregnancy for MMF (r=0.09) and rate-of-change metric (r=0.19), far lower than for the time-weighted average [TWA] (r=0.64), would be consistent with a nearly random phenomenon. However, a random event would not be expected to be associated with risk of miscarriage...Putting aside the biological plausibility of an effect of MMF of 16 mG or higher...we are left with the question of what these measures capture about a woman's environment and behavior. Before taking on the extremely challenging goal of replicating the association with magnetic fields, the more modest and readily attainable goal should be to determine what is driving these indices...."

Savitz, Response to Li and Neutra, *Epidemiology,* March 2002 (in press).

"In his latest response...Savitz considered the measure of MMF untrustworthy because he speculates that measuring MMF is like measuring 'a random event.' An implicit assumption in his speculation is that MMF is highly associated with daily activities and daily activities are essentially random events. While we would agree that MMF is probably more likely than TWA to be related to daily activities, daily activities are by no means 'random events.'...[Our] study also showed that no association was found if the study was restricted to women who were measured on a nontypical day. This suggests that peak exposures need to occur on a daily basis in early pregnancy to have an effect. Of course the ultimate resolution to the reliability of MMF measurement will come from studies that measure MMF on multiple days...[S]tudies are [also] needed to identify the mix of sources that produce these peaks...."

Li and Neutra, Further Response to Savitz, *Epidemiology,* May 2002 (in press).

Tenforde To Lead NCRP; RF/MW Panel May Be Revived

Dr. Thomas Tenforde is set to become the next president of the National Council on Radiation Protection and Measurements (NCRP) in Bethesda, MD. Currently the senior chief scientist at the Battelle Pacific Northwest Labs in Richland, WA, Tenforde will move to the Washington, DC, area as soon as he is formally elected.

The directors of the NCRP recommended that Tenforde become president at their December 17 board meeting. The next step is for the council's nominating committee to endorse the board's decision. The entire NCRP membership will vote on the nomination at the council's annual meeting on April 11. This process is "usually perfunctory," William Beckner, NCRP's executive director, told *Microwave News*.

The NCRP has always placed the most emphasis on ionizing radiation and this will no doubt continue. Nevertheless, Tenforde will have to address two pieces of unfinished business on non-ionizing radiation: whether to reinstate Dr. James Lin's committee on RF/MW radiation and whether — and in what form — to issue a report on extremely-low-frequency (ELF) EMFs drafted by a committee chaired by Dr. Ross Adey.

Last summer, on the recommendation of Ron Petersen, NCRP vice president for non-ionizing radiation and a member of its board, Lin's committee was disbanded because it was moving too slowly (see *MWN,* S/O01). At their December meeting, the directors of the NCRP asked Tenforde to consult with Lin and Petersen on whether the committee should be revived. Lin's work on updating NCRP's 1986 RF/MW exposure limits began in 1995 (see *MWN,* S/O95). Tenforde is scheduled to report back to the board by the end of February, according to Beckner.

"I hope we can move forward," Tenforde told *Microwave News*. "I am open to a variety of actions to resolve the differences of opinion. It might require adding or replacing some members of the committee. We have a lot of flexibility."

In an interview, Petersen said a key element in reviving Lin's panel is fund-raising, given the council's budget shortfall.

Lin, who is at the University of Illinois, Chicago, is encouraged by the news that his committee might soon be back in business. But at the end of January, as we go to press, Lin said that he had not yet heard anything from Tenforde or the NCRP.

The NCRP began work on the ELF EMF report under a contract from the Environmental Protection Agency in 1983 (see *MWN,* D83). In an 800-page draft completed in 1995, Adey's panel urged that strong action be taken to control EMF exposures (see *MWN,* J/A95). The report has been under review and revision ever since.

In the summer of 1999, NCRP President Charles Meinhold said that the NCRP would post a draft of the report for public comment on its Web site by the end of the year (see *MWN,* J/A99). It was not clear whether the NCRP would include Adey's recommendations. Then last fall, Meinhold reiterated that the report would be released — but, he said, the recommendations would be omitted (see *MWN,* S/O01). Nothing has yet appeared, however. Adey, now semiretired, is based in Redlands, CA.

"I don't have a plan," Tenforde said about the ELF EMF report. "I'm thinking about the options." He called the document a "remarkable resource that contains a wealth of information." But he also wondered whether there was sufficient interest in EMFs to warrant its publication by the NCRP.

Part of Tenforde's hesitation over the EMF report is due to his long-held skepticism that magnetic fields are responsible for the association between childhood leukemia and power lines. "The bulk of the data, especially the laboratory data, do not support the link," he said. "There may be something else we do not understand that can explain the association." (For more on Tenforde's interest in other explanations, see *MWN,* N/D88).

Meinhold, who is with the Brookhaven National Lab in Upton, NY, has led the NCRP since 1990. He has wanted to step down for some time, but the board has had a hard time finding a replacement.

The presidency will continue to be a part-time position. But Tenforde made it clear that he will be devoting a lot of energy to his new job and would place special emphasis on fund-raising. "I plan to spend much of my time working on the NCRP. A lot of things need attention."

Tenforde has had a long association with the NCRP. He was first elected to the council in 1988 and was appointed the scientific vice president for non-ionizing radiation in 1995. He served until 2000, when he was replaced by Ron Petersen, then of Lucent Technologies and now a consultant (see *MWN,* M/J00).

Tenforde has been a member of the International Commission on Non-Ionizing Radiation Protection (ICNIRP) since 1992. He will complete his third and final term in 2004.

Beckner has agreed to continue as executive director for at least a year, but not longer than two. He said that he will soon be 70 and that it is time to move on.

Russia Offers RF Weapons

Russia's arms export agency, Rosoboronexport, is offering two powerful RF electronic warfare weapons — but only qualified buyers with deep pockets need apply.

The weapons, called Ranets-E and Rosa-E, were presented at Malaysia's International Maritime and Aerospace Exhibition (LIMA 2001) in October, and on October 25, Rosoboronexport issued a press release over the *PR Newswire*.

The Ranets-E, a ground-based "cannon," uses 10-20 nanosecond pulses at around 30 GHz with an output power of more than 500 MW, and, according to the release, "is capable of incapacitating an enemy's high-precision weapons in a radius of 10 km." Rosoboronexport claims that it can disable a missile's guidance system. Rosa-E, operating in the same frequency range with an output power of 5-10 kW, can zap radar systems at a distance of 500 km.

Rosoboronexport makes the following qualification:

> Clients may not purchase a finished product or the technical documentation of either model. Potential customers need to clearly define their tactical and technical preferences as well as finance the Russian researchers' and producers' work. After this, their request will be accepted or denied. If accepted, they can receive a model after concluding a special agreement. The model can be tested at a military range.

Standards Watch: German, Spanish and U.S. Developments

The **German** government is sticking with **ICNIRP** and shelving a proposal to adopt a stricter standard for mobile phone antennas. Last July, the Federal Environment Ministry announced that it was weighing the adoption of precautionary limits for RF/MW radiation, citing Switzerland's 4 V/m (4 μW/cm^2) standard as a possible model (see *MWN,* J/A01). But such strict standards are "not scientifically justified at present," the prime minster's office stated on December 7. Instead, the government is calling for voluntary measures — that is, prudent avoidance. Germany's **Radiation Protection Commission**, a panel that advises the government, supported a mix of the ICNIRP limits and prudent avoidance in a report released in September (see *MWN,* S/O01). The commission, whose resident expert on non-ionizing radiation is Dr. **Jürgen Bernhardt**, the vice chair of ICNIRP, called for "minimizing" exposures to both EMFs and RF/MW radiation, especially in places where people spend a significant amount of time. The mobile phone operators oppose precautionary limits and it is widely believed that they made a deal to sponsor health research in order to avoid them (see p.8 and *MWN,* M/J01).

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Spain has also decided to follow **ICNIRP**, with an added helping of precaution. On September 29, the Spanish parliament approved a new law, a Royal Decree, which requires that exposures from all **RF/MW** sources meet ICNIRP's limits for the general population. The Ministry of Health and the Ministry of Science and Technology had drafted the law, based on the advice of an expert panel. The panel's report, issued in August, concluded that the existing scientific evidence supports the ICNIRP guidelines and noted that the EU Council of Ministers had recommended that all member states adopt the ICNIRP limits (see *MWN,* J/A99). The panel, however, also pointed to biological effects that occurred at lower levels and advocated a "precautionary" approach. As a result, the new law requires that SARs be provided with all mobile phones and that base stations be sited to minimize exposures in schools, hospitals and other "sensitive areas." The expert panel also endorsed the ICNIRP limits for **ELF EMFs** with a recommendation that power lines be located to avoid unnecessary exposures. The parliament did adopt the ELF guidelines, but without establishing a mechanism to enforce them and without including any of the precautionary language. Dr. **Alejandro Úbeda**, a research scientist at the Ramón y Cajal Hospital in Madrid who coordinated the panel's work with Dr. Francisco Vargas of the Ministry of Health, told *Microwave News* he is disappointed that his report did not mention IARC's designation of ELF EMFs as possible human carcinogens (see *MWN,* J/A01). He explained that the nine-member panel had already completed its work by the time the IARC committee met for its EMF review last June. The report, *Electromagnetic Fields and Public Health,* is available at <www.msc.es/salud/ambiental/ondas/camposelectromag.htm>. The Ministry of Science and Technology has posted the text of the ordinance, *Real Decreto 1066/2001,* at <www.mcyt.es/notas_prensa/gabinete_mcyt/oct2001/rdemisiones.htm>, along with a summary of its main provisions. These documents are all in Spanish, but an English translation of the expert panel's report will be available soon, according to Úbeda.

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Dr. **Ralf Bodemann**, who is responsible for EMF issues at **Siemens**, has been appointed vice chair of the IEEE International Committee on Electromagnetic Safety (**SCC-28**). Bodemann, an active member of the EMF Working Group of the Trans Atlantic Business Dialog, is based in Munich, Germany....Lt. Col. **Bruce Ruscio** of the U.S. **Air Force** has taken over as chair of the panel reviewing the epidemiological literature for the ongoing revision of SCC-28's RF/MW exposure standard (see p.1). Ruscio is much involved in the continuing controversy over the USAF's PAVE PAWS radar on Cape Cod.

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IEEE SCC-28 has threatened to take legal action against the **EMR Network** for posting the September draft revision of the IEEE RF/MW exposure standard on the Internet (see *MWN,* S/O01). The draft is "an internal document" and the property of the IEEE, Dr. **Eleanor Adair**, the chair of SCC-28, wrote in a December 8 e-mail demanding its immediate removal. "If this is not done," Adair warned, IEEE's lawyers "can take appropriate action." Deb Carney, an attorney in Golden, CO, said that the network has no plans to comply with Adair's demand. The issue may now be moot: The SCC-28 subcommittee revising the standard has decided to take a fresh look at key provisions of the proposal (see p.1). At press time, the draft was still in the "news" section of the network's site, <www.emrnetwork.org>.

SAR Measurement Protocol Almost Completed (Really)

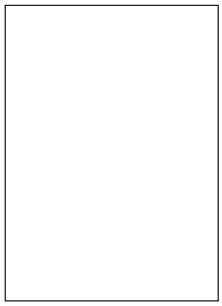
After five years of work, the IEEE's standard for measuring SARs from mobile phones will soon be completed.

"All the issues have been resolved," Ron Petersen, the chair of the IEEE's Committee on Product Safety with Respect to Electromagnetic Energy (SCC-34), told *Microwave News*. A vote by the full committee will take place in April, and the standard could then be forwarded to the IEEE Standards Board for a final okay in September.

"It was much more work than I ever expected," said Howard Bassen of the FDA's Center for Devices and Radiological Health in Rockville, MD, who chaired the SCC-34 subcommittee that wrote the standard. "The manufacturers need a very detailed protocol, which gives very accurate SARs, in order to meet the needs of the regulatory agencies." The standard was originally requested by the FCC in 1997 (see *MWN,* M/A97 and J/F01). The next meeting of Bassen's subcommittee will be in Ottawa, May 2-3.

consensus to return to a two-tier standard, the same way the existing standard is now structured. But in San Antonio, the subcommittee decided to "reconsider the two-tier approach." (A consensus statement of the Fort Lauderdale group, and how it was modified by those in San Antonio, appears below.)

The division within ICES has prompted some members to back away from a full-scale revision of the current standard in favor of making small, incremental changes. "There was a sense in San Antonio that the old standard isn't too bad and that some parts need tuning up," said Ron Petersen, the executive secretary of SCC-28. "I don't see much wrong with what we have now," added Petersen, a consultant based in Bedminster, NJ, who used to work for Lucent Technologies.



"Everything is open."
— Dr. Eleanor Adair

Part of the reason for the different outcomes at the two meetings is that those representing the federal health agencies were present only in Fort Lauderdale, not in San Antonio. "There is a different perspective in the group when the health agencies are present," commented Dr. Gregory Lotz of the National Institute for Occupational Safety and Health (NIOSH) in Cincinnati.

While many members of ICES still want a one-tier standard, the health agencies are unified against it. "A standard that does not recognize the need for safety factors for different members of the population would have little value," said Robert Curtis, the director of the Occupational Safety and Health Administration's (OSHA) Health Response Team in Salt Lake City.

A number of those in Fort Lauderdale were pleased with the progress made at the meeting. "I think we are moving in the right direction toward a scientifically supportable standard," said Dr. Robert Cleveland of the Federal Communications Commission in Washington.

"The earlier draft was based on faulty concepts and we are back to a more acceptable proposal," said Dr. Niels Kuster of IT'IS in Zurich. Neither Kuster nor Cleveland attended the San Antonio meeting.

But not all those at the Florida meeting agreed with the proposed changes, as later became clear in Texas. Some resent the pressure from the federal health agencies. "There were some remarks in Fort Lauderdale that 'if you don't do it our way, we aren't going to play' and people did not like it," said Dr. John Leonowich, a staff scientist at the Battelle Pacific Northwest Labs in Richland, WA. Leonowich did not go to San Antonio.

Some see the split as the health agencies against everyone else. But, in fact, the four Motorola staff members who were at the Fort Lauderdale meeting did not appear to be backing a full-scale relaxation of the existing standard. "Motorola's participation was definitely helpful in revising the proposal drafted by the Revision Working Group," said NIOSH's Lotz.

One of the many unresolved issues is whether the new limit for partial-body exposures should be changed. (The draft had proposed raising it to 10 W/Kg.) Also undecided are the size and shape of the averaging volume.

SCC-28 Working Group: Consensus Statement

At a January 10-11 meeting held at Motorola's offices in Ft. Lauderdale, FL, the Revision Working Group of IEEE's SCC-28 agreed on a consensus statement for revising the IEEE's standard for RF/MW radiation exposures. This statement, reprinted below, was then modified by SCC-28's subcommittee 4 at its meeting in San Antonio, January 19. Text that is struck through below was deleted in San Antonio, and the text that was added is in italics.

Based on our current understanding and pending the conclusion of the review and white paper process, the consensus of the Revision Working Group is as follows:

1. The RF safety standard should be based on science.

2. RF safety standard revision should be derived from peer-reviewed publications and documents that are reviewed by the SC-4.

3. The adverse effect level remains at 4 W/Kg subject to revision following completion of the literature evaluation and white papers.

4. The maximum exposure limits should be based on established adverse effects after inclusion of an appropriate safety factor(s).

5. Safety factor(s) should consider uncertainties in the biological database (e.g., ~~unknown health consequences~~, measurements, environmental conditions, exposure duration, individual variability, and other factors).

6. Nonthermal RF biological effects have not been established and none of the reported nonthermal effects are proven adverse to health (does not apply to electro-stimulation). Thermal effect is the only established adverse effect.

7. The microwave hearing effect is not adverse and should not be used for setting the peak power limit.

8. The shape and size of the averaging volume and the peak SAR limit ~~will be determined after the WHO temperature workshop in March~~ *are still to be determined*. The important end point is the temperature change.

9. RF standard should be harmonized with other international standards to the extent where scientifically defensible.

10. Rationales must be documented for all changes relative to the current standard.

11. *The editorial committee w*~~W~~ill add *in the informative section a paragraph* dealing with potentially sensitive subpopulations, such as children.

12. *Reconsider* ~~Keep~~ the two-tier approach (whole-body average SAR 0.4 and 0.08 W/Kg), ~~and leave~~ the peak SAR value and averaging volume. ~~blank, which are to be decided after the WHO temperature workshop results become available.~~

The partial-body limits are crucial to Motorola and the rest of the telecom industry because they determine the allowable specific absorption rate (SAR) for mobile phones. Essentially all parties agree that this part of the current standard was set arbitrarily. "We recognize as a group that the partial-body exposure limit is less-than-well-founded on science," said OSHA's Curtis.

Further debate on the partial-body limit has been delayed until after the March thermoregulation workshop being organized by the WHO's EMF project (see p.13). Most of those who will attend — with the exception of Adair and Motorola's Dr. Joe Elder — will be from outside the RF/MW community. WHO's Dr. Leeka Kheifets declined to disclose the invitation list.

At the San Antonio meeting, SC-4 asked members to submit a one-page statement on key elements of the standard — for instance, whether the standard should be one-tier or two-tier and whether the SAR averaging volume should be 1g or 10g. Tell said that these viewpoints are due by March 1 and will be assembled for the next meeting of the Revision Working Group, in Washington, April 8-9.

Dr. C.K. Chou, cochair of SC-4, told *Microwave News* that the subcommittee is not planning to respond directly to the 14 questions raised by the federal health agencies but that they would be addressed in the revised standard (see *MWN,* J/A99).

The goal is to have a first draft of a new standard for the next SC-4 meeting, which will be held in conjunction with the Bioelectromagnetics Society's annual conference in Quebec City, Canada, during the last week of June — and a completed draft for a vote by the full SC-4 at the end of the year.

« Eye on Europe »

Germany's six service providers have agreed to sponsor a four-year health **research program**, with a total budget of €8.5 million ($7.6 million) in exchange for the government's pledge not to tighten exposure limits for mobile phone towers (see p.6). In addition, the companies promised to give local officials and the public a greater role in decisions on siting base station antennas, to avoid the placement of antennas near schools or kindergartens and to install a network of measurement stations to monitor RF/MW radiation from their systems. Government officials welcomed these measures as "an important contribution" and said that they will monitor their implementation by the carriers. The new industry-backed research program would supplement a government-funded effort announced last summer (see box on p.9). According to the environment ministry, an "independent body" will direct the industry program, but a spokesperson for T-Mobil in Darmstadt told *Microwave News* that no decision has yet been reached as to who will run it.

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The fallout continues from the letter by five **Swedish professors** attacking Drs. **Lennart Hardell** and **Olle Johansson** for "talking nonsense" about mobile phones, dioxin and other health risks (see *MWN,* S/O01). The letter was translated into English and republished in the *Bioelectromagnetics Society Newsletter,* which is edited by Dr. **Mays Swicord** of Motorola. In a letter that appeared in the next issue of the newsletter (November/December), Dr. **Kjell Hansson Mild** of the National Institute for Working Life in Umeå, Sweden, wrote that he is "astonished" that he, a past president of BEMS and a collaborator of Hardell's, was not given the opportunity to respond. In an accompanying letter, Dr. **Michael Kundi** of the University of Vienna writes that instead of "muzzling" scientists who don't agree with the majority, a strategy should be devised to convince the public that its concerns are being taken seriously. Then on December 17, the Swedish tabloid *Aftonbladet* ran an exposé on one of the five professors, Dr. **Hans-Olov Adami**, an epidemiologist at the Karolinska Institute in Stockholm. NOBEL PROFESSOR HIRED BY CHEMICAL GIANT ran the headline. (Adami is a member of the selection committee for the Nobel Prize.) At issue is Adami's work for **Exponent** Inc., which does a lot of consulting work for the chemical industry — and specifically on dioxin. Dr. **Jack Mandel**, who runs Exponent's health and envionmental group, did not respond to a request for confirmation of his relationship to Adami. (Mandel has criticized EPA's and IARC's designation of dioxin as a known human carcinogen.) Exponent's Dr. **Michael Kelsh**, based in Menlo Park, CA, told *Microwave News* that Adami had not worked on his study of Motorola workers (see *MWN,* M/A00). Adami told *Aftonbladet* that industry could never make him say anything that he could not defend scientifically.

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Telecommunications antennas and toxic chemicals are being blamed for a **cancer cluster** in the provincial capital city of Valladolid, north of Madrid. The story has drawn widespread attention not only in **Spain** but across Europe. Beginning in December 2000, three children at an elementary school with approximately 450 students have been diagnosed with leukemia — a rate many times greater than the national annual incidence of 4.3 cases per 100,000. In addition, a fourth child at the school was diagnosed with Hodgkin's disease. In October, parents petitioned the courts for an order to turn off the transmitters — operating at 3.5 GHz and 26 GHz — on the roof of a building near the school. A report on a preliminary investigation of the cluster, issued in November, eliminated the antennas as a cause, primarily because they had been operating only a month before the first case was diagnosed. Unconvinced, a municipal judge on December 21 ordered the antennas be turned off. Media coverage of the incident has been so extensive that the **WHO** EMF project was moved to issue a statement to the press on January 23 correcting what it calls a "distortion" of its position on the possible health effects of radiation from mobile phones and base stations. The project managers, Drs. Leeka Kheifets and Michael Repacholi, asked journalists to distinguish between ELF EMFs and microwaves. It is the former, not the latter, that was designated a possible hu-

man carcinogen by IARC last summer, they explained (see *MWN,* J/A01). A full-scale investigation of the Valladolid cluster is now under way, focusing on the children's exposures to toxic chemicals and both ionizing and non-ionizing radiation, according to the January 12 issue of the *Lancet*.

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COST281, **EBEA** and **ICNIRP** have taken their case against precautionary-based exposure limits to the president of the European Parliament — and have posted the letter on the COST281 Web site. In a November 27 letter to Nicole Fontaine, Drs. **Norbert Leitgeb**, **Paolo Vecchia** and **Jürgen Bernhardt**, representing the three organizations, respectively, argued that standards should not be "based on fragmentary scientific evidence or the scientifically unrepresentative opinions of a few individuals." Just in case there is any doubt as to whom they are referring, their letter is posted right above COST281's critique of Dr. **Gerard Hyland**'s report on low-level health effects (see *MWN,* N/D01). Hyland's paper is now available at the COST281 Web site. All three documents are at: <www.cost281.org/activities.php>. The COST281 review of the Hyland report was originally requested by Dr. **Tom McManus**, the chief technical advisor at **Ireland**'s Department of Public Enterprise in Dublin. In mid-January, Pat Cox of Ireland became the new president of the European Parliament.

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Gert Anger of the **Swedish Radiation Protection Authority** (SSI) has issued a new report on **SARs** and **emitted power** from 21 different mobile phones operating at 900 MHz and 1800 MHz. Most of the SAR measurements, carried out by IMST in Kamp-Lintfort, Germany, according to the 1998 CENELEC protocol, were released last year (see *MWN,* M/A01). Emitted power is an indicator of the amount of power used for communication (see *MWN,* J/F01). Anger found that the average phone used only 16% of its available power. The report (2002:01, released January 17), which is in Swedish with an English abstract, is available on the SSI's Web site, <www.ssi.se>. (See also p.2.)

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In a new report, the **Health Council of the Netherlands** has found that radiation from mobile phones "does not constitute a health hazard, according to the present state of scientific knowledge." In contrast to the advice of expert panels in England, France and Germany, the Dutch council "feels there is no need for recommending restrictions on the use of mobile phones by children." The council allows that some biological effects have been documented in experimental studies, but that these are "minimal" and "reversible" and "cannot be considered hazardous to health." The report, released on January 28, was drafted by the council's EMF committee, chaired by Dr. **Eric Roubos**, a professor of zoology at the Catholic University of Nijmegen. A copy of the full 96-page report is available in English on the council's Web site, <www.gr.nl>. A copy may also be ordered from the council by fax: (31+70) 340-7523 or by e-mail: <order@gr.nl>. The council has previously issued reports on GSM radiation and on EMFs (see *MWN,* N/D00 and M/J00, respectively; also J/A01).

Germany Plans Broad Research Program on Mobile Phones

The Federal Radiation Protection Office in Salzgitter, Germany, is considering proposals on 15 different projects in its new research program on mobile phone safety (see *MWN,* J/A01). The four-year effort, which is being administered with the assistance of the Federal Environment Ministry, has a total budget of €8.5 million ($7.6 million).

Among the proposals requested by the radiation office are:

- A repeat of the Australian mouse lymphoma experiment known as the Repacholi study, but with a different type of transgenic mouse: the *AKR/J* strain instead of the *Pim1* strain. In addition, the mice would be exposed to SARs "substantially below," as well as close to, the ICNIRP limits.
- *In vivo* experiments investigating effects of GSM and UMTS (3G) signals on the ears and eyes and looking for genetic and other effects in rats over several generations of exposures.
- Research on effects in isolated pineal glands under various exposure conditions.
- Studies of protein expression, signaling and other functions in various cell types exposed to both pulsed and CW radiation.
- An assessment of the feasibility of a study of health risks among people in occupations with high RF/MW exposures.
- An epidemiological analysis, beginning with a pilot study, of health complaints and radiation from mobile phone base stations, with a study population of approximately 2,000.

The list of proposed projects, posted at <www.bfs.de/forsch/index.html>, also includes a study of lymphoma in mice exposed to 50 Hz EMFs. The deadline for submitting applications was January 5.

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The **U.K.**'s National Radiological Protection Board (**NRPB**) has been folded into a new government agency, whose main mission will be to control infectious diseases. Sir **Liam Donaldson**, the chief medical officer at the Department of Health, announced the reorganization on January 10. The National Infection Control and Health Protection Agency is designed to "provide an integrated approach to protecting the health of the public against infectious diseases as well as chemical and radiological hazards," the department stated. The threat of a terrorist attack was only part of the reason for the shuffle: epidemics of BSE and foot-and-mouth disease have caused huge economic losses across Britain. "We have been assured that the NRPB will remain a distinct entity within the agency," NRPB's Dr. **Michael Clark** told *Microwave News*. Clark said that the NRPB staff — like many observers — were surprised by the changes.

U.K. Mobile Phone Research Under Way; Fifteen Projects Receive $6.4 Million

On January 25, the U.K. Mobile Telecommunications and Health Research Program announced its first 15 projects, with total funding of approximately £4.5 million ($6.4 million). The program, which has a total projected budget of £7.4 million ($10.5 million) and is supported equally by industry and government, was recommended by Sir William Stewart in his May 2000 report (see *MWN*, M/J00).

The big winners are epidemiologist Dr. Anthony Swerdlow, who will receive close to a quarter of all the money awarded, and MCL, formerly called Microwave Consultants Ltd., which also got two grants (and is consulting on a third). Swerdlow is a member of the National Radiological Protection Board's (NRPB) Advisory Group on Non-Ionizing Radiation (AGNIR), as well as of ICNIRP. Dr. Edward Grant, a director of MCL, was a long-time member of the AGNIR who very recently stepped down. NRPB researchers received a total of £731,000 (more than $1 million).

Dr. David de Pomerai, a relative newcomer to RF/MW research, was thrilled at winning a grant. "It will be a change not to run my microwave research on a shoe-string budget," he told *Microwave News*.

Details of each project listed in the table below are available at <www.mthr.org.uk>. The table also lists two additional mobile phone grants which were funded by the U.K. Department of Trade and Industry. A second call for proposals was issued at the end of last year (see *Nature*, December 6).

Name/Institution	Title	Cost/Years	Comments
Dr. Martin Bootman Babraham Institute	Effect of Pulsed RF EMFs on Redox Signaling & Calcium Homeostasis	£500,000 (≈3yr)	Use of new screening technology to monitor changes in cellular calcium and in nitric oxide
Dr. Peter Burns Transport Research Lab	Conversations in Cars: Relative Hazards of Mobile Phones	£75,000 (1 yr)	Compare the distraction of use of hands-free phone with other common driver activities
Dr. Ray Cartwright University of Leeds	U.K. Case Control (CC) Study of Adult Brain Tumors	£265,000 (≈2 yr)	Supports an extension to U.K. component of IARC Interphone study (see *MWN*, M/A00)
Dr. Philip Chadwick MCL	International EMF Dosimetry Project	£220,000 (3 yr)	Coordinating international effort to provide free on-line resource for EMF and RF dosimetry
Dr. Robert Clarke National Physical Lab	"Traceability" for Mobile Telecom and Health Research	≤£97,000 (3 yr)	Calibration services for those labs involved in the MTHR projects
Dr. David de Pomerai University of Nottingham	Cellular & Subcellular Effects of MWs in the Nematode	£323,000 (3 yr)	Follow-up on stress response and changes in gene expression in roundworms (see p.14)
Dr. Peter Dimbylow NRPB	Assessment of SARs in the Head from TETRA Handsets	£75,000 (1 yr)	Computer modeling and experimental measurements of the TETRA helical antenna
Dr. Paul Elliott Imperial College, London	Cohort Study of Mobile Phone Users (Pilot Study)	£202,500 (1 yr)	Feasibility study for a long-term effort; Karolinska's Ahlbom is a member of the team
Dr. Camelia Gabriel MCL	Measurement of the Dielectric Properties of Biological Tissue at MW Frequencies	£350,000 (3 yr)	Dosimetry for both pig and human tissues, and how dielectric properties change with age
Dr. Linda Luxon National Hospital for Neurology and Neurosurgery	Evaluation of the Effects of Mobile Phone Use on Labyrinthine Function	£180,000 (2 yr)	Does RF cause imbalances in the ear, leading to headaches and nausea? (see *MWN*, J/A00); team includes Robin Cox and MCL's Chadwick
Dr. Simon Mann NRPB	Measurement of RF Power Densities near Microcell & Picocell Base Stations	£66,000 (1.5 yr)	Further surveys at 20 sites (see *MWN*, J/A00); will work with EC/JRC project (see p.13)
Dr. Riccardo Russo University of Essex	Mobile Phone Radiation and Cognitive Function	£200,000 (2.5 yr)	Double-blind studies on effects of GSM and analog signals on memory and attention
Dr. Zenon Sienkiewicz NRPB	Effects of RF Radiation on Brain Physiology and Function	£590,000 (3 yr)	Looks for changes in specific areas of the brain, and in learning and memory performance
Dr. Anthony Swerdlow Institute of Cancer Research	CC Study of Leukemia in Relation to Use of Mobile Phones	£880,000 (4 yr)	Will enroll 900 cases and 900 controls; ICR's Mel Greaves is on the team
Dr. Anthony Swerdlow Institute of Cancer Research	CC Study of Brain Tumors & Acoustic Neuroma Mobile Phones: SE England	£280,000 (2.5 yr)	Will enroll 1,000 cases and 1,000 controls; part of the IARC Interphone study
Dr. Anthony Barker† Royal Hallamshire Hospital	Effects of Mobile Phone Radiation on Blood Pressure	£330,000 (2 yr)	Five different signals, including TETRA, will be tested on 120 normal volunteers
Dr. Stuart Porter† University of York	Interactions of Emerging Mobile Telecom Systems with the Human Body	£454,000	Exposure and absorption from phones, hands-free kits, laptops, wearable PCs & base stations

*£1≈$1.42

†Sponsored by the Department of Trade and Industry

« Wireless Notes »

The long-awaited paper by Drs. **Ray Tice** and **Graham Hook** describing their work for Dr. **George Carlo**'s **WTR** on the genotoxic effects of mobile phone radiation appears in the February issue of *Bioelectromagnetics (23*, pp.113-126, 2002). Their experiments at ILS in Research Triangle Park, NC, are the centerpiece of Carlo's passionate claims that cell phone radiation can no longer be considered benign and that follow-up studies are needed (see *MWN,* M/A99 and J/A99). While Tice and Hook did not find any increases in DNA breaks, they did see more micronuclei in cultured human blood cells exposed to four different types of cell phone signals (both analog and digital) at SARs of 5 W/Kg and higher. ILS is repeating these *in vitro* studies under a **CTIA** contract, as is Dr. **Maria Scarfi** of the University of Naples (see *MWN,* M/J01). Carlo has also finally released the March 1999 report written for WTR by Drs. **Henry Lai** and **N.P. Singh** on their 1988 *in vivo* study of DNA breaks following exposure to analog 837 MHz radiation. This study has been the subject of a great deal of controversy (see *MWN,* M/A99 and M/J99). Attorneys at **Kirkland & Ellis**, which is representing Motorola in the ***Newman*** brain tumor lawsuit (see *MWN*, S/O00), have been demanding a copy of the Lai-Singh report for months. Carlo said that he did not want to release the report until it had been peer reviewed. Last fall, Carlo asked Dr. **Jerry Phillips** in Colorado Springs, CO, to do the peer review and the report was made available in December.

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Dr. **Russell Owen** is leaving the **FDA** to join the **EPA**'s National Health and Environmental Effects Research Lab in Research Triangle Park, NC. "I'm very excited about it," he told *Microwave News*. Since 1995, Owen has headed the radiation biology branch at the FDA's Center for Devices and Radiological Health in Rockville, MD, with responsibility for cell phones. At the EPA, Owen will be the chief of the molecular toxicology branch within the environmental carcinogenesis division. He said that he will be setting up his own lab but will not be doing research on the health effects of electromagnetic radiation. Nevertheless, he added, "I plan to stay active as a member of ICNIRP." He was elected to the commission in 1998. Owen is no stranger to the Durham-Chapel Hill area, having completed his undergraduate and graduate studies at Duke University. No word yet as to who will lead the FDA's effort on cell phones after Owen leaves in late February or March.

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Motorola has asked Dr. **Larry Anderson**'s group at the **Battelle** Pacific Northwest Labs in Richland, WA, to follow up on the experimental findings of Dr. **Pierre Aubineau** at the University of Bordeaux. Aubineau's work could explain why some users of cell phones develop headaches (see *MWN,* N/D01). The Battelle group will estimate the SARs in the dura mater, one of the membranes that surround the brain, according to Dr. **Mays Swicord**, Motorola's director of EME programs in Plantation, FL. "It's a small dosimetry contract," he told *Microwave News*.

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The **FCC** has denied the **EMR Network**'s petition that the agency take a fresh look at its RF/MW exposure guidelines — but the network is not giving up. On December 11, the FCC's Office of Engineering and Technology (OET) stated that it would not open an "inquiry," as the network had requested in the fall (see *MWN,* S/O01). Since it is "well established" that the FCC is not an expert health agency, it should not decide whether its RF/MW standard protects the public, OET's **Bruce Franca** told the network of grassroots groups fighting telecommunications towers. Instead, Franca referred the network to the EPA or the FDA, on whose advice the FCC "relied heavily" in developing its guidelines. On January 10, the EMR Network filed a formal appeal asking FCC Chair Michael Powell and the other commissioners to overrule the OET. Franca's argument is "astonishing," wrote **James Hobson** of Miller & Van Eaton in Washington, who is representing the network. The FCC "cannot lawfully avoid" its responsibility to stand behind its rules, he argued. **Janet Newton** of Marshfield, VT, the director of the EMR Network, pointed to the inconsistency in the agency's position. "When we asked the court to overturn the FCC's rules, the commission convinced the court that it *is* competent to decide which standard is appropriate," she told *Microwave News* (see *MWN,* M/A00 and J/F01). If the FCC denies the latest appeal, the network may go back to court. The FCC faces no formal deadline for responding to the appeal, but if it waits too long a judge could be asked to intervene.

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The **Friends of the Earth** (FOE) and the **Forest Conservation Council** have not fared any better than the EMR Network. On January 4, the **FCC**'s Wireless Telecommunications Bureau (**WTB**) dismissed petitions filed by the two groups seeking a single environmental impact statement (**EIS**) for *all* the antenna **towers** it licenses (see *MWN,* J/A01). The FOE and the council contend that the towers kill migratory birds, encroach on wildlife habitat and give off radiation that may be a human health hazard — and that the WTB okays thousands of towers with virtually no environmental review. The WTB ruling clears the way for the approval of more than 30 proposed towers that had been challenged by the environmental groups. The FCC argued that the FOE and the council are not legally qualified to challenge those tower applications — that is, they lack standing — and advised them to raise their concerns through the FCC's rulemaking process. "There may be legitimate issues here, but this is not the right way to raise them," WTB spokesperson Meribeth McCarrick told *Microwave News*. The forest council's John Talberth countered that his group had resorted to blocking the towers because the FCC had ignored earlier requests to open a rulemaking proceeding. "They know that these are important concerns," he said in an interview. "They just don't want to deal with them yet." Both Talberth and FOE's Brian Dunkiel said that they will appeal WTB's decision to FCC Chair Michael Powell and the other commissioners by the February 6 deadline.

FROM THE FIELD

Across the Spectrum

"It's sort of a no-brainer."

—Alex Story, 27, Alexandria, VA, on his decision to save $30 a month by terminating his landline phone service and relying exclusively on his mobile phone, quoted by Yuki Noguchi, "More Cell Phone Users Cut Ties to Traditional Service," *Washington Post,* p.E5, December 28, 2001

[S]hould we be making public health decisions for more than 100 million users of handheld cell phones on the basis of data from 106 patients, particularly when the latency for cancer to appear is typically longer than the latency experienced by these few patients?

— Dr. Allan Frey, Randomline Inc., Potomac, MD, "Hold the (Cell) Phone..." (letter), *Science,* pp.440-441, January 18, 2002. The 106 patients are those with brain tumors included in the Inskip and Muscat epidemiological studies, who had used cell phones for more than a short period of time (see *MWN,* J/F01). Both study teams concluded that they did not find a brain tumor risk. Frey's letter is in response to a November 16 article by Mark Parascandola on the upcoming *Daubert* hearing in the Christopher Newman cell phone–brain tumor lawsuit. Frey is a consultant to Peter Angelos's law firm in Baltimore, which is representing Newman (see also *MWN,* N/D01).

Letter to the Editor

ALS and Electroshock Therapy

December 26, 2001

To the Editor,

In amyotrophic lateral sclerosis [ALS] studies, it has been difficult to separate the relative etiologic contributions of EMFs and electric shocks. Patients receiving electroconvulsive shock therapy receive numerous electric shocks producing unconsciousness without chronic EMF exposures.

If electric shocks cause ALS, they should be a high-risk population.

Samuel Milham, MD
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Olympia, WA 98502
E-mail: <smilham2@attbi.com>

In a report released last November 8, the Advisory Group on Non-Ionizing Radiation of the U.K.'s National Radiological Protection Board concluded that work in electrical occupations is associated with an increased risk of ALS (see MWN, *N/D01). The group, which is chaired by Sir Richard Doll, suggested that a large case-control study taking account of employment history, electroshock treatments and transcranial magnetic stimulation, among other factors, could help clarify the possible roles of EMF exposures and electric shock in causing ALS.*

On the Internet

MCL Calculator

Need to know the ICNIRP occupational exposure limit for electric fields at 400 kHz or the ANSI/IEEE "controlled" power density standard at 2.4 GHz? Now the math-challenged have quick, reliable access to such numbers, thanks to MCL in London. The company's Web site, **<www.mcluk.org>**, has a calculator that provides the ICNIRP, IEEE or NRPB limits for any specified frequency. Time-averaged and peak values are included as well as contact currents. If you make a mistake, like asking for a power-density limit below 10 MHz, the computer explains what you did wrong. Especially useful is its ability to compare the limits for the various standards. MCL makes it all very easy. Elsewhere on the site are details of the consulting and research support services offered by MCL's team of experts, which is led by Drs. Philip Chadwick, Camelia Gabriel and Edward Grant (see also p.10). The firm was formerly called Microwave Consultants Ltd.

Germans Talk About EMFs

The Jülich Research Center in Jülich, Germany, has established a site, **<www.emf-risiko.de>**, to address "scientific and social controversies over EMFs," with special emphasis on mobile phones. The center's Group on Humans, Environment and Technology, has posted audio files of an EMF forum featuring former ICNIRP Chair Dr. Jürgen Bernhardt, Dr. Lebrecht von Klitzing of the University of Lübeck and Dr. Roland Glaser of Humboldt University in Berlin. The center's analysis of the four reports on health research commissioned by the wireless carrier T-Mobil (see *MWN,* M/J01 and J/A01) is also on the site, as is *Guidelines for Addressing Problems of Electromagnetic Fields in Communities*, a book written at the request of the German Federal Environment Ministry. General descriptions of the work are available in both German and English, but most of everything else is only in German.

NRPB Revamps Web Site

The U.K.'s National Radiological Protection Board (NRPB) has completely redesigned its Web site, **<www.nrpb.org>**. The home page has a special button for information on electromagnetic radiation and fields. The NRPB's *Radiological Protection Bulletin* can be downloaded from this site — the *Bulletin* is no longer published in print form.

The Frequency Fence

In 2004, extraterrestrials will use the electric power grid, radiation from mobile phone towers and television broadcasts to impose an "electromagnetic-induced form of mind control" on humanity—the "frequency fence." So say Terry and Isha Robinson of the International Sovereignty Alliance (ISA) in a report posted at **<www.abovetopsecret.com>**, a site that covers topics such as the NSA's Echelon surveillance system and that perennial favorite, Area 51, with the aim of "exposing the secrecy that exists within the government and military organizations of the world." "Actually," Terry Robinson told *Microwave News* from ISA's headquarters in Kapaa, HI, "it will probably happen in 2003." For those who wish to protect themselves, the ISA recommends its course on "DNA strand activation," available on six audio cassettes for $99.00 plus shipping and handling. For details, go to ISA's Web site, **<www.dimensionalshift.20m.com>**.

2002 Conference Calendar (Part II)

Part I appeared in our last issue.

March 1: **JRC Collaborative Action: Human Exposure to Radiation from GSM and GPRS/UMTS Base Stations Across Europe,** Joint Research Center (JRC), Ispra, Italy. On March 2, the JRC will host two roundtable discussions: **R&D Issues on Human Exposure EMF Measurements and Protocols** and **EMF Risk Perception & Communication**. Contact: Dr. Demosthenes Papameletiou, EC/JRC, Institute for the Environment and Sustainability, I-21020 Ispra, Italy, (39+0332) 785282, Fax: (39+0332) 786272, E-mail: <demosthenes.papameletiou@jrc.it>.

March 21-22: **Adverse Temperature Levels in the Human Body Workshop,** World Health Organization (WHO), Geneva, Switzerland. Contact: Dr. Leeka Kheifets, Radiation Program, WHO, CH-1211 Geneva 27, Switzerland, (41+22) 791-4976, Fax: (41+22) 791-4976, E-mail: <kheifetsl@who.int>.

May 16-17: **International Conference on Electromagnetic Environments and Health in Buildings,** Royal College of Physicians, London, U.K. Contact: Jill Skinner, Abacus Communications, The Pool House, South Hill, Chislehurst, Kent BR7 5EF, U.K., (44+20) 82952951, Fax: (44+20) 84670145, E-mail: <jill@abacuscom.co.uk>, Web: <www.emr-environments.com>.

June 14-19: **12th Annual Conference of the International Society for the Study of Subtle Energies and Energy Medicine (ISSSEEM),** Boulder, CO. Contact: Penny Hiernu, ISSSEEM, 11005 Ralston Rd., Ste.100D, Arvada, CO 80004, E-mail: <issseem@compuserve.com>, Web: <www.issseem.org>.

June 26-28: **Mediterranean Microwave Symposium,** Cáceres, Spain. Contact: MMS, Secretariat, Escuela Politécnica de Cáceres, Universidad de Extremadura, 10071 Cáceres, Spain, (34+927) 257-443, Fax: (34+927) 257-202, E-mail: <mms2002@tsc.unex.es> or <llandesa@unex.es>, Web: <http://tsc.unex.es/mms2002>.

July 21-25: **2002 IEEE Power Engineering Society (PES) Summer Meeting,** Palmer House Hilton, Chicago, IL. Contact: IEEE PES Executive Office, 445 Hoes Ln., Piscataway, NJ 08855, Web: <www.ieee.org/power>.

August 11-15: **12th Conference of the International Society of Exposure Analysis (ISEA)** and **14th Conference of the International Society for Environmental Epidemiology (ISEE),** University of British Columbia, Vancouver, Canada. Contact: Dr. Michael Brauer, UBC Conference Center, 5961 Student Union Blvd., Vancouver, BC V6T 2C9, Canada, (604) 822-1050, Fax: (604) 822-1069, E-mail: <brauer@interchange.ubc.ca>, Web: <www.conferences.ubc.ca/iseaisee2002>.

August 17-24: **27th General Assembly of the International Union of Radio Science (URSI),** Exhibition and Congress Center, Maastricht, The Netherlands. Contact: Dr. Leon Kamp, Dept. of Applied Physics, Eindhoven University of Technology, PO Box 513, NL-5600 MB Eindhoven, The Netherlands, (31+40) 247-4292, Fax: (31+40) 244-5253, E-mail: <URSI2002@tue.nl>, Web: <www.ursi-ga2002.nl>.

August 18-21: **3rd International Conference on Microwave and Millimeter Wave Technology,** Beijing, China. Contact: Ms. Fang Min, Chinese Institute of Electronics, PO Box 165, Beijing 100036, China, (86+10) 6828 3463, Fax: (86+10) 6828 3458, E-mail: <shaz@sun.ihep.ac.cn>, Web: <www.cie-china.org/icmmt2002>.

August 18-22: **16th International Epidemiological Association World Congress of Epidemiology,** Montreal, Canada. Contact: Congress Secretariat, c/o Events International Meeting Planners, 759 Victoria Sq., Ste. 300, Montreal, PQ H2Y 2J7, Canada, (514) 286-0855, Fax: (514) 286-6066, E-mail: <iea2002@eventsintl.com>, Web: <www.iea2002.com>.

August 19-23: **IEEE International Symposium on Electromagnetic Compatibility,** Minneapolis, MN. Contact: Duane Bagdons, International Certification Services, E-mail: <drbicsi@hutchtel.net>, Web: <www.2002-ieee-emc.org>.

August 25-30: **39th CIGRÉ General Session,** Paris, France. Contact: Liliane Ney, CIGRÉ, 21 rue d'Artois, Paris 75008, France, (33+1) 5389-1290, Fax: (33+1) 5389-1299, E-mail: <secretary-general@cigre.org>, Web: <www.cigre.org/GB/2002/fr2002session.htm>.

September 9-13: **International Symposium on Electromagnetic Compatibility,** Sorrento, Italy. Contact: AEI Central Office, Massimo Iandolo, Piazzale R. Morandi 2, Milan 20121, Italy, (39+02) 7779-0218, Fax: (39+02) 798-817, E-mail: <emceurope2002@aei.it>, Web: <www.aei.it/emceurope2002.html>.

September 11-14: **16th EPICOH Congress on Epidemiology in Occupational Health,** Barcelona, Spain. Contact: EPICOH Technical Secretariat Suport Serveis, Calvet 30, Barcelona 08021, Spain, (34+93) 201-7571, Fax: (34+93) 201-9789, E-mail: <suport@suportserveis.com>, Web: <www.suportserveis.es>.

September 19-22: **19th Annual Meeting of the European Society for Magnetic Resonance in Medicine and Biology (ESMRMB),** Florence, Italy. Contact: ESMRMB, Neutorgasse 9/2A, Vienna A-1010, Austria, (43+1) 535-1306, Fax: (43+1) 535-7041, E-mail: <office@esmrmb.org>, Web: <www.esmrmb.org>.

September 23-24: **3rd International Conference on Electromagnetic Fields and Human Health: Fundamental and Applied Research,** Moscow, Russia. Andrey Vasin, Institute of Biochemical Physics, Russian Academy of Science, Kosigina 4, Moscow 117334, Russia (7+95) 190-5421, E-mail: <yurgrigor@cityline.ru>, Web: <www.pole.com.ru/conf2002>. Following this meeting, on September 25-27, there will be a conference on **Harmonization of EMF Standards in Connection with the Science for East European Countries**. This is the latest in a series organized by the World Health Organization (WHO).

October 6-10: **24th Annual Electrical Overstress/Electrostatic Discharge Symposium,** Convention Center, Charlotte, NC. Contact: Steve Voldman, IBM Microelectronics, MS 972F, 1000 River St., Essex Junction, VT 05452, (802) 769-8368, E-mail: <a108501@us.ibm.com>, Web: <www.esda.org/symposia.html>.

October 7-11: **2nd International Workshop on Biological Effect of EMFs,** Aldemar Paradise Royal Mare Hotel, Rhodes, Greece. Contact: Prof. Panos

Meeting Notes

• The objective of the March 1 **EC/JRC** workshop is to begin drafting a protocol for measuring RF/MW radiation levels associated with mobile phone base stations. The meeting is by invitation only.

• The WHO EMF Project has scheduled three by-invitation-only meetings. On March 21-22, it will host a **Temperature Workshop** in Geneva, which is being organized by Dr. Joe Elder of Motorola and WHO's Dr. Leeka Kheifets. The project's international advisory committee will meet in Geneva, June 6-7. And from October 28 to November 1, the ***WHO Workshop on Finalizing the Framework for Harmonized EMF Standards*** will be held in Guilin, which is in Guangxi Province, China. For more information, contact Kheifets — see March 21-22 listing at left.

• The ***WHO–USAF Asia-Pacific EMF Conference***, scheduled for October 21-27 at the five-star Arcadia Beach Resort on Phuket Island, Thailand, has been postponed. Dr. Jon Klauenberg, of the USAF's RFR branch at Brooks AFB, explained that this was due to limits on overseas travel following the September 11 attacks. Klauenberg said that it may be held next year. He can be reached at (210) 536-4837, Fax: (210) 536-3977, E-mail: <b.jon.klauenberg@brooks.af.mil>.

Kostarakis, (30+1) 650-3129, Fax: (30+1) 653-2910, E-mail: <conf2002@imm.demokritos.gr>, Web: <www.uoi.gr/conf_sem/bioeffects>.

October 15-17: **IEE Radar Conference,** Edinburgh, Scotland, U.K. Contact: IEE Conference and Exhibition Services, Savoy Pl., London WC2R 0BL, U.K., (44+207) 344-5477, Fax: (44+207) 240-8830, E-mail: <radar2002@iee.org.uk>, Web: <www.iee.org.uk/Conf/Radar>.

October 20-24: **1st Asian and Oceanic Congress for Radiation Protection (AOCRP),** Seoul, Korea. Contact: Dr. Myung-Jae Song, R&D Office, Nuclear Environment Technology Institute, KHNP, PO Box 149, Yusung, Daejon 305-600, Korea, (82+42) 870-0202, Fax: (82+42) 870-0269, E-mail: <mjsong@khnp.co.kr>, Web: <www.aocrp-1.com>.

October 24-27: **24th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBS)** and **2002 Annual Fall Meeting of the Biomedical Engineering Society (BMES),** Westin Galleria Hotel, Houston, TX. Contact: EMB Executive Office, (732) 981-3433, Fax: (732) 465-6435, E-mail: <emb-exec@ieee.org>, Web: <embs-bmes2002.org>.

November 10-14: **Engineering and Physical Sciences in Medicine,** Convention Center, Rotorua, New Zealand. Contact: Dr. David Black, Enviromedix, Private Bag 24 904, Royal Oak, Auckland, New Zealand, (64+9) 625-0407, Fax: (64+9) 625-2292, E-mail: <david@enviromedix.co.nz>, Web: <www.epsm2002.com>.

November 12-14: **12th International Symposium on Antennas,** Acropolis Convention Center, Nice, France. Contact: Secrétariat JINA 2002, France Télécom R&D, Fort de la Tête de Chien, 06230 La Turbie, France, Fax: (33+492) 106519, E-mail: <jina.cnet@wanadoo.fr>, Web: <www. jina2002.com>.

Hot New Papers

Wolfgang Löscher, "Do Cocarcinogenic Effects of ELF Electromagnetic Fields Require Repeated Long-Term Interaction with Carcinogens? Characteristics of Positive Studies Using the DMBA Breast Cancer Model in Rats," *Bioelectromagnetics, 22,* pp.603-614, December 2001.

"By reviewing the Hannover series of experimental studies on MF effects in the DMBA model, we have identified a number of factors that seem to be critical for the outcome of such laboratory studies: (1) The rat substrain used is possibly the most important factor in determining the results from EMF exposure. We have started to directly compare MF bioeffects in different SD [Sprague-Dawley] substrains in our laboratory...(2) The dose of DMBA is critical because the cocarcinogenic effect of MF increases with decreasing background tumor incidence.... (3) The duration of MF exposure is important, because our data strongly indicate that MF exposure affects tumor growth rather than tumor incidence....(4) The flux density used for MF exposure is important, because the cocarcinogenic effect of MF seems to be lost at high (mT) flux densities, indicating a flux-density window in the μT range. (5) The location of tumors across the mammary gland complexes of the female rat is important, with the cranial thoracic complexes being most sensitive to EMF exposure....Even though the effects of MF exposure seen in our experiments were small, MF effects of similar magnitude in human populations would represent a critical adverse health effect because of the high incidence of female breast cancer. A critical question is whether these results are real or are due to chance or methodological biases. That in our six experiments group tumor incidence in MF-exposed groups was never below sham controls, but above controls in five experiments, argues against chance as an explanation for the findings."

David de Pomerai et al., "Growth and Maturation of the Nematode *Caenorhabditis Elegans* Following Exposure to Weak Microwave [MW] Fields," *Enzyme and Microbial Technology, 30,* pp.73-79, January 2002.

"Prolonged exposure to weak MW fields...at 25˚C induces a heat-shock response in transgenic *C. elegans* strains carrying *hsp16* reporter genes. A comparable response to heat alone requires a substantially higher temperature of 28˚C...Here we investigate two further biological consequences of prolonged MW exposure [750-1000 MHz, SAR 0.001 W/Kg] at 25˚C in synchronized cultures of wild-type worm larvae, namely alterations in (i) growth rate (GR) and (ii) the proportion of worms later maturing into egg-bearing adults (MP). Both of these parameters are significantly increased following MW exposure (GR by 8-11% and MP by 28-40%), whereas both are significantly decreased (GR by 10% and MP almost abolished) after mild heat treatment at 28˚C for the same period. It follows that the biological consequences of MW exposure are opposite to, and therefore incompatible with, those attributable to mild heating. This evidence does not in itself necessitate a non-thermal mechanism, but does eliminate explanations that invoke the bulk heating of tissues by MWs." (See also *MWN,* M/J00.)

New Research Projects

• Dr. **Peter French** of St. Vincent's Hospital in Sydney, **Australia**, is investigating whether long-term, intermittent exposures to mobile phone radiation can modulate the genetic activity of human brain cells. The experiment will test French's hypothesis that phone use can stimulate the expression of **heat shock proteins**, leading to the development of cancer (see *MWN,* J/A01). Telstra, the Australian telecommunications giant, is providing the TEM exposure system. French told *Microwave News* that he expects to announce results by the end of the year.

• An **epidemiological** study of people living near the Lookout Mountain antenna farm outside Denver is under way. Drs. **John Reif** and **James Burch** of Colorado State University in Ft. Collins, the coprincipal investigators, will determine whether broadcast RF/MW radiation affects the production of melatonin and ornithine decarboxylase (ODC), among other biological markers. Past studies suggesting that higher-than-expected rates of brain cancer on Lookout Mountain and a proposal to build new DTV transmitters have added fuel to the long-running controversy over possible health impacts (see *MWN,* M/A99 and J/F00). The new study, which is being sponsored by the National Institute of Environmental Health Sciences (**NIEHS**), is the first epidemiological study of broadcast radiation ever funded by a U.S. government agency. Both Reif and Burch declined to discuss the project with *Microwave News*.

C. Cranfield, A. Wood, V. Anderson and K. Menezes, "Effects of Mobile Phone Type Signals on Calcium Levels Within Human Leukemic T-Cells (Jurkat Cells)," *International Journal of Radiation Biology, 77,* pp.1207-1217, December 2001.

"In an experiment in which SARs in individual human leukemic cells have been accurately determined [915 MHz GSM, 1.5 W/Kg (95% CI: 1.0-2.2W/Kg)], no changes in average calcium level have been de-

tected. In addition, no significant alteration has been shown in either the percentage of cells showing 'spiking' or the height and number of these spikes. The significant change in average frequency derived from the PSD [power spectral density] of the variations in fluorescent intensity was for one combination of experimental conditions only and is difficult to assess in terms of biological sequelae and could be a statistical anomaly."

Päivi Heikkinen et al. (including Sakari Lang and Jukka Juutilainen), "Effects of Mobile Phone Radiation on X-Ray-Induced Tumorigenesis in Mice," *Radiation Research, 156,* pp.775-785, December 2001.

"Two hundred female CBA/S mice were randomized into four equal groups at the age of 3 to 5 weeks. The mice in all groups except the cage-control group were exposed to ionizing radiation at the beginning of the study and then to RF radiation for 1.5 h per day, 5 days a week for 78 weeks. One group was exposed to continuous NMT (Nordic Mobile Telephone)-type frequency-modulated RF radiation at a frequency of 902.5 MHz and a nominal average specific absorption rate (SAR) of 1.5 W/Kg. Another group was exposed to pulsed GSM (Global System for Mobile)-type RF radiation (carrier-wave frequency 902.4 MHz, pulse frequency 217 Hz) at a nominal average SAR of 0.35 W/Kg....The RF radiation exposures did not increase the incidence of any primary neoplasm in the tissues examined significantly. The incidence of glandular polyps in the uterus ($p=0.011$) was decreased in the group exposed to continuous RF radiation, and the incidence of benign pheochromocytomas in the adrenal glands was lower in both RF radiation–exposed groups ($p=0.041$ and $p=0.039$ for the continuous RF and pulsed RF group, respectively). However, the incidence of hyperplasias in the adrenal medulla was not significantly different in those groups... The results of the current study suggest that long-term exposure of mice to low-level RF radiation (902 MHz) at these exposure levels and modulation characteristics does not affect the development of malignant lymphomas induced by ionizing radiation....Chou et al. [1992, known as the Guy study] reported a significant increase in the overall incidence of primary malignancies in rats exposed to 2.45 GHz microwaves at an SAR of 0.15-0.4 W/Kg. There were no differences, however, for any specific type of tumor. In our study, the proportions of animals with primary malignant neoplasms were slightly higher in the two groups exposed to RF radiation (56% and 50%) than in the sham RF radiation–exposed animals (40%), but this difference was not statistically significant, and survival was not changed. Furthermore, the exposures to RF radiation did not significantly increase the incidence of any primary neoplasm considered separately. There was a statistically significant decrease in the incidence of benign pheochromocytomas in RF radiation–exposed groups. It remains to be determined whether this statistically significant difference is a real effect of the exposure to RF radiation or is a consequence of chance....The exposure to RF radiation did not cause any nonneoplastic changes that could be interpreted as promotion of tumor development....The RF radiation exposures apparently did not cause any other harmful effects in the animals."

Paolo Bernardi et al., "Power Absorption and Temperature Elevations Induced in the Human Head by a Dual-Band Monopole-Helix Antenna Phone," *IEEE Transactions on Microwave Theory and Techniques, 49,* pp.2539-2546, December 2001.

"A numerically efficient way to evaluate specific absorption rate (SAR) deposition and temperature elevation inside the head of a user of a cellular phone equipped with a dual-band monopole-helix antenna is proposed. The considered antenna operates at both frequencies (900 and 1800 MHz) [GSM]. The results obtained show that, for a given radiated power, although the maximum SAR value as averaged over 1 g in the brain is higher at 900 MHz than at 1800 MHz, the maximum temperature increase in the brain is higher at 1800 MHz. However, taking into account that the average power levels radiated at the two operating frequencies are different (250 mW at 900 MHz and 125 mW at 1800 MHz), higher temperature elevations are obtained at 900 MHz. In this last case, the temperature increases are on the order of 0.2°C in the ear, and less than 0.1°C in the external brain region close to the phone. When the heating effect due to the contact of the ear and cheek with the phone is also taken into account, it is found that the predominant heating effect in the ear, able to cause temperature increases as high as 1.5°C, is the one due to the phone contact, while SAR deposition plays a significant role only in the heating of the external brain region."

"MICROWAVE NEWS" FLASHBACK

Years 20 Ago

• Two U.S. government advisory panels, ERMAC and FMAC, weigh issuing a statement assuring the public that, "No health hazard can result from total incident radiation lower than 50 $\mu W/cm^2$."

• Exposures at 17 out of 21 workplaces with RF heaters and sealers exceed OSHA's 10 mW/cm^2 limit, a NIOSH survey finds.

• Multnomah County, OR, extends its moratorium on new broadcast transmitters and considers adopting its own RF/MW standard. These actions follow a study by Dr. William Morton linking RF/MW radiation to uterine cancer in parts of Portland.

Years 10 Ago

• The Wisconsin Public Service Commission orders state utilities to use the "best available control technology" to reduce EMFs from new and upgraded transmission lines.

• Over 150 researchers gather in Brussels for the inaugural conference of the European Bioelectromagnetics Association.

• Florida health officials identify a cluster of Hodgkin's disease cases near Patrick Air Force Base. Seven of the eight cases lived within 400 yards of the radar, used by both the USAF and the FAA.

Years 5 Ago

• A memo written by Motorola spokesman Norman Sandler to Burson-Marsteller reveals that they have been "war-gaming" their response to the impending release of a study by Drs. Henry Lai and N.P. Singh showing that microwaves can cause breaks in DNA.

• Living near a broadcast tower carries increased risks of adult leukemia, according to Dr. Helen Dolk in the U.K., and of childhood leukemia, according to Dr. Bruce Hocking in Australia.

• U.S. and Swedish researchers find statistically significant links between EMF exposures at work and Alzheimer's disease.

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UPDATES

AT THE MOVIES

Turning Off the Lights... Say you want to rob some casinos and need to cut off the power to the alarms and closed-circuit video cameras. How would you do it? In the 1960 production of *Ocean's Eleven,* Frank Sinatra and the members of his "rat pack" used explosives to topple one of the transmission line towers feeding electricity to Las Vegas. That is too low-tech for Steven Soderbergh's 2001 remake with the same title. Soderbergh must have heard that street lights in Hawaii's Waikiki beach mysteriously went out after a 1962 nuclear test in the Pacific. So, this time around, the gang, led by George Clooney, steals a portable EMP generator from a research lab. When the zapper is activated, Vegas goes dark. Another striking difference between the two movies is that most of the stolen cash goes up in smoke at the end of the 1960 film. But in the remake, Clooney escapes with the loot, as well as the pretty girl (Julia Roberts). Hollywood screen writers are no strangers to the marvels of EMP. In the 1995 James Bond movie, *GoldenEye,* agent 007 battles Russian hoods who harness a satellite that uses EMP to disable electronics. And in *Eraser,* which appeared the following year, Arnold Schwarzenegger contends with corporate and government thugs armed with EMP guns. Also in 1996, EMP weapons were featured in *Broken Arrow* and *Escape from L.A.* (see *MWN,* S/O96).

MILITARY RADAR

Health Concerns in Azerbaijan... Agence France-Presse (AFP) reports that citizens living in the shadow of the Russian missile defense radar in Qabala, in northern Azerbaijan, are complaining of too many birth defects and too many sick children as well as the sudden deaths of apparently healthy adults (January 23). "It's like living next door to Chernobyl," said one local teacher. On its Web site, GlobalSecurity.org states that the radar, completed in 1984, has a projected output power of 350 MW. A joint Russian-Azeri study commission exonerated the radar from any blame for the health complaints, according to the AFP. This is not the first time a Russian radar has been the target of local concern. In the mid-1990s, a number of studies pointed to health and ecological effects in the vicinity of the military radar station in Skrunda, Latvia (see *MWN,* S/O94 and S/O96).

PEOPLE

Dr. **Anders Ahlbom** of the Karolinska Institute in Stockholm has been awarded the International Prize for Tumor Prevention by the Italian Association Against Cancer. Ahlbom is being honored for his epidemiological studies on the cancer risks associated with EMFs. The award, which includes a check for 10 million lire (over €5,000 or $4,600), is presented every four years. Past winners include Dr. **Irving Selikoff** and **Cesare Maltoni** for their work on asbestos and vinyl chloride, respectively. Ahlbom will be feted at a ceremony in Latina, an hour's drive south of Rome, on February 22....On December 31, Dr. **Neil Cherry** was named an Officer of the New Zealand Order of Merit. Cherry, of Lincoln University in Canterbury, was honored for "services to science, education and the community" by Queen Elizabeth II, who also enjoys the title of Queen of New Zealand. "My com-

munity work includes appearing without payment on behalf of over 25 communities in New Zealand and Australia trying to keep cell sites away from their homes and workplaces," Cherry told *Microwave News*. Cherry has long voiced concern that RF/MW radiation exposure standards are too lenient and has been especially critical of ICNIRP's limits (see *MWN,* M/A97 and M/A 00). The award comes as Cherry has been diagnosed with motor neuron disease, a condition in which muscles progressively and irreversibly degenerate over a three-to-five-year period. He plans to continue working: "I will be able to use a computer to write and communicate for a long time in this period," he said....**Mike Silva** of Enertech Consultants in Campbell, CA, has joined EPRI as a half-time consultant to help manage its new RF safety and wireless technology program. Silva declined to discuss his move up from the ELF part of the spectrum, referring calls to EPRI's PR office. He can be reached at <msilva@epri.com>....**Mark Douglas** has left the antenna development group at Sony Ericsson Mobile Communications in Research Triangle Park, NC, to become the engineering manager at Dr. **C.K. Chou**'s EME lab at Motorola in Plantation, FL....Dr. **Marvin Ziskin** of Temple University in Philadelphia is the new chair of IEEE's Committee on Man and Radiation (COMAR). He replaces **Howard Bassen** of FDA's Center for Devices and Radiological Health, who served a two-year term. Ziskin is on the board of directors of the NCRP.

PRECAUTIONARY PRINCIPLE

Assorted Notes... The European Environment Agency (EEA) has published a report (No.22) that examines how the precautionary principle has been applied — or not — over the last hundred years. Based on 14 contributed case studies, *Late Lessons from Early Warnings: The Precautionary Principle 1896-2000* presents 12 lessons for policy makers. These include acknowledging ignorance, uncertainty and risk, identifying gaps in scientific knowledge and following up early warnings. Among the agents studied are ionizing radiation, asbestos, benzene, DES and MTBE, as well as mad cow disease. The 200-page report, released on January 10, is available free on the Internet at: <http://reports.eea.eu.int>. Earthscan Publications Ltd. in London will issue the report in the spring. Tel: (44+207) 278-0433, Fax: (44+207) 278-1142, E-mail: <earthinfo@earthscan.co.uk>, Web: <www.earthscan.co.uk>....More than 75 scientists from 17 countries issued a statement following the *International Summit on Science and the Precautionary Principle,* held in Lowell, MA, September 20-22. They urged governments to "adopt the precautionary principle in environmental and health decision-making under uncertainty when there are potential risks." Among the signers were Drs. Marco Martuzzi of the WHO in Rome and David Ozonoff of Boston University. The full statement and a list of signers are at: <www.uml.edu/centers/lcsp/precaution>....Drs. Ken Foster of the University of Pennsylvania in Philadelphia and Paolo Vecchia of Italy's National Institute of Health in Rome are seeking papers on the precautionary principle for publication in the winter issue of *IEEE Technology and Society Magazine*. Papers are due on April 1. This special issue of the magazine will appear in December. For more information, contact Foster at (215) 898-8534, or <kfoster@seas.upenn.edu>.

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As We Go to Press

NAS–NRC Committee on Potential Health Effects of PAVE PAWS Radar

On February 5, the National Academy of Sciences–National Research Council (NAS–NRC) announced the members of its committee to assess the potential health effects of PAVE PAWS radiation (see *MWN,* N/D01).

The provisional members of the committee are:

- Dr. Frank Barnes, University of Colorado, Boulder, chair
- Dr. Robert Hansen, RC Hansen Inc. (consulting engineers), Tarzana, CA, vice chair
- Dr. Larry Anderson, Battelle Pacific Northwest Labs, Richland, WA
- Dr. Graham Colditz, Harvard Medical School and School of Public Health, Boston, MA
- Dr. Francesca Dominici, Johns Hopkins University School of Public Health
- Dr. Kenneth McLeod, State University of New York, Stony Brook
- Dr. Keith Paulsen, Dartmouth Medical Center, Hanover, NH
- Dr. Leslie Robison, University of Minnesota, Minneapolis
- Dr. Susan Santos, University of Medicine & Dentistry of New Jersey, Piscataway
- Dr. Jan Stolwijk, emeritus, Yale University School of Medicine, New Haven, CT

Both Anderson and Hansen have security clearances, according to Dr. Rick Jostes of the NAS–NRC.

The NAS–NRC is inviting comments on these provisional choices for 20 calendar days from February 5. Go to: <http://nationalacademies.org> and search for "PAVE PAWS."

Keeping Current: Follow-Up on the News

◆ Baltimore attorney Peter Angelos, who is heavily involved in cell phone lawsuits, is set to collect $250 million for representing the state of Maryland in tobacco litigation. The state had originally promised to pay him 25% of any award. But when the state won $4 billion, many balked at giving him a ten-figure payday. Angelos has offered to take a 75% cut in return for being paid over six years instead of 20 and avoiding future litigation.

◆ Israel's Ministry of Defense has evaluated dozens of nonlethal weapons, Major General Isaac Ben-Israel, the outgoing chief of military R&D, told *Defense News* (December 17-23). Among these are: EMP and high-powered microwaves. It is not clear whether they have ever been deployed. Ben-Israel also said that his directorate has explored mind-control technologies, but decided that they were not effective.

◆ Narda Safety Test Solutions will hold a three-day seminar on measuring and managing sources of electromagnetic radiation at Narda's headquarters in Hauppauge, NY, April 9-11. Cell phone and radio transmitters as well as radar will be covered. For more information, contact Richard Strickland at (631) 231-1700, ext. 322 or <richard.strickland@narddasts.com>.

◆ U.S. soldiers who served in the 1990-1991 Gulf War are "nearly twice as likely" to develop ALS, according to a study of more than 2.4 million men and women by the VA and the defense department. Forty Gulf veterans with ALS are now eligible for compensation and other benefits, the VA announced in December. (See also p.12.)

◆ The U.K. Electricity Association has posted a revised edition of its 10-page pamphlet, *Electric and Magnetic Fields [The Facts],* on its Web site, <www.electricity.org.uk>. Also posted is a one-page briefing, *Recent Developments,* dated May 2001.

◆ The Science and Technology Committee of the Knesset, Israel's parliament, has adopted a recommendation that the use of cell phones by children should be kept to a minimum, according to the January 2 *Jerusalem Post*.

◆ The long-delayed DMBA–RF/MW rat studies by Germany's Drs. Hella and Christian Bartsch will appear in the February issue of *Radiation Research (see MWN,* J/A99 and N/D00).

Consumers Betrayed and Abandoned

When shopping for the most reliable washing machine or the best shampoo for the dollar, many Americans depend on *Consumer Reports,* published by the Consumers Union (CU). On the other side of the Atlantic, the British consult *Which?,* the magazine of the U.K. Consumers' Association (CA).

But this strategy is a loser when it comes to learning about the possible risks associated with electromagnetic radiation.

February is cell phone month at *Consumer Reports*. This year, the magazine features 13 pages on how to buy the best phone, find the best service plan and weigh the hazards of driving while on the phone — one full page is on hands-free headsets.

Yet there is not a single word about possible radiation health risks.

Perhaps the CU only addresses phone radiation in odd numbered years. It did devote a single paragraph in its 8-page cover story last February — 2000 was another fallow year — but even so, it used wording usually favored by industry. "To date no *conclusive* evidence has demonstrated [a brain tumor] risk," the CU editors wrote [emphasis added].

Of course we agree with that. Everybody does. But it obscures the many uncertainties about what might happen if you put a radio transmitter next to your brain day after day, year after year.

Expert panels in England, France, Germany and Spain have all advised that children should limit their use of mobile phones. The British Medical Association and the German Academy of Pediatrics have made similar recommendations.

Sir William Stewart, the former science advisor to the British prime minister, has been particularly vocal in trying to stop the marketing of phones to children — a message he repeated at the end of January on announcing the 15 new grants for mobile phone research (see p.10).

The CU appears to be apathetic about any long-term risks to children. Or maybe it is simply unaware of what is going on in other parts of the world. We tried to ask the new editor of *Consumer Reports* for the CU's point of view, but she did not respond to our messages.

In 1997 and again in 2001, the CU suggested that concerned readers use a hands-free set. But over in England, the CA has discouraged their use, arguing that these sets can actually increase radiation exposure (see *MWN,* M/J00 and S/O00).

With the exception of ERA Technology, which made the measurements for the CA, none of the many test labs we contacted on three continents thinks that there is any substance to ERA's and CA's claims. But in the ensuing media storm, the CA has made no effort to respond to its naysayers.

Microwave News has learned that one of CA's own technical experts advised the staff not to publish the article on hands-free sets. "I told them there must be something seriously wrong with their tests," said Dr. Alan Preece of the University of Bristol.

When a U.K. government agency scheduled a meeting to bring all the parties together to settle the confusion, the ERA engineers did not show up (see *MWN,* N/D00).

The CA dug in its heels and refused to back down. Given the CA's stature, the U.K. Department of Health decided not to endorse hands-free kits to cut radiation exposure. In its consumer brochure on *Mobile Phones and Health,* issued in 2000, the department waffled and told consumers that "the level of effectiveness of hands-free kits to reduce SAR is still uncertain."

Today, close to two years after the CA sounded the alarm, the issue remains in limbo — though the government has now funded a project to settle the question (see p.10).

The CA deserves credit for having raised a potentially serious problem. But having done so, it has the responsibility to finish what it started. By casting doubt on the only generally recognized way of limiting radiation exposure from mobile phones and then doing nothing to clear up the confusion, the CA has abandoned its public.

The one benefit of CA's botched cell phone crusade is that it has generated a lot of media attention. The U.K. press, unlike its U.S. counterpart, has actively covered every twist and turn in the mobile phone health controversy — some would say it has been *hyper*active. Nevertheless, the media are a reflection of public anxieties, and together they have prompted the new broad-based English research program.

By ignoring the uncertainties about safety and hiding behind mealymouthed truisms, the Consumers Union has done nothing to educate the American consumer about cell phone health risks. It has also encouraged continued government complacency.

Once Again, the TCO Shows the Way

In Sweden, the TCO, the Swedish union of white-collar workers, is showing what can be done. Unwilling to wait until the uncertainties are resolved years from now, it is proposing a sensible technical solution.

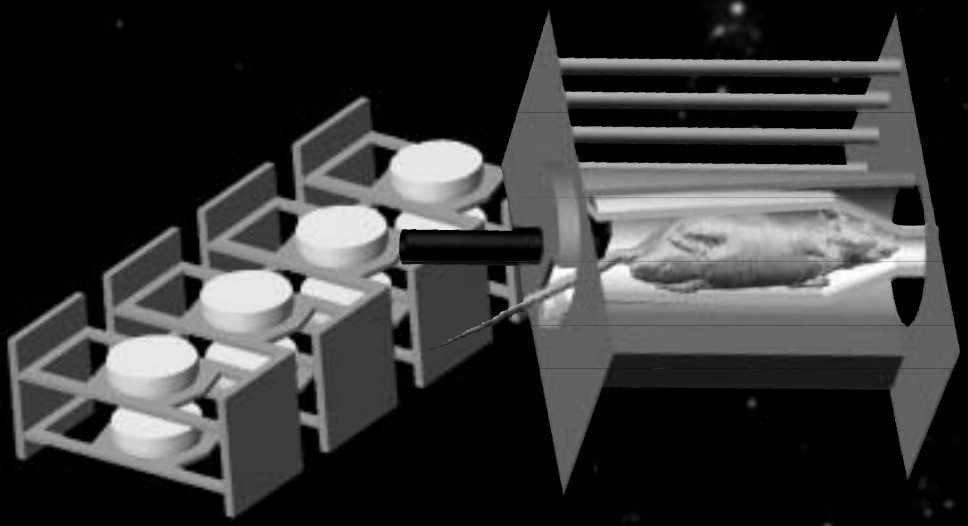
The TCO is pushing for a stricter SAR standard and is promoting a new index of performance, the communication efficiency of a mobile phone (see *MWN,* J/F01; also p.9). Consumers and workers all over the world already owe a huge debt to the union for pushing the computer industry into making safer computer monitors — and to Per Erik Boivie, who masterminded TCO's campaign. TCO95 and TCO99 stickers are known the world over as signs of safe computing. The union is now applying the lessons learned with VDTs to mobile phones.

The CU and CA should wake up and catch up. Consumers on both sides of the Atlantic deserve better.

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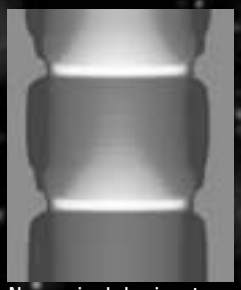
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Swedish Study Must Be Followed Up

Swedes Find GSM Radiation Causes Nerve Damage at Very Low Doses

Leakage Through the Blood-Brain Barrier

In a new paper that is sure to reignite concerns over the safety of mobile phones, Drs. Leif Salford and Bertil Persson have shown that extremely low doses of GSM radiation can cause brain damage in rats.

Salford, a neurosurgeon, and Persson, a biophysicist, both at Sweden's University of Lund, report that they see nerve damage following a single two-hour exposure at a specific absorption rate (SAR) of 0.002 W/Kg. The effect becomes statistically significant at 0.02 W/Kg. These nonthermal levels are a hundred to a thousand times lower than the 2 W/Kg exposure standard recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP).

Salford and Persson first showed that low-level microwave radiation can cause leakage through the blood-brain barrier (BBB) over ten years ago (see *MWN*, J/F92 and J/A92). In this latest work, they again show that microwave

(continued on p.19)

1993 FDA Memo

Data "Strongly Suggest" Microwaves Can Promote Cancer

In the spring of 1993 at the height of public concern over cell phone–brain tumor risks, Food and Drug Administration (FDA) biologists concluded that the available data "strongly suggest" that microwaves can "accelerate the development of cancer." This assessment is in an internal agency memo recently obtained by *Microwave News* under the Freedom of Information Act.

"Of approximately eight chronic animal experiments known to us, five resulted in increased numbers of malignancies, accelerated progression of tumors, or both," wrote Drs. Mays Swicord and Larry Cress of FDA's Center for Devices and Radiological Health (CDRH) in Rockville, MD. They also pointed to other evidence from laboratory (*in vitro*) studies that supported a cancer risk.

Yet, in its public statements at that time, the agency played down these findings. For instance, in a Talk Paper issued in early February, the FDA stated that there was "limited evidence that suggests that lower levels [of microwaves] might cause adverse health effects."

"A few studies suggest that [microwave] levels [from cellular phones] can accelerate the development of cancer in laboratory animals," the FDA added, "but there is much uncertainty among scientists about whether these results apply to the use of cellular phones."

(continued on p.5)

Brillouin Precursors Round 2: Attacks on Albanese Intensify; Editors at "Radiation Research" Join Forces with Robert Adair

Dr. Richard Albanese, a U.S. Air Force (USAF) medical doctor and a voice of concern about the safety of PAVE PAWS radar radiation, has once again been sharply criticized by Dr. Robert Adair — and this time the editor-in-chief of *Radiation Research,* Dr. Sara Rockwell, has joined the fray.

In an editorial* appearing in the January issue of *Radiation Research,* Rockwell and Dr. John Moulder of the Medical College of Wisconsin, Milwaukee, denounce Albanese's arguments as an "unpublished, non-standard" theory that is stirring up public controversy and delaying the modernization of the radar system. Moulder is a senior editor of the journal.

The editorial accompanies a commentary† by Adair, a Yale University physicist, who writes that Albanese suffers from "the mistaken belief that the PAVE PAWS radiation is quite different from the radiation from other scanning radar systems." Adair insists that, "Real pulses used in radar technology seldom, if ever, generate significant Brillouin precursors. PAVE PAWS does not."

Even if PAVE PAWS radiation could induce Brillouin precursors, Adair adds, such effects "are far too small to have any conceivable effect on physiology." (See also *MWN,* M/J02.)

"The first reaction of most radiation scientists is to ignore such [non-standard] theories," Moulder and Rockwell write. But it is "appropriate and necessary for the public good," for "rigorously peer-reviewed journals such as *Radiation Research"* to step in when a theory influences public policy.

Albanese declined to comment.

"They are not playing fair," objected Dr. Kurt Oughstun, who has long collaborated with Albanese. "Albanese hasn't published anything about all this because the Air Force won't let him," Oughstun told *Microwave News*. "This is all politics."

Oughstun pointed out that he and others have published numerous papers on Brillouin precursors in the peer-reviewed literature, so it is "extremely misleading" to suggest that Albanese's theories are based on unpublished data.

Albanese "does not appear to be acting as if there are any restrictions," Moulder told *Microwave News*. "I've never heard that Albanese has made that claim."

Oughstun is skeptical. "It's common knowledge that Albanese is required to clear his papers with his superiors. If the editors didn't know that, they should have," he said.

At the opening meeting of the NAS–NRC inquiry on PAVE PAWS, held last March 15 in Washington, Albanese was clearly concerned about disclosing secret information. He interrupted his own presentation to say that any further discussion of biological effects of phased-array radiation would have to take place in "another setting." After the meeting, he told *Microwave News* that the USAF can block the release of any paper that does not conform to official policy (see *MWN,* M/A02).

Rockwell, a physicist who is a professor of therapeutic radiation at Yale University's medical school in New Haven, CT, said that she and Moulder "sought no information on the classified papers or any other aspect of Dr. Albanese's classified research." Rather, she said, they relied on Albanese's unclassified papers and presentations — "most of which were not readily available." These documents were collected by Adair and made available to the editors and reviewers during the peer review of his commentary. (In the interview, Rockwell noted that, earlier in her career, she had worked on classified projects for the military.)

Lt. Col. Bruce Ruscio, a public health advisor at the Cape Cod Air Force Station, did not respond to requests for comment.

Non-Standard Theories Defined

According to Moulder and Rockwell, theories such as Albanese's "tend to have certain elements in common":

- No "formal statement...that contains enough information on the details...to allow rigorous analysis"
- They are based on data that are "not in the peer-reviewed literature" or not otherwise available to the public
- They "often include *ad hominem* attacks on the proponents of 'standard' theories"
- The authors' training has "little or no relevance to the theory or even to the general area"
- The authors have "few or no relevant peer-reviewed publications."

USAF Researcher at Center of Storm

Dr. Richard Albanese has worked at Brooks Air Force Base in San Antonio since 1971 and has done research on Brillouin precursors for over 15 years. Albanese studied chemistry and mathematics as an undergraduate at Princeton University and received a degree in medicine from Columbia University. He has a top secret security clearance.

Albanese believes that the radiation from PAVE PAWS is qualitatively different from other types of radar and could cause harmful biological effects by inducing Brillouin precursors on entering the human body (see *MWN,* M/A02). In a May 2000 letter to the Massachusetts Department of Health, he warned that the potential effects of PAVE PAWS phased-array radiation are "completely unexplored" (see *MWN,* S/O00).

Albanese has also been an outspoken critic of an Air Force study that tried to downplay the health effects of Agent Orange, a herbicide used during the Vietnam War.

An abbreviated listing of Albanese's publications is posted on the Web at: <www.pavepaws.org>.

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* J. Moulder and S. Rockwell, "Critiquing Unpublished Theories," *Radiation Research, 159,* pp.1-2, January 2003.

† R. Adair, "Environmental Objections to the PAVE PAWS Radar System: A Scientific Review," *Radiation Research, 159,* pp.128-134, January 2003.

They cite a number of other examples of non-standard theories, including the epidemiological studies of Poland's Dr. Stanislaw Szmigielski, which point to increased cancer risks among Polish military personnel exposed to RF/MW radiation, and the work of Dr. Denis Henshaw of the U.K.'s University of Bristol suggesting that electric fields play a role in the power line–cancer equation (see *MWN,* J/F98 and M/A96, respectively). They also question the work of Dr. Neil Cherry of New Zealand's Lincoln University.

Henshaw is puzzled by the label. "I'm afraid I do not recognize our 1996 paper as in any way being a 'non-standard' theory," he said in an interview. The Advisory Group on Non-Ionizing Radiation of the U.K.'s National Radiological Protection Board is investigating Henshaw's hypothesis (see *MWN,* N/D01).

NAS–NRC Panel Says PAVE PAWS Data Inadequate To Judge Safety, But No Decision on Need for Epidemiological Study

Midway through its planned two-year investigation, a panel of the National Academy of Sciences–National Research Council (NAS–NRC) finds that it does not have enough information to determine whether the USAF's PAVE PAWS missile defense radar on Cape Cod, MA, poses a health risk to those living nearby.

Currently available data "are not adequate for determining the biologic and potential health effects" of PAVE PAWS radiation, the panel's chair, Dr. Frank Barnes of the University of Colorado, Boulder, wrote in an interim report* dated November 15.

The NAS–NRC panel is calling for more precise information on the type of signal — the waveform — to which nearby communities are exposed, as well as their levels of exposure.

The USAF is sponsoring the NAS–NRC inquiry at the urging of Sen. Edward Kennedy (D-MA) (see *MWN,* J/F01). Cape Cod residents have voiced concerns that radiation from the system — which has been operating since 1980 at 420-450 MHz with a peak power of 582 kW — is responsible for elevated cancer rates on the Cape (see *MWN,* J/F98).

While the new report states that "epidemiologic methods" are "important to the determination of possible health effects," it stops short of recommending an epidemiological study of those living near the radar. Dr. Susan Santos, a panel member, cautioned that it remains to be seen whether a study is warranted.

If the NAS–NRC panel were to recommend such a study, it would probably meet with resistance from the Armed Forces Epidemiological Board (AFEB). "There is no immediate indication to support either initiation of new, or further analysis of existing, epidemiologic investigations," the board stated in a December 10 memorandum† prepared at the request of the USAF Surgeon General.

According to the new report, waveform data would be used to determine "the comparability of the PAVE PAWS phased-array radiation with radiation emitted by non-phased-array systems," and, in turn, the "adequacy of the existing RF energy literature" for assessing potential effects.

The panel cites "issues related to the rise and fall portions" of the waveform. Barnes explained that this is a reference to Brillouin precursors, which could cause harmful biological effects, according to Dr. Richard Albanese of the USAF in San Antonio (see p.2).

Dr. Kurt Oughstun of the University of Vermont, Burlington, who briefed the panel last September, said in an interview that he is "very pleased" by the request for more waveform data. "Until we find out what the pulses actually look like," he said, "no one can really say that it is impossible for PAVE PAWS to generate Brillouin precursors."

Dr. Robert Adair of Yale University has dismissed Albanese's concerns as unfounded (see p.2).

Additional power-density measurements are needed, the November 15 report states, because previous surveys by the USAF "were not designed to cover a wide range of census tracts for epidemiologic purposes" (see *MWN,* M/J87),

"You need to see some data on exposures in order to assess any health impacts," Santos, a consultant on risk analysis based in Medford, MA, told *Microwave News*. She explained that the panel would then try to combine that information with data on the incidence of various health problems — for example, from the Massachusetts cancer registry.

According to the report, the panel is eager to see the results of a measurement survey initiated by the PAVE PAWS Public Health Steering Group (PPPHSG), a committee of local health officials which receives financial and administrative support from the USAF. But this survey is not expected to be finished before September, when the panel's work is due to be completed. NRC's Dr. Rick Jostes told *Microwave News* that the panel may ask the USAF for an extension so that it can include the measurements in its final report.

Calculated exposure estimates have been prepared for the USAF by MITRE, an engineering firm with headquarters in Bedford, MA, that works closely with the U.S. military. But Barnes said that it is not clear whether the panel will be able to use these estimates — because of technical problems, not because of military secrecy. "They have been very cooperative in giving us everything we've asked for," Barnes said in an interview.

In a press release dated November 19, the USAF said that it was "very pleased" by the interim report, which "has validated the approach" it has taken in addressing health questions about PAVE PAWS. Requests for clarification were left unanswered.

* The November 15 NAS–NRC report is available at <www.nap.edu/books/NI000483/html/>.

† AFEB's recommendations are at <www.ha.osd.mil/afeb/2003/2003-03.html>.

Status of Research on Microwaves and Cancer — FDA's View in 1993

Reprinted below are excerpts from an April 7, 1993, memo prepared by Drs. Mays Swicord and Larry Cress of FDA's CDRH.

The literature contains reports of probably thousands of experiments relating to microwave [MW] bioeffects. Very few of these are relevant to the question of whether MWs can in some way accelerate the development of cancer in humans. This is because endpoints other than cancer were examined in most of the studies; many examined behavioral effects, cataract development or thermoregulation. In addition, many of these studies involved acute exposures to relatively high levels of MWs. For the types of exposures involved with devices such as cellular phones and police radar, long-term exposures to much lower power levels are of interest. The majority of the reported experiments also involved exposures at 2450 MHz, the "oven" frequency; higher and lower frequencies are employed in police radar and cellular phones, respectively. In spite of these caveats, there are a few reported experiments which bear directly on the question of cancer progression and chronic, low-level exposures. This small and incomplete database strongly suggests that under at least some circumstances these exposures do indeed accelerate the development of cancer by some unknown mechanism.

In Vivo Experiments

Of approximately eight chronic animal experiments known to us, five resulted in increased numbers of malignancies, accelerated progression of tumors, or both. One of the experiments, conducted 30 years ago, involved relatively high-level exposures and suffered from a number of problems...

A much more disturbing study is that of Guy and Chou. Financed by the Air Force, this well-planned and executed study was intended to examine a number of biological, behavioral and biochemical endpoints. Two groups of 100 rats each were used; the exposed group was treated with pulsed-modulated waveform for 22 hours each day over a period of two years. Although no one type or anatomic site of tumor predominated, 18 of the exposed animals developed a malignancy of some type versus only 5 of the control animals, statistically significant at the p= 0.001 level. In addition, 7 of the exposed animals developed "benign" pheochromocytomas versus only one of the control animals, also highly significant (p=0.02). Although this study has been discounted by some critics because no one tumor site or target organ predominated, this is precisely what one would expect for an agent which accelerates the progression of naturally occurring malignant cells. That is, any transformed neoplastic group of cells occurring in an organ will be promoted without reference as to site or type of tumor. These results are particularly disturbing because the rate of MW energy deposition in the rats' bodies is comparable to that of users of cellular phones and other portable communications equipment. The study's applicability to these devices may be questioned, however, on the grounds that the frequency is 3 times that used in cellular phones and the modulation is also different.

Szmigielski published reports of experiments using three different models of tumor progression. One group used a strain of mice with a high rate of spontaneous mammary tumors, a second group had the chemical carcinogen 3,4-benzopyrene applied to their skin and a third group was injected with sarcoma cells which resulted in pulmonary tumors. Animals were exposed to 2450 MHz unmodulated MW radiation two hours a day for several months....All groups showed earlier appearance and accelerated growth of tumors, suggesting a tumor-promoting activity. In addition, the mice exposed to higher levels developed tumors at a faster rate than the group receiving less radiation.

The only study reported in the peer-reviewed literature that did not show accelerated tumor progression used mice with melanomas subcutaneously implanted under their skin. Exposure to 2450 MHz MWs (both unmodulated and pulsed) for 2.5 hours a day did not affect tumor progression or survival times. One reason that this study may have given a negative result is that the mice only lived about 6 weeks after implantation of the highly malignant melanoma cells. The Szmigielski data show that about 4 months of exposure is necessary before tumor progression is accelerated by MWs. The melanoma-implanted mice thus did not survive long enough for their disease to be accelerated by the MW exposure.

In Vitro Experiments

Although the animal experiments described above offer the strongest evidence implicating the ability of MWs to promote cancer, other evidence exists in the form of *in vitro* data. A standard method for screening chemical agents for the ability to promote neoplastic transformation employs cells in culture. This technique has been applied to MW radiation by Balcer-Kubiczek and Harrison who found that although 2450 MHz MWs alone did not cause malignant transformation in their system, low-level MW irradiation did increase the amount of transformation caused by TPA, a phorbol ester tumor promoter. Furthermore, the magnitude of this effect increased with increasing MW power level, strongly suggesting that it is not an artifact. It must be noted that the MWs used in this study were modulated at 120 Hz, raising the question of whether the observed effect could actually be due to the lower frequency component.

A number of other *in vitro* experiments also suggest that low-level MW irradiation can interact with the cell's growth-control mechanisms in ways that could be harmful. Byus has demonstrated the ability of modulated MWs to increase cellular ornithine decarboxylase (ODC), an enzyme that is also induced by chemicals known to be cancer promoters. Czerska and colleagues have similarly found that MW exposure can induce the transformation of human lymphocytes, but pulsed MWs are more effective than unmodulated MWs. Dutta has found that very low-level irradiation can induce oncogene expression in cultured neuroblastoma cells, but this work has been published only in abstract form. Cleary has demonstrated that irradiation can induce the proliferation of cultured glioma cells, and that the effect persists for several days after irradiation, but the published experiments involved power levels greater than those likely to be encountered with cellular phones and similar devices. A number of other experiments have demonstrated genetic abnormalities, such as chromosome despiralization, but many of these studies used crude exposure systems and dosimetry, and some of the reported effects may have been due to heating and not MW exposure per se.

Summary of Research Situation

Most of the published MW bioeffects literature describes experiments that are not relevant to the question of whether MWs can accelerate cancer progression. In particular, very few chronic, low-level animal exposure experiments have been done. It should be noted that most of the experiments described above have not been replicated, and most were conducted with frequencies and modulation different from cellular phones. The fact remains, however, that the data which exist strongly suggest that MWs can, under at least some conditions, accelerate the development of malignant tumors. These *in vivo* data are also supported by *in vitro* data which have demonstrated not only malignant transformation but other effects on the cell's growth-control mechanisms. Taken together, these two lines of evidence make a compelling case for further research to either confirm or refute previous work.

1993 FDA Memo: Microwave Data "Strongly Suggest" a Cancer Risk *(continued from p.1)*

The cell phone scare became front-page news in early 1993 after CNN reported that David Reynard of St. Petersburg, FL, had filed a lawsuit charging that his wife had developed brain cancer after using a cell phone. The suit was originally filed in April 1992 (see *MWN,* M/J92).

The Talk Paper also stated that, "If there is a risk from these devices — and at this point we don't know if there is — it is probably small." This view was widely quoted in the press. In contrast, Swicord and Cress were silent on the magnitude of any possible risk in their memo.



IN 1993, MOTOROLA'S MAYS SWICORD WAS AT THE FDA

In 1993, Swicord was the chief of the radiation biology branch at FDA's CDRH. He is now the director of electromagnetic energy programs at Motorola's Florida Research Labs in Plantation. Cress is still at the CDRH today.

"My view at the time was that the database certainly did not support very strongly that there is nothing there," Swicord told *Microwave News* this January.

And Cress said that, "It was our honest scientific evaluation of the existing, albeit inadequate, database."

At the time the Swicord-Cress memo was being prepared, the Cellular Telecommunications Industry Association (CTIA) was under great pressure to calm public fears and a jittery market in cell phone stocks. Its initial strategy, later abandoned, was to ask the FDA to supervise a research program on the possible health effects of microwave radiation.

Swicord and Cress wrote that there is "a compelling case for further research to either confirm or refute the previous work." (Extended excerpts of the Swicord-Cress memo are reprinted on p.4.)

At a February 2, 1993, Congressional briefing convened by Rep. Edward Markey (D-MA), Swicord, together with representatives of the Environmental Protection Agency (EPA) and the Federal Communications Commission — as well as Markey himself — all called for more research (see *MWN,* J/F93).

A number of former and current FDA staff members suggested that Swicord and Cress used strong language in their memo to help secure funding for their particular sphere of interest at the CDRH. Cress, however, rejected this explanation. "It was not a funding document," he said.

The FDA documents also reveal that:

• A document prepared to brief then CDRH Director Dr. Bruce Burlington stated that, "Evidence exists of nonthermal and cytotoxic effects at power levels produced by cellular phones." The briefing document was prepared by Dr. Elizabeth Jacobson, then CDRH's deputy director for science, and was largely based on the Swicord-Cress memo. Both Burlington and Jacobson have since left the agency.

• Dr. Richard Adamson of the National Cancer Institute (NCI) "adamantly opposed" a proposal to use industry funds to pay for a government-run research program, according to the Jacobson document. An interagency coordinating committee cochaired by Adamson reacted negatively to the proposal "because of the appearance of conflict of interest," Jacobson wrote.

• Jacobson told Burlington that, in her view, the NCI brain tumor study — which included questions on cell phones — was "flawed" because "it ignores the fact that widespread use of phones is a very recent phenomenon, and if there is any 'latent period' for development of tumors, a negative result will be hard to interpret." Adamson later left the NCI to run the Washington office of the National Soft Drink Association. The NCI study, which was released in December 2000, did not find a link between cell phones and brain cancer (see *MWN,* J/F01). An editorial in the *New England Journal of Medicine* by Drs. Dimitrios Trichopoulos of Harvard School of Public Health in Boston and Hans-Olov Adami of the Karolinksa Institute in Stockholm that accompanied the NCI paper concluded that it is "highly unlikely" that cell phones increase the risk of brain tumors.

• Jacobson also advised Burlington that, "With a burgeoning wireless...industry, it is imperative to establish a clear scientific understanding of health effects from low-level microwave exposure."

• Swicord and Cress were disturbed by the results of the long-term microwave exposure study by Drs. Bill Guy and C.K. Chou at the University of Washington, Seattle (see *MWN,* J/A84). They wrote: "Although this study has been discounted by some critics because no one tumor site or target organ predominated, this is precisely what one would expect for an agent which accelerates the progression of naturally occurring malignant cells....These results are particularly disturbing because the rate of microwave energy deposition in the rats' bodies is comparable to that of users of cellular phones..." Guy later helped oversee the research program set up by Dr. George Carlo and paid for by the CTIA. Chou, who later received $1.5 million from Carlo for a dosimetry study, now works with Swicord at Motorola's Florida labs.

• At about the same time that the cell phone industry was telling the American public that thousands of scientific studies proved the safety of hand-held phones, Swicord and Cress advised that, "Very few of these are relevant to the question of whether microwaves can in some way accelerate the development of cancer in humans."

Three years before the cell phone–brain tumor scare took center stage, the EPA drafted a report which concluded that microwave radiation should be classified as a possible human carcinogen (see *MWN,* M/J90). Like Swicord and Cress, the EPA analysts based their finding on the results of the Guy-Chou long-term exposure study and the experiments of Poland's Dr. Stanislaw Szmigielski (see *MWN,* My81).

This January, on the tenth anniversary of the cell phone flare-up, Jacobson told *Microwave News* that parts of the briefing document were a "little zingy." They "were designed to get the director's attention."

Both Swicord and Cress have had a major change in their outlook. "More than 300 studies have been done since then, including a number of animal studies, and there is no indication of a problem," Swicord said.

Cress agrees. "My evaluation has gone from being concerned to believing that there is a very small chance of health effects."

Australians Concede Error in Cell Phone Cancer Paper; Explanation Baffles Skeptics

Drs. Tammy Utteridge and Tim Kuchel have admitted that they mistakenly published conflicting and confusing data in a widely cited paper that discounts cancer risks from mobile phones.

Their correction resolves many of the contradictions in the original paper. But critics say they cannot understand how the error could have been made and they continue to view the Australian paper with deep skepticism.

Writing in the February issue of *Radiation Research* in response to letters that challenge their work, the Australian researchers explain that they had presented data on the survival of their mice in terms of "days of exposure" — instead of absolute age. Because the mice were not exposed on weekends and national holidays, they appeared to die earlier than they actually did. This error muddled the interpretation of their results.

For instance, the original paper, published in *Radiation Research* last September, showed that all the transgenic mice had died at about 19 months of age, but were still being handled and weighed at the age of 28 months (see *MWN,* S/O02).

Many are not satisfied with the explanation offered by Utteridge and Kuchel. "This is the most ridiculous thing I have ever read," said Dr. Alexander Lerchl of Germany's International University Bremen. "If that happened in my lab, I would fire those responsible immediately." Lerchl had pointed to the anomaly in the ages of the mice in one of three letters published in *Radiation Research*.

"A time axis that is computed by leaving out weekends and public holidays is not easily produced," commented Dr. Michael Kundi of the University of Vienna. "The whole story about the mislabeled figures is incredible," he told *Microwave News*. Kundi is the author of another of the published letters. Omitting the days without exposure is an unheard-of way of describing the survival age of the mice, he said.

Dr. Ron Melnick of the National Institute of Environmental Health Sciences (NIEHS) in Research Triangle Park, NC, said that he had never heard of anyone reporting survival data in terms of days of exposure instead of absolute age.

"I have not seen it before," agreed Dr. Mays Swicord. "It's a strange thing." Swicord is the director of Motorola's electromagnetic energy programs in Plantation, FL. (See also p.1.)

"This is a major correction to their paper," said Melnick, who is leading the effort to design a set of animal experiments to test the carcinogenicity of wireless signals under the U.S. National Toxicology Program. "They should have published a formal correction in the journal."

Lerchl also believes that the Australians' indirect acknowledgment is insufficient: "If I was in the situation of Utteridge and coauthors, I would at least write an erratum."

Neither Utteridge nor Kuchel responded to questions from *Microwave News* on why they counted exposure days instead of actual age. Kuchel, of the Institute of Medical and Veterinary Science in Gilles Plains, has consistently refused to be interviewed since the paper was published last summer.

Utteridge, who has now left the institute, exchanged numerous e-mails with *Microwave News* last year. But at the time, despite repeated questions about the apparent inconsistencies in the published data, she never revealed that the axes had been mislabeled.

The third letter is from the World Health Organization's EMF project in Geneva, headed by Dr. Michael Repacholi. Repacholi was the lead author on the original transgenic mouse study, which points to a cancer risk following exposure to GSM radiation (see *MWN,* M/J97). The new study sought to confirm or refute the Repacholi finding.

Repacholi and colleagues spell out a number of concerns they have with the Utteridge-Kuchel paper and suggest that the transgenic mice used in the follow-up study are different from the ones Repacholi had originally used because, among other reasons, they have a much higher rate of spontaneous cancer.

That concern has now been resolved with the corrected survival curves. "If what Utteridge and Kuchel say is correct, their study makes a lot more sense and one is left with the conclusion that the two studies — Repacholi's and Utteridge's — show different effects of RF radiation," NIEHS' Melnick said. "Some other factor may be involved. I am not sure how to reconcile the two sets of results."

Questions About Dosimetry Left Unanswered

One of the objectives of the Utteridge-Kuchel experiment was to correct what they called a "shortcoming" of the original Repacholi study: the wide variation in the mice's radiation exposures. The specific absorption rates (SARs) varied considerably because the animals were allowed to roam unrestrained in their cages.

The Australian team opted to use a setup in which the mice were exposed in a confined space in order to better regulate the dose. The system was designed, supplied and paid for by Motorola. In their paper, Utteridge and Kuchel report the SARs as single values (for instance, 0.25, 1, 2 or 4 W/Kg) — without allowing for variations in dose, as Lerchl points out in his letter.

In their published reply, the Australians note that, to their surprise, there was a large variation in the weight of the mice: Some were 26 g and others weighed 62 g "for most of the study." But they do not go the next step and discuss the implications for the published SAR values. (As the weight of the animals goes up, the SARs go down.)

In fact, Utteridge and Kuchel are again totally silent on the question of SAR variability in their February response.

Motorola's Swicord said that his group has completed a detailed analysis of the dosimetry in the Australian study. It has not yet been submitted for publication.

Another contentious issue is whether the control mice — the comparison group — developed cancer at an abnormally high rate, which would make it difficult, if not impossible, to see any cancer increase due to radiation exposure. In their letters, both Kundi and Lerchl speculate that the mice may have experienced stress while being restrained during the exposures.

In their original paper, Utteridge and Kuchel did not present the cancer incidence among the mice not placed in the exposure apparatus. (These are called the cage controls; the shams were also not exposed but were placed in the restraining chambers.) These data, presented in their February letter, show that the sham and cage controls had similar cancer rates at the end of the experiment, which would argue against any problem caused by restraint stress.

The Australians do not, however, present data on the mortality of the cage controls over the life of the experiment. Such data are presented for the other exposed animals, including the shams.

"It's perplexing that they do not give the time course for either the free-roaming controls or the positive (ENU) controls," Dr. Lawrence Goldstein of WHO's EMF project said in an interview. "Incidence data alone provide limited information."

Kundi, Lerchl and Melnick would all like to see information on the survival of the cage controls over time.

Swicord said that Utteridge told Motorola that they had not included the time course data for the cage controls because they fell on top of the other curves and would only have cluttered up the figures.

As to whether the Utteridge-Kuchel study could be considered a replication of the Repacholi study, Goldstein said that, "The two studies are different experiments." For his part, Repacholi told *Microwave News* that he "would not go so far as to say that the experiments are totally different because they use the same animal model and similar methodology."

In general, the Australian researchers discount their critics. In their published reply, they state, "We are particularly puzzled by the criticism of our study, the results of which are consistent with the remaining body of evidence worldwide, while the study of Repacholi *et al*. remains the anomaly."

« Eye on Europe »

COST281's advisory against carrying out an epidemiological study of health impacts of mobile phone base stations has itself become a target of criticism (see *MWN,* N/D02). The European cell phone health research committee believes that there is "insufficient basis" for such an effort and, even if a study were done, it could neither show small risks nor demonstrate the absence of risks. After COST issued its "scientific comment" on December 9, a Swiss official, who asked not to be identified, said that the COST position has not been well received throughout the government. This is significant because the COST commentary was originally requested by the Swiss Office of Public Health. Then, in a widely circulated e-mail to COST281 Chair Dr. **Norbert Leitgeb** of Austria's University of Graz, Dr. **Elisabeth Cardis** disputed COST's overly negative view of the limits of epidemiological analysis. Cardis of IARC in Lyon, France, is leading the international study of mobile phone use and cancer (see *MWN,* M/A00). These arguments and counterarguments will no doubt come up again at ***Mobile Communication Base Stations and Health,*** a COST281 workshop to be held in Dublin, May 15-16. For more information, contact Gerd Friedrich of FGF, the German mobile phone industry research group, at <info@fgf.de>; Friedrich serves as the secretary of COST281.

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In response to what it calls "controversial" laboratory studies, **COST281** has set up a new task force to organize an international project on possible **genotoxic** effects of mobile phone radiation. This new effort grew out of discussions held at a workshop on ***Genetic and Cytogenetic Aspects of RF Field Interactions,*** held in Löwenstein, Germany, in late November. That meeting was organized by **FGF** and COST281, as well as a German state environmental agency. Those participating in this project plan to meet at the May workshop in Dublin and devise ways to secure funding to set up simultaneous experiments in multiple laboratories. Abstracts of the papers — as well as some of the slide presentations — from the Löwenstein meeting are available at the COST Web site, <www.cost281.org>. Earlier, the COST panel launched a "short-term mission" on mobile phones and children after its workshop in Rome last May (see *MWN,* M/J02).

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On December 9, as expected, health and labor officials of the **European Union**'s **Council of Ministers** received draft **occupational limits** for exposures to EMFs and RF/MW radiation based on **ICNIRP**'s guidelines (see *MWN,* N/D02). Discussions among the 15 member states will now probably continue "throughout 2003" before a final agreement is reached, a spokesperson for the council told *Microwave News*. An updated version of the draft is available in English at: <register.consilium.eu.int/pdf/en/02/st15/15400-r1en2.pdf>.

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Officials of **Germany**'s Federal Office for Radiation Protection (known as the BfS) have spelled out why they favor a **precautionary approach** to radiation from mobile telecommunications. In a new paper, Drs. **Anne Dehos** and **Wolfgang Weiss** argue that "indications of biological effects...at intensities below the currently applied limit values" require a policy response, because if an actual hazard were to emerge it "might affect a large number of people." The two members of BfS' Institute for Radiation Hygiene, outside Munich, advise that public exposures be kept "as low as possible." For instance, they suggest keeping calls short and using a land-line phone when available. They do not cite BfS' previous recommendation to limit use of mobile phones by children (see *MWN,* J/A01 and N/D01). Their paper, which is in German with an abstract in English, is in the December 2002 issue of *Gesundheitswesen — Public Health — (64,* pp.651-656). It is available free at: <www.thieme.de/gesu>.

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The five mobile phone companies in the **U.K.** have set up the **Mobile Operators Association** (MOA). Previously, they were represented by a group within the Federation of the Electronic Industry (**FEI**), but decided to go off on their own after FEI merged with a computer association and changed its name to "Intellect." **Mike Dolan,** who ran the FEI group, is the executive director of the MOA and continues to be based in London. For more information, go to <www.mobilemastinfo.com>.

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Vodafone Portugal has signed an agreement with the Institute of Telecommunications to tell the public more about radiation from mobile phone base stations. Under the new initiative, known as **ITEM** — Technical Information on Exposure to Electromagnetic Radiation in Mobile Communications — the institute will measure radiation levels around 400 Vodafone antenna sites, set up a network of remote monitoring stations in a medium-sized city and maintain an Internet site so that all these data are easily accessible.

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German-speaking **high school students** can learn about the possible health effects of electromagnetic radiation with **interactive software** from Austria's Technical University of Graz. Lectures, pictures and calculations show, for example, how magnetic fields around a power line or microwaves from a mobile phone base station decrease with distance. The university's Andreas Abart, who led the CD development team, formerly wrote public information brochures for an electric utility and a wireless operator. The new software may be offered next year in English, French and Italian. *Electromagnetic Fields and Waves... Electrosmog?* is available for €45 ($48) from DBV Verlag, (43+316) 383033, Fax: (43+316) 383043, E-mail: <office@dbv.at>, Web: <www.dbv.at>.

EMF NEWS

EMFs and Chemicals Together Increase Brain Cancer Risk

Combined exposures to extremely-low-frequency electromagnetic fields (ELF EMFs) and certain types of toxic chemicals can act synergistically to increase brain cancer risks, according to a new study of Swedish workers led by Dr. Marina Pollán of Spain's National Center for Epidemiology in Madrid.

But, interestingly, this finding holds only for gliomas — tumors that develop in the glial cells, or supportive tissue, of the brain — and not for meningiomas, which grow in the membrane that surrounds the brain. While gliomas are malignant, meningiomas are usually benign,

"Our study is the first to try to assess a possible interactive effect — that is, whether the effects of ELF EMFs vary when workers are also exposed to chemicals," Pollán told *Microwave News*.

Pollán's team, which includes Dr. Birgitta Floderus of the Karolinska Institute in Stockholm, analyzed cancer incidence among Swedish men who had held jobs between 1970 and 1989 — a cohort of more than 1.5 million. Their results appear in the December 2002 issue of *Cancer Epidemiology, Biomarkers & Prevention (11,* pp.1678-1683).

In jobs likely to entail exposure to solvents, the glioma risk was more than 50% higher among those also exposed to EMFs above 2 mG. For men exposed to pesticides or herbicides, the risk was approximately doubled when combined with similar ELF EMF exposures, and for lead the combined risk was nearly four times greater.

All three associations are statistically significant. There was a trend of increasing risk with higher EMF exposure for both pesticides/herbicides and lead. The association for lead is based on only a handful of cases.

No increase in the risk of glioma or meningioma was seen for EMF exposures in the absence of chemical agents.

Although very few epidemiological studies have looked for synergies between EMFs and other agents linked to cancer, Pollán points out that such a combined analysis makes sense because "there is consensus" that if EMFs do play a role in cancer, they act as a promoter, requiring the presence of initiators such as chemical carcinogens.

Others — for instance, Dr. Susan Preston-Martin of the University of Southern California — have previously reported higher risks for gliomas than for meningiomas among those exposed to EMFs (see *MWN,* M/A90). And in a 1996 meta-analysis of brain tumors among EMF-exposed workers, Dr. Leeka Kheifets, then at EPRI and now at the WHO in Geneva, found that the risk increased about 25% when the analysis was narrowed from all brain tumors to only gliomas (see *MWN,* J/F96).

"You see a clearer picture when you exclude the non-gliomas," said Dr. Samuel Milham, an epidemiologist and consultant based in Olympia, WA. "It's basic epidemiology that you're better off not lumping different types of tumors together if there are differences in etiology."

Dr. David Savitz of the University of North Carolina, Chapel Hill, who in recent years has expressed a great deal of skepticism over the value for continuing to do EMF epidemiological studies (see p.14 and *MWN,* M/J01 and S/O01), agreed that distinguishing among cancer types "is a very logical thing to do when you have the data to do it." But he noted that the link between brain cancer and chemicals "is just as murky" as the link with EMFs. "How promising is it to put together two murky areas of research?" he wondered in an interview.

In his own study of workers at five electric utilities, Savitz was unable to look at specific types of brain cancer because he used death certificates that lacked such information (see *MWN,* J/F95).

IEEE Rebuffs Appeals On ELF Standard

The IEEE has rejected challenges to its new ELF standard on procedural grounds, without addressing the substantive issues. Bob Ashley and David Fichtenberg filed formal appeals last October, shortly after the standard was approved by the IEEE Standards Board (see *MWN,* N/D02).

The standard, designated C95.6, "shall proceed without change through the publishing process," a three-member panel convened by the board recommended on January 8. The panel noted that IEEE rules require that it only consider procedural issues and that it therefore could not consider technical matters.

Fichtenberg, a resident of Seattle, contended that ICES (formerly SCC-28) Subcommittee 3 (SC-3) violated IEEE ethics guidelines in developing the standard by ignoring possible long-term health effects, such as cancer, and that the 5 kV/m limit for electric fields specified by the standard would allow members of the public to receive painful shocks.

The panel responded that it does not have the authority to address ethics violations, and found Fichtenberg's other objections to the standard to be invalid because he raised them after SC-3's members had voted on it.

Ashley, who is at St. Cloud State University in St. Cloud, MN, disputed the validity of the standard's separate limits for "controlled" and "uncontrolled" environments. He also claims that SC-3 ignored his input. The appeals panel concluded that the SC-3 working group that drafted the standard, chaired by Kent Jaffa of PacifiCorp in Salt Lake City, UT, had given Ashley "an opportunity to express opinions" and "discussed [his] comments openly and at length."

Neither Ashley nor Fichtenberg responded to repeated requests for comment.

Industry Lobby Glosses Over EMF Leukemia Risk

The National Electrical Manufacturers Association (NEMA), an industry lobby group based in Washington, is discounting possible cancer risks from exposure to power-frequency EMFs.

The "available scientific evidence" indicates that EMF exposure "is not a cause" of long-term chronic health effects, including cancer, according to a statement adopted by NEMA's board of governors on November 10 (see box at right).

NEMA does not mention childhood leukemia—in contrast to a number of scientific review panels that have cited epidemiological evidence showing a doubling of risk with average exposures above 3-4 mG (see, for example, *MWN,* J/A01).

According to NEMA, its conclusions are based on reports from the NIEHS' RAPID program, the NAS–NRC and the U.K.'s NRPB, as well as the American Physical Society.

The statement does not cite the designation of EMFs as a "possible human carcinogen" by the RAPID working group or by IARC (see *MWN,* J/A98 and J/A01, respectively).

Dr. Steinar Dale, chair of NEMA's EMF task force, which wrote the statement, told *Microwave News* that it does not mention epidemiological evidence pointing to leukemia risks because "we did not want to go into that level of detail." He said that he sees "no inconsistency" between the statement and others that do note childhood cancer risks.

According to Dale, of ABB Power Systems in Raleigh, NC, NEMA decided that its previous statement on EMFs and health, adopted in 1996, should be updated to reflect the findings of the RAPID program. In 1996, NEMA found "no credible basis" for EMF health risks.

Douglas Bannerman, who has long monitored EMF health developments for NEMA, declined to comment.

NEMA represents more than 400 companies with total revenues exceeding $100 billion.

At the end of January, Dale left ABB and resigned as chair of the NEMA EMF task force. No replacement has yet been named.

NEMA Statement on EMFs & Cancer

The board of the National Electrical Manufacturers Association (NEMA) adopted the following statement on November 10. It is available at: <www.nema.org>.

It is generally recognized that extra-low-frequency (50-60 Hz) electromagnetic fields (ELF EMF) are present in the environment as a result of the generation, transmission, distribution and use of electricity in modern society.

The available scientific evidence indicates that public exposure to ELF EMF is not a cause of long-term chronic adverse health effects, based on the multimillion dollar, 6-year National Institute of Environmental Health Sciences (NIEHS) RAPID research program. The RAPID program's findings, reported to the U.S. Congress in 1999, are supported by several highly respected and independent organizations including the National Research Council of the National Academy of Sciences (1996), the American Physical Society (1995), the World Health Organization (ongoing) and the British National Radiological Protection Board (2001).

NEMA believes that standards for human exposure to ELF EMF are only warranted if a credible scientific basis can be established for adverse effects. Such a basis has not been established for long-term chronic health effects, e.g., cancer, brain tumors, etc. At the same time, NEMA recognizes that exposure to low-frequency magnetic field strengths at levels much greater than typically encountered may cause short-term reactions. Standards that seek to minimize exposure to such field strengths may be warranted.

NEMA recognizes that there are global and political pressures to adopt ELF EMF regulations and standards. Where standards for exposure to ELF EMF are warranted, ELF EMF regulations and standards must comply with rules established by the World Trade Organization for international trade and should be harmonized globally so as to allow the free flow of goods and services across state and national borders.

Catholic School Seeks To Silence Opponent in Power Line Fight

Catholic school officials in Edmonton, Canada, have threatened to sue EMF activist Lisa Amyotte for making "defamatory" statements about health risks at a school currently under construction 108 m from a 240 kV power line.

As a result, Amyotte told *Microwave News* that she will refrain from speaking out against the school—"for the moment." She will instead press for more protective policies on the general issue of EMFs from power lines.

Last November 8, a local planning board rejected the school site because the EMFs — estimated to be 1-2 mG — could increase childhood cancer risks. But a month later, the city council overruled the board; the school is now expected to open in the fall.

In a December 31 letter, Teresa Haykowsky, an attorney for Edmonton Catholic Schools (ECS), warned Amyotte that she faced legal action "in the event that you do not cease and desist in your defamatory conduct."

Haykowsky declined to be interviewed, referring questions to ECS spokesperson Lori Nagy. Nagy told *Microwave News* that Amyotte had made "inaccurate and misleading" statements that "go beyond freedom of expression."

The letter cites a large number of Amyotte's remarks to the press that ECS deems to be defamatory. These include:

> "We believe a safe Catholic school for all children now and in the future is worth fighting for."
>
> "If we can prevent one child from going to that school that might have gotten leukemia it will have been worth it."

At Amyotte's request, several prominent public health scientists have written to the city advocating a policy of prudent avoidance and warning that building a school near a power line would entail health risks (see *MWN,* N/D02).

Officials of the city's public health system, Capital Health, paved the way for the city council's approval of the new school. In a December 4 memorandum, Capital Health concluded that the planning board's decision "appears to be [an] improper application of the principle of prudent avoidance."

Former Head of IARC Backs the Precautionary Principle

Reprinted below are excerpts from a paper, "Primary Prevention Protects Public Health," presented by Dr. Lorenzo Tomatis at Carcinogenesis Bioassays and Protecting Public Health, *a conference organized in memory of Dr. Cesare Maltoni of the Ramazzini Foundation in Bologna, Italy (see* MWN, *M/J02). The proceedings have been published as* Vol.982 *of the* Annals of the New York Academy of Sciences. *Tomatis was the director of the International Agency for Research on Cancer (IARC) from 1982 to 1993. He now lives in Trieste, Italy. His e-mail address is: <ltomatis@hotmail.com>.*

Originally, Group 2B [of IARC's classification of carcinogens] was conceived as a temporary grouping of agents for which further investigation was urgently needed. It has now become a huge parking lot, with over 200 agents or mixtures of agents, in which the available data are of variable quality and quantity. The possibility that new data will become available on these agents in the near future now appears remote....

EMFs provide another example of controversy. There is apparent consensus on the epidemiological evidence for an increased risk of childhood leukemia, with a far from negligible relative risk of 2.0 for postnatal exposure to 0.4 ∝T [4 mG]. Although it has been stated authoritatively that the energy [of] EMFs is insufficient to damage DNA directly and that EMFs cannot therefore have tumor initiation activity, at the same time the need to identify possible mechanisms of action has been emphasized. A severe limitation of the experimental approach for studying the possible carcinogenic effect of EMFs is use of the same criteria traditionally applied to study the carcinogenicity of chemical agents. In the sequence of events that lead to malignant transformation, mechanisms other than direct interaction with or damage to DNA may be involved. Thus, experimental approaches should be used that can support or refute alternative mechanisms that could modify the risk of cancer. In the absence of a mechanism that can satisfactorily justify the increased risk, EMFs have joined the hundreds of agents in IARC Group 2B. However, in contrast to its companions in this large parking lot, EMF has actually stimulated the interest of epidemiologists and, importantly, the release of funds for additional research.

Another relevant example of uncertainty...is non-Hodgkin's lymphoma (NHL), whose incidence has continued to increase throughout the past quarter of a century....Several risk factors have been incriminated, including nitrites in drinking water, EMFs, hair colorants, dietary habits and (above all) occupational exposure to organic solvents, pesticides and herbicides. Whatever the role of each of these factors, none alone can clearly explain the continuous, widespread increase in the incidence of NHL....

We may find ourselves facing a choice between an active attitude, expressed as the adoption of measures of primary prevention in the absence of certainties, and a passive attitude that finds in the etiological uncertainties justification to disregard prudent primary prevention. In the case of NHL, the first attitude would involve drastic measures to reduce the use of pesticides, herbicides and organic solvents; evacuation, at least temporarily, of residences with high levels of EMFs; and orientation towards a utopic, but essential, reduction in consumption. Clearly, this first choice reflects the widely discussed precautionary principle, which indicates that urgent intervention is justified in the face of a potentially serious risk even in the absence of incontestable scientific evidence of a cause-effect relationship.

A cautious, prudent attitude is sometimes interpreted as antitechnological and antiscientific. In fact, those who champion an attitude of caution are simply recognizing that predictive knowledge in most instances is of lesser quality and remains at a lower level than technological knowledge. Recognition of our limited capacity to predict the long-term consequences of our knowledge can only lead to learning more, and thus it represents a stimulus, and certainly not an impediment, to research.

By adopting an attitude of responsible caution, we also accept that we have a duty to provide accurate information on possible or potential risks and to prevent relevant data from being ignored or concealed. Only with such an attitude can we avoid the entire human species being exposed to everything that technological progress can invent.

Hot New Papers

S. Hadjiloucas, M.S. Chahal and J.W. Bowen, "Preliminary Results on the Nonthermal Effects of 200-350 GHz Radiation on the Growth Rate of *S. cerevisiae* Cells in Microcolonies," *Physics in Medicine and Biology, 47,* pp.3831-3839, November 7, 2002.

"Exponentially growing *Saccharomyces cerevisiae* yeast cells grown on dry media were exposed to EMFs in the 200-350 GHz frequency range at low power density to observe possible nonthermal effects on the microcolony growth. Exposure to the EMF was conducted over 2.5 h. ...A statistically significant difference (using a paired t-test at $p<0.01$) between control and exposed groups (enhanced growth) was observed for several small microcolonies which were exposed to 341 GHz radiation. For all other frequencies enhanced or stunted growth was not observed to a statistically significant level. The enhanced growth observed for the exposed microcolonies at 341 GHz suggests a 'window effect' at the earlier stages of growth....Based on these observations, a more detailed study was performed where the effects of exposure duration on the growth of microcolonies were investigated at 341 GHz. A much larger number of microcolonies was observed after sequentially exposing the same microcolonies to radiation over a period of 30, 60, 90, 120 and 150 min....A statistically significant difference (using a t-test) between control and exposed groups is apparent for all of the exposure times except for that at 150 min, but it is clear that the greatest difference occurs within the first 30 min of exposure....These results suggest that exposure to radiation has the greatest effect when the cells are at an early growth stage."

Reprints: Dr. Sillas Hadjiloucas, School of Systems Engineering, Reading University, Reading, U.K., E-mail: <cybsh@cyber.reading.ac.uk>.

Fung Hin Tat, Kam Chak Wah and Yau Hon Hung, "A Follow-Up Study of Electromagnetic Interference [EMI] of Cellular Phones on Electronic Medical Equipment in the Emergency Department [ED]," *Emergency Medicine, 14,* pp.315-319, September 2002.

"Compared with our study of GSM cellular phones in 1997, the current PCS cellular phones impose less EMI on electronic medical equipment found in the ED....Malfunction of electronic medical equipment is determined primarily by the EM shielding of the medical device, the distance between the cellular phone and that device and the EMI characteristics of the cellular phone. The phone's frequency is of greater importance than its power. A frequency of 900 MHz is more likely to cause EMI than 1800 MHz....Of interest is the fact that the hemoglucostix meter was still affected by cellular phone EMI despite being labelled with several EMI standard certificates (CE, GS & UL). This labelling reflects the current lack of a widely adopted specific standard for cellular phone EMI on electronic medical equipment....As a result of this study it is suggested that a separation distance of 1 m between a cellular phone and any electronic medical device provides adequate safety from EMI and should form the basis of policy which seeks to control the usage of cellular phones within a hospital. This policy would also take into account the situation in which two mobile phones ring simultaneously within a small confined area containing electronic medical equipment."

Reprints: Dr. Kam, Tuen Mun Hospital, Hong Kong, China, E-mail: <kamcw@ha.org.hk>.

Justin Bekelman, Yan Li and Cary Gross, "Scope and Impact of Financial Conflicts of Interest in Biomedical Research: A Systematic Review," *Journal of the American Medical Association, 289,* pp.454-465, January 22/29, 2003.

"This comprehensive review of the literature confirms that financial relationships among industry, scientific investigators and academic institutions are pervasive. About one fourth of biomedical investigators at academic institutions receive research funding from industry....Despite the prevalence of these relationships and the broad concerns they have generated, a relative paucity of data has been published describing the impact of financial ties on biomedical research. Although only 37 articles met inclusion criteria, evidence suggests that the financial ties that intertwine industry, investigators and academic institutions can influence the research process. Strong and consistent evidence shows that industry-sponsored research tends to draw pro-industry conclusions. By combining data from articles examining 1,140 studies, we found

Nonthermal Cell Phone Radiation Leads to "Gross" Mutagenic Activity

Maya Mashevich et al. (including Rafi Korenstein), "Exposure of Human Peripheral Blood Lymphocytes to Electromagnetic Fields Associated with Cellular Phones Leads to Chromosomal Instability," *Bioelectromagnetics, 24,* pp.82-90, February 2003.

"We have examined whether *in vitro* exposure of human peripheral blood lymphocytes (PBL) to continuous 830 MHz EMFs causes losses and gains of chromosomes (aneuploidy), a major 'somatic mutation' leading to genomic instability and thereby to cancer. PBL were irradiated at different average absorption rates (SAR) in the range of 1.6-8.8 W/Kg for 72 hr in an exposure system based on a parallel plate resonator at temperatures ranging from 34.5-37.5°C....A linear increase in chromosome 17 aneuploidy was observed as a function of the SAR value, demonstrating that this radiation has a genotoxic effect. The SAR-dependent aneuploidy was accompanied by an abnormal mode of replication of the chromosome 17 region engaged in segregation...suggesting that epigenetic alterations are involved in the SAR-dependent genetic toxicity. Control experiments (i.e., without any RF radiation) carried out in the temperature range of 34.5-38.5°C showed that elevated temperature is not associated with either the genetic or epigenetic alterations observed following RF radiation...These findings indicate that the genotoxic effect of the EM radiation is elicited via a nonthermal pathway. Moreover, the fact that aneuploidy is a phenomenon known to increase the risk for cancer should be taken into consideration in future evaluation of exposure guidelines. ...These findings support the view that exposure to RF radiation of average SAR values of 2.6-8.8 W/Kg may lead, through a nonthermal pathway, to a carcinogenic activity. Our study does not elucidate the specific primary mechanism by which radiation interacts with the cell and alters its genetic material. However, it does demonstrate that exposure to RF radiation results in a gross somatic mutation leading to a major modulation in gene expression which may be amplified by epigenetic mechanism of gene expression..."

Reprints: Prof. Rafi Korenstein, Sackler School of Medicine, Tel-Aviv University, Israel, E-mail: <korens@post.tau.ac.il>.

Korenstein has also studied the genotoxic effects of ELF EMFs, see *MWN*, J/A00. (See also p.1.)

that industry-sponsored studies were significantly more likely to reach conclusions that were favorable to the sponsor than were nonindustry studies....Several studies found that industry-sponsored research appears to be of similar quality to other research....Consistent evidence also demonstrated that industry ties are associated with both publication delays and data withholding. These restrictions...serve to compound bias in biomedical research. Anecdotal reports suggest that industry may alter, obstruct or even stop publication of negative studies."

Reprints: Dr. Gross, Yale University School of Medicine, New Haven, CT, E-mail: <cary.gross@yale.edu>.

Edwin van Wijngaarden, "An Exploratory Investigation of Suicide and Occupational Exposure," *Journal of Occupational and Environmental Medicine, 45,* pp.96-101, January 2003.

"This exploratory study evaluated the association between suicide and occupational exposure to EMFs, pesticides and hydrocarbon solvents. The study population comprised 11,707 suicide deaths...from U.S. death certificate files for the years 1991 and 1992. Exposure assignment was based on job title reported on the death certificates. Exposure to EMFs and pesticides was weakly associated with suicide risk, while little evidence for an increased risk was seen for hydrocarbon solvents. The association for EMF exposure was highest for suicide between ages 20 and 35 (odds ratio: 1.5)....Interestingly, a pattern across age groups similar to the one reported here has been reported previously [Van Wijngaarden, 2000]. A difference in the nature of depression and suicide between age groups may account for the possibly increased vulnerability of younger people to the effects of EMFs."

Reprints: Dr. Wijngaarden, Applied Epidemiology Inc., Amherst, MA, E-mail: <evanwijngaarden@appliedepidemiology.com>.

See *MWN,* M/A00 for a discussion of the 2000 suicide paper.

Chung-Yi Li and Fung-Chang Sung, "Association Between Occupational Exposure to Power-Frequency Electromagnetic Fields and Amyotrophic Lateral Sclerosis [ALS]: A Review," *American Journal of Industrial Medicine, 43,* pp.212-220, February 2003.

"Although there is some consistency in the findings, a causal link between occupational exposure to EMF and ALS cannot be substantiated based on the existing data because of certain methodological limitations and the small number of publications. Our review shows that confounding is of greater concern than the potential exposure misclassification due to inadequate exposure assessment or selection bias in interpreting the results from the selected studies. Most studies did not consider work-related factors potentially associated with ALS in the analysis. Of particular interest was the role of electrical trauma in the possible link between EMF exposure and ALS. Trauma due to electric shock was frequently observed as a risk factor of ALS. As people employed in electric utilities are more likely than others to experience electric shock or trauma, the excess number of patients with ALS or deaths from it among electricity-related occupations may be due to repeated electric contusions rather than to exposure to high levels of EMF. The study by Gunnarsson et al. attempted to assess the separate effect of EMF exposure and electrical shocks on the risk for ALS. The results showed a substantially elevated risk for ALS for those that work with electricity (OR: 6.7), but reported null effects from either EMF exposure (OR: 0.6). Further studies should consider investigating the separate effect of EMF exposure and electrical shocks to make more specific causal interpretations. An alternative way of separating EMF exposure from electrical shocks is to conduct a residential study since there is no indication that people living near high-voltage power lines are prone to electrical shocks."

Reprints: Dr. Chung-Yi Li, College of Medicine, Fu Jen Catholic University, Hsinchuang, Taiwan, E-mail: <chungyi@mails.fju.edu.tw>.

Letter to the Editor

Unambiguous Confirmation of a Nonthermal Effect in the Inorganic World

January 15, 2003

To the Editor:

In your last issue (*MWN,* N/D02), some argued that nonthermal microwave effects do not exist. With respect to the processing of inorganic materials we have conclusively demonstrated that nonthermal microwave radiation can influence the microstructures, phase transformations and sintering of materials.

We see startling differences when various materials are exposed separately to E- and H-fields in a microwave single-mode cavity. While the controversy over biological and human health effects — whether good or bad — goes on, our most extraordinary discovery merits everyone's attention because it shows that microwave magnetic fields can cause major phase changes in inorganic solids.

Working at Penn State's Materials Research Institute, we have found striking differences between the effects of magnetic and electric fields at 2.45 GHz on common high-tech, high-melting-point, inorganic materials. In a series of papers and patents (see below), we have shown that magnetic materials can be turned into glasses and that they lose their permanent power to stick to iron! And this occurs in 5-15 seconds!!

Confirmation that this is a field effect is simply stated: We have repeated the experiment in our laboratory hundreds of times and each time the magnetic field transformed the material into an amorphous phase within a few seconds. But when we exposed the identical sample in the very same cavity to only an electric field, we saw the opposite effect: The material became even more crystalline.

While these exposures were at GHz frequencies, the fields involved were less than a gauss, and the temperatures measured at the surface were far below the melting point of the exposed material. Initial work on cell cultures confirmed that differences between E- and H-fields were also manifest in the biological world.

For more details on Penn State's Microwave Processing Center, please visit: <www.mri.psu.edu/centers/mpec>.

Prof. Rustum Roy, E-mail: <rroy@psu.edu>
Prof. Dinesh Agrawal, E-mail: <dxa4@psu.edu>
Microwave Processing and Engineering Center
Materials Research Institute, Pennsylvania State University
University Park, PA 16802

R. Roy, R. Peelamedu, L. Hurtt, J. Cheng and D. Agrawal, "Definitive Experimental Evidence for Microwave Effects: Radically New Effects of Separated E- and H-Fields, such as Decrystallization of Oxides in Seconds," *Materials Research Innovations, 6,* pp.128-140, September 2002.

R. Roy, R. Peelamedu, C. Grimes, J. Cheng and D. Agrawal, "Major Phase Transformations and Magnetic Property Changes Caused by Electromagnetic Fields at Microwave Frequencies," *Journal of Materials Research 17,* pp.3008-3011, December 2002.

R. Roy, J. Cheng and D. Agrawal, "Microwave Processing in Pure H-Fields and Pure E-Fields," U.S. Patent No.6,365,885, April 2, 2002.

2003 Conference Calendar (Part II)

Part I appeared in our last issue.

January 24-25: **Non-Ionizing Electromagnetic Fields and Radiations and the Impacts of New Technologies on Health and Environment,** Porto Alegre, RS, Brazil. Contact: Brazilian Association for Defense of Concerned Dwellers and Users of Cellular Telecommunications Equipment, Tel & Fax: (55+11) 3666-8081, E-mail: <abradecel@hotmail.com>, Web: <www.abradecel.org.br>.

February 21: **National Toxicology Program (NTP) Workshop on Genetically Modified Rodent Models for Cancer Hazard Identification,** Hamilton Crowne Plaza Hotel, Washington, DC. Contact: Diane Spencer, Liaison & Scientific Review Office, NTP, (919) 541-2759, E-mail: <spencer2@niehs.nih.gov>.

March 11-14: **Mobile Health and the Environment,** Melia White House Hotel, London, U.K. Contact: Tamara James, IBC Conferences, 30-32 Mortimer St., London W1W 7RE, U.K., (44+1932) 893-853, Fax: (44+1932) 893-893, E-mail: <cust.serv@informa.com>, Web: <www.ibctelecoms.com>.

March 24-25: **ICNIRP/WHO International Workshop on Weak ELF Electric Field Effects in the Body** (attendance by invitation only), NRPB , Chilton, U.K. Contact: Rüdiger Matthes, ICNIRP, Germany, (49+89) 3160-3288, Fax: (49+89) 3160-3289, E-mail: <rmatthes@bfs.de>.

April 18-22: **3rd International EMF Seminar in China: EMFs and Biological Effects,** Guilin, China. Contact: Zeng Qunli, Bioelectromagnetics Lab, Zhejiang University School of Medicine, 353 Yan-an Rd., Hangzhou 310031, China, (86+571) 8721-7094, Fax: (86+571) 8721-7410, E-mail: <zengql@cmm.zju.edu.cn>.

June 8-11: **22nd Annual Scientific Conference of the Society for Physical Regulation in Biology and Medicine (SPRBM),** San Antonio, TX. Contact: Gloria Parsley, 2412 Cobblestone Way, Frederick, MD 21702, (301) 663-4556, Fax: (301) 694-4948, E-mail: <gloriaparsley@aol.com>, Web: <www.sprbm.org>.

June 8-15: **IEEE Microwave Theory and Techniques Society (MTT-S) International Symposium,** Convention Center, Philadelphia, PA. Contact: Richard Snyder, (973) 492-1207, Fax: (973) 492-2471, E-mail: <r.snyder@ieee.org>, Web: <www.ims2003.org>.

June 11-13: **3rd International Symposium on Nonthermal Medical/Biological Treatments Using EMFs and Ionized Gas (ElectroMed 2003),** San Antonio, TX. Contact: Dr. Michael Murphy, RFR Branch, 8315 Hawks Rd., Bldg.1162, Brooks AFB, TX 78235, (210) 536-4833, Fax: (210) 536-3977, E-mail: <Michael.Murphy@brooks.af.mil>, Web: <www.electromed2003.com>.

June 12-14: **36th Annual Meeting of the Society for Epidemiologic Research (SER),** Marriott Marquis Hotel, Atlanta, GA. Contact: SER, PO Box 990, Clearfield, UT 84098, (801) 525-0231, Fax: (801) 774-9211, E-mail: <membership@epiresearch.org>, Web: <www.epiresearch.org/meeting/index.html>.

June 19-24: **17th International Symposium on Bioelectrochemistry and Bioenergetics (BEB 2003),** Florence, Italy. Contact: Prof. Maria Rosa Moncelli, Dept. of Chemistry, Universita di Firenze, via della Lastruccia 3, 50019 Sesto Fiorentino (Firenze), Italy, (39+55) 457-3100, Fax: (39+55) 457-3098, E-mail: <moncelli@beb2003.org>, Web: <www.beb2003.org>.

June 19-25: **13th Annual Conference of the International Society for the Study of Subtle Energies and Energy Medicine (ISSSEEM),** Boulder, CO. Contact: ISSSEEM, 11005 Ralston Rd., Ste.100-D, Arvada, CO 80004, (303) 425-4625, Fax: (303) 425-4685, E-mail: <issseem@cs.com>, Web: <www.issseem.org>.

June 22-26: **25th Annual Meeting of the Bioelectromagnetics Society (BEMS),** Outrigger Wailea Resort, Maui, HI. Contact: Gloria Parsley, see June 8-11 above, Web: <www.bioelectromagnetics.org>.

June 22-27: **IEEE International Symposium on Antennas and Propagation** and **North American Radio Science Meeting,** Hyatt Regency Hotel, Columbus, OH. Contact: Ron Marhefka, ElectroScience Lab, Ohio State University, 1320 Kinnear Rd., Columbus, OH 43212, (614) 292-5752, Fax: (614) 292-7297, E-mail: <Marhefka.1@osu.edu>, Web: <aps2003.eng.ohio-state.edu>.

Meeting Notes

• The **precautionary principle** (PP) is a hot topic on the conference circuit this winter. The **WHO** EMF project, the NIEHS and the EC are organizing a three-day meeting, February 24-26, at the EC in Luxembourg. Only the first day is open to the public — the other two are by invitation only. We asked **NIEHS**' Dr. **Chris Portier**, who will be there, if he would let us come. "Sorry," he replied, it's up to WHO's Dr. **Leeka Kheifets**, who is organizing the meeting. She also said no, pointing out that those invited to serve on the working groups would take up all the available space. Others, including all members of the press, had also been refused, she told us, closing with, "Of course, we will be happy to share with you materials as they become available." In late January, a seminar on the PP and EMFs was on the agenda at the **World Social Forum** in Porto Alegre, **Brazil**. The forum was held at the same time as the World Economic Forum was being held in Davos, Switzerland — the two meetings attracted very different attendees. And March 20-22, the **European Policy Center** in Brussels is organizing a conference on ***The US, the EU and Precaution: Comparing Risk Management in a Complex World***. One of the case studies on the provisional agenda will be moderated by Dr. **Granger Morgan** of Carnegie Mellon University (CMU) in Pittsburgh; Dr. **Peter Wiedemann** of Germany's Jülich Research Center will give a presentation. Last January, the policy center worked with the EC to host a conference on risk management at which Dr. John Graham of the U.S. Office of Management and Budget spoke on the PP (see *MWN,* M/A02). Graham received his doctorate from CMU in 1983; Morgan was his advisor.

• Prof. **Zhaojin Cao** of the Chinese Center for Disease Control and Prevention in Beijing will present a paper on epidemiological studies in **China** at the April EMF seminar in **Guilin**.

July 13-18: **Power Engineering Society (PES) Summer Meeting,** Toronto, Canada. Contact: Joe Bailey, Toronto Hydro, (416) 542-2874, Fax: (416) 542-2833, E-mail: <jbailey@torontohydro.com>, Web: <www.ieee.org>.

July 20-24: **48th Annual Meeting of the Health Physics Society (HPS),** Town & Country Hotel and Convention Center, San Diego, CA. Contact: HPS Secretariat, 1313 Dolley Madison Blvd., Ste. 402, McLean, VA 22101, Web: <www.hps.org>.

July 27-August 1: **International Conference on Magnetism,** Palazzo dei Congressi, Rome, Italy. Contact: Mrs. G. Ianni, ISM-CNR, Area della Ricerca di Roma, PO Box 10, 00016 Monterotondo Scalo (RM), Italy, (39+06) 9067-2285, Fax: (39+06) 9067-2470, E-mail: <icm2003@mlib.cnr.it>,Web: <www.icm2003.mlib.cnr.it>.

August 17-21: **6th International Symposium on Antennas, Propagation and EM Theory (ISAPE),** Beijing, China. Contact: Dayong Liu, ISAPE 2003, PO Box 165, Beijing 100036, China, (86+10) 6828-3463, Fax: (86+10) 6828-3458, E-mail: <davidwd@btamail.net.cn>, Web: <www.cie-china.org/isape2003>.

August 18-22: **IEEE Symposium on Electromagnetic Compatibility,** Hynes Convention Center, Boston, MA. Contact: Vita Feuerstein, IEEE Conference Services, 445 Hoes Ln., Piscataway, NJ 08855, (732) 562-6826, Fax: (732) 981-1203, E-mail: <emc2003info@ieee.org>, Web: <www.emc2003.org>.

September 7-12: **IEEE/PES Transmission & Distribution Conference & Exposition,** Convention Center, Dallas, TX. Contact: Al Dirnberger, TXU Electric, (817) 215-6363, E-mail: <al_dirnberger@txu.com>, Web: <www.ieeetd.org>.

September 17-21: **25th Annual International Conference of the IEEE Engineering in Medicine and Biology Society,** Cancun, Mexico. Contact: Universidad Autónoma Metropolitana-Iztapalapa, Dept. of Electrical Engineering, Av. San Rafael Atlixco 186, Col. Vicentina, Iztapalapa 09340, Mexico, (525) 804-4905, ext.204, Fax: (525) 804-4631, E-mail: <j.stock@ieee.org>, Web: <www.itzamna.uam.mx/cancun>.

September 18-21: **20th Annual Meeting of the European Society for Magnetic Resonance in Medicine and Biology (ESMRMB),** Rotterdam, The Netherlands. Contact: ESMRMB, Neutorgasse 9/2A, Vienna A-1010, Austria, (43+1) 535-1306, Fax: (43+1) 535-7041, E-mail: <office@esmrmb.org>, Web: <www.esmrmb.org>.

September 21-25: **13th Annual Conference of the International Society of Exposure Analysis (ISEA),** Palazzo dei Congressi, Stresa, Italy. Contact: ISEA Secretariat, International Center for Pesticide Safety, via Magenta 25, 20020 Busto Garolfo (MI), Italy, Fax: (39+33) 156-8023, E-mail: <mail@icps.it>, Web: <www.ktl.fi/isea2003>.

September 24-26: **15th Annual Conference of the International Society for Environmental Epidemiology (ISEE),** Perth, Australia. Contact: Andrea Hinwood, PO Box 749, Wembley, WA 6913, Australia, E-mail: <andrea.hinwood@environ.wa.gov.au>, Web: <eventedge.com.au/isee/index.html>.

November 6-12: **WHO/U.S. Air Force Asia Pacific EMF Conference,** Bangkok, Thailand. Contact: Dr. Michael Murphy, see June 11-13 above; Web: <www.who.int/peh-emf/meetings/thailand2002/en>.

November 13-15: **6th International Congress of the European Bioelectromagnetics Association (EBEA),** Budapest, Hungary. Contact: Diamond Congress Ltd.-EBEA 2003, PO Box 48, H-1255 Budapest, Hungary, (36+1) 214-7701, Fax: (36+1) 201-2680, E-mail: <diamond@diamond-congress.hu>, Web: <www.diamond-congress.hu/ebea2003/entry.htm>. The meeting will be followed by a COST 281 workshop.

Across the Spectrum

"There's some snake oil out there."

— David Heim, deputy editor, *Consumer Reports,* Yonkers, NY, referring to devices to reduce radiation exposures from mobile phones, quoted by Ellen Sheng, "Cell Phone Radiation Is Team's Focus," *Wall Street Journal,* p.B3A, December 18, 2002

It only needs the perception, let alone the reality, of financial conflicts and commercial pressures to destroy the credibility of important organizations such as IARC and its parent, WHO.

— Editorial, "Transparency at IARC," *The Lancet, 361,* p.189, January 18, 2003

If it is not worth doing, it is not worth doing well.

— Dr. David Savitz, University of North Carolina School of Public Health, Chapel Hill, in a commentary, "Health Effects of Electric and Magnetic Fields: Are We Done Yet?" *Epidemiology, 14,* p.16, January 2003

"It's preventive medicine. And it's less expensive than medications and antidepressants."

— Dr. Damien Léger, neurophysiologist, Paris, France, on using light to treat patients with seasonal affective disorder (SAD), quoted by Elaine Sciolino, "Paris Journal: Call It the City of Darkness, and Give It Vitamin D," *New York Times,* p.A4, January 6, 2003

"The real world intervenes from time to time. And you reach in there and take something out that is still in a developmental stage, and you might use it."

— Donald Rumsfeld, U.S. secretary of defense, on using high-power microwave weapons (HPM) in a war with Iraq, quoted by Mark Thompson, "Electrical Storm: America's Ultra-Secret Weapon," *Time,* p.27, January 27, 2003

"MICROWAVE NEWS" FLASHBACK

Years 20 Ago

• Budget cuts force the EPA to close its program on RF/MW radiation at its Health Effects Research Lab.

• Citing evidence of a possible risk to pregnant women who work with VDTs, the Canadian Center for Occupational Health and Safety recommends that radiation exposure standards be extended to include the VLF frequencies emitted by computer terminals.

• After a 25-year run, the U.S. government's Electromagnetic Radiation Management Advisory Council (ERMAC) disbands when the NTIA decides against renewing the council's charter.

Years 10 Ago

• Responding to public concerns over a lawsuit linking cell phone use to brain cancer, the wireless industry promises to sponsor research on possible health risks.

• The Centers for Disease Control and Prevention find that ELF EMFs have no known role in inducing or promoting cancer in women living on Long Island, NY. Nevertheless, NIH Director Bernadine Healy favors more research on the question.

Years 5 Ago

• A four-year-old, unpublished EPA draft obtained by *Microwave News* states that power-frequency EMFs "must be considered as one risk factor" for cancer.

• The FDA tells Rep. Edward Markey (D-MA) that more research is needed on cell phone safety. It points, with approval, to the congressionally mandated EMF RAPID program.

• The International Agency for Reseach on Cancer unveils plans for a multi-country, multimillion-dollar study of cancer among mobile phone users.

UPDATES

CIRCADIAN RHYTHMS

Cancer: A Matter of Timing... Genes that regulate circadian cycles also play a role in preventing cancer. A team led by Dr. Cheng Chi Lee of Baylor College of Medicine in Houston reports that 71% of transgenic mice lacking one of the eight core circadian genes developed lymphoma within 16 months following a single dose of ionizing radiation, compared to 5% of wild-type mice — a highly significant difference ($p<0.00001$). In another experiment, all transgenic mice, even without initiation with radiation, were found to have abnormal cell growths (hyperplasias) in their salivary glands at 18 months, and all of the male mice developed teratomas or other types of tumors. No hyperplasias or teratomas were seen in any of the wild-type controls. These results were also highly significant. Lee found that, when exposed to gamma radiation, the mutant mice had a much smaller increase in cell death — cell death serves as a cancer-suppressing response — than wild-type controls. The absent gene "can be regarded as a tumor suppressor," Lee concludes in a paper published in the October 4 issue of *Cell (111,* pp.41-50, 2002). He adds that "other circadian regulators may play a similar role in tumor suppression as well." In a commentary on these new results appearing in *Nature (420,* pp.373-374, November 28, 2002), Drs. Michael Rosbash of Brandeis University in Waltham, MA, and Joseph Takahashi of Northwestern University in Evanston, IL, point out that health problems among shift workers have already been linked to "disruption of physiological systems that are under circadian control" — such as melatonin production. The new results, they write, suggest that "there might also be a direct connection" between interference with circadian mechanisms at the genetic level and illnesses linked to shift work.

CONSUMER REPORTS

Advice on Mobile Phones..."Research hasn't proved any hazards, but there may be cause for concern." That is the view offered by *Consumer Reports* in this year's survey of wireless phones and service providers. The influential publication, published by the Consumers Union in Yonkers, NY, devotes a full page to phone safety in its February issue. It notes "provocative findings," including those of Sweden's Dr. Lennart Hardell on brain tumor risks and Finland's Dr. Dariusz Leszczynski on changes in gene expression (see *MWN,* S/O02 and J/A02, respectively). The article also advises readers that expert panels in France, Germany and the U.K. have discouraged the use of phones by children. Closer to home, it cites the FDA's research agreement — or CRADA — with the CTIA, the wireless industry lobby group, and the agency's "carefully worded but equivocal" position on the health issue: that although available evidence does not point to any health problems, there is "no proof" that phones are "absolutely safe." Previously, *Consumer Reports* largely ignored health concerns in its coverage of mobile phones (see *MWN,* J/F00 and J/F02), though it suggested the use of hands-free sets for those wanting to reduce their radiation exposure. This year, it adds that those who are concerned should limit the use of phones by children and teenagers: "Encourage them to wear a headset or to send text messages."

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DOSIMETRY

Hot Pockets... Using a hands-free set can result in higher radiation exposures if the phone is placed in a pocket: The 1g and 10g SARs are two-to-seven-times greater than those obtained for a model head (with a plastic ear), according to calculations and measurements by Drs. Om Gandhi and Gang Kang of the University of Utah, Salt Lake City. A phone could therefore meet U.S. and European SAR limits but still be "severely out of compliance if it were placed in the shirt pocket," they warn in a paper published in the December issue of *Physics in Medicine and Biology (47,* pp.4301-4313, 2002). This is because when placed in the pocket, there is no separation between the phone and the human body — under the most widely used testing protocols, there is a stipulated separation of 6 mm between the skull and the phone. (The Australian Consumers' Association issued a similar warning a few years ago based on a report by Chris Zombolas of EMC Technologies in Melbourne; see *MWN,* S/O00). Gandhi presented these results at the URSI meeting held in Maastricht, The Netherlands, last August. His paper prompted Dr. C.K. Chou, the director of Motorola's RF dosimetry lab in Plantation, FL, to comment that, "You have to have a separation distance. We don't recommend putting a phone in your pocket." Chou, who plays a key role in the IEEE committees writing standards for radiation exposures and for devising test methods, said that holders are provided with Motorola phones and that, "If you carry the phone on the body, put it in the holder."

DRIVING & PHONING

Inattention Blindness... Tests by psychologists at the University of Utah in Salt Lake City show that using a cell phone disrupts a driver's ability to process visual information. In the February/March issue of *Injury Insights,* published by the National Safety Council in Chicago, Dr. David Strayer and coworkers write that, "Legislative initiatives that restrict handheld devices but permit hands-free devices are not likely to eliminate the problems associated with using cell phones while driving. These problems are attributed in large part to the distracting effects of the phone conversations themselves."

PEOPLE

Dr. Boris Pasche has been appointed a contributing editor of the *Journal of the American Medical Association* with responsibilities for oncology, genetics and molecular medicine. Pasche, the director of the cancer genetics program at Northwestern University's medical school in Chicago, has played a leading role in the development of low-energy-emission therapy (LEET) to treat chronic insomnia. LEET uses nonthermal RF radiation with very specific ELF-modulations to induce sleep (see *MWN,* M/J96).... Dr. **Brian Beard** of the FDA's electrophysics branch in Rockville, MD, has taken over as the chair of IEEE SCC-34 Subcommittee 2's working group on computational dosimetry for mobile phones. He replaces **Kwok Chan** of the FCC lab in Columbia, MD (see *MWN,* M/A97). Beard works with **Howard Bassen**, the branch chief, who chairs both Subcommittee 2 and the other

working group — on experimental dosimetry....Dr. **Edwin van Wijngaarden** has completed his doctoral studies at the University of North Carolina, Chapel Hill, and has joined Applied Epidemiology Inc. in Amherst, MA, a research and consulting firm specializing in environmental and occupational health. (See p.12 for his latest paper on the possible link between EMFs and suicides.)...The NCRP is moving to assure a smooth succession when **William Beckner**, its executive director, retires. The council has invited applications for the position of deputy executive director, who is expected to take over from Beckner when he steps down in about a year....Dr. **Tom Rozzell** has retired as the director of fellowship programs at the National Academy of Sciences in Washington. Rozzell, who was previously at the Office of Naval Research, was one of the founders of the Bioelectromagnetics Society and the first editor of its newsletter.

PRECAUTIONARY PRINCIPLE

Common Sense or Environmental Extremism?... Dr. Ken Foster poses this question in a paper on the precautionary principle (PP) — part of a collection of nine short papers on the PP and RF radiation that makes up the winter 2002/2003 issue of the *IEEE Technology and Society Magazine*. Foster of the University of Pennsylvania in Philadelphia and Dr. Paolo Vecchia of the National Institute of Health in Rome served as the guest editors of the special issue. In another paper, they offer a commentary on the continuing controversy over the Vatican's RF transmitters in Cesano, outside Rome. (This is not their first collaboration on the PP; see *MWN,* M/J00.) "The case of the Vatican radio shows that a misuse of the PP not only may cause mistrust in science by the public but lead to a misuse of data and methodology by scientists themselves." On the other hand, writing with his colleague Dr. Carlo Petrini in another paper in the same collection, Vecchia takes a softer approach, arguing that the PP "may be the most effective way to force society to address uncertainties about such problems and to avoid letting decision makers evade their responsibilities." (For another recent paper on the PP and RFR, see *MWN,* N/D02).

SAILING

Room for Health Concerns... Umpires will officiate aboard the competing sailboats during the final stage of this year's America's Cup off the coast of New Zealand, race officials announced January 9 — even though the umpires will be close to the antennas that transmit telemetry and communication signals. Bryan Willis, chair of the international jury and chief umpire, told the *New Zealand Herald* (January 10) that referees are simply better able to call penalties when they are close to the action. A plan to put umpires on board was proposed during the last cup regatta, in 2000, but was rejected by the jury because referees would be one-and-a-half meters away from the antennas, and the panel was unwilling to take the health and insurance liability risks. Nevertheless, this year, umpires will be positioned only a half-meter away. Willis noted that insurance liability remains a significant concern for the jury. "[It] could kill the plan, but we're doing what we can to resolve the issue."

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SECONDHAND RADIATION

Phones in Railway Cars... Japan's Dr. Tsuyoshi Hondou caused quite a stir last year when he predicted that a railroad car full of mobile phone users could result in unhealthy exposures to RF/MW radiation (see *MWN,* M/J02 and J/A02). A number of observers immediately issued statements denouncing his model. Now, two research groups with ties to the wireless industry have published their criticisms. "It seems highly improbable that ICNIRP basic restrictions or even reference levels could be exceeded" in an enclosed space, Nokia's Dr. Anssi Toropainen concludes in the January 2003 issue of *Bioelectromagnetics (24,* pp.63-65). Toropainen contends that every passenger in a commuter rail car would need to have four or five 900 MHz GSM phones operating at full power (250 mW) to exceed the ICNIRP ambient limit of 450 ∝W/cm^2, while each passenger would have to be using 16 phones in order to exceed the SAR limit of 0.08 W/Kg. Hondou's arguments are also the subject of an exchange in the December issue of the *Journal of the Physical Society of Japan, (71,* p.3100-3102, 2002), where he originally published his concerns. Drs. Axel Kramer, Jürg Fröhlich and Niels Kuster of IT'IS in Zurich contend that even in a worst-case scenario — with many people using phones at full power — "exposure can never reach 25% of the...SAR safety limits for environmental exposure." Closed spaces "do not impose safety issues other than those in any other location." Hondou, who is at Tohoku University in Sendai, responds that the IT'IS calculations are wrong because they assume that radiation will be absorbed equally by each passenger. The criticisms are "based on naïve implicit assumptions which are neither relevant nor valid," he writes.

Keeping Current: Follow-Up on the News

◆ Half of all 14- to 20-year-olds in the U.S. will own a cellular phone by the end of the year, according to the Zelos Group, a research and consulting firm based in San Francisco. And Student Monitor, another data group, estimates that 70% of the 5.6 million full-time college students in the U.S. now own cell phones, the *New York Times* reports (January 20).

◆ As expected, the Australian Communications Authority (ACA) has released draft standards to regulate radiation emissions to protect the public and workers. The objective is to ensure that exposures are below the ICNIRP limits (see *MWN,* N/D02). The deadline for comments is February 20. The proposals are available at: <www.aca.gov.au/standards/emr/draftemrstd.htm>.

◆ Coming soon from ICNIRP: The report on health risks posed by radiation from anti-theft devices, funded by the EC's Fifth Framework research program (see *MWN,* M/A00), is now in press. And guidance on judging compliance of pulsed and complex non-sinusoidal waveforms below 100 kHz with ICNIRP's limits will appear in the March 2003 issue of *Health Physics* and soon afterwards at <www.icnirp.org>.

◆ The appeal in the Newman cell phone–brain tumor case was filed by the Peter Angelos law firm on January 21 in the U.S. Court of Appeals for the Fourth Circuit in Richmond, VA (see *MWN,* S/O02 and N/D02). The reply from the defense team is due February 24.

◆ The first issue of *EHP Toxicogenomics,* dated January 2003, is out. The journal is a quarterly supplement to *Environmental Health Perspectives,* which is published by NIEHS. The print edition is free for the first year for qualified subscribers. For more information, go to: <ehp.niehs.nih.gov/txg>. And the IEEE Power Engineering Society has inaugurated a new bimonthly magazine, *IEEE Power & Energy.*

◆ Two years ago, U.K. researchers argued that teenagers were substituting mobile phone use for smoking (see *MWN,* N/D00). Now, a group in Finland has found contrary evidence among 10,000 Finnish teenagers. In a letter to the *British Medical Journal* (January 18), the Finns allow that their results may not apply to other countries "where parents do not help pay for their children's mobile phone costs as much as they do in Finland."

radiation can impair the BBB, but they now add that the chemicals that leak through the BBB probably damage neurons in the cortex, the hippocampus and the basal ganglia of the brain. The cortex is close to the surface of the skull, while the basal ganglia are much deeper.

Salford and Persson write that the damaged neurons they observed may in fact be dead brain cells.

Perhaps their most surprising observation is that leakage through the BBB was still evident eight weeks after a single two-hour exposure — even at these low doses.

Salford and Persson close their paper with this warning:

> [N]euronal damage of the kind here described may not have immediately demonstrable consequences, even if repeated. It may, however, in the long run, result in reduced brain reserve capacity that might be unveiled by other later neuronal disease or even the wear and tear of aging. We cannot exclude that after some decades of (often) daily use, a whole generation of users may suffer negative effects maybe already in their middle age.

Neither Salford nor Persson could be reached for comment.

The paper will appear in a future issue of *Environmental Health Perspectives,* a peer-reviewed journal published by the National Institute of Environmental Health Sciences (NIEHS). The editors posted a typescript copy of the paper on the journal's Web site* on January 29.

Salford and Persson exposed three groups of eight rats to digital 915 MHz microwaves at 0.002, 0.02 and 0.2 W/Kg, and another eight served as controls. They note that, "We realize that our study comprises few animals, but the combined results are highly significant and exhibit a clear dose-response relationship."

"They used enough animals that it would be hard to say that what they saw is an artifact," said Dr. Henry Lai of the University of Washington, Seattle. Lai has previously reported that microwaves can cause DNA breaks in the brains of rats (see *MWN,* N/D94). "DNA breaks could lead to cell death, and this would look like what Salford is reporting," Lai said. (See also p.11.)

Salford and Persson exposed rats that were 12 to 26 weeks old in order to simulate the level of development of "human mobile-phone-addicted teenagers." The rats were allowed to live on for about 50 days after their exposures before they were sacrificed and their brains examined.

Dr. Yngve Hamnerius of Chalmers University of Technology in Göteborg, Sweden, had suggested this delay before examining the rats' brains. Some 20 years ago, he and other researchers at Chalmers found damage in the brains of rabbits that had been exposed to pulsed microwaves similar to those from radar for one hour a day for three days. The Chalmers team told the 1984 annual meeting of the Bioelectromagnetics Society that no acute effects were seen, but that morphological and biochemical changes became apparent three to four months later.

The implications of this observation were never pursued until now. "People very rarely wait before looking for an effect," Hamnerius told *Microwave News*. He believes that Salford and Persson's new work "should be taken seriously."

*The paper is posted at: <www.ehponline.org>; its tracking number is: doi:10.1289/ehp.6039.

VIEWS ON THE NEWS

The Blood-Brain Barrier Work Must Be Followed Up — Now

Salford and Persson's new results were announced as this issue was going to press. Because we have often run editorials on the need to address the long-festering issue of leakage through the BBB (see, for example, *MWN,* N/D99), we are devoting this page to their study and offering only a few brief comments.

First, we must admit that we are surprised by the low levels of radiation implicated by their experiment — a finding that only makes the need for a follow-up even more urgent.

Second, the over one billion users of mobile phones deserve to know — and without further delay — whether, as Salford and Persson speculate, long-term exposure to microwaves contributes to premature aging, and possibly worse.

The U.S. health agencies have given the cell phone industry a free ride for far too long. It's about time they began serving those who use the phones — and pay their salaries.

In the summer of 2001, Drs. Pierre Aubineau and Fatma Töre of the University of Bordeaux reported leakage from blood vessels in the brains of rats, including the BBB, exposed to non-thermal levels of microwaves (see *MWN,* N/D01).

The ability of microwaves to cause leakage through the BBB was first demonstrated by U.S. scientists in the mid-1970s, but research was later cut off by the U.S. military funding agencies. Over the years, sporadic reports have briefly rekindled interest in the area.

Salford and Persson's own reports of BBB leakage have not been followed up. For instance, not a single study was undertaken by the U.S. mobile phone industry's six-year research effort directed by Dr. George Carlo and its lobbying arm, the CTIA.

"This is yet another instance in which a long-standing observation has been ignored for too long," said Dr. Ross Adey, who has been doing brain research for more than 50 years. Adey is based in Redlands, CA.

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Microwave News *invites letters from its readers. We ask writers to be brief, and we reserve the right to edit contributions for length.*

ERMAC-FMAC To Issue Statement on RF/MW Safety

Briefings on Regulations and Standards

The Electromagnetic Radiation Management Advisory Council (ERMAC) and the Frequency Management Advisory Council (FMAC) intend to issue a statement to assure the public that low levels of non-ionizing radiation are not hazardous. The councils decided to release a statement at a joint meeting in Washington, DC, on December 18. ERMAC chairman Donald Jansky of the National Telecommunications and Information Administration (NTIA) hopes the document will be ready by late March.

Council members, responding to growing public apprehension over non-ionizing radiation, agreed that some type of formal assurance is needed before the Environmental Protection Agency (EPA) proposes a federal guideline in 1983. They were split, however, over whether or not to cite a number for safe population exposure in the statement—and if so, what number.

Jansky asked everyone on the councils to submit a proposal for a statement by mid-January. Dr. Samuel Koslov of the Johns Hopkins University Applied Physics Laboratory and FMAC's Sidney Metzger of the Communications Satellite Corp. were charged with editing these drafts.

As of the end of January, Koslov had received six drafts representing a wide range of views.

Federal Agency Actions

EPA's David Janes told the meeting that his agency's schedule cannot be speeded up; it will need until at least September 1983 to propose a population exposure guidance. When asked what the guideline might be, he would only say that EPA is considering numbers bounded on the low side by the Soviet standard (0.005 mW/cm^2) and on the high side by levels slightly lower than the new American National Standards Institute (ANSI) standard (1.0–5.0

(continued p. 2)

A Proposed ERMAC-FMAC Statement

by Professor Charles Susskind

Whereas no regulatory arm of the US government is likely to adopt a maximum permissible level of non-ionizing radiation exposure for the general public in the next two years;
Whereas several existing and proposed US standards have been set at this level variously between 100 uW/cm^2 and 10 mW/cm^2;
Whereas further research is needed to determine where this level should be set;
Whereas no health hazards have been demonstrated below 100 uW/cm^2;
Therefore, the ERMAC and the FMAC declare that the state of the art enables them to say that no health hazard can result from total incident radiation lower than 50 uW/cm^2.
This statement is issued without prejudice toward any level that may be adopted, and in the knowledge that this level is likely to be well above 50 uW/cm^2.

ERMAC-FMAC MEETING

(continued from p. 1)

mW/cm^2). Janes estimated the guidance will require one million dollars to complete. The agency's Environmental Biology Division in Research Triangle Park, NC, is now circulating its criteria document for the guidance.

Briefings at the meeting from other federal agencies provided the following updates on standards actions:

• Paul Strudler of the National Institute for Occupational Safety and Health (NIOSH) would not say what standard the institute will propose in its long-awaited criteria document. But he did note that thinking at NIOSH is "not that different" from that at EPA, ANSI and the American Conference on Governmental Industrial Hygienists (ACGIH).

• The Federal Communications Commission's (FCC) Robert Cleveland announced that the agency's response to a 1979 notice of inquiry (NOI) on potential radiation hazards was imminent. At a January 28 meeting, the commission did act on the staff recommendation; it intends to apply its environmental rules to radiofrequency/microwave (RF/MW) transmitters. The details are in the FCC's advanced notice of proposed rule making, which had not yet been released. Observing that times have changed since the commission issued its NOI, Cleveland reported that the National Association of Broadcasters (NAB) has reversed its initial position and now supports radiation guidelines —possibly because inquiries from the general public on radiation hazards have risen sharply. (For other NAB news, see updates on communications, p. 6.)

• Two staffers at the Occupational Safety and Health Administration (OSHA) are still working on an advanced notice of proposed rule making for a new RF/MW standard, but the agency has no schedule for issuing it.

• A spokesman for the Bureau of Radiological Health (BRH) said the bureau intends to abandon proposed plans for a performance standard for diathermy products. (See p. 4.)

• A settlement has been reached between BRH and the American Home Appliance Manufacturers on amending BRH's microwave oven standard. (See updates on ovens, p. 7.)

Other News

Summaries of non-governmental standards activities, state and local rule making, international actions, litigation and siting problems filled the rest of the busy morning agenda. Items from these briefings included:

• A scientific committee of the National Council on Radiation Protection and Measurement (NCRP) hopes to complete its report on the bioeffects of RF/MW radiation at a March meeting. Disagreement over the general population standard continues, however, with proposals ranging from 0.1 mW/cm^2 to 1 mW/cm^2.

• The BRH's Dr. Zory Glazer said the ACGIH would discuss its proposed standard in January; at that meeting in Cincinnati, final consideration of the RF/MW threshold limit value (TLV) was postponed until an April 21–23 meeting in San Antonio, TX. The ACGIH's rationale has been published in *Supplemental Documentation 1981* to the ACGIH TLV book.

• Filmways, Inc. of Syracuse, NY, has taken the town of Onondaga, NY, to court over its moratorium on construction of broadcast stations. The company wants the building ban lifted and is seeking more than five million dollars in damages for the delay of its proposed station on channel 43.

• The new ANSI standard is in galleys and will be published soon.

• The military does enforce national RF/MW exposure standards in Poland, according to Dr. Przemyslaw Czerski, a visiting scientist at BRH. Enforcement is separate, though, for security reasons. Czerski believes that the same holds true for the Soviet Union.

• Koslov reported that preliminary results of work at the Johns Hopkins University Applied Physics Laboratory suggest tissue damage occurs at about 10 mW/cm^2 at high frequencies. (See p. 5.)

ERMAC-FMAC Statement

Much of the debate on the proposed ERMAC-FMAC statement on public safety focused on citing a safe level of RF/MW exposure. Many members feared a number could become a de facto standard and urged that no specific levels be set. Metzger suggested avoiding a number by issuing a general assurance that population exposures from current RF/MW equipment are safe. A general statement on the state of the art in bioeffects research was also proposed.

Other members favored citing a low number that would cover normal population exposures. ERMAC's Professor Charles Susskind of the University of California at Berkeley offered a proposal which assured that exposures below 50 uW/cm^2 are safe (see p. 1 for complete text). According to electronics engineering consultant Jules Cohen, AM transmitters might exceed the 50 uW/cm^2 level; he suggested adding some type of frequency dependency.

ERMAC's Dr. Ross Adey of the Veterans Hospital in Loma Linda, CA, argued that ERMAC and FMAC "should not get involved with contingencies" and should produce a simple document with one number. Adey also asked that the statement acknowledge the need for more study before a final standard is set. He urged that "we must not sweep under the rug the low-level effects that are now understood...if we wish to enjoy credibility in the eyes of the public."

Both EPA's Janes and Dr. Nicholas Steneck from the University of Michigan told the councils that guidelines require public participation. Janes, defending EPA's lengthy rule-making process, said that given the public's concerns, "I don't see how any group can issue a guidance without a chance for public review and comment." Steneck asserted that the public will question the ERMAC-FMAC statement. "You end up nowhere, official statements from above are not effective," he said. Jansky quickly replied that "it would be irresponsible not to do anything."

Whatever the final form of the statement, FMAC's Judge Ann Aldrich of the US District Court in Cleveland stressed that it could provide long-term benefits to industry. Comparing non-ionizing radiation to asbestos, Aldrich advised industry to weigh the costs of enforcing a standard against the potential costs of future litigation.

ERMAC and FMAC considered several courses of action in addition to issuing a statement. ERMAC's Professor A.W. Guy from the University of Washington, Seattle, suggested using the ANSI standard as an interim guideline, but council members rejected endorsing this or any current or proposed standard. When model state regulations came up for review, Aldrich warned that they present "thorny jurisdictional issues." Cleveland said the FCC has not addressed the issue of local preemption. Facilitating an interim federal guideline was also on the list of possible actions, but representatives from EPA, NIOSH, OSHA and the FCC ruled out any chance of such a policy statement coming from government.

NTIA is waiting for the proposals for a statement to come in before scheduling another meeting. In a speech before a meeting at the Bell Labs in Whippany, NJ, Bill Mumford of ERMAC came out in support of the Susskind proposal.

The minutes for the December 18 meeting will be ready soon and will go out to all attendees. Others can request a copy from Janet Healer, Office of the Chief Scientist, NTIA, 1325 G Street, Washington, DC 20005.

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OCCUPATIONAL HEALTH: RF SEALERS

The table below summarizes 19 of 21 field surveys of worker exposure to radiofrequency (RF) heaters and sealers made by the National Institute for Occupational Safety and Health (NIOSH) between 1978 and 1981.

The machines operate in the ISM (industrial, scientific and medical) bands at frequencies between 10 and 50 MHz, with power outputs ranging from 0.8 to 75 kilowatts. All measurements are corrected for the duty cycle (the on/off schedule) of the units.

Most of the surveyed units sealed plastic on products such as binders, luggage and handbags, though the devices are used in a broad range of applications.

In 17 work places at least one tested machine exposed workers to radiation exceeding the equivalent of the Occupational Safety and Health Administration (OSHA) 10 mW/cm^2 standard. Because exposure occurs in the near field of the power source, the standard should be cited in terms of the electric field and magnetic field intensities: for 10 mW/cm^2, these are 200 V/m and 0.5 A/m respectively.

Occupational Exposure to RF Radiation from Heat Sealers: Summary of NIOSH Work Place Surveys

Work Place	Survey Date	# Units At Site	# Units Tested	# Units Emitting ≥200 V/m	# Units Emitting ≥0.50 A/m	Highest Reading/Location‡
Hazel, Inc., Washington, MO	11-20-78	~33*	6	3	1	>1461 V/m N >0.53 A/m K
Standard Plastic Products, Inc., South Plainfield, NJ	11-29-78	~10	3	3	1	>1259 V/m N,W,K 0.60 A/m K
Henry Richards Company, Inc., Hamden, CT	12-6-78	~64*	11	10	3	>823 V/m C 1.03 A/m C
Tag-A-Long Handbags & Accessories, Inc., East Haven, CT	12-6-78	9	4	4	1	445.1 V/m C 0.58 A/m C
Jaclyn, Inc., West New York, NJ	12-7-78	~33*	6	4	1	1493 V/m K, 1363 V/m E 1.40 A/m E
Celebrity Inc., New York, NY	12-8-78	~41*	5	5	3	595 V/m C, 566 V/m E 0.60 A/m E
Chrysler Trim Plant, Lyons, MI	2-14-79	13	5	2	1	2700 V/m E,C 1.21 A/m E
General Motors Fisher Body Trim Plant, Grand Rapids, MI	2-15-79	33	11	0	0	ND
Ford Motor Utica Trim Plant, Utica, MI	2-15-79	28	5	1	0	867 V/m W 0.184 A/m W
Dielectrics, Inc., Chicopee Falls, MA	3-14-79	~49*	4	2	0	222 V/m W 0.06 A/m E
Blair Industries, Chicago, IL	4-5-79	28	5	1	2	400 V/m E 0.54 A/m E
Fabrico Manufacturing Corp., Chicago, IL	4-6-79	64*	8	4	4	563 V/m E 6.52 A/m C
Holum and Sons, Inc., Westmont, IL	6-25-79	14	6	2	•••	247 V/m W
Wilson Jones Company, Chicago, IL	6-26-79	7	5	2	•••	391 V/m K
S.I. Jacobson Manufacturing Company, Chicago, IL	6-27-79	22	9	5	•••	390 V/m K
Georgia-Pacific Corp., Ste. Genevieve, MO	8-29-79	20*	7	1	0	263 V/m E 0.12 A/m C,K
Georgia-Pacific Corp., St. Louis, MO	8-30-79	~29	7	0	0	191 V/m W 0.46 A/m K
National Blank Book Company, Inc., Holyoke, MA	2-11-80	22*	9	8	7	506.5 V/m W 2.01 A/m A 0.005
Beaverite Products, Inc., Beaver Falls, NY	2-14-80	8*	8	6	4	896.2 V/m W,G 2.40 A/m A 0.005

ND—Not detected.

*Some or all machines located in wire mesh enclosed room to eliminate RF interference with other devices to comply with FCC regulations.

•••Magnetic field measurements not taken.

‡E-Eye, C-Chest, W-Waist, G-Gonad, K-Knee, A-Ankles

HIGHLIGHTS

Microwave Charge Dismissed in Watson Case

A federal judge in US District Court in Los Angeles has dismissed the charge that microwave radiation played a role in causing birth defects to the child of a marine who served at the US embassy in Moscow, according to Peter Danelo of the Seattle firm, Carmody, Syrdal, Danelo & Klein. A second charge of medical malpractice by navy doctors is still pending.

Marine Sergeant George Watson's son was born with a hydrocephalic condition soon after Watson returned from a tour of duty in Moscow. He sued the government for not taking fast enough action to limit the injury to his son and for his exposure to microwaves while at the embassy—the exposure, he claimed, was responsible for his son's condition. (No. CV-80-5737)

District Court Judge Cynthia Hall, who has recently taken over the case, based her dismissal on a decision in the Ninth Circuit Court of Appeals. In that case, *Monaco* v *U.S.* (No. 79-4787, decided November 9), the court affirmed an earlier decision that the government had immunity from claims by those serving in the armed forces under the *Feres* doctrine.

Another VDT-Related Cluster Reported

A new cluster of problem pregnancies among VDT workers has been reported by a Communications Workers of America (CWA) local in Renton, WA. In the last 18 months, three out of three pregnancies of women working at Pacific Northwest Bell have had adverse outcomes. A 23-year-old woman gave birth to a mongoloid child a year ago last July. Since then, one woman's child was born with an open spine and another was stillborn—both women are in their 20's. No other pregnancies have come to term during this period, but one woman is two months pregnant and another is five months pregnant. Both are still among the 100 women working on 38 VDTs at the company.

According to Carl Rude of CWA Local 9103, the union is negotiating with Pacific Northwest Bell and Washington's Department of Labor and Industries for a joint epidemiological study at Renton. If no agreement is reached, the union will ask the state to do a compulsory on-site inspection for ionizing and non-ionizing radiation. Rude admitted that the chances for a thorough epidemiology are "very slim."

Rude has contacted other locals around the state and advised them of the potential problem.

A number of miscarriage and birth defect clusters among clerical workers have been reported; in each case, however, no cause for the adverse outcomes has been identified (see *MWN*, November 1981).

DoD Budget: PAVE PAWS Loses, ELF Wins

The final $199.7 billion FY82 defense budget cleared Congress in December. Funds to begin building the new SE and SW PAVE PAWS radars did not make it through the conference committee, though it did allocate $3.8 million for continued R&D on the warning system. The conferees agreed to consider a supplemental request for the $71 million in procurement funds, but a DoD spokesperson said the Air Force will probably ask for the money in the FY83 budget. The $3.8 million will allow the environmental assessments for the two radars to proceed and, as the Senate Appropriations Committee suggested, the improvement of the "overall system detection and performance."

The conferees sided with the Senate on Project ELF; the submarine communications program will receive the full $34.8 million; Senator William Proxmire (D-WI) registered his disapproval in the conference report. In arguing against the project, the House Appropriations Committee noted: "The Committee concludes that ELF is an outmoded concept in search of a mission and should be discontinued."

Other budget decisions include: $79.6 million to buy AN/TPQ-37 artillery locating radars developed by Hughes Aircraft Co.; $82.1 million for the AF's EHF satcom system; and $30.2 million for DARPA's blue-green communications system. There was also a special $200,000 allocation for hardening White House communications to EMP.

Medical Devices: Rules & Research

The Bureau of Radiological Health (BRH) has decided to withdraw its proposed rules for performance standards for diathermy products. The decision is now under review at the Food and Drug Administration (FDA) and will probably be approved. The rationale for abandoning the regulation, proposed in July 1980 (45 *FR* 50359), is that no equipment is now being manufactured in the US and that the standards would not cover existing equipment. Hyperthermia researchers had told BRH that they were worried the rules would interfere with their work. (See *MWN*, February 1981.)

The Bureau of Medical Devices (BMD) is circulating a draft policy for Class II devices. The new policy statement was the subject of a meeting in Washington, DC, on January 26. Hyperthermia units and NMR imagers are in Class III and are therefore not affected. Diathermy devices used for heat treatment are Class II, but it is not yet clear how the policy will apply to them. The policy statement will now be published in the *Federal Register* to solicit further public comment.

BMD and BRH are in the process of working out new arrangements to handle applications for radiation-emitting equipment. The new agreement promises more autonomy for BRH. It is on the FDA's commissioner's desk and is almost sure to be signed.

Research on hyperthermia is receiving more funds. The National Cancer Institute (NCI) is soliciting proposals for another five-year project, a hyperthermia quality assurance program (*Commerce Business Daily*, December 16). According to the institute's Dr. David Pistenmaa, this new effort will complement the study, already underway at five teaching hospitals, that is assessing the performance of microwave, RF and ultrasound systems (see *MWN*, November 1981).

Oregon County Plans RF/MW Standard...

Multnomah County, outside Portland, OR, has extended its moratorium on new building applications for broadcast facilities to May 25, and will consider adopting a radiofrequency/microwave (RF/MW) standard after a study on the possible biological effects of this radiation is completed. The Board of County Commissioners imposed the freeze on December 3 after station KLRK's proposal for a radio transmitter raised questions about potential radiation hazards at a public hearing last year. The moratorium was originally slated to end March 30, but was extended at a January 26 board meeting.

This January, the county hired Nero and Associates of Portland to evaluate the RF/MW bioeffects literature and to recommend an appropriate safety standard for the county. The

county has contracted another firm, Cogan and Associates, to evaluate land use and develop a siting standard. A total of $11,500 has been allocated for the two studies.

Independent of the studies, County Health Officer Dr. Charles Schade has formed a blue ribbon committee to review the work of Dr. William Morton of the University of Oregon's Health Sciences Center in Portland. Several years ago, a study by Morton revealed a significantly higher incidence of uterine cancer in Portland's West Hills section, which has the highest RF/MW radiation levels in the city. Neighborhood opposition to adding a transmitter to an antenna farm in this area eventually led to the city's adoption of an Interim Radiofrequency Emission Standard in 1980.

...Unexpected Results Found in Portland Cancer Study

A study on the incidence of certain cancers among Portland, OR, residents has found a significant correlation between three types of cancer and radiofrequency/microwave (RF/MW) radiation levels, according to Dr. William Morton of the University of Oregon's Health Sciences Center in Portland. Morton recently submitted a preliminary report on the study, which began in 1978, to the Environmental Protection Agency's (EPA) Experimental Biology Division.

Acting Division Director Dr. Joe Elder has just taken over and said he had not had a chance to study the report.

Morton indicated that RF power density levels positively correlated to the number of reported cases of lymphatic leukemia, adenocarcinoma of the uterus and breast cancer. No correlation was found for non-lymphatic leukemia and cancer of the pancreas.

Morton said that he had not anticipated these results. He was particularly surprised that for the three frequency bands examined, the correlations occurred with the low and high VHF TV bands (54-88 MHz and 176-216 MHz respectively), and not with the FM radio band (88-108 MHz) where power density levels are relatively much higher. Calculated radiation levels ranged from under 0.004 to under 0.018 uW/cm^2 for low and high VHF TV and from under 0.013 to under 0.44 uW/cm^2 for FM radio. These averages were extrapolated from EPA measurements taken in 1977.

Now that the preliminary report is complete, Morton will seek EPA funding for another year of work. His last EPA grant ran out at the end of 1980.

US-USSR Tentatively Agree on Measurement Work Plan

Members of the US-USSR Working Group for Metrology have agreed on a provisional work plan for cooperation during a visit by three Soviet scientists last December, according to Dr. Arthur McCoubrey, associate director for measurement services at the National Bureau of Standards (NBS). The plan, which is still subject to formal approval, would result in the exchange of technical information—including the measurement of non-ionizing radiation fields. Later, there would be an exchange of visits by research scientists.

Dr. Donald McRee of the National Institute of Environmental Health Scientists participated in the talks and said that he was pleased with their outcome. "This could give us the opportunity to learn about the Soviets' capability to measure fields in bioeffects research," he said.

Ric Tell of the Environmental Protection Agency's radiation lab in Las Vegas, NV, one of the labs on the Soviets' tour, said that he felt the trip was more of a fact-finding mission and that he hoped there would be an opportunity for technical discussions at later meetings. Tell was particularly interested in comparing radiation hazard instruments and field survey data with the Soviets.

The microwave expert on the Soviet delegation was A.I. Mekhanikov, who is the deputy director of VNIIFTRI—the All Union Scientific Institute for Physico-Technical and Radio-Technical Measurement—north of Moscow. The institute is akin to the NBS labs in Boulder. The head of the delegation was L.K. Isayev, who is the chief of metrology administration at Gosstandart.

New Findings at Hopkins Lab

Preliminary research indicates a new type of tissue damage from exposure to 2.45 GHz radiation at 10 mW/cm^2, according to Dr. Samuel Koslov of the Johns Hopkins University's Applied Physics Lab. Koslov announced the new findings at last December's ERMAC meeting (see page 1). While 1 mW/cm^2 may be a safe level at GHz frequencies, he said, 5 mW/cm^2 may not be safe for prolonged exposures.

The Hopkins researchers are not ready to publish the results, nor was Koslov willing to be more specific about the type of effect or susceptible organ. Koslov did express his concern that, if this effect is confirmed, it would mean that the new ANSI standard, which allows exposures of 5 mW/cm^2 above 1.5 GHz, would not provide enough protection for the public. "I would have violent objections to the application of the ANSI standard in the upper frequency range if applied to the general population," he warned.

Workshop on Behavioral Effects

An interdisciplinary workshop on *Behavioral Effects of Microwave Radiation Absorption* is *tentatively* scheduled for March 16-19 at the Homestead Lodge near Salt Lake City, UT. The first day of the meeting will be devoted to a literature review; the second to contemporary topics, including drug-microwave synergy, chronic exposure studies, dosimetry and extrapolation among target systems; and the third to future directions for research.

The workshop is open to all; there will be a $50 registration fee. For more information contact Professor John D'Andrea at the Department of Electrical Engineering, University of Utah, Salt Lake City, UT 84112, (802) 581-8590 or 851-6943.

Changes at EPA

Dr. Daniel Cahill has left the Environmental Protection Agency (EPA) to go work for Carolina Light and Power (CP&L). Dr. Joe Elder is filling in as acting director of the agency's Experimental Biology Division in the Office of Research Development in Research Triangle Park, NC. In an interview, Cahill said that the change was a "career move: I just ran out of room."

Meanwhile back at the agency's headquarters in Washington, Dr. Gordon Burley is still the acting director of the Office of Radiation Programs. Burley replaced Dr. David Rosenbaum, who left EPA to start his own consulting firm: Technical Analysis Corp. of Arlington, VA. Rosenbaum said that he had decided to leave as a result of the budget cuts and lay offs. "I could see it was only going to get worse," he said. Burley had been chief of the environmental standards branch and moved up when Rosenbaum and three division directors all left.

UPDATES

Biological Effects....NASA has issued a new literature review, *Electromagnetic Field Interactions with the Human Body: Observed Effects and Theories.* The report, prepared for NASA by Dr. Jeremy Raines of Techovators of Rockville, MD, is available from the National Technical Information Service, Department of Commerce, Springfield, VA 22161. It can be ordered by its NASA document number: N81 25668; $12 for a paper copy and $4 for microfiche....Professor Edward Grant of Queen Elizabeth College, London, has published a short article on the "Biological Effects of Microwaves and Radio Waves," in the *Proceedings of IEE* (UK), *128,* Pt A, 602, December 1981. Grant sums up with "the 10 mW/cm^2 standard, although adequate at frequencies in excess of 1 GHz, is too high in respect of lower frequencies, and needs revision."...Dr. Ewa Manikowska-Czerska, a visiting scientist at BRH, is scheduled to present a seminar on "Meiotic Chromosome Aberrations and their Biological Significance Following Microwave Exposure" on February 2 in Bethesda....BRH's Dr. Whit Athey has raised some objections to a model devised by EPA's Drs. William Joines and Carl Blackman which allows them to scale the internal electric fields that induce calcium efflux from chick brain tissue. Athey thinks that the uncertainties are too large to allow conclusions to be drawn from the model. Joines and Blackman reply with a new and more detailed version of the model; this too is consistent with the data. In an interview, Blackman said that, while he agrees that the model is not thoroughly validated, he thinks it has less uncertainty than Athey indicates in his paper. For both points of view, see *Bioelectromagnetics, 2,* 407-413, 1981....Drs. Ernest Albert and James Kerns of George Washington University describe their recent experiments on the effects of microwaves on the blood brain barrier (BBB) in *Brain Research, 230,* 153, 1981. Two-hour exposure with 2.45 GHz CW at 10 mW/cm^2 resulted in reversible permeability of the BBB to horseradish peroxidase. ...EPA's Claude Weil proposes a terminology system for dosimetry in the December issue of the *Bioelectromagnetics Newsletter*....A group headed by Albert Friend, Jr. of the Naval Electronic Systems Command in Washington has published a paper in the *IEEE Transactions on Microwave Theory and Techniques, MTT-29,* 1271, December 1981, which indicates "no hemolysis in red blood cells exposed *in vitro* to large microwave pulse with peak SAR's of more than 1 kW/g."...The NY Overhead Power Lines Project is still scheduling a meeting for February 19–21 in New York City. For more information contact: Dr. Maria Reichmanis at (518) 474-3215....Some have speculated that Russian radar is responsible for the increased incidence of heart disease among Finns living in North Karelia. Beginning in 1972 a program was initiated to try and control the risk of disease. A five-year report of the North Karelia Project is described in the *American Journal of Public Health, 72,* 43, January 1982. While the data show some encouraging results, they are far from conclusive. Microwaves were not included in the discussion....Linda Garmon reviews research on the effects of ions in the December 5 *Science News.*

Communications....The National Association of Broadcasters' (NAB) Advisory Committee on Radiation and Regulation has informed the EPA that it supports a national population exposure standard for non-ionizing radiation. In a December 14 letter to Kathleen Bennett, assistant administrator for air, noise and radiation, the NAB urged sufficient funding be provided to complete a guidance and stated "there are sound economic, scientific and policy reasons for our position." Citing increasing state and local rule making, a December NAB memo to its state officers carried the same message....A public forum for users of the Private Operational-Fixed Microwave Service, sponsored by the Private Radio Bureau, will be held in Washington, DC, on March 31. Topics on the agenda include interference analysis and public access to microwave applications and data base information. Contact: John Small, FCC, Room 8202, Washington, DC 20554, (202) 632-7197....The FCC affirmed its earlier ruling giving AT&T half of each new cellular communications market on December 17. (See *MWN,* May 1981.) Twenty-five potential competitors to AT&T had petitioned the commission to reconsider its April ruling....Now the commission has begun an inquiry on the future needs of private land mobile radio users, a group including police, doctors, utility crews and taxi drivers (NOI No. 82-8). Contact: FCC's Joseph Levin, (202) 254-3301....In another inquiry, the FCC is asking for comments on the allocation of the 40.5–400 GHz spectrum to comply with the 1979 WARC actions (46 *Federal Register* 60221, December 9)....Air-to-ground telephones will enable American Airlines passengers to make calls while airborne. Airfone, Inc. is installing the one-way system on some planes this year....Arthur D. Little, Inc., of Cambridge, MA, is developing a search scenario for detecting and locating trapped miners using radio transmitters under a $108,000 contract from the US Bureau of Mines. According to ADL's Robert Lagace, the system's ability to transmit detectable rescue signals to the surface in the 500–3,000 Hz frequency range has been recently tested in some 94 mines in US coal fields. The bureau has sponsored the development of both seismic and electromagnetic trapped miner location systems since 1970....RCA plans to build nationwide communications networks among 50 cities. RCA Network Services, Inc. has joined 11 other applicants seeking FCC permission to start microwave digital termination systems.

Compatibility & Interference....The FCC has issued a rule that will allow the commission to shut down any source of electromagnetic interference which could peril human safety or damage property (47 *Federal Register* 1392, January 13, 1982). The regulation is a result of EMI from TV news equipment, which affected the space shuttle's tracking and communications equipment during last April's flight. Now the FCC's Chief of Field Operations can order broadcasters or cable operators to shut down interfering equipment....Comsearch, Inc., of Falls Church, VA, and Chomerics, Inc., of Woburn, MA, have set up measurement laboratories for EMI and EMC tests. ...The Navy has awarded BE&C Engineers, Inc., of Tukuila, WA, a subsidiary of Boeing, more than $4 million to deliver an electronic warfare and EM environmental effects test facility....And the Naval Surface Weapons Center in Dahlgren, VA, has issued a $902,000 contract to Eldyne of San Diego, CA, for engineering design support for EMC....The Naval Sea System Command intends to ask for EMI services next month (*Commerce Business Daily,* January 25)....The Rome Air Development Center is looking for a contractor to assess EMC in C^3 systems which use microelectronics....The National Association of Broadcasters' Radio Board is trying to secure government help to stop interference to AM stations from Cuba.

Government....Everyone is waiting for the president to unveil his FY83 budget. Among the leaked items are OMB proposals to phase out the Public Health Service Commissioned Corps, to further cut the EPA budget, to close down some FDA labs and to kill the NASA 30/20 GHz program (see satcom updates)....Barry White, a former OSHA regional administrator, has been named to head OSHA's directorate of Safety Standards Programs....After the *New York Times* ran a story about the antennas on the Soviet embassy in Washington, DC being used for surveillance (December 11), the embassy issued a denial. In a follow-up piece on December 21, a spokesman for the FBI reaffirmed the accusation....About a hundred people attended the Technical Electronic Product Radiation Safety Standards (TEPRSSC) meeting in Rockville, MD, December 9–10. RCA's Howard Johnson, a member of TEPRSSC, proposed that BRH consider a generic regulatory approach to reducing leakage from all electronic products which emit non-ionizing radiation. BRH Director John Villforth replied that he did not agree with such an approach.... BRH has issued a new subject index for its publications, dated October 1981 (No. FDA 82-8070)....The FAA has issued final rules prescribing minimum standards for microwave landing systems (MLS) not operated by the federal government (46 *FR* 61560, December 17)....And at the end of January, the FAA unveiled a 20-year, $9-billion plan to modernize the air traffic control system....The Department of Commerce is looking for someone to review NTIA's Spectrum Management Program (*Commerce Business Daily,* December 18).

IEEE....The responses to the IEEE's Committee on Social Implications of Technology's (CSIT) editorial on the Committee on Man and Radiation's (COMAR) draft position paper on human exposure to RF/MW appear in the December issue of *Technology and Society*, the CSIT newsletter. (See *MWN*, October 1981.)

Litigation....A defense motion to dismiss Nettie Yannon's suit against RCA in the New York State Supreme Court, Richmond County, was denied this January.

Measurement....The Department of Commerce has approved a request to develop a voluntary laboratory program (LAP) for electromagnetic calibration services. The request was made some six years ago by Dr. Bruno Weinschel of Weinschel Engineering in Gaithersburg, MD, who said that while he was pleased with the decision, he felt it had been a long time coming. The next step is to set up a workshop, probably in Washington, DC, to consider criteria for evaluating labs....Meanwhile NBS's MAP is growing. The measurement assurance program recently approved five labs on the West Coast, those at Boeing, Hewlett-Packard, Hughes, Rockwell and TRW. NBS is now looking at five labs back East and will be making a final selection in the spring.

Medical Applications....A team from Harvard reports hyperthermia can inhibit the activity of natural killer cells *in vitro* in the January 2 *Lancet*. The authors speculate that "fever may act as an immunoregulatory mechanism by decreasing NK activity."...A group from UCLA compares ways of heating deep-seated tumors, including with the Magnetrode unit, which failed to win FDA premarket approval last year (see *MWN*, May 1981), in the *IEEE Transactions on Biomedical Engineering*, January 1982. They express a preference for sources which produce an electric field parallel to skin/fat/muscle interfaces....BRH's Christian Hochuli and Dr. Gideon Kantor describe temperature measurements with a minimally disturbing probe in microwave diathermy in the December issue of the *IEEE Transactions on Microwave Theory and Techniques*....Dr. Robert Balaban of the National Heart, Lung and Blood Institute in Bethesda, MD, arranged the session on the application of NMR in biology and medicine at this year's AAAS meeting. Many of the papers described work using P-31 NMR....The January 23 *Science News* reports from the AAAS meeting that scientists from the University of Hawaii and the California Institute of Technology have found that a rotating magnetic field appears to significantly retard the growth of a mouse tumor that contains magnetite. Human cancer cells are not known to contain such particles....Electro-Biology, Inc., is planning to offer one million shares of common stock to the public....A team from Finland describes the use of magnetic measurements—magnetic susceptibility plethysmography—to measure changes in total cardiac volume in the January *IEEE Transactions on Biomedical Engineering*.

Military Systems & Radar....The Navy Electronic Systems Command has awarded two $3.5 million contracts for studies on the design of submarine laser communications, one to Lockheed Missiles and Space Co. in Palo Alto, CA, and one to TRW in Redondo Beach, CA....And the Office of Naval Research is negotiating with Sanders Associates of Nashua, NH, for research on blue-green noise measurements....*Discover* ran a piece on Project ELF in the January issue....In December, DoD won one of Senator Proxmire's Golden Fleece awards for the Navy's handling of a research program on the health effects of ELF radiation. A bull was kept at the Wisconsin Clam Lake facility as part of a program that even Vice Admiral G.R. Nadler acknowledged was useless from a scientific point of view. Cost: $13,000....In other contract news, the Navy awarded $1.6 million to GE in Syracuse, NY, and $920,000 to Calculon of Philadelphia, PA, for work on the AN/TPS-59—a D-band, long-range, 3-D air surveillance phased array radar....The Office of Naval Research is negotiating with Comsearch of Falls Church, VA, for below deck electromagnetic surveys and has awarded Ohio State University $350,000 for research on electromagnetic radiation and scatter and $1 million to SRI in Menlo Park, CA, for work on the over-the-horizon backscatter radar....The armament division at Eglin AFB wants to upgrade and modernize the DoD radar scatter facility at the White Sands Missile Range, NM....And the AF wants to build an RF anechoic chamber at Wright-Patterson AFB, OH.

Ovens....The Association of Home Appliance Manufacturers (AHAM) has withdrawn its objection to BRH's proposed amendments to the microwave oven performance standard (see *MWN*, May 1981). In a November 24, 1981 letter to BRH, AHAM said it was satisfied by a FDA Advisory Opinion on the amendments released November 20. BRH will now republish the amendments in the *Federal Register*, where they appeared on November 28, 1980 (45 *FR* 79028)....Microwave oven manufacturers had a good year in 1981, and AHAM forecasts an even better one for 1982. Shipments grew by 20% last year; a total of 4.3 million units were produced or imported. As of last November, AHAM expected factory shipments to increase to more than 4.7 million units in 1982, up almost 10%—the largest projected growth for any appliance....The *Washington Post* reports that DOE is in the process of canceling proposed rules that would have set minimum efficiency standards for major appliances including ovens. According to the December 21 item, OMB must still approve the DOE analysis....Raytheon's John Osepchuk writes that "there is almost vanishing probability of interference of today's pacemakers by today's microwave ovens," in an article in the November/December 1981 issue of *Microwave World*: "Debunking a Mythical Hazard."...The Cooking Appliance Section of the International Microwave Power Institute (IMPI) has assembled a ten-year bibliography on microwave cooking. The cost of the report has still to be set. Contact: Ms. Diane Ellison, IMPI, 301 Maple Avenue West, Tower Suite 520, Vienna, VA 22180, (703) 281-1515....Cober Electronics, Inc., of Stamford, CT, has introduced a new, 6 kW microwave batch pre-heater (Model BPH-6000)....And Cober has released a new brochure to describe its continuous microwave dewaxers for the precision casting industry. For a free copy, contact: Casting Industry Brochure, Cober Electronics, Inc., 102 Hamilton Avenue, Stamford, CT 06902.

Power Lines....Most of the recent issue of *Bioelectromagnetics* (Volume 2, Number 4) is devoted to studies of the biological effects of 60-Hz power lines....The third symposium on *Environmental Concerns in Rights-of-Way Management* is scheduled for February 15–18 at the Hyatt Islandia Hotel in San Diego, CA. Among the sessions is one on the health and safety of high power transmission lines and the siting of new energy facilities. Dr. Gus Tillman of the Cary Arboretum of the New York Botanical Gardens is chairing the session, which will feature speakers from Western Electric, Bonneville Power and Georgia Power. Contact: Lisa Lava-Kellar, 215½ S. Main Street, Ann Arbor, MI 48104, (313) 996-2696.

Satellite Communications....Alascom, Inc.'s request to build a satcom station on Vashon Island, WA, was denied by the King County zoning adjuster on December 31. (See *MWN*, December 1981.) The company has appealed the ruling and a public hearing is scheduled for March 2 to review the decision....National Satellite Service, Inc., a Hughes Aircraft Company subsidiary, wants to build a satcom station in the Spring Creek area of Brooklyn, NY. A draft environmental impact statement for the proposed facility is being reviewed by the city before proceedings on a land use variance can begin....NASA is contracting Arthur D. Little, Inc. of Cambridge, MA, for a profile of the domestic satellite communications industry....OMB wants to cut NASA's 30/20 GHz program from the FY83 budget, according to the December 21 *Aviation Week and Space Technology*. NASA is reportedly appealing the cancellation. The funding picture may be looking better with the recent appointment of Dr. Burt Edelson, formerly of COMSAT, as NASA's head of science applications....Meanwhile, NASA has recently awarded close to one million dollars in contracts to ITT, General Electric and Western Union Telegraph for 30/20 GHz studies....During a review of its satellite services policies this January, the FCC invalidated RCA's November auction for transponder leases. (See *MWN*, December 1981.) At the same meeting, the commission decided to solicit public comment on whether satellite owners should be allowed to negotiate private sales of transponders. Under current FCC rules, use is allocated at fixed rates on a first-come, first-serve basis....*Compendium of Communication and Broadcast Satellites: 1958–1980*, edited by Martin P. Brown Jr., has been published by the IEEE Press. Cost: $34.95, $26.20 for IEEE

members. Order prepaid from the IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854.

Technology.... Research on electromagnetic launcher technology, or railgun, continues. The Defense Advanced Research Projects Agency has awarded the Rand Corp. in Santa Monica, CA, nearly $300,000 to continue their work on it. The Air Force has its own program and is looking for a contractor to design and produce a railgun which can launch a projectile weighing ten grams with a muzzle velocity of 3 km/sec. For more information contact: AF's Bill Lucas, (904) 882-8240. Both projects are classified Secret. Nevertheless, *Science News* ran a progress report on the railgun in its December 12 issue.... Companies making anti-shoplifting devices are jockeying for new markets, especially supermarkets, according to a January 28 article in the *New York Times*. The industry is dominated by a few companies, including Sensormatic Electronics Corp. of Deerfield Beach, FL, Knogo Corp., of Hicksville, NY, and Checkpoint Systems, Inc., of Thorofare, NJ.... Raytheon's William Brown details the status of the microwave power transmission component for solar power satellites in the December *IEEE Transactions on Microwave Theory and Techniques*.... DOE's Laramie Energy Technology Center has awarded the University of Wyoming a $75,655 contract to study the basic principles involved in RF retorting of oil shale.... In other contract news the Air Force has awarded the Polytechnic Institute of New York in Brooklyn $277,000 for research on "Microwaves, Electromagnetic Theory and Information Processes," and NASA is negotiating with Ball Aerospace of Boulder, CO, for a "Shuttle Active Microwave Experiment."

VDTs.... *Health and Ergonomic Considerations of Visual Display Units*, a two-day seminar sponsored by the Ergonomics and Non-Ionizing Radiation Committees of the American Industrial Hygiene Association (AIHA) will be held March 1-2 in Denver, CO. Contact: J.R. Conti, AIHA, 475 Wolf Ledges Parkway, Akron, OH, 44311, (216) 762-7294.... The Ontario Ministry of Labor's advisory task force on video display terminals (VDTs) has finished its review of potential non-ionizing radiation health effects and is moving on to ionizing radiation. (See *MWN*, December 1981.) According to task force chairman Dr. Gordon Stopps of the University of Toronto's Occupational and Environmental Health Unit, no recommendations will be made before late spring or early summer.... The Newspaper Guild (TNG) and the International Typographical Union have published *Humanizing the VDT Workplace*, a 48-page health manual for local officers and shop stewards. The booklet is designed to help identify and eliminate VDT-related health and safety problems.... TNG has published its constitution, adopted at last year's guild convention, which includes its collective bargaining program and bargaining recommendations for VDT health issues. Copies are available from TNG, 1125 15th Street, NW, Washington, DC 20005.

LETTERS

To the Editor: I would like to draw your attention to an incorrect piece of news reported at the bottom of page 5 in your October issue. The London *Times* article did indeed imply that the National Radiological Protection Board (NRPB) had the only on-going microwave bioeffects research program in the UK, and that I had failed to obtain grants to carry out research in this area. You were quite entitled to draw these conclusions but in fact both are untrue.

I have a research team of eleven people and am supported financially in the UK by the NRPB itself, as well as by the Cancer Research Campaign. Generous support has also been provided by all three of the United States Armed Services and in addition I receive money from the NATO Scientific Affairs Division. I certainly would not like the impression to be given that my research team is short of funds and personnel; it would also be unfair to those organizations which support the research.

Professor E.H. Grant

Physics Department, Queen Elizabeth College, Campden Hill Road, London W8 7AH, United Kingdom.

CONFERENCE CALENDAR

• March 15-18: *International Workshop on Physics and Engineering in Medical Imaging*, Asilomar Conference Grounds, Pacific Grove, CA. Contact: University Extension, University of California, PO Box AZ, Irvine, CA 92716.

• March 29-April 2: 3rd *International Congress of Thermology*, Bath, England. Contact: Congress Secretariat, Martlet Conference Services, 24 Preston Street, Brighton, Sussex BN1 2HN, England.

• April 21-23: *Biomedical Engineering Society Annual Meeting*, New Orleans, LA. Contact: Dr. Yoram Ruby, Department of Biomedical Engineering, Case Western Reserve University, Cleveland, OH 44106.

• April 26-28: 1982 *Microwave Power Tube Conference*, Naval Postgraduate School, Monterey, CA. By invitation only, DoD Secret clearance required. Contact: Bill Lin, Litton Industries, 960 Industrial Road, San Carlos, CA 94070.

• May 24-28: *International IEEE/APS Symposium, National Radio Science Meeting and Nuclear Electromagnetic Pulse Meeting*, University of New Mexico, Albuquerque, NM. Contact: Dr. Kendall F. Casey, Dikewood Corp., 1613 University Blvd., NE, Albuquerque, NM 87102.

• June 7-8: 1st *Southern Biomedical Engineering Conference*, Louisiana State University Medical Center, Shreveport, LA. Contact: Dr. S. Saha, Department of Orthopaedic Surgery, Louisiana State University Medical Center, PO Box 33932, Shreveport, LA 71130.

• June 15-17: IEEE MTT-S *International Microwave Symposium*, Hyatt Regency Hotel, Dallas, TX. Contact: J.R. Griffin, Texas Instruments, Mail Stop 3432, PO Box 405, Lewisville, TX 75067. On June 18 immediately after the conference, there will be a one-day workshop on *Medical Applications of Electromagnetic Energy*. Contact: Dr. Gordon Short, BSD Medical Corp., 420 Chipeta Way, Salt Lake City, UT 84108.

• June 28-July 2: 4th Annual *Bioelectromagnetics Society Meeting*, Beverly Wilshire Hotel, Beverly Hills, CA. Contact: BEMS, 1 Bank Street, Suite 307, Gaithersburg, MD 20878.

• July 20-22: IEEE Annual Conference on *Nuclear and Space Radiation Effects*, Caesars Palace, Las Vegas, NV. Contact: A. Ochoa, Jr., Div. 2144, Center for Radiation-Hardened Microelectronics, Sandia National Laboratory, Albuquerque, NM 87185. This meeting will be followed on July 23 by the *Hardened Electronics and Radiation Technology Conference* hosted by the Defense Nuclear Agency. A Secret security classification is required to attend. Contact: Director, DNA, Attn: ISSO/Barbara Perkins, Washington DC 20305.

• July 25-30: 17th Annual Symposium of the *International Microwave Power Institute*, Town and Country Hotel, San Diego, CA. Contact: IMPI, 301 Maple Ave. W., Tower Suite 520, Vienna VA 22180.

• August 11-13: 4th Annual *Satellite Communications Users Conference*, Regency Inn, Denver, CO. Contact: Satellite Communications Magazine, 3900 S. Wadsworth Blvd., Denver, CO 80235.

• September 5-11: *World Congress on Medical Physics and Biomedical Engineering*, including the 13th *International Conference on Medical and Biological Engineering* and the 6th *International Conference on Medical Physics*, Congress Center, Hamburg, Germany. Contact: MPBE 82, Congress Organization, PO Box 302360, D-2000 Hamburg 36, Federal Republic of Germany.

• September 6-10: 7th *Colloquium on Microwave Communication*, Budapest, Hungary. Contact: Secretariat of the 7th Microcoll, H-1525, Budapest 114, POB 15, Hungary.

• September 8-10: *International Symposium on Electromagnetic Compatibility*, Marriott Hotel, Santa Clara, CA. Contact: Dr. Andrew Nalbandian, 20617 Debbie Lane, Saratoga, CA 95070.

• September 20-21: 4th Annual *Conference of the IEEE Engineering in Medicine and Biology Society*, Marriott Hotel, Philadelphia, PA. Contact: Dr. Alfred R. Potvin, Department of Biomedical Engineering, PO Box 19138, University of Texas, Arlington, TX 76019.

• September 20-22: 2nd Annual *Meeting of the Bioelectric Repair and Growth Society*, Oxford, England. Contact: Dr. B.F. Sisken, Wenner Gren Research Laboratory, University of Kentucky, Lexington, KY 40506.

• September 22-24: 35th Annual *Conference on Engineering in Medicine and Biology*, Marriott Hotel, Philadelphia, PA. Contact: ACEMB, 4405 East-West Highway, Suite 210, Bethesda, MD 20814.

MICRO WAVE NEWS

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Microwave News *invites letters from readers. We ask writers to be brief, and we reserve the right to edit contributions for length.*

EPA Set to Close RF/MW Research Lab

The Environmental Protection Agency (EPA) is planning to close down the radiofrequency and microwave (RF/MW) radiation program at the agency's Health Effects Research Laboratory. EPA Administrator Anne Gorsuch did not request any funds for the program in her fiscal year (FY) 1984 budget, and unless Congress forces a change, all EPA research on RF/MW radiation will stop on September 30.

As this issue goes to press, the official budget has yet to be released by the President; nevertheless, most researchers contacted by *Microwave News* had already heard about the decision and expressed their dismay and disappointment. EPA staff refused to comment until the budget was made public.

The cut back comes at an inopportune time. EPA's Office of Radiation Programs (ORP) has just officially announced its intention to set a safety level, or "guidance," for public exposures to RF/MW radiation (see p. 3). The lab, which is part of EPA's Office of Research and Development (ORD) in Research Triangle Park, NC, was to have supported that effort. In addition, cuts in this year's (FY83) budget have already forced a reduction in many research programs at EPA and other federal agencies.

EPA is not the only federal agency whose non-ionizing radiation program is in trouble: NIOSH has lost much of its staff as it closed its Rockville offices, and NTIA has let ERMAC's charter expire and has ended its role in coordinating federal RF/MW bioeffects research. See p. 2.

The RF/MW research group's FY83 budget is $1.5 million, compared with $2.12 million in FY82. ORP's budget, which includes both ionizing and non-ionizing radiation activities is slated to stay at its FY83 level, approximately $10 million.

The EPA R&D effort represents about 15 percent of the federal budget for non-ionizing radiation research, of which more than 60 percent is controlled by the military, primarily by the air force and the navy.

EPA's research budget will be the subject of congressional hearings tentatively scheduled for March 2, 9 and 16 by the subcommittee on natural resources, agriculture research and environment of the House Committee on Science and Technology. Tony Clark, a consultant to the subcommittee, said "you can be assured that the budget cuts will be addressed at the hearing." Representative James Scheuer (D-NY) is the chairman of the subcommittee.

Last summer, Kathleen Bennett, EPA's assistant administrator for air, noise

(continued on p. 2)

Computer RFI

Many computer users are experiencing problems caused by radiofrequency interference (RFI). In the course of checking out these complaints, we have contacted a number of computer manufacturers; they respond that computer susceptibility to RFI is rare and not a general problem. We invite our readers to send us reports about specific incidents and solutions so that we can sort this situation out.

EPA to Close Lab *(continued from p. 1)*

and radiation, made a strong case for the continued funding of the RF/MW research group. In a memo to Courtney Riordan, the acting assistant administrator for R&D, Bennett argued that her staff at ORP would need the help of the health effects research team in the development of the public health guidance through FY89. Even once a public limit is issued in FY85, Bennett wrote, EPA will still have to address a number of important issues such as mechanisms, modulation, chronic exposures and frequency specific effects. (The full text of Bennett's memo appears below.)

Paradoxically, the announcement that the RF/MW lab is scheduled to be disbanded comes only a few weeks after a peer review committee issued a glowing assessment of its work. In its report, the committee wrote: EPA RF/MW research is "of high quality and is highly regarded by peers in the scientific and engineering community. The breadth of expertness in the division is impressive." They cite "the excellent leadership and scientific competence" of the acting head of the lab's division, Dr. Joe Elder. The committee's members were Professor Carl Durney of the University of Utah (chairman), Dr. Elliot Postow of the Naval Medical R&D Command and Dr. Don Justesen of the VA Medical Center in Kansas City, MO.

One of the projects to be terminated when the lab closes is Dr. Carl Blackman's experiments on the effects of ELF modulated fields on calcium efflux in the brain. The review committee singled out this work as being "of immense potential significance in the determination of safety standards and in establishing a sound scientific basis for such standards."

In a telephone interview with the members of the peer review panel, all three expressed their disappointment with EPA's decision. "We need that kind of research and I will be sorry to see it go," said Durney. "The whole area is headed for extinction unless something is done... I am alarmed," said Justesen. ●

Memorandum from Kathleen M. Bennett, Assistant Administrator for Air, Noise, and Radiation, to Courtney Riordan, Acting Assistant Administrator for Research and Development, on Non-ionizing Radiation Research Needs.

I am writing to document the research activities we will need from the Office of Research and Development (ORD) to support our regulatory program for non-ionizing radiation.

Over the next few years (FY84-85) we will be developing guidance to control the radiofrequency exposure of the public. We will need the continued support of the health effects research staff to evaluate new research results through the public comment period. More importantly, the guidance we are developing will not address such important areas as mechanisms, inhomogeneous absorption, modulation, population sensitivity, chronic low-level exposure and frequency specific effects. Research in these areas needs to begin now so that you can address these issues in a major revision of the health effects document in support of our reevaluation of the radiofrequency guidance in FY89.

We also need your assistance in reaching decisions on the need for regulation at frequencies not covered by the guidance we are now developing, i.e., for frequencies above 100 gigahertz (GHz) and frequencies below 10 kilohertz (kHz), especially at 60 hertz (Hz), the frequency used for high voltage power transmission. This is a critical area, since the trend is to higher transmission voltages and effects are now seen in animals at levels very near those produced by present transmission voltages. We need an evaluation of effects, definition of uncertainties, and research to resolve these uncertainties.

The technological advances in the use of the electromagnetic spectrum are rapid and to a great extent unpredictable. As the spectrum becomes crowded, pressures mount to move to higher and higher frequencies and different applications. We do not perceive that the issuance of guidance for radiofrequencies in FY85 will reduce the support we need from ORD to make regulatory decisions at higher and lower frequencies or to reevaluate guidance for issuance in FY89. The health effects research staff is the only source of support we have tracking and evaluating research results and for conducting an integrated (intramural and extramural) research program to resolve important issues.

ERMAC Fades Away

The charter of the Electromagnetic Radiation Management Advisory Council (ERMAC) expired on January 9 and the National Telecommunications and Information Administration (NTIA), its parent agency, has made no move to renew it. NTIA head Bernard Wunder said that he has not yet decided ERMAC's future.

The agency did not request any money in its fiscal year 1983 budget for the coordination of federal research on the biological effects of non-ionizing radiation, bringing this work to a stop last October 1. Because no other agency has stepped forward to take over ERMAC from NTIA, the council may cease to exist.

Janet Healer, NTIA's program manager for non-ionizing radiation activities and an ERMAC member since its creation in 1968, has been temporarily assigned to other duties at NTIA.

ERMAC's sister committee, the Frequency Management Advisory Council (FMAC) will be renewed. Donald Jansky, associate administrator of NTIA and FMAC chairman has resigned to open up his own consulting firm. Jansky served as ERMAC's chairman at its last two meetings and had tried to find funds to allow its continued operation. ●

NIOSH in Disarray

The Rockville staff of the National Institute for Occupational Safety and Health (NIOSH) has dispersed. Just before Christmas, a congressional ban on moving NIOSH personnel out of the Washington, DC, area was revoked: employees were given 30 days to report to their new offices in Atlanta, GA, or Cincinnati, OH. Most refused to be reassigned. The resulting upheaval promises to further delay the completion of the institute's criteria document on radiofrequency and microwave (RF/MW) radiation.

NIOSH's criteria document development division was slated to go to the institute's laboratories in Cincinnati, OH. Of the three experts on non-ionizing radiation in Rockville, MD, Dave West has left to join the National Center for Devices and Radiological Health and Drs. Momtaz Wassef and Paul Strudler are believed to be resisting the move to Ohio. Neither could be reached for comment. Wassef had been the principal writer of the document; now that responsibility has been transferred to the Physical Agents Effects Branch, which has always been in Cincinnati.

When the move was first proposed two summers ago (see *MWN*, July/August 1981), there were some 152 employees in Rockville; by last Christmas only 60 remained—most of these will stay in Washington, DC. For example, only one of 24 members of the criteria development division has decided to go to Cincinnati. Many NIOSH staffers have found new jobs at the center or other parts of the Food and Drug Administration and the Department of Health and Human Services.

Senior NIOSH officials in Cincinnati are reevaluating plans for the RF/MW criteria document. They are weighing the possibility of changing course and releasing a much shorter report which could serve as rationale for a future RF/MW occupational exposure standard. A trimmed down document could be completed by this summer, reliable sources said, whereas there was practically no chance a complete criteria document could be finished this year with the present staff. ●

HIGHLIGHTS

EPA Moves Forward on RF/MW Exposure Guidance

The Environmental Protection Agency (EPA) has formally announced its plan to propose a "guidance" for general population exposure to radiofrequency/microwave (RF/MW) radiation in September. EPA officials already have a working number for the limit, though they do not plan to reveal it for some time.

Observers are confident that the number will be somewhere between the 50 uW/cm² standard proposed in New York City and the new American National Standards Institute's 1,000 uW/cm² recommended guideline. Specifically, many are betting on 200 uW/cm², which Massachusetts has proposed.

When final, the "guidance", unlike a standard, will only apply to federal agencies and their facilities. As the first national limit for public RF/MW exposure, however, its importance will far exceed its legal reach. Last year, the Federal Communications Commission (FCC) announced it will use EPA's number in determining whether proposed broadcast sources seeking licenses pose health hazards. (See *MWN*, March and September 1982.) The guideline will not cover occupational exposures or emissions from consumer products which, according to EPA, can be "more easily controlled" through performance standards.

The group at the Office of Radiation Programs (ORP) has finished a working draft of the guidance and plans to circulate it for inter-agency review this month. The office sent out letters in January requesting that interested federal agencies each appoint a staffer to participate in this preliminary evaluation.

The agency's Office of Research and Development (ORD) has prepared a draft criteria document on RF/MW bioeffects, which will serve as the basis for the guidance. The report is scheduled for public release in March when it goes to the Scientific Advisory Board (SAB) for review. The agency is now setting up a special panel to advise the SAB. Reliable sources say Professor Charles Susskind of the University of California, Berkeley, will be asked to chair the group. (By law, EPA must also consult the National Council on Radiation Protection and Measurement and the National Academy of Sciences on the guidance.) The publication of the criteria document is tentatively scheduled to coincide with release of the agency's notice of proposed recommendation in September.

Another support document, an economic impact study by the Environmental Sciences Division at the Department of Energy's Lawrence Livermore National Laboratory in Livermore, CA, should be completed by early summer.

The communications industry has been anxiously awaiting a national guideline on RF/MW radiation as proposed broadcast sources have met increasing opposition from community groups. Comments submitted last year on FCC's proposed RF/MW rules reflect industry fears over restrictive state and local standards.

EPA field measurements indicate most ambient radiation levels fall below even the strictest possible guideline. Based on readings from 15 cities, EPA estimates that over 99 percent of the population is exposed to RF/MW fields of less than 1 uW/cm². The median residential exposure is 0.005 uW/cm² at FM radio and TV frequencies (up to 806 MHz) and 0.019 uW/cm² at AM radio frequencies. These bands are "the principal contributors to the general radiofrequency environment." Above 806 MHz, exposures are estimated to be "much less than 1 uW/cm² for most of the population." (The agency has asked for comments on what frequencies the guidance should cover.)

For people living near high power transmitters, exposures can be "considerably higher"—as high as 5,000 uW/cm² in localized areas—according to EPA. Measured levels near FM broadcast antennas reported in the notice go as high as 350 uW/cm² in a residential neighborhood and 97 uW/cm² in a tall office building. Exposures "in the range of 10 to 100 uW/cm² can occur at distances up to 0.5 miles from some radar systems and satellite communication earth terminals."

The agency lists five key areas it will consider in establishing limits, including: 1) mechanisms of interaction, 2) possible thresholds of effects, 3) reversibility of effects, 4) dependence of effects on duration of exposure and 5) whether biological effects adversely affect human health. It provides few clues, however, as to what types of exposure may be unsafe. The agency does cite Eastern European reports of behavioral and nervous system effects at levels below 1 mW/cm², but then qualifies that this "limited clinical data suggest that these effects are reversible."

As for the key question regarding public safety, the agency only states, "It is not known whether the long-term, low-level exposures received by the general population can lead to irreversible adverse health effects, overt clinical disease, or whether adaptation can occur."

EPA is now awaiting comments on the scope and approach the guidance should take. The specific questions it wants addressed are listed below. Comments on the advanced notice (47 *FR* 57338, December 23, 1982) are due by February 22 but ORP's Norbert Hankin admits that he expects to receive some late replies. The agency will hold public hearings after the release of the proposed guidance.

Questions Posed by EPA

We specifically request comment on the following:

1. What conceptual approach should be used to develop limits for exposure? Examples of some possible approaches for establishing exposure limits include:
   (a) Threshold for biological effects.
   (b) As low as reasonably achievable.
   (c) Limit risk to a level comparable with that for other environmental pollutants.
   (d) Use of best available or best achievable technology.
2. What range of frequencies should be included in the guidance?
3. Should different guidance be developed for partial-body and whole-body exposure?
4. Should the exposure limits take into account the fact that the rate of energy absorption varies with frequency?
5. Should limits be placed on maximum as well as average exposure?
6. Should limits be placed on instantaneous as well as time-averaged specific absorption rates?

We would appreciate comments on these questions and identification of other issues that should be considered in the development of this guidance. ●

Canadian Group Recommends Limits for VLF Radiation from VDTs

A Canadian advisory group has recommended extending radiation standards to include the very low frequencies (VLF) emitted by some video display terminals (VDTs). In a statement issued in January, scientists at the Canadian Center for Occupational Health and Safety (CCOHS) say that although there is no known link between VDT exposure and reported reproductive problems, a cautious approach demands reducing emissions through shielding or terminal redesign until present uncertainty is resolved.

The center recommends that, on an interim basis, exposures to non-ionizing radiation from VDTs be limited to 60 V/m, as measured 30 cm from the set, for frequencies above 10 kHz. In Canada, a 60 V/m limit is already recommended by the province of Ontario for frequencies down to 300 kHz and by the federal government for frequencies down to 10 MHz. No standard in either the US or Canada now covers the 10–300 kHz band, though the

American Conference of Governmental Industrial Hygienists (ACGIH) has proposed limiting exposures to 614 V/m between 10 kHz and 3 MHz. The new American National Standards Institute (ANSI) standard does not recommend safety levels for frequencies below 300 kHz.

In considering possible causes for eight clusters of miscarriages and birth defects reported among VDT Operators (see *MWN*, July/August 1982), CCOHS scientists contend that "the weight of the scientific evidence is against ionizing radiation" because most VDT surveys show "negligible" X-ray emissions. Instead, they are looking to the pulse-modulated VLF fields produced by VDT flyback transformers.

Although the presence of VLF fields is widely acknowledged, most experts do not believe they are biologically active. CCOHS is focusing attention on the pulsed nature of these emissions because "pulse-modulated fields could be biologically more harmful than [unmodulated] fields." This is the first explanation, other than chance, for the clusters.

The center's Dr. Karel Marha cautions that research on the specific fields associated with VDTs must still be done. Nevertheless, he says the results of experiments with related pulsed fields provide a basis for concern. Czech researcher Dr. Hana Pafkova, for example, exposed pregnant mice for 17 days to a pulsed 300 Hz field with a peak value of 28,500 V/m and a pulse width of 10 microseconds and found "an unfavorable effect" on embryonic development. (Published in *Pracovni Lekarstvi, (Occupational Medicine) 32*, 334, 1980, written in Czech with an English abstract.)

In a telephone interview with *Microwave News*, Marha pointed out that the time-averaged field used by Pafkova was actually about 85.5 V/m, a level he called "not very high." He stressed that no one knows whether there is a radiation problem, but added, "*if* something is going on, these fields could be responsible."

The center's recommendation to limit these exposures drew sharp criticism from the Canadian Business Equipment Manufacturers Association in Toronto. In a telex sent January 10, the association's general manager Jim Flood warned the center that its statement would only create needless concern among VDT users and asked that it be withheld. According to Flood, "the center has proposed solutions to problems that don't exist: there is no evidence indicating VLF radiation is a hazard."

CCOHS scientists say only research, ranging from mathematical modeling to animal testing, will resolve the radiation issue and urge that this work be started. Noting that epidemiological studies are either underway or planned, they warn that there are too many confounding factors in this type of research to provide any clear-cut answers.

Marha has prepared a short paper, *The State of Knowledge Concerning Radiations From Video Display Terminals*, which reviews the types of emissions from VDTs. CCOHS is located at 250 Main Street East, Hamilton, Ontario, L8N 1H6, Canada.

NBS Designs New Meter to Measure E- and H-Fields Simultaneously in Near Field

Researchers at the National Bureau of Standards (NBS) have shown the theoretical feasibility of building a meter that can measure electric and magnetic fields *simultaneously* in the near field. Preliminary experiments, run at 100 MHz, indicate that the theory is correct. NBS' Dr. Moto Kanda said that a fully designed meter should be available within two years.

A sensor capable of measuring both electric and magnetic fields at a given point would represent a significant breakthrough—with widespread applications in the biological effects and radiofrequency interference communities. At present, there is no quick and reliable way of characterizing the components of low frequency (below 300 MHz) electromagnetic fields, which have extensive near fields.

Speaking from their laboratory at NBS' Electromagnetic Fields Division in Boulder, CO, Moto Kanda and Frank Ries said that, in the months ahead, they plan to design an isotropic antenna, to establish a flat frequency response for broadband measurements and to develop a fiber optic link so that the new sensor would not perturb the field.

Once the research and development is completed, NBS will disclose the meter's design to encourage the private sector to manufacture and market it. Kanda and Ries said that a number of companies have already expressed interest in the new meter.

Kanda is scheduled to describe the theoretical basis for the sensor in a paper to be presented at the *Electromagnetic Compatibility Symposium* to be held in Zurich, Switzerland, in early March.

Wertheimer Extends Cancer Study to Adults

Dr. Nancy Wertheimer and Ed Leeper have extended their 1979 work on childhood cancer and 60 Hz fields to adults: they have identified a "highly significant" association between the incidence of adult cancer and alternating magnetic fields (AMFs), though it was "considerably weaker" than the association observed for children. They contend that prolonged exposure to AMFs may promote the development of cancer.

While admitting that epidemiologically derived results can always turn out to be artifactual, the Colorado researchers argue that the association between cancer and the presence of high current electrical distribution lines may be a causal link because: "(1) a dose-relationship was observed; (2) two different control procedures yielded essentially similar results; (3) the strength of the associations observed in different age, urbanicity and socioeconomic groups was consistent with a causal interpretation; (4) a distinct pattern of latency between first exposure to the [high current configurations] and cancer diagnosis was seen, which is consistent with a hypothesis of cancer promotion produced by [exposure to AMFs]."

Wertheimer and Leeper maintain that the stronger association with children relative to adults may not indicate that children are more susceptible to the effects of AMFs—rather that any increase in cancer rates would show up more clearly in a population with a low incidence of cancer such as children.

In recent months, there have been three other reports connecting extremely low frequency (ELF) radiation to cancer. Studies from Washington state and California have found indications that workers exposed to electromagnetic fields have a greater risk of developing leukemia (see *MWN*, July/August and December 1982). And a Swedish team found support for Wertheimer and Leeper's 1979 results among Stockholm residents exposed to 50 Hz fields (see *MWN*, November 1982).

"Adult Cancer Related to Electrical Wires Near the Home" appears in the *International Journal of Epidemiology, 11*, 345, 1982. Wertheimer is with the Department of Preventative Medicine and Community Health at the University of Colorado Medical Center in Denver.

ITT Settles Engell Suit

Attorneys for ITT and Robert Engell agreed to an out of court settlement on December 23. Engell had filed a $4.5 million claim alleging that he had developed pancreatic cancer due to radiation exposure from tactical air navigation (TACAN) equipment manufactured by ITT. None of the attorneys involved would divulge the amount of the settlement, though one source did remark that more than nuisance money is involved.

Marc Moller and Michael Young, two of Engell's attorneys at the New York City law firm of Kreindler & Kreindler, said that they

were pleased with the outcome in the light of the present state of knowledge on radiation injuries. They said that Engell is satisfied. Matthew Shafner of O'Brien, Shafner, Garvey, Bartinik & Stuart of Groton, CT, was co-counsel on the case.

ITT was represented by John FitzGerald of the Hartford, CT, firm of Howard, Kohn, Sprague & FitzGerald; he refused to discuss the settlement.

A jury had been selected and the trial was scheduled to begin on January 5 in US District Court in Hartford. Engell's original suit, filed in 1977, named General Dynamics, Raytheon, Rockwell International and Varian Associates as co-defendants along with ITT. All four companies settled out of court in November; those agreements also stipulated that the settlements be kept confidential.

Engell worked at the Naval Air Rework Station on Quonset Point, RI, from 1965 until it was closed in 1973. He and one of his coworkers, Donald Cadieux both developed pancreatic cancer. More specifically, Engell had nonbeta islet cell cancer of the pancreas while Cadieux had adenocarcinoma of the pancreas. Cadieux died in October 1974; his widow's claim of wrongful death was barred under the Rhode Island statute of limitations.

One medical opinion, solicited by Engell's attorneys and placed in the court's records, states that "to find two men under 40 to have contracted pancreatic cancers in the same place is so highly unusual as to invite the inference that the disease states in each of them was occupation related." The expert was Dr. Leonard Dauber, an assistant clinical professor of medicine at Albert Einstein College of Medicine in New York City.

ITT never acknowledged that TACAN radiation caused the cancer; but, according to Young, the company filed papers with the court admitting there were no warnings of potential radiation dangers on the equipment when Engell worked on it. Among those listed as experts for ITT were: Drs. Don Justesen, Sol Michaelson, John Osepchuk, and Paul Tyler.

TACAN operates at frequencies of 1.025–1.213 GHz. In addition, the men were probably exposed to X-ray radiation from the rectifier tubes in the high voltage power supply.

UPDATES

Biological Effects... Dr. Carl Blackman and his colleagues at EPA published their latest findings on ELF-induced calcium efflux from brain tissue in the December *Radiation Research*. As Blackman reported at last summer's BEMS conference (see *MWN*, July/August 1982), the EPA group used 16 Hz sinusoidal fields *without* a carrier wave and found two power windows of enhanced efflux at 5–7.5 V/m and 35–50 V/m. These results are similar to those obtained with 50 and 147 MHz carrier waves modulated at 16 Hz, leading them to the conclusion that the RF carrier is not the responsible agent. They write that the experiment provides: "strong evidence against any potential mechanism of action that invokes generalized heating as the underlying cause." Blackman's findings disagree with those of a similar experiment run some years ago by Drs. Suzanne Bawin and Ross Adey. While both groups identified the same frequency specificity, Bawin and Adey found a reduction in calcium efflux while the EPA researchers found an enhancement—a difference that remains unexplained. At the 1982 BEMS meeting, Blackman said that he planned to see if higher ELF frequencies affected calcium mobility. In a telephone interview, Blackman said that he is in the process of running experiments at frequencies of up to 120 Hz. He predicted that he would have some results for the 1983 BEMS meeting, which will be held in Boulder, CO, in mid-June.... Professor Bill Guy will also be in Boulder to present the near-final results of his multi-million dollar, long-term study. Guy's research team at the University of Washington, Seattle, turned off the power last September after exposing 98 rats to 2450 MHz, 8 Hz pulsed microwaves for 36 months. The statisticians are still at work, Guy told *Microwave News*, but the preliminary indications are that there were no significant differences between the exposed and control animals. At last year's BEMS meeting, there was a paper out of Guy's lab indicating there might be some changes in T and B cells among the rats exposed to microwaves, but these were not confirmed by later tests. Guy said that he would like to do some more work on the effects of radiation on the immune system as well as the metabolic changes that follow irradiation. Now that the experiment is over, Guy intends to design improved applicators for hyperthermia treatment.... Another, though less ambitious, chronic study is reported by two Canadian researchers in the second issue of *Journal of Bioelectricity*, published by Marcel Dekker. Dr. J.A. Tanner of the National Research Council of Canada in Ottawa and Dr. C. Romero-Sierra of Queen's University in Kingston, exposed a colony of leghorn chickens to 7.06 GHz CW from a four-foot parabolic dish for more than 200 days: field intensities ranged from 0.19 uW/cm² to 360 uW/cm² depending on the location of the cage with respect to the dish. Microwaves increased egg production by 13 percent over the controls but was accompanied by double the mortality rate—mostly from avian leukosis and tumors in the central nervous system. In addition, the birds that survived showed a pronounced deterioration in health. The authors explain these adverse effects at such low levels with the hypothesis that "high intensity fields trigger thermal effects that block the non-thermal effects identified with low intensity fields."... Meanwhile scientists at the Battelle Northwest Laboratories have been investigating the effects of magnetic fields on trout. Battelle's Dr. John Strand reports that "fertilization was enhanced when ova and sperm of rainbow trout were exposed to a 1-tesla magnetic field before fertilization." A number of other magnetic field studies are also underway at the lab; to date, no adverse impacts have been detected.... As anticipated, ONR has picked up the abstracting of the bioeffects literature from NTIA. The BENER (Biological Effects of Non-Ionizing Electromagnetic Radiation) digests will continue to be prepared by Bruce Kleinstein under a newly created company, Information Ventures. Kleinstein, who is based in Philadelphia, PA, has received a one-year $72,000 contract, renewable for two more years, to prepare a quarterly review of the world's bioeffects research. The digest will pick up where NTIA left off; the first issue will begin with January 1982. If renewed, the total contract will be worth $212,000.... The research group at the University of Utah continues to turn out a large number of papers. Two recent additions were published in the November *IEEE Transactions on Microwave Theory and Techniques:* Professor Om Gandhi presents a review of the bioeffects and medical applications of RF/MW fields and, with two of his colleagues, some results on radiation absorption in the near field.... The most recent contribution to the debate on the potential hazards of fluorescent lights appeared in the November 27 *Lancet*. Dr. Robert Stern of Harvard Medical School contends that the increased risk of melanoma associated with fluorescent light in a recent study (see *MWN*, September and December 1982) is likely to reflect a bias in the selection of controls rather than a true risk .... Professor Albert Krueger died in December at the age of 80. Krueger, who spent much of his career at the University of California, Berkeley, was a leading researcher on the biological effects of air ions.

Communications... MCI Communications Corp. is bullish on fiber optics. Since November the company has purchased rights-of-way for over 4,000 miles of cables, including the Washington, DC, to New York City corridor. MCI chairman William McGowan says the east coast link will boost transmission capacity at a cost that is "far more economical" than expanding the company's existing point-to-point microwave network. The new technology, which is digital, can also improve transmission quality because it is immune to interference.... Meanwhile, ITT continues its efforts to site a point-to-point tower in northern New Jersey, one link in a planned network between Newark and Boston. A permit application was rejected by South Nyack, NY, last year and the company is now seeking approval in Ringwood, NJ, for the tower. In a January 21 release addressing community concern over potential radiation hazards, the company said the calculated power density at the base of the tower would be 0.02 uW/cm².... The organizers of the community group opposing RCA's application for an additional point-to-point station at its satcom facility in Vernon, NJ, (see *MWN*, November 1982) showed up at Ringwood's January public meeting on the ITT tower. RCA came too.... The November 1982 issue of the *Proceedings of the IEEE* is devoted to UHF-TV.... Telex Communications' Hy-Gain divi-

sion has issued a catalog of commercial, industrial and military HF, VHF and UHF antennas. For a copy, write to Hy-Gain, CIM Department, 8601 NE Highway Six, Lincoln, NE 68505.... Next year, your car radio might belt out the top 40 in stereo. Delco Electronics, a division of General Motors and the largest US maker of car radios, has decided to use Motorola's system for AM stereo radio. This is a major break in the standoff among three non-compatible systems hoping to win market acceptance. Harris Corp. and Magnavox are the losers in this round.

Compatibility & Interference...The FCC has closed its books on a notice of inquiry, adopted in December 1975, to investigate possible interference from spark-type ignitions to communication systems. In a memorandum, opinion and order released January 4, the commission states that there is little justification for pursuing the matter because the incidence of RFI from spark-type ignitions is decreasing and will probably continue to do so.... Video games, on the other hand, are another story. In mid-December, the AP featured a story about RFI complaints at a fire company in Milford, DE. Two video games had to be removed from the firehouse because they were interfering with land mobile units in the firetruck and confounding the transmission of alerts to the firemen's homes. The video game RFI problem may get worse after Christmas, according to an FCC staffer quoted by the AP, when all those games come out from under the trees....The Army Aviation R&D Command and NBS are planning a five-year effort to improve the army's EMC measurement program for helicopters, light aircraft and remote-piloted vehicles. The EMC program will include an assessment of shielding materials and military standards 461 and 462, as well as a study of the feasibility of establishing a government high-field-strength EMC test facility and a study of improved methods for electromagnetic pulse testing ....The FAA has signed a contract with the Department of Electrical Engineering at Ohio University in Athens to measure radiated emission from ISM equipment at an open field test site and at the actual location where the ISM equipment is operated. The FAA wants field strength measurements in the air over the ISM devices at a minimum of three different altitudes above the test site....The Energy and Environment Division of the Lawrence Berkeley Laboratory at the University of California has issued the *Proceedings of the Lighting-Electromagnetic Compatibility Conference*, held at the lab last March 18-19. A limited number of copies of the report (No. LBL-15199) are available from Dr. Rudy Verderber, Lighting Systems Research Group, LBL, Berkeley, CA 94720. Afterwards, it will be available from the National Technical Information Service, Springfield, VA 22161.

EMP...Concern over the possible impact of electromagnetic pulse (EMP) radiation on communications and energy systems continues to grow. While DOD has budgeted a major effort to protect vital military communication links from EMP disruptions, Edward Teller is worried about the EMP threat to industry. Writing in the October issue of the *IEEE Spectrum*, Teller speculates that in the event of heavy EMP radiation "it would be easier to enumerate the apparatus that would continue to function than the apparatus that would stop." Teller calls for the declassification of essential DOD documents because, unless precautions are taken, "the civilian economy faces the prospects of grinding to a halt in a nuclear encounter." With respect to the effects of EMP on electric power systems, a number of studies are already underway: the Zaininger Engineering Co. is characterizing EMP coupling and interactions for the Oak Ridge National Laboratory (Zaininger has subcontracted research on EMP effects on three phase circuits to the Dikewood Corp. and on magnetohydrodynamic-EMP surges on long transmission lines to the Mission Research Corp.) The Boeing Co. is looking at the effects of EMP on power system components for the Defense Nuclear Agency (DNA); DNA is also sponsoring the development of an advanced arrestor for EMP from surface nuclear bursts at General Electric. The Nuclear Regulatory Commission has contracted with Sandia National Laboratory for a major study of the effects of EMP on nuclear power plant safety systems; other related studies are planned. (Preliminary results from Sandia indicate that safety systems should not be damaged.) Most recently, Union Carbide, which runs Oak Ridge for DOE, has issued a RfP (No. 19-4456) for an assessment of the effects of EMP on utility electric power systems and for recommendations on how they can be protected....Much of the public awareness of EMP is attributable to articles by William Broad in *Science* and Janet Raloff in *Science News*. Broad has now written a popular piece, "The Chaos Factor," which is the cover story in the January/February issue of *Science 83*. Broad recently left *Science* to join the *New York Times*....A comparison of electromagnetic fields (in the frequency range 10^4–10^7 Hz) from nuclear EMP with those from lightning appears in the November issue of the *IEEE Transactions on Electromagnetic Compatibility*.

Government...Bruce E. Fein has been appointed general counsel at the FCC. Fein comes to the commission from the Department of Justice.... FDA has renewed the charter of its Technical Electronic Product Radiation Safety Standards Committee (TEPRSSC) for two more years. The date of the committee's next meeting has not been announced.

International...The Industrial Injuries Advisory Council in London, UK, is reviewing occupational risks associated with exposure to electromagnetic fields, including ionizing and non-ionizing radiation. For more information contact the council at Friars House, 157-168 Blackfriars Road, London SE1 8EU....Visiting Chinese scientist Zhi-Yuan Shen reports that the *Third National Symposium on Microwave Power Applications* will be held in China later this year; the exact date and place of the conference have yet to be decided. With respect to medical applications, he said that needles are being used as antennas to transmit microwaves in acupuncture treatments in Chinese hospitals. The needles transmit 1 GHz radiation.... Howard Bassen and John Monahan of the National Center for Devices and Radiological Health left for the Soviet Union in mid-January as part of the joint US-USSR research program on non-ionizing radiation (see *MWN*, July/August 1982). Bassen will be checking dosimetry at Dr. Mikhael Shandala's lab in Kiev, while Monahan will review the experiment's behavioral protocols. Afterwards, Monahan will visit other labs in Moscow and Leningrad.

Measurement...NBS has issued three new publications: (1) a new edition of its catalog, *Calibration and Related Measurement Services of the National Bureau of Standards* (SP 250-1982), which includes a special appendix listing contacts and prices for each service. It is available for $6.00 prepaid from the Superintendent of Documents, US Government Printing Office, Washington, DC 20402. Stock No. 003-003-02446-5. The appendix is updated every six months free of charge; (2) *Metrology for Electromagnetic Technology: A Bibliography of NBS Publications* (NBSIR 82-1677). This volume, which covers papers and reports published by the bureau's Electromagnetic Technology Division staff between 1970 and 1981 on microwave circuits and pulsed electromagnetic phenomena among many other subjects, can be purchased for $9.00, prepaid, from the National Technical Information Service (NTIS), Springfield, VA 22161. Order No. PB 83-111658; (3) *Bibliography of the NBS Electromagnetic Fields Division Publications* (NBSIR 82-1673) lists the division's 1980–81 reports on measurement methods and standards as well as antenna systems and RFI. Available from NTIS for $6.00. Order No. PB 83-119776....A session at the *1983 Measurement Science Conference* held in Palo Alto, CA, January 20–21, featured three papers on automated testing techniques for microwave technology. Algie Lance of TRW Systems in Redondo Beach, CA, organized the session and presented one of the papers; the other two were by Mike Cuevas and John FitzPatrick, who both work at Hewlett-Packard. For more information, contact Lance at (215) 535-5167..

Medical Applications ... A hyperthermia unit manufactured by BSD Medical Corp. of Salt Lake City, UT, failed to receive premarket approval (PMA) from the FDA at a December 8–9 Radiologic Devices Panel meeting in Rockville, MD. An evaluation by officials at FDA's National Center for Devices and Radiological Health recommended approval for the cancer treatment unit with respect to safety and engineering, but there were some doubts about the machine's efficacy due to insufficient statistical controls in the submitted clinical data. BSD presented results from treatments with radiation and hyperthermia but not with radiation alone. Dr. J. William Dirksen, director of research and regulatory affairs at BSD told *Microwave News* that the company was in the process of generating the necessary data and that the company would resubmit the PMA application in early February. In 1981, Henry Medical Electronics' Magnetrode unit also failed to clear PMA (see *MWN*, May 1981). To date no hyperthermia device can be marketed to treat cancer....At the same meeting, there was discussion, initiated by the National Electrical Manufacturers Association (NEMA), on the possibility of changing the classification of NMR imagers from Class III to Class I or II, which do not require PMA. The panel expressed its interest in reclassification, but advised that it was up to NEMA to take formal action by filing a petition. In an interview, NEMA's Robert McCune said the group

was in the process of polling its member companies on the merits of such an action. . . .*The National Cancer Institute (NCI) has set up* a new committee, the Cancer Therapeutics Program Project Review Committee to advise NCI staff on "the merit review of applications requesting support for clinical and laboratory program project proposals." . . . In the latest issue of the *Journal of Bioelectricity* (Volume 1, Number 2, 1982), Drs. Stephen Smith and Jose Feola of the University of Kentucky College of Medicine report on experiments designed to see whether the pulsed magnetic fields used to heal nonunion fractures affected the course of malignant tumor development. *They used a pulse generator made by Electro-Biology (which also* supported the research) that emits a 5 millisecond train of 29 pulses, repeating at 15 Hz, inducing a peak magnetic field of about 20 gauss—an average field of 2–3 gauss. They found the magnetic field had: (1) little effect on survival, though there was a slight trend towards reduced survival; (2) a "quite remarkable" effect on internal organs; and (3) a general trend "towards the inhibition of the tumor and suppression of metastasis." As the authors themselves note, the results present "an interesting picture, not altogether easy to interpret." . . . *In the same issue of the Journal of Bioelectricity* Dr. Robert Becker, who recently retired from the Upstate Medical Center in Syracuse, NY, presents a review of "Electrical Control Systems and Regenerative Growth." . . . A group from Aberdeen, Scotland has used NMR to examine six patients in the first trimester of pregnancy, prior to termination. They report in the January 1/8 *Lancet* that the "fetal detail displayed by NMR is greater than that seen by ultrasound" and that there appear to be "no short or medium term side-effects." They caution, however, that "there is *insufficient information from animal work about [NMR imaging's] mutagen*icity to advocate the use of NMR in human pregnancy at this time." . . . Other recent NMR articles include a description of NMR imaging at Hammersmith Hospital in London in the November issue of *Radiography*, and "NMR Spectroscopy of Living Cells" by R.G. Shulman of Yale University in the January *Scientific American*. . . . IBM Instruments has agreed to help advance NMR imaging with grants of $1.9 million to Harvard Medical School's Brigham and Women's Hospital and $1.5 million to MIT's National Magnet Lab . . . . *Clini-Therm Corp. of Dallas, TX, will do R&D on cancer treatment for* Hyperthermia Associates of Nashville, TN, under a $440,000 contract. . . . Dr. Margaret Patterson has developed a "black box" that sends weak electrical signals into the brain to help addicts kick the habit. Her NeuroElectric Therapy works for drugs, alcohol and cigarettes. In a detailed article in the January *Omni*, Kathleen McAuliffe describes the box and Patterson's remarkable success rate. Interestingly, Patterson found that different frequencies helped different addictions: 75–300 Hz for narcotics and sedatives, lower frequencies for barbituates and approximately 2,000 Hz for cocaine and amphetamines. Patterson claims that her treatment does not cause any compensating "electronic addiction."

Ovens. . . A total of 4.07 million microwave ovens were shipped in 1982, down 7.9 percent from 1981, the record year for the industry. Despite the decline, sales have nearly doubled during the last five years. The Association of Home Appliance Manufacturers (AHAM), which compiles these statistics, believes that the future will be rosy: it points out that only one in four homes now has a microwave oven. . . . DOE has decided that energy efficiency standards for ovens, ranges and clothes dryers are not worth setting. In a final rule published in the December 22 *Federal Register* (47 *FR* 57198), the agency finds that such standards "would not result in a significant conservation of energy and would not be economically justified." When DOE first proposed a "no standard" approach, some congressmen voiced their displeasure (see *MWN*, June 1982). This time, Congress was in recess for the Christmas holidays and the rule passed relatively unnoticed . . . . Rubbermaid has introduced a line of microwave cookware made of a new material it calls "Micrel." The company claims the products are "virtually unbreakable and won't warp, even with drastic temperature changes from freezer to microwave oven to dishwasher, where it is bottom rack safe." . . . Magic Chef plans to introduce a new line of microwave ovens at the end of January.

Power Lines. . . The Minnesota Environmental Quality Board (MEQB) has concluded that the state's construction permit for the Cooperative Power Association-United Power Association 800 kV DC power line is adequate to protect public health and safety without modification. In its December 21 ruling, the board did order continued monitoring of the electrical environment around the line, however, and asked the Minnesota Department of Health to investigate the potential interference hazards of a line converter station to pacemakers. The board decision on the line running from a North Dakota coal field to Minneapolis/St. Paul, MN, follows the recommendations of its scientific advisory panel. The panel states in its report that "no additional standards are needed for safe operation of the line," though it also says that resolution of power line health effects issues "will definitely require well defined and replicated epidemiological studies," which in turn require more research on air ion concentrations. The advisors conclude that "the likelihood of long-term biological effects from the air ions generated by the line is considered to be low. However, we have virtually no direct information from any long-term studies of air ion effects." (See *MWN*, October and December 1982.) MEQB also reviewed a dairy cattle study by researchers at the University of Minnesota and reports on the state's program monitoring the electrical environment around the lines. For information on the availability of the reports, contact George Durfee, Manager, Power Plant Siting Program, MEQB, 15 Capitol Square Building, 550 Cedar Street, St. Paul, MN 55101.

Satellite Communications. . . The draft environmental impact statement (EIS) for Teleport, a satellite communications complex planned for Staten Island, NY, was released by the New York City Development Corp. and the Port Authority (PA) of NY and NJ on January 3. The facility would include 17 satellite antennas and eventually employ over 7,000 people. According to the draft, radiation levels near Teleport are not expected to exceed 3 uW/cm² — *well below the 50 uW/cm² limit proposed as a population standard* for New York City. Summary information in the EIS indicates safeguards in the project's design and operation would include continuous radiation monitoring and an alarm system, with an automatic cut-off, activated if radiation levels exceed 50 uW/cm². The facility would be surrounded by some form of wall to shield its antennas from external interference and to reduce RF/MW levels outside the site. Dr. Paul Tyler of the Defense Nuclear Agency reviewed the bioeffects literature for the statement, which *concludes that "no hazardous conditions have been identified at the power* density levels (maximum 3 uW/cm²) and radio frequencies (4 to 14 GHz) proposed for use" at Teleport. (Details are presented in a technical support document, *The Teleport Electromagnetic Energy Study*, 1982, by Ammann & Whitney, which was not yet available in late January.) Both Teleport, sponsored by the PA and Merrill Lynch, and an all-office development plan are considered in the EIS. A hearing on the project before the NYC Department of Environmental Protection and the NYC Planning Commission is *scheduled for February 2. (See MWN, June 1982.)* . . . RCA Americom's request to build a satcom station in the Indianola-Kingston area, near Seattle, WA, was denied by the Kitsap County Board of Commissioners for the second time on January 24. Company plans to site the facility on the county's Bainbridge Island and later in a forest near Kingston have met strong community opposition. Commenting on the ruling, Americom spokesman John Williamson said the company "will not pursue the Kitsap proposal at the present time," though "we still plan to start serving the Seattle area in *1983, from one location or another." The board refused RCA's application* last year but was asked to consider it again after the company filed suit in state court (see *MWN*, December 1982) . . . . A state superior court judge for nearby King County, WA, denied a citizen's group petition to block completion of Alascom's satcom station on Vashon Island. Members of Vashon for Quality Environment are likely to appeal the January decision to a higher court (see *MWN*, December 1982) . . . . The UN General Assembly has approved a resolution barring direct satellite transmissions across national borders *without the receiving country's consent. The December 10 vote* followed the endorsement of the measure by a UN special political committee in November. . . . *The Satellite Communications Market in Western Europe*, a 383-page report from Frost & Sullivan, includes estimates for various sectors of this market totalling over $8.5 billion by 1992. Report No. E564 costs $1,600 and is available from the company at 106 Fulton Street, New York, NY 10038, (212) 233-1080.

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VDTs... The Labor Education and Studies Center of the Canadian Labor Congress (CLC) has recommended in-depth studies to determine whether VDTs pose radiation risks. Citing concern over PCB's as well as very low frequency radiation, the center also urges that "long-term studies into reproductive hazards be undertaken immediately." The recommendations are included in its 241-page report on VDTs, which covers mainly non-radiation issues. A center survey of 2,330 Canadian workers found no evidence linking cataracts or reproductive problems to VDTs, but it cautions that only a study following a large group of workers over a long period could give conclusive results. The full report, *Towards a More Humanized Technology*, is available for $20, and a 46-page digest for $5, from the Center at 2841 Riverside Drive, Suite 301, Ottawa, Ontario, K1V 8N4, (613) 731-3052.... The Labor Council of Metropolitan Toronto reviews the CLC report in a special issue of its *VDT Newsletter* to be released this month. The council is also planning a conference on stress associated with VDT work on April 30. For information, contact the Council's VDT Committee, Room 407, 15 Gervais Drive, Don Mills, Ontario.... Several state legislatures may consider action on VDTs this year. In New York, a draft VDT safety bill sponsored by Brooklyn Assemblyman Frank Barbaro should be finished this month. And bills for establishing committees to investigate VDTs and possibly recommend legislation have been prepared by Connecticut's Committee on Labor and Public Employees (Study Bill 5132) and by Massachusetts' Committee on Commerce and Labor. VDT legislation proposed last year in Massachusetts (House Bill 2910) never reached the floor. (See *MWN*, April, 1982.)... NIOSH will investigate the relationship between stress and VDT work during an eight month study headed by Dr. Lawrence Scheifer at its laboratories in Cincinnati, OH. About 30 typists will participate. The project is not connected with two ergonomics studies now starting up under NIOSH's Dr. Michael Smith. (See *MWN*, December 1982.)... The North Carolina Occupational Safety and Health Project has asked interested union locals in the state to participate in a VDT worker survey on stress, ergonomics and potential reproductive problems. Contact Tobi Lippin, NCOSH, Box 2514, Durham, NC 27705.... Reports on new office technology appearing in the International Labor Organization's (ILO) *Social and Labor Bulletin* have been compiled and republished. The ILO book covers reports appearing since 1979 from a number of countries on such topics as general policy issues, labor relations and collective agreements, trade union viewpoints and the working environment. The 174-page *New Technologies: Their Impact on Employment and the Working Environment*, 1982, is available for $11.40 from ILO, Washington Branch, 1750 New York Avenue, NW, Washington, DC 20006.... Two Canadian researchers have concluded that "there are clearly no significant technological or economic problems in achieving emission levels far below the current regulatory limit" for X-ray emissions from VDTs. In the November 1982 *Health Physics*, C.A. Hirning and J.H. Aitkin of the Ministry of Labor in Toronto report: "As long as VDTs are being made with X-ray emissions as low as the vast majority of those currently available, there is no significant radiation risk to the users and no need for any additional regulatory action. If, however, a trend toward higher emission levels were observed... then the [as low as reasonably achievable] principle should be invoked to require manufacturers to reduce emissions again to the present negligible levels."... The Electronic Industries Association is working on a new standard, *Recommended Practice for Measurement of X-Radiation from Direct-View Television Picture Tubes*, TEPAC Publication No. 164. For information, contact the EIA, 2001 I Street, NW, Washington, DC 20006, (202) 457-4900.... A summary of the October 1982 *International Conference on Office Work and New Technology*, sponsored by Working Women should be available in March. For information, contact the organization at 1224 Huron Road, Cleveland, OH 44115.... Word processors have been the source of a different kind of office problem at Ford Motor Company in Dearborn, MI: a gambling operation handling over $5,000 a week. The January 10 *Computerworld* reports that state police nabbed three clerks who allegedly used their terminals to run a football betting pool. ●

Microwave News has published *VDTs: Health and Safety*, an 80-page booklet with an index containing all of our 1981–2 coverage of video display terminal issues. Copies are available prepaid for $5.95 plus $1.00 for postage and handling from: *Microwave News*, PO Box 1799, Grand Central Station, New York, NY 10163. For bulk rates (over 10 copies), please call us at (212) 794-9633. (US funds please. If your check is not drawn on a US bank, please add $3.00 per order.)

SHORT COURSES

• March 2–4: *Mobile Communications Engineering*, Washington, DC. Fee: $685. Contact: George Washington University, Continuing Engineering Education, Washington, DC 20052, (800) 424-9773.

• March 7–8: *EMI/Testing Praxis*, suburban Philadelphia, PA. Fee: $495. Contact: R&B Enterprises, 1050 Colwell Lane, Conshohocken, PA 19428, (215) 828-6236. Repeated • May 16–17.

• March 7–11: *Microwave Circuits: Theory and Applications*, Vienna, VA. Fee: $850. Contact: Continuing Education Institute, 10889 Wilshire Blvd, Suite 1000, Los Angeles, CA 90024, (213) 824-9545. Repeated • April 4–8 in Palo Alto, CA.

• March 7–11: *MIL-STD 461/462 & System-Level EMI Testing and Procedures*, Washington, DC. Fee: $965. Contact: Don White Consultants, PO Box D, Gainesville, VA 22065, (703) 347-0030.

• March 14–17: *Computational Methods in Electromagnetics*, Champaign, IL. Fee: $580. Contact: Southeastern Center for Electrical Engineering Education, 11th & Massachusetts Avenue, St. Cloud, FL 32769, (305) 892-6146.

• March 14–18: *Spread-Spectrum Techniques and Vulnerability*, New York, NY. Fee: $565 (IEEE), $715 (non-IEEE). Contact: IEEE Continuing Education, Attn: Rosanne Santangelo, 445 Hoes Lane, Piscataway, NJ 08854, (201) 981-0600 x 328.

• March 21–23: *MM Wave Technology*, Washington, DC. Fee: $650. Contact: Palisades Institute for Research Services, 201 Varick St., New York, NY 10014, (212) 620-3377. Repeated • April 5–7 in San Francisco, CA.

• March 22–25: *Grounding and Shielding*, Orlando, FL. Fee: $760. Contact: Don White Consultants, see March 7 above.

• March 24–25: *Hazardous Electromagnetic Radiation and Its Biological Effects*, Washington, DC. Fee: $625. Contact: George Washington University, see March 2 above.

• March 28–April 1: *EMI Design and Testing*, Orlando, FL. Three one-day sessions on *Requirements & Testing per FCC Docket 20780*, *Designing to Meet FCC Docket 20780* and *Printed Circuit Board and Wiring Design for EMI Control*. And one two-day session on *Grounding, Bonding and Shielding*. Fee: $260 for one-day sessions and $495 for two-day sessions. Contact: R&B Enterprises, see March 7 above. Repeated: • April 11–15 in San Francisco, CA; • April 18–22 in Los Angeles, CA: • May 2–6 in Chicago, IL; and • May 9–13 in Boston, MA.

• March 29–31: *Interference Control: An Introduction to EMI/RFI/EMC*, Washington, DC. Fee: $760. Contact: Don White Consultants, see March 7 above.

• April 5–8: *Millimeter-Wave Radar*, Washington, DC. Fee: $780. Contact: George Washington University, see March 2 above.

• April 12–14: *Advanced Radar Technology*, Washington, DC. Fee: $685. Contact: George Washington University, see March 2 above.

• April 18–22: *Spectrum Management*, Washington, DC. Fee: $855. Contact: George Washington University, see March 2 above.

• April 25–29: *Communications Satellite Engineering*, Fee: $855. Contact: George Washington University, see March 2 above.

• May 2 & 4: *EMI Test and Evaluation*, San Jose, CA. Fee: NA. Contact: Don White Consultants, see March 7 above. This course will be given at the *Test & Measurement Expo*. A number of other courses and workshops are also scheduled. For more information, contact Meg Bowen, (617) 254-1445.

• May 16–20: *Basic Radiological Health Course*, San Antonio, TX. Fee: $450. Contact: University of Texas Health Science Center, Medical School Continuing Education Services, 7703 Floyd Curl Drive, San Antonio, TX 78284, (512) 691-6295.

• May 23–27: *Radar Systems and Technology*, Washington, DC. Fee: $855. Contact: George Washington University, see March 2 above.

• June 6–10: *Advanced Radiological Health Course*, San Antonio, TX. Fee: $550. Contact: University of Texas Health Science Center, see May 16 above.

• June 13–17: *Radiation Safety Officer's Course*, San Antonio, TX. Fee: $600. Contact: University of Texas Health Science Center, see May 16 above.

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Microwave News invites contributions to *From the Field*, our monthly column featuring news and opinions from the RF/MW community. Letters from readers are also welcome.

EPA RF/MW Report Revised

The Environmental Protection Agency (EPA) has revised its draft report on the biological effects of radiofrequency and microwave (RF/MW) radiation and now states that significant effects occur at a specific absorption rate (SAR) of about 1 W/Kg. The report being prepared by EPA's Office of Research and Development (ORD), under the direction of Dr. Joe Elder, will form the basis of the first national exposure limits for the general population. EPA's limits are known as the RF/MW "guidance."

The 1 W/Kg SAR is four times lower than the threshold level cited in the 1982 American National Standards Institute (ANSI) safety guidelines, which apply to both occupational and public exposures. ANSI used a safety factor of ten to arrive at its exposure limit of 1 mW/cm^2 at body resonant frequencies of 30-300 MHz, based on an SAR of 0.4 W/Kg. EPA has not yet indicated what kind of a safety margin it will use for its RF/MW guidance.

EPA is surveying FM stations to assess the economic impact of its guidance. See p.3.

At a January meeting to review the new ORD draft, David Janes, who heads the group preparing the guidance at the Office of Radiation Programs (ORP), told *Microwave News* that the revisions have not significantly changed the report's conclusions and will not affect the numbers in the draft guidance. It is rumored that the agency will propose a 100 uW/cm^2 limit at certain frequencies, though no details have yet been made public.

(continued on p.2)

Congressional Pressure in Radar Accident Investigation

The Secretary of the Air Force has joined the investigation into the radiation accident at Clear Air Force Station in Alaska. The Air Force's Office of Environment and Safety and its Surgeon General will review the ongoing investigation and report back to the Secretary.

The growing interest in the September 14 accident in which six workers were over-exposed to radar radiation follows a call for a new investigation by Alaska Congressman Don Young. In a January 14 letter to Air Force Secretary Verne Orr, Young asked for a new survey of the workers' radiation exposure by a "neutral party at the earliest possible date" and a "full scale investigation of the internal safety practices and procedures at Clear Air Force Station." Young, a Republican who is Alaska's only congressman, asked Orr to look into the accident personally.

The six workers, all civilian technicians, have charged that there was a gross misunderstanding of radar radiation at Clear and that there were extensive delays in providing them with expert medical attention. In addition, they have questioned the reliability and accuracy of the Air Force's September 22 accident simulation (see *MWN*, November 1983).

(continued on p.2)

Radar Accident (continued from p.1)

Young's Letter

In his letter to Orr, Congressman Young wrote: "I am convinced that the Air Force and the civilian contractor have not cooperated in good faith with the affected employees." He added that some of the test equipment used in the accident simulation run by the Air Force and FELEC Services was "defective, improperly calibrated and improperly employed by operating personnel."

Young pressed Orr for a new simulation of the accident "in order to reestablish employee trust in their government and its agencies."

Captain Johnny Whitaker, an Air Force spokesman, told *Microwave News* that no new simulation of the accident was planned. He said that there is no deadline for the continuing investigation. "It will take whatever time is necessary," he said.

Alaska Senators Ted Stevens and Frank Murkowski, both Republicans, have endorsed Young's efforts, but, for the moment, are letting him take the lead in applying pressure on the Air Force.

In an interview, an aide to Senator Stevens said that the senator was pleased with the way Congressman Young was pursuing his inquiry. Earlier, Stevens had announced that he was satisfied with the Air Force's investigation.

Senator Murkowski has expressed concern over the medical attention the workers had received. In a December 5 letter to General James Hartinger, the commander-in-chief of the North American Air Defense (NORAD) Space Command in Colorado, Murkowski wrote: "I am particularly concerned about those who feel that they have not received adequate attention almost three months after the accident." He went on to ask "why there are still so many unanswered questions from the workers at this late date."

Before the Air Force Secretary became involved, the investigation into the accident was being handled by the Air Force Inspection and Safety Center at Norton Air Force Base, CA. The center is under the aegis of the Air Force's Inspector General.

Clear Air Force Station is operated for the Air Force by FELEC Services Inc., a subsidiary of ITT.

Mishap Report

At the end of December, the safety center released a "mishap report" on the Clear incident. The report states that it "appears" that the workers were exposed to radiation for eight minutes. This has been contested by the workers, who believe the exposure was longer —perhaps as long as 17 minutes.

The report also details the approximate levels of exposure experienced by the six men while they were performing routine maintenance on one of the Ballistic Missile Early Warning System (BMEWS) radars. According to the Air Force report, the workers' exposures ranged from a maximum of 105 mW/cm^2 for Karl Kepler to 12-19 mW/cm^2 for Richard Eldridge and John Jessup. Two of the men, Ronald Foster and Edward Forsling, were exposed to 45-55 mW/cm^2 and one, William Emmons, to 90 mW/cm^2. Two electricans who were at the base of the radar when the power was turned on were exposed to less than 25 uW/cm^2.

One of the workers expressed doubts about the relative intensities of the exposures. In an interview, Eldridge disputed the Air Force's contention that he and Jessup received a fraction of Emmons's dose. "Emmons could not have been standing more than three feet away from us," he said, "because he was supervising our welding." Emmons confirmed to *Microwave News* that he was very close to Eldridge at the time of the accident; he estimated that they were about 18 inches apart. Emmons added that he might have been a little closer to the trap door leading to the screen of the radar antenna.

Other recent developments concerning the radar accident include:

- The Alaska Department of Labor's Division of Labor Standards and Safety issued two citations against FELEC Services for over-exposing six workers to radiation. The citations carry a penalty of $840. On January 6, Ralph Drew, FELEC's manager at Clear, notified the state that the company would contest the citations.
- John Jessup and Ronald Foster went to Brooks Air Force Base for a medical examination in January. The other four men were examined at Brooks in October. The two FELEC employees originally declined to go to Brooks because they lacked confidence in Air Force objectivity.
- On February 1, Thomas Lucas, a field attorney with the National Labor Relations Board (NLRB) is scheduled to meet with Eldridge to hear his grievance regarding his dismissal from FELEC on November 10 (see *MWN*, December 1983).
- Repeated requests by *Microwave News* for the accident report prepared by FELEC Services went unanswered. ●

EPA Guidance (continued from p.1)

Report Revisions

At a January 24-25 meeting in Research Triangle Park, NC, a special EPA Scientific Advisory Board (SAB) panel found that the revised ORD report provides a satisfactory review of the literature and a sound basis for setting exposure guidelines. Its approval follows extensive revisions in ORD's treatment of thermal physiology, the backbone of the first draft.

ORD rewrote its summary and conclusions to accommodate criticisms made at the panel's first meeting last September (see *MWN*, October 1983).

Instead of focusing on thermoregulatory response thresholds, the draft now cites a range of considerations for pinpointing the onset of significant bioeffects at 1 W/Kg, including effects on endocrine gland function, blood chemistry, hematology and immunology. The authors also state that behavioral changes can occur in certain environments at lower threshold SARs than those cited by ANSI. In addition, they mention one experiment which indicates RF/MW radiation may be a cancer promoter and another which shows radiation may affect brain cells. Finally, the special

susceptiblity of the central nervous system to radiation and the need for more research on calcium efflux are noted.

In the initial draft, ORD calculated that human thermoregulatory response was triggered by SARs of about 0.27 to 0.81 W/Kg, or 1.2 to 2.6 mW/cm^2 at body resonant frequencies.

At the September panel meeting, Dr. Eleanor Adair and other panelists warned that EPA's ORD should not have estimated human thermal response thresholds from animal data. Accepting this criticism, ORD concluded that these thresholds cannot be adequately predicted given the lack of human data.

Although thermoregulation was the most thoroughly discussed and revised area of the report, panelist Dr. Stephen Cleary advised at the close of the January meeting that the time devoted to this topic does not reflect its importance regarding regulation of public exposures.

ORD agreed to a number of additional minor changes at the January meeting and has a little work left to do. For example, EPA's Dr. Carl Blackman will write a brief review of post-1980 literature on calcium efflux.

On the whole, the panel decided that the addition of papers published after 1980 would not affect the basic conclusions of the report.

Panel Recommendations

In addition to tentatively approving the report, the panel decided to outline a number of research areas that it believes EPA should pursue after the guidance is set. In a draft of the cover letter they will send to SAB Chairman Dr. Norton Nelson, the panel members singled out the effects of frequency modulation, chronic versus acute exposures, partial body versus whole body exposures, high power pulsed sources versus ones that are adequately characterized by average power, and several other topics.

Panel chairman Dr. Charles Susskind suggested that a final draft of the report be sent to SAB Director Dr. Terry Yosie by mid-February so that the board's executive committee can review it before its April meeting. The executive committee must approve the final report.

Speedy approval could be important for ORP, which is pushing to complete a draft guidance and supporting material by June 1. The proposal will not be released before the bioeffects report is issued and must itself receive final EPA approval and pass a review by the Office of Management and Budget.

Both the revised report, *Biological Effects of Radiofrequency Radiation,* No. EPA-600/8-83-026A, and the cover letter must still be reviewed by the following panel members who were unable to attend the meeting: Drs. Barbara Chang, Carl Durney, Steven Horvath, Abraham Lilienfeld and Charlotte Silverman.

Panel members attending the meeting were Drs. Eleanor Adair, Stephen Cleary, Arthur Guy, Sol Michaelson, Mary Ellen O'Connor and Chairman Charles Susskind. Yosie and SAB Executive Secretary Dr. Douglas Seba were also present.

EPA's guidance will only apply to federal facilities, but since it is the first and only federal exposure rule for the general public, it will become the de facto US standard. The draft has already circulated among federal agencies for review.

EPA Surveys FM Stations

EPA is surveying over 1,000 FM radio stations to better assess the economic impact of its planned public exposure guidance for RF/MW radiation. Officials at the agency's Office of Radiation Programs (ORP) in Las Vegas, NV, anticipate that the survey will show that public exposures to FM radiation are lower than EPA models currently predict.

Though the agency is evaluating the potential effect of the guidance on all types of broadcasters, the survey is limited to FM (88-108 MHz) because, as a class, these stations are estimated to produce the highest public exposures falling within the 500 kHz-100 GHz range of the guidance.

According to the cover letter sent out with the questionnaires last month, participation is voluntary but a "prompt and accurate response will help to insure that a realistic estimate" of the economic effect of the guidance is achieved.

In an interview with *Microwave News,* EPA's Ric Tell explained that land use data from the questionnaires will indicate whether or not areas near the stations with high RF/MW levels are accessible to the public. An inaccessable area will not be considered a public hazard. Of the more than 4,000 FM stations in the US, the agency sent questionnaires to those estimated to produce the highest exposure levels.

The agency has asked broadcasters how close the public can get to the targeted FM antennas and whether there are other broadcast sources either sharing a station's tower or in the immediate area, as in an antenna farm.

Although the guidance will only be enforceable for government facilities, private sector broadcasters are likely to be required to meet EPA limits by the Federal Communications Commission (FCC). Commission policy is still not set, but it has proposed rules that would require compliance from new or modified facilities. The FCC has yet to say how it will deal with existing broadcasters.

EPA will summarize the survey responses and then forward the data to a team at Lawrence Livermore National Laboratory in California, which is preparing the economic assessment for EPA (see *MWN,* December 1981). The agency hopes to have the proposed guidance and its supporting aterial ready for publication in early June.

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HIGHLIGHTS

Navy Loses ELF Suit

On January 31, Federal Judge Barbara Crabb ruled in favor of the State of Wisconsin and Marquette County, Michigan, and stopped all work on Project ELF, the Navy's submarine communications system. The Navy must now prepare a supplemental environmental impact statement (EIS) before construction can resume.

Wisconsin Attorney General Bronson La Follette had charged that the Navy's 1977 EIS failed to take into account recent studies on the health effects of extremely low frequency (ELF) radiation as well as changes in the proposed antenna design (see *MWN*, July/August 1983). The suit was filed on July 20, 1983 in US District Court for Western Wisconsin.

The judge not only barred further construction of the ELF antenna in northern Wisconsin and Michigan's Upper Peninsula, but stopped the placement of receivers on submarines. The Navy has not yet announced whether it will appeal the decision.

The verdict came as we go to press with this issue. We will publish a more detailed story with excerpts from the judge's 69-page decision next month.

EPA and NIEHS To Replicate Delgado Study

Researchers at the Environmental Protection Agency (EPA) and the National Institute for Environmental Health Sciences (NIEHS) will attempt to replicate Dr. Jose Delgado's experiment which found that very weak, pulsed magnetic fields affect growth and development. The work reported by Delgado's lab in Spain has received widespread attention because it showed that magnetic fields less intense than the earth's produced severe effects.

Dr. Ezra Berman, an expert in teratology at EPA's Health Research Laboratory in Research Triangle Park, NC, told *Microwave News* that the experiment must be repeated "simply because the results are so unusual." The replicate study could get underway by the end of this summer.

Delgado's group at the Centro Ramon y Cajal Hospital in Madrid found significant malformations in chick embryos exposed to pulsed magnetic fields of 0.12, 1.2 and 12 microTesla (uT) for 48 hours at frequencies of 10, 100 and 1000 Hz. Delgado reported that the most marked effect occurred at 100 Hz and 1.2 uT (see *MWN*, March 1983 and *Journal of Anatomy, 134*, 533, 1982).

In a recently published follow-up experiment, Delgado showed that pulse shape was the key variable in achieving an effect (see *MWN*, November 1983 and *Journal of Anatomy, 137*, 513, 1983).

Berman said the US effort will attempt to repeat the experiment as closely as possible but with more eggs. He noted that Delgado worked with a total of 68 eggs, while the US experiment will probably use 40 to 50 eggs per exposure group.

Current plans call for running the experiment at NIEHS facilities at North Carolina State University in Raleigh. The institute's Dr. Don McRee will perform the exposures and Berman will examine the eggs. Ric Tell, from EPA's Office of Radiation Programs in Las Vegas, NV, will handle the critical job of designing the exposure conditions. The exposures will take about three months to complete.

Both Berman and Tell stress that the main difficulty in doing the study is that no one knows exactly how Delgado's group set up its experiment. The researchers hope they will get more detailed information.

Tell has tried to reproduce the Delgado experiment himself with no success and told *Microwave News* he is very pleased that people with greater expertise will try it.

The importance of Delgado's study is magnified by the general lack of research on extremely low frequency (ELF) fields. EPA is just beginning to turn its attention to this area. According to an EPA spokeswoman, the agency hopes to develop an ELF research program in the coming years, now that its work on a general population guidance for the 500 kHz-100 GHz range is nearly complete. Congress has also taken an interest in ELF and last year directed the agency to investigate the effects of 60 Hz power line radiation (see *MWN*, June 1983).

Shortwave Radiation Linked to Heart Disease

Chronic exposures to 27 MHz radiation have been associated with heart disease in a new epidemiological study of male physical therapists. This report is believed to be the first from the US to make this link, although a number of Soviet and Eastern European studies have associated radiofrequency and microwave radiation with heart ailments.

Health data from 3,004 therapists who used ultrasound, infrared, microwave and shortwave diathermy equipment were analyzed. Only the link between shortwave (27 MHz) diathermy and heart disease was statistically significant. The study by Dr. Stanford Hamburger, James Logue and Phyllis Silverman of the Food and Drug Administration's (FDA) National Center for Devices and Radiological Health is reported in the *Journal of Chronic Diseases, 36*, 791, 1983.

The paper does not address the pregnancy outcomes of the therapists' wives. In a telephone interview, Silverman said that the pregnancy data from the survey are being prepared for a second paper.

The data used in this study were collected by Dr. Jeanne Stellman under a two-year FDA contract while she was at the American Health Foundation. In 1980, Stellman reported preliminary results which indicated a number of adverse health effects among the therapists including hypertension, hearing disorders, bilateral cataracts and blood and endocrine disorders —but not heart disease. Stellman is now at Columbia University in New York City.

Stellman told *Microwave News* that recent analyses confirmed her earlier findings, but she could not explain the

differences between her results and those of FDA. Stellman is in the process of writing up her results in a number of papers and expects to publish them later this year. She said that her study had been delayed by a shortage of funds: "It took the Office of Management and Budget (OMB) a year to approve my questionnaire, and after that I ran out of money." Stellman said that she has been finishing her research in her spare time.

Silverman suggested that the two sets of results might be due to differences in the statistical techniques used by FDA and Stellman.

Another possible explanation lies in the data sets analyzed by FDA and Stellman: each reports a different response rate. The FDA group claims a response rate of 58 percent, while Stellman has questionnaires from 68 percent of the original sample. Silverman said that while she believes the FDA group did not have about 400 of the original Stellman questionnaires, they did have a computer tape with all the data. (Only those cases that were accompanied by questionnaires were included in the FDA analysis.) A check of the missing responses indicated no obvious pattern of adverse health effects, according to Silverman.

New Jersey Weighs ANSI's RF/MW Exposure Standard

New Jersey is moving forward with plans to adopt a radiofrequency and microwave (RF/MW) radiation exposure standard based on the new American National Standards Institute (ANSI) guidelines. The proposed rules, which at their strictest level would limit public exposures to 1 mW/cm^2 in the 30-300 MHz frequency band, were discussed at two public hearings last month.

In a statement issued before the January 24 and 31 hearings, the New Jersey Commission on Radiation Protection maintains that the ANSI C95.1-1982 standard "represents a consensus of current thinking by scientists active in this discipline," and that it is "extremely conservative, thereby assuring a wide margin of safety." The commission is composed of representatives from state government and the private sector and has the authority to set state radiation standards.

According to the commission, the action is a response "to the public's apprehension concerning misuse of radiofrequency radiation in the absence of national safety level guidelines." Commission member Eugene Fisher of the state's Bureau of Radiation Protection told *Microwave News* that the group "is not confident that a federal standard will be in place in the near future."

If no major revisions are required, the eleven-member New Jersey committee could approve the standard in February.

Massachusetts, the first state to set RF/MW population limits, took a different standard-setting approach last year and adopted a rule five times more strict than ANSI (see *MWN*, November 1983).

One of the commission's main objectives is economic. It believes that a standard will help in eliminating "unnecessary time delays in the installation of new facilities with a cost saving to industry which will ultimately result in a reduction in the cost of such service to the public." Several communications companies planning to build new facilities or expand existing ones in New Jersey have met stiff community resistance over the RF/MW safety issue (see *MWN*, November 1982 and November 1983). A number of residents opposing new broadcast sources have announced that they believe the proposed standard is too high.

The New Jersey rules would apply only to public exposures in the 300 kHz-100 GHz frequency range. In addition to broadcast sources, the frequency-dependent standard would include an emission standard for microwave ovens. Emissions from units built after 1971 would be limited to 5 mW/cm^2 measured at a distance of 5 cm and to 10 mW/cm^2 for those built before 1971. The draft's wording regarding ovens is unclear and Fisher reports that an appliance manufacturers' group is proposing new language for this section of the rule.

In addition to the January hearings, the public was invited to comment on the action in writing before February 3. Submissions are being collected by Fisher at the Department of Environmental Protection, Bureau of Radiation Protection, 380 Scotch Road, Trenton, NJ 08628.

The committee members are Max Weiss, Chairman, AT&T Bell Telephone Laboratories; Benjamin Sonnenblick, Rutgers University; Henry Powsner, Princeton Medical Center; Seymour Baron, Burns & Roe; Fred Sterzer, RCA Laboratories; and representatives from the New Jersey Departments of Health, Labor and Environmental Protection.

Ontario Hydro Plans VDT-Pregnancy Research

Researchers at Ontario Hydro have announced they will investigate possible links between pregnancy problems among VDT operators and electromagnetic (EM) radiation from terminals. In a progress report on their continuing work on VDTs, the scientists recommend both a laboratory and an epidemiological study. The latter, which would be more costly and take longer, may not be undertaken.

The report, "Hazards Assessment of Video Display Units [HAVDU] — Report on Phase I Activities," concludes that there is no danger to operators from ionizing radiation, including X-rays, but stops short of dismissing EM radiation risks. The Ontario Hydro investigators measured EM fields and charges from flyback transformers, low-voltage circuitry and display screens.

The Ontario Hydro report recommends "an experiment involving the exposure of small animals to [EM] fields be performed to gain evidence on potential adverse pregnancy outcomes due to exposure to the types and magnitudes of the [EM] fields generated by a VDT." In an interview after the report was released, Ontario Hydro's Robert Facey told *Microwave News* that this study will use VLF fields between 15 and 17 kHz. Ontario Hydro will spend $50,000

and solicit $40,000 from outside sources for this research. The company will fund the entire project if external help is not available, Facey added.

The proposed epidemiological study would cost $500,000 and take four years to complete. Its purpose would be to increase the "limited" data available on pregnancy outcomes among VDT operators. Ontario Hydro's Phase I report calls for a limit of $100,000 on its total contributions and recommends that the company solicit additional funds starting in April 1984 unless a similar study is underway elsewhere.

The scientists also propose to measure magnetic fields near VDTs in Phase II using techniques similar to those used to characterize electric fields in Phase I.

EM fields from the flyback were in the very low frequency (VLF) range (15.8-18.5 kHz) with average (root mean square) field strengths between 3 and 30 V/m at 30 cm from the front of the terminal. These emissions are pulsed and Ontario Hydro researchers measured peak values as low as 4 V/m and as high as 170 V/m.

Electrostatic fields of up to 7,000 V/m were measured. Fields from the electronic circuitry were less than 1 V/m.

The report cautions that all the EM readings are approximately ten times the real exposure levels as a result of the measurement method used. Dr. Stuart Harvey, who supervised the EM testing, explained that the meter used in the laboratory gives a reading that exceeds actual levels by this amount.

The significance of these radiation readings is unclear. "No experimental data were uncovered which directly demonstrate evidence of biological harm due to fields generated by VDTs; however, conversely, to our knowledge there is no published work which shows the absence of such effects," the study explains.

With regard to ionizing radiation, measurements failed to find emissions above ambient levels in 80 percent of the units tested. The remainder of the units produced readings two to four times that of background apparently due to the presence of potassium-40, a radioactive isotope, in the glass screens. These levels are of "no medical significance" according to the researchers.

Ergonomic guidelines available to VDT users and supervisors are inadequate, according to the report. In most cases guidelines are not compatible or consistent. The study recommends design standards for desks, chairs, keyboards, screen characteristics and lighting.

Project HAVDU was started in 1982 in response to a labor-management agreement, and to concerns among company scientists that VDT work is a "cause of anxiety among women employees." The Phase I report was presented to Ontario Hydro's Board of Directors in mid-November and became publicly available in mid-January. The projected completion date for Phase II is April 1985.

Copies of the full report can be ordered from Mr. Robert Facey, Safety Services, Ontario Hydro, 757 McKay Road, Pickering, Ontario L1W 3C8, Canada. The cost per copy is $13 US, $16 Canadian. A 35-page summary is available from the same address for $4 US, $5 Canadian.

SHORT COURSES

March 5-6: ***Grounding, Bonding & Shielding,*** San Francisco, CA. Fee: $495. Contact: R&B Associates, 20 Clipper Rd., W. Conshohocken, PA 19428, (215) 825-1960. Repeated ***March 8-9:*** Los Angeles, CA.

March 5-7: ***Planning for and Operating an NMR Imaging Facility,*** Washington, DC. Fee: $750. Contact: Continuing Engineering Education, George Washington University (GWU), Washington, DC 20052, (800) 424-9773.

March 12-15: ***Modern Microwave Measurements,*** Washington, DC. Fee: $895. Contact: Continuing Education Institute (CEI), 5410 Leaf Treader Way, Columbia, MD 21044, (301) 596-0111 or (213) 824-9545.

March 12-15: ***Computational Methods in Electromagnetics,*** Galveston Island, TX. Fee: $650. Contact: Ann Beekman, Southeastern Center for Electrical Engineering Education (SCEEE), Central Florida Facility, 11th & Massachusetts Ave., St. Cloud, FL 32769, (305) 892-6146.

March 12-16: ***Radiowave Propagation for Communications Systems Design,*** Orlando, FL. Fee: $875. Contact: GWU, see March 5 above.

March 15-16: ***Lightning Protection,*** Orlando, FL. Fee: $625. Contact: GWU, see March 5 above. Repeated ***June 4-5:*** Washington, DC.

March 19: ***Applying Military Electromagnetic Compatibility Specifications,*** St. Louis, MO. Fee: $295. Contact: Jean Tucker, ECOS Environmental Solutions, 205 W. Harrison St., Oak Park, IL 60304, (312) 383-2505. Repeated ***April 16:*** Chicago, IL.

March 19-23: ***Flat-Panel and CRT Technologies,*** Los Angeles, CA. Fee: $895. Contact: UCLA Extension Short Course Program, PO Box 24901, 6266 Boelter Hall, Los Angeles, CA 90024, (213) 825-1047.

March 20-22: ***Grounding & Shielding,*** Sunnyvale, CA. Fee: $815. Optional fourth day for $235. Contact: Don White Consultants Inc. (DWCI), Star Route 625, PO Box D, Gainesville, VA 22065, (703) 347-0030.

March 22-24: ***NMR: A Primer for Radiologists,*** Hilton Head Island, SC. Fee: $375. Contact: K.V. Pyles, Foundation for Education in Magnetic Resonance, 111 Glade Park East, Kittanning, PA 16201, (412) 545-7085.

April 3: ***EMC: The FCC Means Business,*** Boston, MA. Fee: $595. Contact: Carol Clark, McGraw-Hill Seminar Center, 331 Madison Ave., Suite 603, New York, NY 10017, (212) 687-0243.

April 9-10: ***Grounding, Bonding & Shielding,*** Washington, DC. Fee: $625. Contact: GWU, see March 5 above.

April 30-May 4: ***EMC Design & Measurement for Control of EMI,*** San Diego, CA. Fee: $995. Optional fifth day for $235. Contact: DWCI, see March 20 above.

April 30-May 4: ***NBS Noise Measurement Seminar,*** Boulder, CO. Fee: $775. Contact: Sunchana Perera, Div. 723.05, National Bureau of Standards, Boulder, CO 80303, (303) 497-3546.

April 30-May 4: ***High Frequency Spectrum: New Concepts and Technologies,*** Washington, DC. Fee: $875. Contact: GWU, see March 5 above.

May 7-11: ***Microwave High Power Tubes and Transmitters,*** Washington, DC. Fee: $875. Contact: GWU, see March 5 above.

May 7-11: ***Microwave Circuits Design: Linear Circuits,*** Palo Alto, CA. Fee: $895. Contact: CEI, see March 12 above. Repeated ***June 4-8:*** Boston, MA.

May 7-11: ***Electromagnetic Interference and Control,*** Washington, DC. Fee: $875. Contact: GWU, see March 5 above.
X4

May 8-11: ***Modern Antennas,*** Washington, DC. Fee:$675. Contact: Linda Billard, Technology Service Corp. (TSC) 8555 16th St., Suite 300, Silver Spring, MD 20910, (800) 638-2628.

May 15-17: ***An Introduction to EMI/RFI/EMC,*** Los Angeles, CA. Fee: $815. Contact: DWCI, see March 20 above.

May 21-23: ***Hazardous RF Electromagnetic Radiation,*** Washington, DC. Fee: $695. Contact: GWU, see March 5 above.

FROM THE FIELD

Responses to Dr. Robert Becker's Letter on Use of Electromagnetic Stimulation for Bone Growth

In our November issue, we published a letter sent to the FDA by Dr. Robert O. Becker on the risks associated with the growing use of medical devices that apply direct currents and pulsed electromagnetic fields to stimulate bone growth. Published below are the FDA's response to Becker and a letter to Microwave News *from Dr. C. Andrew L. Bassett.*

Dear Dr. Becker:

The Food and Drug Administration (FDA) has completed its initial review of your concerns regarding the safety of electromagnetic stimulation of biological tissues as a treatment therapy. The agency believes it is essential to continually evaluate the safety and effectiveness of electromagnetic stimulation as the technology evolves and new data accumulates. We would like, therefore, to thank you for your comments and encourage you to submit any additional comments or relevant data, as you feel appropriate.

We are familiar with most of the information you provided. The bulk of the data you refer to has only recently become available (articles dated 1982 and 1983). As you observed there is little, if any, corroborating evidence for much of the recent research you cited.

As you know, the agency has approved three premarket approval applications for devices involving electromagnetic stimulation for healing of bony defects. These approvals were based on all the information available at the time of approval. These approvals required that four-year follow-up examinations be performed by the sponsor on all patients in the approved trials. These examinations were explicitly requested to substantiate "long-term" safety and effectiveness of the approved devices. This four-year time period has not been reached by all patients; thus, the data which will address many concerns is incomplete.

Furthermore, we are also aware of the need to proceed judiciously in the clinical application of a new therapeutic modality such as electromagnetic stimulation. This agency has determined that all such devices are significant risk devices. As such, any sponsor wishing to clinically investigate these devices must receive FDA approval for an investigational device exemption (IDE) prior to initiating the trial. Therefore, we will continue to evaluate the most up-to-date information available regarding the safety and effectiveness of these devices.

Thank you again for your comments. If you have any questions regarding this matter contact me at (301) 427-7156.

Carl A. Larson, Ph.D.
Director, Division of Surgical and Rehabilitation Devices
Office of Medical Devices
National Center for Devices and Radiological Health
Food and Drug Administration, Silver Spring, MD 20910

To the Editor:

Dr. Robert O. Becker has called for a moratorium on clinical application of "bone growth stimulators" because he postulates a possible link between such devices and "malignant transformation." Anyone who has followed his writing and statements will recognize that this position has not changed for the past ten years. In fact, at the 1973 New York Academy of Sciences Conference on "Electrically-Mediated Growth Mechanisms on Living Systems," Dr. Becker sounded his first alarm, "When this field began to open up and clinical use was being postulated, and some patients were actually undergoing treatment, I raised the question of possible induction of malignant cellular changes." [1]

During the intervening ten years, more than 40,000 patients have been treated with various electrical devices to modify bone formation by one mechanism or another, without a single report of malignancy as the result of such use. Extensive laboratory investigations of these devices have taken place *in vitro* and *in vivo* all over the world, again, with no evidence that they *induce* cancer. This point is conceded by Becker, himself, in his FDA letter.

In the United States, where the electrical devices have been regulated by the FDA since 1979, there is a legal requirement for device manufacturers to report all untoward reaction and, to my knowledge, the cancer issue is a "non-issue" at the present time.

I will not attempt to point out or correct each of the inaccuracies which are contained in the letter. Interested readers are referred to the appended bibliography for details, which can place the issues in a more comprehensive light. There are two main inaccuracies, however, which deserve attention by your readers. The first concerns safety testing and is embodied in his sentence, "When the FDA approved these devices there were no studies on the effects of...magnetic fields on embryonic growth and development or malignant growth." The facts are: extensive data from teratologic and toxicologic studies in animals were made available to the FDA for the two pulsed electromagnetic field (PEMF) modes which were approved. These included documentation of a lack of chronic-exposure PEMF effects on multiple soft tissues and organs such as the heart, kidneys, liver, spleen, adrenals, lung and brain, among others. Furthermore, mice mated, delivered and reared through the F5 generation (constantly exposed individually to two types of PEMFs) showed no birth, development or functional abnormalities. In addition, both pulse modes were tested on Meth A sarcomas in Balb/C mice and were demonstrated to have no effect on tumor weight, mitotic indices, tumor microanatomy or behavior. Similarly, both pulses had no effect on normal animal longevity or the spontaneous tumor incidence in Swiss Webster mice. All of these data were submitted to the FDA as part of the pre-market approval and continuing monitoring processes. Under the Freedom of Information Act, I believe, these findings have been available to one and all, if they were concerned. As a matter of record, the safety of these two pulse modes has been investigated, independently, both in academic and commercial settings, and the original assessments confirmed.

The second critical issue which deserves comment is what I call the "lumping syndrome." No one would consider saying to a physician or a scientist, "I treated my patients with drugs" without specifying the agents, their dose, their routes or schedules of administration. Yet, electrical modalities of a wide variety, are now being "lumped" into the "bone growth stimulator" heading with little or no evidence that each fits [2]. Similarly, because one type of time-varying electromagnetic field produces an untoward effect under *highly selected* circumstances, *all* such fields frequently are impugned. Conversely, because PEMFs are effective in a given clinical setting, entrepreneurs who try a "coattail" approach, either are unaware, themselves, of the very selective nature of pulse specifity or are counting on an uninformed user, when "equivalency" is claimed.

With every passing month it is more and more clear that both different and similar pulses can cause different biological effects in different tissues at different times in the cell cycle [3-14]. In fact, the postulated importance of frequency, amplitude and cell cycle "windows" to achieve selected alterations in cell function is now supported by a considerable body of scientific data. Falling prey to the "lumping syndrome" signals a lack of familiarity with those data.

(continued on p.8)

FROM THE FIELD

Finally, a moratorium on FDA-approved clinical applications of *selected* PEMFs, clearly, is not justified by the facts. Deleterious effects have not been reported in the more than 20,000 patients treated with these two pulse modes. The longest follow-up, now, is nine years and the method has been used successfully on a number of occasions to heal ununited fractures in bone with quiescent (treated) primary tumors. In none of these individuals has there been any evidence of "re-lighting" the tumor for intervals exceeding five years post-treatment. Let us not risk "throwing the baby out with the bath water."

C. Andrew L. Bassett, MD

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[1] A.R. Liboff and R.A. Rinaldi, *Annals of the New York Academy of Sciences, 238,* 587, 1974.
[2] C.A.L. Bassett, *Calcified Tissue International, 34,* 1, 1982.
[3] C.A.L. Bassett et al., in *Electrical Properties of Bone and Cartilage: Experimental Effects and Clinical Applications,* C.T. Brighton et al. eds. New York: Grune and Stratton, 1979, pp. 427-441.
[4] S. Fitton-Jackson and C.A.L. Bassett in *Tissue Culture in Medical Research (II),* R.J. Richards and K.T. Rajan eds., Oxford, England: Pergammon Press, 1980, pp.21-28.
[5] L.A. Norton, *Clinical Orthopedics & Related Research, 167,* 280, 1982.
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[7] C.A.L. Bassett et al., *Journal of Bone and Joint Surgery, 64A,* 888, 1982.
[8] R. Goodman et al., *Science, 220,* 1283, 1983.
[9] I.A. Cook and C.A.L. Bassett, *Orthopedic Transactions (Journal of Bone and Joint Surgery), 7,* 361, 1983.
[10] H. Ito and C.A.L. Bassett, *Clinical Orthopedics & Related Research, 181,* 245, 1983.
[11] G.A. Rodan and D.E. Johnson, *Transaction of the Biological Repair and Growth Society, 1,* 2, 1981.
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[13] W.R. Adey, *Biosystems, 8,* 163, 1977.
[14] C.A.L. Bassett in *Metabolic Surgery,* H. Buchwald and R.L. Varco, eds., New York: Grune and Stratton, pp. 255-306, 1978.

UPDATES

BIOLOGICAL EFFECTS

Collection of Papers... The IEEE Press has assembled into one large volume a collection of more than 60 papers on the interaction of RF/MW radiation with living systems. The papers, reprinted as they were originally published, are divided into seven groups, each with an introduction and a list of references. *Biological Effects of Electromagnetic Radiation* was edited by Dr. John Osepchuk of Raytheon with the help of Drs. James Frazer, Om Gandhi, Arthur Guy, Don Justesen, Sol Michaelson and John Mitchell. The 593-page collection is available for $47.95 to IEEE members and $79.95 to non-members from IEEE Press, 445 Hoes Lane, Piscataway, NJ 08854, (201) 981-0060.

COMMUNICATIONS

WARC... Delegates from 112 nations have gone to Geneva, Switzerland, for the World Administrative Radio Conference's (WARC) five-week meeting on high frequency (shortwave) communications. For a review of the issues to be addressed, see the January 9 *Broadcasting*....The FCC has amended its rules to comply with the "Final Acts" of the 1979 WARC. The commission states that this action "provides domestic radio spectrum users with protection from harmful interference as provided by international regulations." The FCC's lengthy discussion of the rules and the public comments they generated, and a modified table of frequency allocations, appear in the January 19 *Federal Register.*

COMPATIBILITY & INTERFERENCE

Aircraft RFI... At the first meeting of the Radio Technical Commission for Aeronautics (RTCA) Special Committee 156 on "Potential Interference to Aircraft Electronics Equipment from Devices Carried Aboard" on December 1-2, a testing program was initiated to determine if there is an RFI problem caused by the use of computers aboard planes (see *MWN,* October 1983). Representatives from the airlines, the air frame manufacturers and the FAA will gather path loss data by simulating the decay of emissions through windows and the aircraft itself. At the same time, the computer companies will check the emissions from various devices. It was noted that radiation levels allowed under RTCA/DO-160A are more stringent that those allowed under FCC Part 15 and that the stricter limits may be needed to prevent harmful RFI. The next meeting of SC-156 is scheduled for February 28-29. In the meantime, the committee members agreed that interim steps to stop passengers from using computers during flight, including during take offs and landings, were not necessary.

Sonic Cable TV Fine Upheld... The FCC has refused to rescind its $6,000 fine against Sonic Cable TV (serving Grover City, Arroyo Grande and Pismo Beach, CA) for leaking signals which interfered with amateur radio communications (see *MWN,* November 1982). The commission did not find Sonic's procedural and substantive arguments persuasive: "Sonic has chosen to raise a plethora of unmeritorious arguments to mask its rule violations." The FCC responded to Sonic's charge that it was the victim of "selective prosecution" by noting that although the "commission's limited resources may result in violators going unpunished, this does not mean we cannot impose sanctions against those we find violating our rules."

Immunity Task Group...ANSI C63's ad hoc committee on enhancing the immunity of home electronic equipment to RFI is moving ahead. Meetings were held in October and December and another is planned for February 10 at the FCC Labs in Columbia, MD.vAt that time, the committee plans to put the final touches on a questionnaire, which will

be published in the American Radio Relay League's (ARRL) magazine, *QST*. FCC's Dan Yates, a member of the committee, pointed out that the questionnaire is virtually identical to the one used by the commisson's Field Operations Bureau for reporting RFI complaints. Meanwhile, the Electronic Industries Association's Consumer Electronics Group has completed its measurements on the immunity of TVs and VCRs; the results are under review. As work on TVs and VCRs winds up, the committee will soon begin studying cordless phones and home security systems. Don Heirman of AT&T Information Systems Labs, the committee chairman, said that the new and the old efforts will continue simultaneously.

NBS Noise Seminar...NBS is holding a week-long seminar on precision noise measurements, stressing applications in antenna and communication systems, April 30 to May 4 in Boulder, CO. Taught by members of the Noise Metrology Group in NBS' Electromagnetic Fields Division, the seminar costs $775. For more information contact NBS' Sunchana Perera, (303) 497-3546.

Resources... The Soviet "Woodpecker" transmitter is causing interference problems again, according to an item in the December *QST*. The magazine quotes a Norwegian official as saying that the Woodpecker, located in Kiev, is interfering with almost a tenth of the radio traffic over the shortwave band in Norway....An article in the November 3 *New Scientist* cites the dangers of trying to use signals from high power CB radios to confuse the electronics of gas station pumps. There is no way of knowing whether the radiation will make the gas meter run faster or slower. And there is the risk that it can trigger an explosion. In fact, author Barry Fox notes, this effect has been exploited in the Northern Ireland conflict....A.J. Mauriello of Radiation Sciences, Inc., in Lansdale, PA, and J.M. Clarke of the Air Force's Electronics Systems Division at Hanscom AFB have published "Measurement and Analysis of Radiated Electromagnetic Emissions from Rail-Transit Vehicles" in the November *IEEE Transactions on Electromagnetic Compatibility*....The Office of Technology Assessment (OTA) cites EMI as one barrier to magnetic levitation systems for high-speed intercity passenger service. See OTA's *US Passenger Rail Technologies*, available for $4.75 from the Government Printing Office, Washington, DC 20402. Order No. 052-003-00938-2....EMI problems in the automobile industry were featured in a December 20 *New York Times* article by John Holusha....Papers are being solicited for the *6th Symposium and Technical Exhibition on Electromagnetic Compatibility* to be held at the Swiss Federal Institute of Technology in Zurich, March 5-7, 1985. The theme of the conference is "protection of the electromagnetic environment." Professor Ralph Showers of the University of Pennsylvania is again serving as the chairman of the Technical Program Committee. Abstracts are due before March 15, 1984. For more information, contact: Dr. T. Dvorak, ETH Zentrum-IKT, 8092 Zurich, Switzerland, 256-2790....NASA has issued a RfP (No.5-79683/235) to "determine critical areas of EMI/EMC interaction between the spacecraft and electronics payload and identify areas where potential EMI problems exist." The space agency anticipates awarding one contract in March.

GOVERNMENT

IEEE Spectrum... Watch for the March issue of *IEEE Spectrum*, which will feature a major article on the current regulatory climate in Washington, DC, as it affects the use of non-ionizing electromagnetic radiation.

INTERNATIONAL

Hungarian Standards... In 1982, Hungary proposed new safety standards for workers and the general population. The proposal is comparable to other Eastern European RF/MW health standards and is more stringent that the new ANSI guidelines and other Western standards. For 300 MHz-300 GHz, the draft exposure limit for the general population is 10 uW/cm^2, while for workers it is 1 mW/cm^2. For 30 kHz-30 MHz, the limits are 20 V/m and 50 V/m for public and occupational exposures respectively; for 30-300 MHz, they are 10 V/m and 20 V/m respectively. Higher exposure levels are permitted for short periods of time, but the absolute maximum levels for *all* individuals are (1) 30 kHz-30 MHz: 1000 V/m; (2) 30-300 MHz: 500 V/m; and (3) 300 MHz-300 GHz: 10 mW/cm^2. The proposed limits do not differentiate between CW and pulsed radiation. The Hungarian paper was translated by Information Ventures, Inc., and is excerpted in its most recent edition of *Biological Effects of Non-Ionizing Electromagnetic Radiation* (Vol. VIII, No. 1, October 1983). A limited number of copies are available from the Office of Naval Research, Code 441, 800 North Quincy St., Arlington, VA 22217 (include a self-addressed mailing label).

MEDICAL APPLICATIONS

BSD's Hyperthermia Units Approved... On November 28, the FDA approved BSD Medical Corporation's BSD-1000 hyperthermia system as "safe and effective" for marketing to hospitals and clinics (see FDA's notice in the January 25 *Federal Register*). The BSD unit, which is designed to treat tumors within two inches of the skin surface with electromagnetic energy, can operate at frequencies between 50-1000 MHz. It is the first hyperthermia device to win FDA approval. Two months later, on January 27, BSD followed up its first success by winning clearance for its new mobile unit, the BSD-300, which generates heat with radiation in a narrower frequency band. The portable unit uses the same technology and applicators as the BSD-1000. The devices are now available for sale by prescription, to be used under the supervision of a licensed physician.

Resources...A multinational group of researchers has devised an innovative method of removing tumor cells from bone marrow. The tumor cells are rendered magnetic by targeting them with monoclonal antibodies which are bound to polystyrene microspheres containing magnetite. The bone marrow can then be "cleaned" with a magnet. Up to

99.9 percent of the tumor cells can be removed with this technique, which is described in the January 14 *Lancet*....The December issue of the *IEEE Engineering in Medicine and Biology Magazine* features five papers on "Therapeutic Uses of Electrical Stimulation." Topics include pain control, growth stimulation of bones, nerves and limbs, electroacupuncture, and soft tissue healing.... General Electric has published a pamphlet, *Parameters Determining the Appearance of NMR Images*. A copy is available at no charge from GE's Medical Systems Operations, PO Box 414, Milwaukee, WI 53201.

MILITARY SYSTEMS

Fourth PAVE PAWS Radar... The Air Force's Electronic Systems Division has awarded Raytheon's Equipment Division a $61.2 million contract to build, install and test a fourth phased array, PAVE PAWS, radar near Goodfellow AFB in Texas. Last November, the AF announced plans for the third PAVE PAWS radar at Robins AFB in Georgia at a cost of $76.9 million (see *MWN*, December 1983). Two other PAVE PAWS radars are already operational at Otis Air Guard Base in Massachusetts and at Beale AFB in California. The radars, which are more than ten stories tall, have two walls, each with 5,354 individual antennas. They can detect sea-launched ballistic missiles 3,000 miles away.

POWER LINES

Progress Report on NY Studies... The Scientific Advisory Panel of the New York State Power Lines Project will meet March 25-26 to review progress on its 16 ongoing studies. Plans for two epidemiological studies just getting under way at the University of Colorado in Denver and the Battelle Pacific Northwest Laboratory in Richland, WA, will be included in the discussions (see *MWN*, September and November 1983). The public is invited to the second day of the meeting, which will be held at the Health Department Labs in Albany. Project Administrator Michael Rampolla said that a written semiannual progress report will be released at the end of this month. For details, contact Rampolla at the NY Power Lines Project, New York State Department of Health, Center for Laboratories and Research, Empire State Plaza, Albany, NY 12201, (518) 474-7888.

Resources...A team from Hydro-Quebec's research institute, IREQ, has studied the corona, electric field and ion-current performance of a ± 900 kV bipolar HVDC transmission line. The results on radio interference, audible noise, corona loss, electric field and ozone generation are presented in the January 1984 issue of *IEEE Transactions on Power Apparatus and Systems*....A session on "Transmission Line Electric Field Effects" is scheduled for February 2 at the IEEE Power Engineering Society's winter meeting in Dallas, TX. Three presentations are planned: one on measurements of E-fields from transmission lines in residential environments by a team from Electric Research & Management; and two on methods of evaluating human exposures to 60 Hz E-fields by Dr. D. Deno of GE and M. Silva of Enertech, and by a group of Japanese researchers....The Minnesota Environmental Quality Board (MEQB) has issued two reports on the state's ± 400 kV DC power line. *A Health and Safety Evaluation of the ± 400 kV DC Power Line*, prepared by a seven-member advisory panel, concludes that "based on currently available scientific literature, there is no indication that the Cooperative Power Association/United Power Association ± 400 kV DC power line represents a risk of effects, symptoms or damage to the health of the general public as a result of short term exposures." One of the experts filed a dissenting report. *A Statistical/Epidemiological Study of Bovine Performance Associated with the CPA/UPA DC Power Line in Minnesota* found no significant changes in milk production or quality among herds near the line. Each report is $13.00, including handling charges, from the MEQB, 100 Capitol Square, St. Paul, MN 55101. An executive summary of each report is available free....There are now 13 gigawatts of HVDC capacity in the world, with 20 GW under construction and a projected annual growth rate of 15 percent a year through 1990, according to an article in the January issue of *IEEE Spectrum*, p.72. The report features a list of the major HVDC projects completed, built or planned around the world with a detailed map of the lines in the US....The General Accounting Office has prepared a report for the Secretary of DOE on *Expanding the Pacific Northwest/Southwest Intertie — Benefits and Impediments*. Report No. GAO/RCED-84-38, November 4, 1983 is available from GAO, Document Handling and Information Services Facility, PO Box 6015, Gaithersburg, MD 20760, (202) 275-6241.

STANDARDS

ANSI Conference... The American National Standards Institute (ANSI) is sponsoring a one-day conference on *Standards and the Law* on March 27 at the Marriott Crystal Gateway Hotel in Arlington, VA. Topics to be covered include the legality of standards, their anti-trust implications and their use in product liability cases. The registration fee is $150. On March 28, ANSI will hold a *Seminar on Administering Domestic Standards Activities*, which has a fee of $50. Those who register for both will receive a $25 discount. For more information, contact Ms. Dolly McKelvey, ANSI, 1430 Broadway, New York, NY 10018, (212) 354-3300.

Oven Leakage...FDA's National Center for Devices and Radiological Health has issued a final rule on its amended procedures for measuring leaks from microwave ovens. In 1980, the Association of Home Appliance Manufacturers had objected to the FDA proposal but both sides reached an agreement in November 1981 (see *MWN*, May 1981 and January/February 1982). Now the FDA has promulgated the rule (46 *Federal Register* 57481, December 30, 1983); and it will take effect on July 2, 1984. For more information contact FDA's Melvyn Altman, (301) 443-3426.

Resources...ANSI's C63 Committee on Radio-Electrical Coordination is proposing to change its name to Committee on Electromagnetic Compatibility and to widen its scope to include setting guidelines on immunity. Meanwhile, its new

C63.12 standard *Recommended Practice on Procedures for Control of System Electromagnetic Compatibility* won official ANSI approval on December 2....The American Society for Testing and Materials (ASTM) has published its Emergency Standard Test Methods (ES 7-83) for *Electromagnetic Shielding Effectiveness of Planar Materials* (see *MWN*, October 1983). A copy is available from ASTM, 1916 Race St., Philadelphia, PA 19103, (215) 299-5400....The IEEE Standard (145-1983), *Definitions of Terms for Antennas* has been published as Part II of the November 1983 issue of the *IEEE Transactions on Antennas and Propagation*....ANSI/IEEE 539-1979, *Definition of Terms Relating to Overhead Power Line Corona and Radio Noise*, has been published and is available for $5.00 from ANSI's Sales Dept., 1430 Broadway, New York, NY 10018, (212) 354-3300.

TECHNOLOGY

Hazeltine Wins MLS Award... The FAA awarded Hazeltine Corp. of Commack, NY, a $90.6 million contract for the production and installation of 172 microwave landing systems (MLS) at airports across the country. As many as 1,250 MLS's are planned over the next 15 years in the US; the world market is projected to be $2-4 billion. In winning the contract, Hazeltine beat out competing systems developed by Bendix Corp. and Wilcox Electric Corp., a subsidiary of Northrop Corp. Hazeltine is expecting to lose about $12 million on the deal; the loss is acceptable, according to Sal Nuzzo, Hazeltine president and CEO, because it will allow the company to diversify into a non-defense market with potential for huge worldwide sales.

VDTs

Legislation...VDT bills are off to a running start in Connecticut, Ohio, Rhode Island and Massachusetts. A special panel of legislators in Connecticut met January 4 to hear the preliminary results of a VDT health and safety study ordered last June. Scientists from the Connecticut Academy of Science and Engineering (CASE) dismissed VDT radiation risks in their report. Speaking for CASE, Dr. Robert Handschumacher of the Yale University School of Medicine said existing radiation data "do not warrant very much more attention." Dr. Robert Wheeler, also of Yale, told the legislators that electromagnetic emissions are virtually eliminated by metallic shielding inside VDT casings. This shielding is required by FCC RFI regulations. The panel is expected to report its findings to the General Assembly by March 1. The study was ordered in a law passed last June (see *MWN*, June 1983)....In Ohio, VDT legislation sponsor Rep. Barbara Pringle testified before the Health and Retirement Committee on January 25. Pringle, whose proposal includes the right to non-VDT work during pregnancy and regular ophthalmological examinations (see *MWN*, November 1983), told *Microwave News* her legislation "would benefit employers as much as the employees" by making VDT operators more productive. More hearings are expected....Influential legislators in Rhode Island and Massachusetts introduced new bills; hearings are all but certain in both states. Rhode Island Rep. Henry Boeniger, chairman of the House Labor Committee, introduced bill H7012 with the backing of the Providence Newspaper Guild. Boeniger expects to hold a hearing in early March. Opponents of the measure, including many Chambers of Commerce in the state, say they intend to kill the bill. Massachusetts Rep. Timothy Bassett wanted to show the "wide range of policy options available" on VDT health and safety, so he introduced four bills (H3023-H3026). The weakest would establish an advisory committee to the state Department of Labor and Industries; the strongest includes mandatory standards for VDT work and periodic eye exams. Bassett, who chairs his state's Committee on Commerce and Labor, told *Microwave News* he wants to encourage a "dialogue" on VDTs but he does not expect a bill to pass this year. He plans to hold a hearing in late February.

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CONFERENCES

March 8-10: ***NMR Imaging,*** Hyatt Regency, San Francisco, CA. Contact: Contemporary Forums, 219 Canyon Vista, Suite 300, Danville, CA 94526, (415) 820-2800.

March 13-14: ***1984 National Radar Conference: Radar Technology for the 80's,*** Atlanta, GA. Contact: Dr. Edward Reedy, Georgia Institute of Technology, Engineering Experiment Station, Radar & Instrumentation Lab, Atlanta, GA 30332, (404) 424-9621.

April 3-5: ***3rd Annual Test & Measurement World Expo,*** Brooks Hall, San Francisco, CA. Contact: Meg Bowen, 215 Brighton Ave., Boston, MA 02134, (617) 254-1445.

April 4-5: ***20th Annual Meeting of the National Council on Radiation Protection and Measurements,*** Washington, DC. Contact: NCRP, Suite 1016, 7910 Woodmont Ave., Bethesda, MD 20814, (301) 657-2652.

April 14-19: ***19th Annual Association for the Advancement of Medical Instrumentation Meeting and Exhibit,*** Washington Hilton, Washington, DC. Contact: AAMI, 1901 North Fort Myer Dr., Suite 602, Arlington, VA 22209, (703) 525-4890.

April 24-26: ***IEEE 1984 National Symposium on Electromagnetic Compatibility,*** Hyatt Regency Hotel, San Antonio, TX. Contact: William McGinnis, Southwest Research Institute, PO Drawer 28510, San Antonio, TX 78284, (512) 684-5111, ext. 2721.

April 29-May 2: ***62nd Annual Convention of the National Association of Broadcasters,*** Las Vegas Convention Center, NV. Contact: NAB, 1771 N Street, NW, Washington, DC 20036, (202) 293-3570.

April 29-May 4: ***9th Conference & Exposition on Overhead and Underground Transmission and Distribution,*** Bartle Hall, Kansas City, MO. Contact: J.R. Miller, Kansas City Power & Light Co., PO Box 19964, Kansas City, MO 64141.

April 30-May 3: ***5th Annual Meeting of the Canadian Radiation Protection Association,*** Banff, Alberta. Contact: Stuart Hunt, 15 Glacier Place, St. Albert, Alberta, T8N 1R7, Canada.

May 6-12: ***6th International Congress of the International Radiation Protection Association (IRPA),*** Berlin, West Germany. Contact: Dr. R. Neider, Bundesanstalt fur Materialprurfung, Unter den Eichen 87, D-1000 Berlin 45, West Germany.

May 7-9: ***1984 Microwave Power Tube Conference,*** Naval Postgraduate School, Monterey, CA. Contact: John Skowron, Raytheon Co., Foundry Ave., Waltham, MA 02254, (617) 899-8400, ext. 4311.

May 7-11: ***Nuclear Magnetic Resonance 1984: National Symposium,*** Hyatt Regency Grand Cypress Resort, Orlando, FL. Contact: Ms. Norine Karwel, Educational Symposia, PO Box 17241, Tampa, FL 33682, (813) 879-8765.

May 20-24: ***16th Annual Meeting of the Conference of Radiation Control Program Directors,*** Des Moines, IA. Contact: CRCPD, 71 Fountain Pl., Frankfort, KY 40601, (502) 227-4543.

May 30-June 1: ***IEEE MTT-S International Microwave Symposium,*** San Francisco, CA. Contact: Dr. Ferdo Ivanek, Harris Corp., Farinon Division, 1691 Bayport Ave., San Carlos, CA 94070, (415) 594-3529. The ***1984 IEEE Microwave and Millimeter Wave Monolithic Circuits Symposium*** will be held in San Francisco May 29-30 in conjunction with the MTT-S meeting.

June 3-8: ***29th Annual Meeting of the Health Physics Society,*** Hyatt Regency, New Orleans, LA. Contact: Richard Burk, Jr., HPS, 4720 Montgomery Lane, Suite 506, Bethesda, MD 20814, (301) 654-3080.

June 25-28: ***1984 International IEEE/AP-S Symposium and National Radio Science Meeting,*** Westin Hotel, Boston, MA. Contact: Professor Harold Raemer, Dept. of Electrical Engineering, Northeastern University, Huntington Ave., Boston, MA 02115.

June 26-28: ***7th International Symposium and Exhibition on Electromagnetic Compatibility,*** Wroclaw, Poland. Contact: W. Moron, EMC Symposium, Box 2141, 51-645 Wroclaw 12, Poland.

June 26-28: ***1984 International Conference on Lightning and Static Electricity,*** Orlando, FL. Contact: J.J. Fisher, US Naval Air Systems Command, PO Box 15036, Arlington, VA 22215, (202) 692-7822.

July 2-6: ***1984 Nuclear EMP Meeting,*** Baltimore Hilton Hotel, Baltimore, MD. Contact: Dr. Arthur Sindoris, Harry Diamond Labs, 2800 Powder Mill Rd., Adelphi, MD 20783.

July 2-6: ***4th International Symposium on Hyperthermic Oncology,*** Aarhus, Denmark. Contact: Dr. Jens Overgaard, Institute of Cancer Research, Radiumstationen, DK-8000 Aarhus C, Denmark.

July 15-19: ***6th Annual Bioelectromagnetics Society Meeting,*** Omni International Hotel, Atlanta, GA. Contact: BEMS, 1 Bank St., Gaithersburg, MD 20878, (301) 948-5530.

July 15-20: ***IEEE Power Engineering Society: 1984 Summer Meeting,*** Washington Plaza, Seattle, WA. Contact: Jack Richardson, Puget Sound Power & Light Co., 10608 NE Fourth St., Bellevue, WA. 98008, (206) 453-6800.

July 22-25: ***21st Annual Conference on Nuclear and Space Radiation Effects,*** Broadmoor Hotel, Colorado Springs, CO; followed by **July 26-27:** ***1984 Hardened Electronics and Radiation Technology (HEART) Conference,*** Fort Carson Army Base, Colorado Springs, CO. Contact for both meetings: B.D. Shafer, Sandia National Labs, Albuquerque, NM 87185, (505) 846-0629.

July 29-August 4: ***8th International Biophysics Congress,*** Bristol, England. Contact: Meon Conferences Services, Petersfield, Hampshire GU32 3JN, England.

August 20-24: ***Conference on Precision Electromagnetic Measurements,*** Delft, Netherlands. Contact: Mrs. I.J. Smits, Department of Electrical Engineering, Delft University of Technology, PO Box 5031, 2600 GA Delft, Netherlands, 31-15-781736.

August 27-30: ***Open Symposium on the Interactions of Electromagnetic Waves with Biological Systems,*** Florence, Italy. (The symposium will be held as part of the URSI Assembly, see August 29 below.) Contact: Dr. Elliot Postow, Naval Medical R&D Command, Bldg. 142, National Navy Medical Center, Bethesda, MD 20814, (202) 295-1140.

August 29-September 5: ***21st General Assembly of the International Union of Radio Science (URSI),*** Florence, Italy. Contact: Professor A.M. Scheggi, Istituto Ricerca Onde Elettromagnetiche (IROE), Consiglio Nazionale delle Ricerche, Via Panciatichi 64, 50127 Florence, Italy, 39-55-4378512.

September 10-13: ***14th European Microwave Conference,*** Liege, Belgium. Contact: Microwave Exhibitions & Publishers, Convex House, 43 Dudley Rd., Tunbridge Wells, Kent TN1 1LE, England.

September 16-21: ***19th Annual Microwave Power Symposium,*** Sheraton-Ritz Hotel, Minneapolis, MN. Contact: IMPI, Suite 520, 301 Maple Ave., Vienna, VA 22180, (703) 281-1515.

September 17-19: ***37th Annual Conference on Engineering in Medicine and Biology,*** Los Angeles Hilton, Los Angeles, CA. Contact: Alliance for Engineering in Medicine and Biology, Suite 402, 4405 East-West Highway, Bethesda, MD 20814, (301) 657-4142.

September 18-20: ***4th International Conference on Electromagnetic Compatibility,*** University of Surrey, Guildford, Surrey, England. Contact: Institution of Electronic and Radio Engineers, 99 Gower St., London WCIE 6AZ, England, (01) 388-3071.

October 2-4: ***6th Annual Electrical Overstress/Electrostatic Discharge Symposium,*** Marriott Hotel, Philadelphia, PA. Contact: Burt Unger, Bell Labs, 600 Mountain Ave., Murray Hill, NJ 07974, (201) 582-2555.

October 16-18: ***1984 International Symposium on Electromagnetic Compatibility,*** Tokyo, Japan. Contact: Professor T. Takagi, Dept. of Communications, Tohoku University, Sendai, 980, Japan, (0222) 22-1800 ext. 4266.

October 22-24: ***International Symposium on Noise and Clutter Rejection in Radars and Imaging Sensors,*** Sasakawa Hall, Tokyo, Japan. Contact: Professor T. Musha, Dept. of Applied Electronics, Tokyo Institute of Technology, 4259 Nagatsuta, Midori-ku, Yokohama, 277, Japan, (045) 922-1111, ext. 2546.

October 22-26: ***9th International Conference on Infrared and Millimeter Waves,*** Osaka, Japan. Contact: Professor A. Mitsuishi, Dept. of Applied Physics, Osaka University, Yamada-Oka, Suita, Osaka 565, Japan.

MICRO WAVE NEWS

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Microwave News invites contributions to *From the Field*, our occasional column featuring news and opinions from the non-ionizing radiation community. Letters from readers are also welcome.

Hawaii Broadcast Radiation: EPA Finds Hot Spots

The levels of radiofrequency (RF) radiation from broadcast antennas in Honolulu, Hawaii, are the highest ever measured in an urban area. According to a recently released report by the Environmental Protection Agency (EPA), human exposures in 12 out of 21 locations exceeded the standards adopted by the state of Massachusetts and/or the limits recommended by the International Radiation Protection Association (IRPA). There are no U.S. federal standards governing non-ionizing radiation exposures for the general public.

Despite such high levels, EPA officials do not believe that RF radiation in Honolulu poses an "immediate risk," because most public exposures are "transient or intermittent." Nevertheless, Joseph Cannon, EPA assistant administrator for air and radiation, advised Mark Fowler, chairman of the Federal Communications Commission (FCC), that "it would be prudent for you to investigate how many people have access to areas with the highest fields, and how often and how long they are exposed." (See the full text of Cannon's letter in "From the Field" on p.8.)

Cannon also wrote that the EPA "intends to propose several options for limiting exposure to RF radiation" in 1985 and to issue a federal standard in 1986. (See related story on p.7.)

AM Levels Exceed ANSI Limits

Richard Tell of EPA's Office of Radiation Programs went to Hawaii with FCC's Dr. Robert Cleveland last May to measure radiation levels after years of public concern over possible health risks (see *MWN*, April 1984).

Tell identified the highest radiation levels near AM (550 kHz-1.6 MHz) radio towers. Next to a tower in Kaimuki, with one FM and three AM stations, he found maximum AM magnetic fields of 9 A/m (the plane-wave equivalent of 3,054 mW/cm^2; AM fields cited below are given in terms of power densities) and FM levels of 830 uW/cm^2. Three AM stations at Ala Wai tower produced a field of up to 306 mW/cm^2 next to an access-limiting fence. In a parking lot at 331 Kamani where there are three AM stations and one FM station, levels as high as 3,261 mW/cm^2 were measured at the base of the tower — this area is closed to the public, however. AM levels inside a nearby clothing store were 23.9 mW/cm^2 near a floor fan and a machine that applies labels. The report notes that the machine caused RF burns.

The levels of very high frequency (VHF) (30-300 MHz) radiation associated with the FM and TV stations were generally below 1 mW/cm^2 in public areas. Four readings did exceed 1 mW/cm^2 in locations accessible only to maintenance personnel — the highest VHF reading, 20 mW/cm^2, was on the roof of the Ala Moana Hotel.

Tell also visited outdoor recreation and sun bathing areas on the top of high-rise apartment buildings that are near broadcast antennas. For instance, on the rooftop of the Villa on Eaton Square, opposite the Ala Wai tower, Tell measured AM levels greater than 24 mW/cm^2; and at an

(continued on p.4)

HIGHLIGHTS

Chromosomal Breaks Among Power Substation Workers

A team of Swedish researchers has identified unusually high rates of chromosomal abnormalities among power substation workers exposed to electromagnetic fields. Further laboratory research showed that spark discharge pulses caused chromosomal breaks, but that 50 Hz fields had no genetic effects on human lymphocytes.

Drs. I. Nordenson and S. Nordstrom of the University of Umea, Dr. K. Hansson Mild of the National Board of Occupational Safety and Health and E. Birke of the Swedish State Power Board in Vallingby observed an increased frequency of chromosomal breakage in a group of switchyard workers exposed to an EM field from a 400 kV system. Their *in vitro* study suggests "that exposure to electric fields (50 Hz, 1 mA/cm^2 current density in the blood sample) does not induce chromosomal damage in peripheral lymphocytes. However, when the exposure was in the form of repeated transient current (ten 3 usec-long pulses with 2.5-3.5 kV/cm peak [electric field] in the sample) a significantly increased frequency of chromosomal breaks was found."

Two of the co-authors, Nordstrom and Birke, have previously shown that the children of men who work in high voltage substations had an increased rate of congenital malformations (see *Bioelectromagnetics, 4,* 91, 1983, and *MWN,* March 1983). The new *in vivo* and *in vitro* investigations were designed to follow up that 1983 epidemiological study.

Analysis of the chromosomes of the substation workers' lymphocytes revealed no increase in gaps but highly significant increases in the rates of chromatid and chromosome breaks (p less than 0.0005), with a fivefold increase in chromosome breaks overall, compared to controls.

The frequency of chromosomal breaks in the *in vivo* study was similar to that induced in lymphocytes by ionizing radiation at a dose of 0.75 Gray (Gy), according to the researchers' paper, which appears in *Radiation and Environmental Biophysics, 23,* 191, 1984. (0.75 Gy is equivalent to 75 rads and is considered to be a large, though not a life-threatening, dose.)

A previous study, published in the same journal (*19,* 235, 1981) by a West German team headed by Dr. M. Bauchinger, failed to uncover any chromosomal changes in workers who had been exposed to 50 Hz fields in 380 kV switchyards for more than 20 years.

During a recent visit to the U.S., Dr. K. Hansson Mild told *Microwave News* that the Swedish team had also recently completed a well-controlled, follow-up study of 19 exposed non-smoking switchyard workers and that the results were the same as in the previous study.

"This constitutes a pretty clear case that spark discharges cause chromosomal damage," Mild said. It is not so much the fields, but the discharges that cause problems, he explained.

According to Mild, the discharges can easily be controlled through grounding.

Immunity Task Group: TVs, VCRs and Cordless Phones

An ad hoc working group is nearing completion of a report on its efforts to enhance the immunity of televisions and video cassette recorders (VCRs) to conducted and radiated interference. The group, which works under the aegis of the American National Standards Committee C63 on Electromagnetic Compatibility, formed a new subcommittee to study the immunity of cordless telephones, and plans are underway to broaden the group's inquiry to include security devices.

Don Heirman, chairman of the ad hoc group, said in a telephone interview that an interim status report describing voluntary standards for the immunity of TVs and VCRs will be presented to the IEEE Standards Board at its March meeting.

The public availability of the report will be decided by the board in March, according to Heirman, who is with AT&T Information Systems in Holmdel, NJ. The final report is due by the end of 1985.

The working group is keying its proposed immunity limits to those developed by the Electronic Industries Association (EIA). Three types of electromagnetic interference (EMI) are being addressed: (1) interference received along with the desired signal; (2) direct radiation; and (3) conducted interference by the power cord and other leads.

The first type is addressed in EIA Interim Standard No.10, *Immunity of TV Tuners to Internally Generated Harmonic Interference from Signals in the Band 535 kHz-30 MHz,* which is an expanded version of the 1980 EIA Bulletin No.8A, *Susceptibility of TV Tuners to Harmonically Generated Interference.* The 8A bulletin covered only CB radiation; No.10 includes AM radio up to 30 MHz. Eb Tingley of EIA's Consumer Electronics Group said that the new standard, which has already been published, will likely go into effect on January 1, 1986.

EIA's Proposed Interim Standard No.16, *Immunity of Television Receivers and Video Cassette Recorders to Direct Radiation from Radio Transmission, 0.5-30 MHz,* seeks to limit radiated EMI. Tingley said that this proposal, which is being voted on by the association's members, would require TVs and VCRs to withstand radiated fields of 1 V/m. (Last spring, EIA raised the possibility of using an immunity level of 3 V/m, but this was rejected by manufacturers as being too strict (see *MWN,* June 1984).

Conducted EMI from the power cord and other leads is being studied by the National Bureau of Standards (NBS) under an EIA contract. According to Tingley, the NBS will also evaluate proposed Special Committee on Radio Interference (CISPR) procedures for measuring conducted interference. The NBS report will not be ready until late 1985.

The ad hoc working group was set up to meet the Congressional mandate of reducing EMI to electronic equipment used in the home as defined in the Communications Act Amendments of 1982, P.L. 97-259 (see *MWN,* September and October 1982). The group is overseeing the development of voluntary immunity standards to forestall

mandatory FCC limits (see *MWN*, May 1983). The Federal Communications Commission's Frank Rose and Dan Yates are working with the ad hoc group.

Cordless Phones

The subcommittee on cordless phones is now trying to pick an independent laboratory to test the susceptibility of units to amateur radio signals. The phones operate at 46-49 MHz, and there is an amateur band at 50-54 MHz, which might cause objectionable EMI.

According to subcommittee member Jay Padgett of AT&T Consumer Products Labs in Neptune, NJ, no decision has yet been made on what data should be collected.

Padgett pointed out that the 49 MHz cordless phones have been on the market for some time, with virtually no interference complaints. Had there been a problem, the industry would have heard something by now.

Eric Schimmel of EIA's Information and Telecommunications Technologies Group agreed with Padgett: "We don't anticipate any problems showing up in the lab tests."

Heirman said that his ad hoc working group will begin addressing the immunity of burglar alarms and other security devices later this year.

VDTs and Problem Pregnancies: Research Underway

The possible link between video display terminals (VDTs) and miscarriages and birth defects is being intensively studied in the U.S. and Europe.

NIOSH Study

Researchers at the National Institute for Occupational Safety and Health (NIOSH) have eliminated half of a planned two-part study of VDTs and reproductive risks, and the remaining part of the project is in limbo while agency officials consider whether it can produce useful information.

NIOSH researchers originally designed the epidemiological study to include both prospective and retrospective components. For the prospective portion, which has been dropped, NIOSH had intended to follow the reproductive histories of approximately 4,000 female telephone operators for two years. The study population would have consisted of 2,000 women working with VDTs and a control group of women using single-line, light-emitting diode (LED) displays. In the retrospective part, NIOSH plans to ask the same women to describe their health and reproductive histories for the *last* two-and-a-half years.

NIOSH was forced to abandon the forward-looking component when representatives of the three telephone and telecommunication companies scheduled to participate announced that the LED operators would soon begin using VDTs, invalidating their role as controls. The announcement came at a meeting held at NIOSH offices in Cincinnati, OH, on December 17 to review the study protocol.

Teresa Schnorr, the lead researcher on the project, said in a subsequent telephone interview that it would have been "preferable" to do both parts of the study and that the agency will now decide whether to do the historical component or nothing at all. But Dr. Jane Gordon, who headed the study until she left the agency in June, told *Microwave News* that the retrospective research "will be of very, very limited use" and will not add much to what is already known. Gordon is now a part-time consultant to the Communications Workers of America.

Meanwhile, the protocol for the retrospective part of the study has come under fire from both industry and labor groups. Industry groups are complaining that NIOSH should look at other occupations, not just telephone operators, to ensure that the results can be generalized to other VDT-based jobs. Union officials want more attention placed on stress and equipment design as possible causes of reproductive abnormalities.

NIOSH will not measure radiation levels or try to determine whether radiation emissions might affect pregnancies. Agency officials downplay possible health effects caused by VDT emissions, including very low frequency (VLF) fields.

Agency officials have not yet set a starting date for the study, but Schnorr hopes to begin distributing questionnaires by late summer.

Other Developments

Researchers elsewhere are also focusing on the VDT-problem pregnancy issue.

- Dr. William Butler, an epidemiologist at the University of Michigan at Ann Arbor, announced at the December 17 NIOSH meeting that he and Dr. Kelley Brix are planning a retrospective epidemiological study of VDTs and reproductive risks. Butler said that they "will cover different ground" than NIOSH. He would not comment on their funding sources or study populations.

- Researchers at Finland's Institute of Occupational Health in Helsinki found no evidence that VDT work can cause birth defects. Using listings in the national birth registry and a limited number of questionnaires, Drs. Kari Kurpa, Peter C. Holmberg, Kaarina Rantala and Tuula Nurminen concluded that working at VDTs produces no increase in the rate of reproductive abnormalities among exposed women. Thus, the authors report in the December 8, 1984 issue of *Lancet* that "our results do not give support to rumors that exposure to VDTs causes birth defects." Responding to this and other VDT research, *Lancet* editorialized on January 12 that continued research "will probably dissipate many of the general fatigue symptoms [reported by operators], and with them will go much of the anxiety about radiation. Much, but never all of the anxiety; where the health of so many is involved, unruffled vigilance is a good prescription."

- A statement has been issued from the first international conference on VDTs and reproductive risks, held November 29-30 in London, England. The meeting, which was closed to the public and the press, brought together re-

searchers from Europe, Canada and the U.S. In a summary statement, conference organizers report that: "...there was general agreement among the panel of expert speakers that the investigations which have been carried out throughout the world — involving both the measurement of emissions from VDTs and the study of groups of operators to see if they have suffered any ill effects — have failed to confirm that the alleged harmful effects are attributable to VDT work. However, there was also general agreement that further surveys and research were justified given the complex and emotive nature of the allegations." A copy of the statement can be obtained from Humane Technology, PO Box 2, Quorn, Nr. Loughborough, Leicestershire LE12 8EG, England. Also available is a complete set of the papers presented at the meeting. It costs 15 pounds in Europe and 16.50 pounds elsewhere (prepaid, price includes postage).

• A NIOSH investigation of a problem pregnancy cluster at Southern Bell's offices in Atlanta, GA, confirmed that a cluster existed but did not find its cause (see *MWN*, April and May 1984). In a report released in late January (HETA 83-329-1498), NIOSH explained that maternal age, VDT use and time spent standing were ruled out as possible agents for the 43 percent miscarriage rate (6 of 14 pregnancies) that occurred among workers on the fifth floor of one of the company's buildings. This is one of three ongoing NIOSH investigations of possible problem pregnancy clusters and the first for which a report has been completed.

FCC Action on RF/MW Radiation Expected Soon

The Federal Communications Commission (FCC) is expected to reach a decision soon on its proposed rules on radiofrequency and microwave (RF/MW) radiation hazards. An FCC staffer said the commission may issue a ruling following its February 14 meeting or soon thereafter.

If the FCC decides to make radiation safety a factor in evaluating environmental risks, it will probably base its guidelines on compliance with either the American National Standards Institute (ANSI) or Occupational Safety and Health Administration (OSHA) standards.

Final action on Docket No. 79-144 has been pending since early 1982, when the FCC proposed a requirement that applicants for new facilities complete an environmental assessment, and possibly an environmental impact statement, if workers or the public could be exposed to radiation levels above 10 mW/cm^2. The rules are designed to meet the commission's obligations under the National Environmental Policy Act (see 47 *Federal Register* 8214, February 25, 1982 and *MWN*, March 1982).

The broadcast and communications industry used the proposal as an opportunity to urge the FCC to preempt state and local RF/MW radiation standards. Some commenters advised the commission to adopt the 1982 ANSI limits; others suggested staying with the more lenient 10 mW/cm^2 OSHA standard (see *MWN*, September 1982).

Hawaii Broadcast Radiation

(continued from p.1)

open access area on top of the Coty Tower he measured VHF power densities of up to 663 uW/cm^2.

Readings were generally lower inside buildings than in the open air because, EPA points out, walls and roofs attenuate the radiation. At VHF frequencies, the two highest indoor readings were 27-60 uW/cm^2 in an apartment on the 10th floor of Coty Tower and 40 uW/cm^2 in the restaurant at the Ala Moana Hotel. These power densities do not exceed any current guidelines used in the U.S., though they are higher than the Soviet Union's standard for the general population.

The radiation levels cited in the report are approximate. Tell cautions that they are accurate within a factor of plus or minus 2 decibel: "This corresponds to a possible uncertainity of +58 percent and -37 percent in the stated power densities and a possible uncertainty of +26 percent and -21 percent in the stated electric or magnetic field strengths. For example, a stated power density of 500 uW/cm^2 could in reality be as low as 315 uW/cm^2 or as high as 790 uW/cm^2."

Reactions in Hawaii

The release of the EPA report caught most people in Honolulu by surprise. "I got no warning that they were going to release the report," said City Councilmember Marilyn Bornhorst, who has expressed concern about radiation exposure.

The EPA report, *Radiofrequency Radiation Measurement Survey, Honolulu, Hawaii, May 14-25, 1984*, was handled with great sensitivity within the agency. Although it was completed last June, EPA delayed release until January while staffers wrote an accompanying "Background Information" fact sheet. Agency officials, one from Washington, DC, and one from the regional office in San Francisco, CA, went to Hawaii to hand deliver the report to key state and local officials and to answer questions.

"I wish we had better data on whether the ANSI standard is safe," Bornhorst said, referring to the guidelines set by the American National Standards Institute in 1982. She added that "I would feel a lot safer if we were following the Portland standard." The city of Portland, OR, has the strictest RF standard in the U.S.

Robert Hall of the Hawaii Institute for Biosocial Research in Honolulu said that he was "shocked" by the disparity between EPA's press release and the numbers in the actual report. He echoed Bornhorst's opinion of the ANSI standard: "We are not going to listen to ANSI." Hall had been pressing EPA to come to Hawaii to assess radiation risks since 1977.

(In its press release, EPA officials said that they do "not

believe that the levels of RF radiation measured at the Honolulu sites pose an immediate risk to the public because it is likely that most exposures are brief or intermittent and few, if any, people are likely to be exposed continuously to the highest levels." Similarly, an FCC press release said: "It was pleased to announce that the results of the study have shown that radio and TV signals in Honolulu do not pose an immediate danger to the public.")

(In its background paper, EPA concludes that heating is the primary health effect of RF radiation. With respect to low-level effects, the agency wrote: "The scientific literature also contains evidence intimating non-thermal effects from RF radiation, but this is unproven." And: "A recent study said to show a non-specific increase in tumors and adrenal effects in laboratory animals chronically exposed at 0.4 W/Kg of RF radiation needs to be analyzed in depth" (see *MWN*, July/August 1984).)

Congressman's AM Station

The family of Democratic Congressman Cecil Heftel owns KSSK-AM, which broadcasts from a tower that produces one of the hot spots reported by the FCC. The radio station is located at Ala Wai Tower, where EPA measured levels of 306 mW/cm^2 near the tower's access-limiting fence.

Ted Bornstein, the congressman's administrative assistant, refused to comment on Heftel's personal business affairs. According to the 1983 *Broadcasting Yearbook*, KSSK is owned by Heftel Broadcasting Corp., of which Cecil Heftel is president. The congressman's district includes Honolulu.

Earl McDaniel, KSSK's general manager, said that he had read the EPA report and that he was pleased to find out that no one is in danger. With respect to remedial actions, he said that the station would look to the FCC.

Councilmember Bornhorst said that her staff is looking into the possibility of proposing an exposure standard for Honolulu. In the meantime, she is urging EPA to set national limits. In addition, Hall said that he and his associates are preparing their own report on radiation exposures in Honolulu.

Both Bornhorst and Hall cited past government deception over pesticide contamination in the state and raised the possibility that EPA was repeating the same errors, thereby risking its credibility on the radiation safety question.

Current Standards

EPA had been planning to propose RF radiation limits of 100 uW/cm^2 for the VHF band and 10 mW/cm^2 for AM frequencies before internal agency disputes stalled the proposal in June of 1984 (see *MWN*, June and July/August 1984). These levels are ten times stricter than the 1982 ANSI limits for both occupational and public exposures — 1 mW/cm^2 and 100 mW/cm^2 at VHF and AM frequencies respectively (see *MWN*, September 1982).

In 1983, IRPA approved limits for the general public of 200 uW/cm^2 (VHF) and 2 mW/cm^2 (AM) (see *MWN*, March 1984). And in 1984, the Johns Hopkins University Applied Physics Laboratory set occupational standards of 100 uW/cm^2 for VHF and 10 mW/cm^2 for AM frequencies (see *MWN*, December 1984).

The state of Massachusetts has its own standard: 200 uW/cm^2 for VHF and 20 mW/cm^2 for AM — designed to be five times stricter than the ANSI limits (see *MWN*, September 1983). In 1980, Portland, OR, set its own — and the strictest — standard: 100 uW/cm^2 for VHF and 500 uW/cm^2 for AM.

At the 21 Honolulu sites where measurements were made, 5 locations (3 AM, 2 VHF) were in excess of the ANSI standard, 11 would violate the Massachusetts standard (6 AM, 7 VHF), and 12 would exceed the IRPA limits (7 AM, 7 VHF). In some locations, both VHF and AM standards were exceeded. Most of the sites are publicly accessible, though only two of the AM readings that were above the ANSI limits were in public spaces. EPA points out that all the locations are near antennas and were picked because they were believed to have the strongest RF fields. EPA also notes that the fields fall off quickly with distance.

Based on previous field studies, EPA has estimated that less than one percent of the U.S. population is exposed to more than 1 uW/cm^2.

Remedial Work Underway

Steps have already been taken to limit exposures near the two publicly accessible AM towers where fields exceed the ANSI standard. William Hassinger, engineering advisor to the chief of the FCC's mass media bureau, told *Microwave News* that the commission is in contact with representatives of the owners of the radio stations and that remedial action is underway.

In one case, Hassinger said, the station owns the affected land and a fence probably will be erected to bar public access. In the second case, a solution may take

Other Radiation Hot Spots

While local zoning laws that force broadcasters to put their antennas in populated areas make downtown Honolulu a special case, there are many other locations in the United States where the public may also be exposed to radiation levels in excess of the ANSI standard.

EPA's Richard Tell said that there are "localized hot spots" throughout the United States. In a telephone interview from his office in Las Vegas, NV, Tell said that he had a computer printout listing about 200 FM stations which can, according to calculations, produce general public exposures greater than the ANSI standard.

Tell recommended that fences be built to block public access to some of these hot spots. "We should go out and identify the worst case exposure locations and tell people where the unacceptable levels are," Tell said.

longer because the property is leased. Hassinger described the owners as "eager to help and resolve the problem."

An FCC press release stated that "any plans or proposals developed by the FCC likely will be highly individualized and will require a great deal of cooperation by all parties concerned."

The FCC has no formal rules governing occupational and public exposure to non-ionizing radiation. Hassinger said that the commission was gauging health risks on the basis of the ANSI limits.

The National Association of Broadcasters (NAB) also said that the stations involved were cooperating to resolve the problem. NAB President Edward Fritts called the Hawaii situation an "isolated and unique" case because broadcast towers are rarely located in inhabited areas.

In a press release, Fritts said that the NAB favored the ANSI standard and asked the federal government to adopt it to "assuage unwarranted public concern and eliminate unnecessary confusion at the state and local level." He noted that, "For more than 50 years, broadcasters have provided communications services...with absolutely no evidence of harm."

The Electromagnetic Energy Policy Alliance (EEPA) also urged the federal government to adopt the ANSI standard. In a press release, the trade group stated that, "The EPA survey results confirm that the Honolulu general public is in no danger from exposure to RF fields generated by radio and television broadcasting."

Beyond ANSI

While the two AM towers should be able to meet the ANSI limits without incurring large costs, Honolulu broadcasters would have more difficulty conforming to tougher limits, like the EPA's stalled 100 uW/cm^2 proposal.

Although EPA could set a standard as early as next year (it may not be 100 uW/cm^2; indeed, EPA may decide a standard is not needed), very little planning is underway to meet limits which are stricter than ANSI's.

FCC's Hassinger believes that a long-term solution will probably be needed. "Wholesale relocation" of the antennas would be good, if feasible, he said, with the goal of "putting some distance between transmitters and people."

At the NAB, Tom Keller, vice-president for science and technology, said that he could not predict whether stricter standards than ANSI's would be adopted or how broadcasters would react to such measures. He said that it is in the broadcasters' best interests to make the antennas more efficient, which would be the case if the towers were placed on the hills overlooking Honolulu.

At present, local laws prevent broadcasters from siting antennas on the adjacent hills, forcing the towers to be built in the middle of the city.

Shock and Burn Hazards

In the course of taking survey measurements, Tell responded to an FCC request to investigate accounts of window washers at high-rise buildings receiving RF burns from the long, metal cables that support their platforms. In one experiment, Tell measured almost one half ampere of current in a cable (extending from the roof of the Villa at Eaton Square), even though the ground level electric field strengths were only 1-2 V/m. According to the EPA report, "it was not possible to measure the open-circuit voltage on the cable, but the voltage was sufficient in strength to produce electrical arcs from the cable to grounded objects."

The report goes on: "Under these particular conditions, (the presence of conductors such as metal cables in low frequency fields), the RF burn phenomena is difficult to control...and shocks and burns present a real hazard for window washers using metal cables. Depending on whether metal cables are hung in close proximity to flammable materials (cloth awnings, grass, brush) or close to street level, fire hazards and/or shocks or burns to passersby inadvertently touching cables might be possible."

EPA has referred the matter to the Occupational Safety and Health Administration (OSHA). In a telephone interview, Bob Curtis of OSHA's Health Response Team in Salt Lake City, UT, acknowledged that metal cables create a shock risk, but explained that non-conducting cables cannot be used because of other OSHA rules.

(As noted earlier, in his report Tell cites a case of a label machine causing RF burns inside a store near a broadcast tower.)

There have also been reports of longshoremen receiving RF burns while working near cranes on docks half a mile from an AM radio tower. And Councilmember Bornhorst said that she knew of a report of sparks causing a fire in garbage at the bottom of an elevator shaft. Hall also said that he knew of a spontaneous fire near a broadcast tower.

Anecdotal stories of neurological disorders and other health complaints among residents of apartment buildings near broadcast towers are also circulating. These could not be confirmed and no health studies have been done.

OSHA's Curtis said that he had also been to Hawaii to take measurements last year but that he had not investigated commercial broadcast sources. He took readings near the Navy's Omega antenna and its communications station at Lualualei (see *MWN*, July/August 1982). Curtis said that his report would be completed in about six weeks.

For a copy of the Hawaii report, contact: Office of Radiation Programs, EPA, 401 M Street, SW, Washington, DC 20460. ●

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EPA Plans To Issue RF/MW Standard in 1986

The Environmental Protection Agency (EPA) now plans to issue federal limits in 1986 for public exposure to radiofrequency and microwave (RF/MW) radiation. The agency's schedule is cited in a letter from Joseph Cannon, EPA Assistant Administrator for Air and Radiation, to Mark Fowler, chairman of the Federal Communications Commission, which accompanied the release of an EPA report on radiation levels in Honolulu, Hawaii (see story on p.1 and the complete text of the letter on p.8).

In his January 22 letter, Cannon wrote that in 1985 EPA will "propose several options for limiting exposure to RF radiation." Among the listed possibilities are a 100, 200 or 1,000 uW/cm^2 standard. The agency may also decide that public exposure can be controlled without a standard.

Cannon also said that he anticipated reaching a decision on a national RF/MW radiation standard in 1986.

David Janes, of EPA's Office of Radiation Programs (ORP) in Washington, DC, confirmed this schedule in a telephone interview with *Microwave News*.

EPA plans to propose limits last summer were stalled by dissent within the agency, principally from the Office of Policy Planning and Evaluation (see *MWN*, June and July/August 1984). In the fall, ORP Director Sheldon Meyers said that EPA would go to the *Federal Register* to obtain more information in an effort to decide on a preferred course of action (see *MWN*, October 1984).

EPA has now combined two steps: the agency will ask for outside opinions and propose a standard at the same time. Janes explained that the agency could save a year using this approach.

Informed sources note, however, that there is little chance a standard could emerge without a strong commitment from the new EPA administrator, Lee Thomas, because of longstanding opposition from the agency's policy office.

Cannon also told Fowler that later this year EPA would issue an economic analysis of the costs to broadcast sources of complying with RF/MW standards. The analysis is being prepared by the Lawrence Livermore National Laboratory (see *MWN*, January/February 1984).

CONFERENCES

March 5-7: **6th Symposium & Technical Exhibition on Electromagnetic Compatibility,** Zurich, Switzerland. Contact: EMC Symposium & Exhibition, ETH Zentrum-IKT, 8092 Zurich, Switzerland, 256-27-90.

March 20: **Symposium on Vision in the High Tech Society,** Sheraton Washington Hotel, Washington, DC. Contact: American Optometric Association, 243 N. Lindbergh Blvd., St. Louis, MO 63141, (314) 991-4100.

March 21-22: **IMTC/85: Instrumentation/Measurement Technology Conference,** Hyatt Regency, Tampa, FL. Contact: Dr. Robert Ashley, Sperry Corp., PO Box 4648, Clearwater, FL 33518, (813) 577-1900, ext. 2228.

March 22-26: **3rd Annual Meeting of the Society for Magnetic Resonance Imaging,** Town & Country Hotel, San Diego, CA. Contact: SMRI, 1340 Old Chain Bridge Rd., Suite 300, McLean, VA 22101, (703) 790-1745.

April 3-4: **21st Annual Meeting of the National Council on Radiation Protection and Measurements,** Washington, DC. Contact: NCRP, Suite 1016, 7910 Woodmont Ave., Bethesda, MD 20814, (301) 657-2652.

April 14-17: **63rd Annual Convention of the National Association of Broadcasters,** Las Vegas, NV. Contact: NAB, 1771 N Street, NW, Washington, DC 20036, (202) 293-3570.

April 16-17: **8th International Colloquium on the Prevention of Occupational Risks due to Electricity,** London, UK. Contact: International Fire Security & Safety Exhibitions & Conferences Ltd., Cavendish House, 128/134 Cleveland St., London W1P 5DN, UK, (01) 387-5050.

April 16-19: **4th International Conference on Antennas and Propagation (ICAP 85),** Coventry, UK. Contact: Institution of Electrical Engineers (IEE), Savoy Place, London WC2R 0BL, UK, (01) 240-1871, ext. 222.

April 17-19: **3rd International Conference on Developments in Power System Protection,** London, UK. Contact: IEE, see April 16 above.

SHORT COURSES

March 18: **Electrostatic Discharge (ESD) Control,** Dallas, TX. Fee: $295. Contact: R&B Enterprises, 20 Clipper Rd., West Conshohocken, PA 19428, (215) 825-1960.

March 18-20: **Dielectric Resonators,** Oxford, MS. Fee: $550. Contact: Division of Continuing Education, University of Mississippi, University, MS 38677.

March 18-21: **Elements of Phased Array Radar System Design,** Atlanta, GA. Fee: $750. Contact: Dept. of Continuing Education, Georgia Institute of Technology, Atlanta, GA 30332, (404) 894-2400.

March 18-22: **TEMPEST-Design, Control & Testing,** Washington, DC. Fee: $1175. (Secret Security Clearance Required.) Contact: DWCI, Star Route 625, PO Box D, Gainesville, VA 22065, (703) 347-0030.

March 20-21: **Electromagnetic Pulse (EMP) Design and Test,** Dallas, TX. Fee: $595. Contact: R&B, see March 18 above.

March 25-26: **Lightning Protection,** Orlando, FL. Fee: $650. Contact: Continuing Engineering Education, George Washington University (GWU), Washington, DC 20052, (800) 424-9773 or (202) 676-6106 in DC. **Repeated** August 12-13: Washington, DC.

April 1-4: **Computational Methods in Electromagnetics,** Monterey, CA. Fee: $750. Contact: Ann Beekman, SCEEE, 11th & Massachusetts Ave., St. Cloud, FL 32769, (305) 892-6146.

April 15-18: **Modern Microwave Measurements,** Palo Alto, CA. Fee: $895. Contact: Continuing Education Institute (CEI), 10889 Wilshire Blvd., Los Angeles, CA 90024, (213) 824-9545 or (301) 596-0111. **Repeated** May 13-16: Alexandria, VA.

April 15-19: **Laser Microwave Hazards Course,** Aberdeen Proving Ground, MD. Fee: NA. Contact: Mrs. Donley, US Army Environmental Hygiene Agency, Aberdeen Proving Ground, MD 21010, (301) 671-4158.

May 6-10: **Radiation Safety,** Evanston, IL. Fee: $895. Contact: Continuing Engineering Studies, 2804 Technological Institute, Northwestern University, Evanston, IL 60201, (312) 492-3365.

EPA Letter to FCC on Hawaii Broadcast Radiation

Reprinted below is the complete text of the January 22 letter from Joseph A. Cannon, assistant administrator for air and radiation at the Environmental Protection Agency (EPA) to Mark S. Fowler, chairman of the Federal Communications Commission (FCC), accompanying the EPA report on the levels of broadcast radiation in Honolulu, Hawaii.

Dear Mr. Fowler:

At your request, a joint EPA and FCC study was conducted in May 1984 to measure the intensity of radiofrequency (RF) radiation fields in the vicinity of broadcast stations in Honolulu, Hawaii. I am happy to provide you with the enclosed report that summarizes the results of these field measurements.

In the study, measurements were made only in areas near antennas, and almost all of the broadcast towers in Honolulu were included. The survey locations are representative of places in Honolulu where public exposures to RF radiation fields are believed to be highest. The results show that public exposures in 12 out of the 21 survey locations exceed limits currently proposed, recommended, and/or adopted by several scientific and technical advisory organizations or regulatory bodies. Because of the combination of exposure levels and public accessibility, at least two of the locations may warrant further evaluation. The measurements and various exposure guidelines are discussed in the report.

RF radiation can produce various biological effects. Most studies use experimental animals exposed for relatively short periods of time, rather than long-term continuous exposures, and few health studies of people have been done. At relatively high levels, health effects are due to heating of cells and tissues, and increases in temperature are dependent on duration of exposure. At lower levels of exposure, the public health significance of experimentally observed effects is not well understood.

Although there are many uncertainties in our current understanding of how exposure to RF radiation affects human health, it is possible to interpret the meaning of the observed biological effects in terms of the potential for adverse health effects in exposed people and to identify subgroups in the population who may be particularly sensitive. Such an interpretation is presented in the enclosed fact sheet. The fact sheet also gives other background information on the survey, and it will be distributed to the public and members of the press who may request the report from us.

We do not believe that the levels of RF radiation measured at the Honolulu sites pose an immediate risk for the following reasons. Field intensities tend to drop off rapidly as distance from the source increases. In general, beyond about 100-150 feet from the base of antenna towers, people are exposed to low levels, typically below 100 microwatts per square centimeter or about 0.04 watts per kilogram of body mass....The highest levels measured in this survey were outdoors in close proximity to the towers, on rooftops, or in areas with access normally limited to maintenance personnel or other workers. Indoor fields are generally low because of shielding by the walls and roofs of buildings. Consequently, it is likely that most exposures are transient or intermittent, and few people are likely to be exposed continuously to the highest fields. However, it would be prudent for you to investigate how many people have access to areas with the highest fields, and how often and how long they are exposed.

I understand that the Commission, in cooperation with local authorities, will decide if and what corrective actions may be needed in Honolulu. I recognize that the results of this study are difficult to interpret in the absence of the Federal Guidance you have requested from EPA. In 1985, EPA intends to propose several options for limiting exposure to RF radiation. The options encompass the range of limits recommended or adopted by various advisory groups such as the International Radiation Protection Association (IRPA) and the American National Standards Institute (ANSI), and include:

1. Controlling public exposure by limiting whole-body average specific absorption rates (SAR) to 0.04 watts per kilogram (W/Kg) for frequencies above 3 Megahertz (MHz) and to 87 volts per meter (V/m) or 0.23 Amperes per meter (A/m) at frequencies below 3 MHz.
2. Controlling public exposure by limiting whole-body average SARs to 0.08 W/Kg for frequencies above 3 MHz and to 275 V/m or 0.73 A/m for frequencies below 3 MHz.
3. Controlling public exposure by limiting whole-body average SARs to 0.4 W/Kg for frequencies above 3 MHz and to 614 V/m or 1.63 A/m for frequencies below 3 MHz.
4. Other possible options, including not establishing Federal Guidance for RF radiation.

I anticipate that we will reach a decision on establishing Guidance in 1986. But, in the absence of formal EPA Guidance, you should at least consider evaluating the two publicly accessible locations in Honolulu where the measured exposure levels exceed the third option level listed above. In addition, we will be glad to help you with additional analyses you may undertake such as calculating exposures at various distances from the towers or identifying techniques (fencing, posting, and/or shielding, etc.) that can be used to limit public access to the higher fields near antenna towers.

We have just published a review of the biological effects of radiofrequency radiation, and various other background documents will also be made available to the public in 1985:

- Radiofrequency radiation in the environment — sources and levels of exposure (Office of Radiation Programs, EPA).
- An estimate of the potential costs of guidelines limiting public exposure to RF radiation from broadcast sources (Lawrence Livermore National Laboratory).
- Assessing the potential impact of Federal radiation safety regulations on AM, FM, and TV broadcast sources (Office of Radiation Programs, EPA).

If you have any questions about the report, please feel free to call me at 382-7400.

Sincerely,

Joseph A. Cannon

VDT Radiation Measurements at SRI International

The following communication was sent to Microwave News *by Jane Clemmensen, a research engineer at SRI International. Clemmensen's letter is dated October 11.*

We would like to provide additional data relative to the article on VDT flyback radiation (*MWN*, September 1984). Our comments will be restricted to Dr. Guy's data since the EPA measurements were peak rather than rms average fields. We did not measure rise and fall times of the horizontal sweep oscillator. We measured the vertical component of the electric field (Ez) and one or more components of the magnetic field (Bx, By, Bz). Unless

otherwise noted B-field values given are for the total B vector.

Our data on VDTs are consistent with Guy's range of rms magnetic fields (25-175 nT [nanotesla] or 0.02-0.14 A/m) which he measured 25-30 cm from the screen. We measured fields 30 cm in front of the screen of an old Heathkit terminal and found the magnetic field at the flyback frequency, 15.5 kHz, to be 63 nT (0.05 A/m). The B-field 40 cm away from the rear of the VDT was 13 nT (0.01 A/m). Our electric field data are not in agreement with Guy's generalization that E-fields measured 25-30 cm from the screen are typically 5 V/m for new VDTs and 50 V/m for older VDTs. We measured a 1.5 V/m electric field at 15.5 kHz at a distance 30 cm from the front of the screen of an old Heathkit terminal. More measurements on a number of different VDTs are clearly indicated before generalizations can be made.

Any discussion of fields from VDTs should also include television sets because they display similar spectral features and produce VLF emissions. The horizontal sweep frequency is standardized in TV sets at 15.7 kHz. In VDTs the flyback frequency varies with make and manufacturer. The electric and magnetic fields originating from the flyback transformers of VDTs and TV sets are also accompanied by strong electric and magnetic fields at harmonics of the 60 Hz power line frequency. The magnitude of harmonic fields is approximately equal to the fields from the flyback transformer. 60 Hz harmonic fields therefore must be measured in addition to VLF radiation.

Our measurements of TV sets were made 1 m in front of the set at the height of a sitting child's head, 0.7 m above the floor. Electric fields at 1 m ranged from 1 V/m for a Sony TV to 3 V/m for an RCA. The single-axis magnetic field 1 m in front of the Sony was 1 nT ($8x10^{-4}$ A/m) for the By orientation. The magnetic field from the RCA TV was 0.5 nT ($4x10^{-4}$ A/m) for the By orientation and 1.5 nT ($1.2x10^{-3}$ A/m) for the Bx orientation.

Jane M. Clemmensen, Research Engineer
Radio Physics Laboratory, SRI International
333 Ravenswood Ave., Menlo Park, CA 94025

UPDATES

BIOLOGICAL EFFECTS

ELF Research at Tulane...A group at the Electroscience and Biophysics Research Lab at Tulane University in New Orleans, LA, has been studying the effects of chronic exposure to high intensity electric fields for EPRI. The experiments were completed in 1982; shortly thereafter, the principal investigator, Dr. Y.J. Seto, died. The other members of the research team are Drs. William Dunlap, S.T. Hsieh, John Lymangrover, Deborah Majeau-Chargois and Cedric Walker. They have published a number of papers describing the results of their multi-generation study. In general, they did not identify any gross effects, though they did find a number of subtle interactions. Exposing rats to 80 kV/m unperturbed 60 Hz electric fields for 42-240 days (a mean of 125 days) resulted in enhanced growth in the long bones, causing both increased length and mass (*Journal of Bioelectricity, 1,* 339, 1982). Exposure for 120 days from conception caused no changes in food and water intake, but there was a statistically significant effect on the pattern of growth, "suggestive of a slight initial developmental delay" (*Journal of Bioelectricity, 2,* 197, 1983). The same 120-day exposure period caused no changes in body chemistry metabolism, as measured by 17 serum chemistry assays (*Journal of Environmental Science and Health, A19,* 865, 1984). Exposing four generations of rats to 80 kV/m did not affect the incidence of gross malformations or resorptions, nor did it change fetal orientations or the offsprings' sex ratios (*IEEE Transactions on Biomedical Engineering, 31,* 693, 1984; this paper also describes the exposure facility.) Still to come are the results on hematology. Some of these findings were presented at the 1982 BEMS meeting in Los Angeles, CA. In that paper, Majeau-Chargois reported a very significant decrease in white blood cells, as well as significant changes in spleen, kidney, adrenal and testes weights (see *MWN,* July/August 1982). According to Hsieh, the hematology results will appear in *Environmental Research, 37,* in August 1985. One of the most interesting findings from the EPRI project was the demonstration of intensity windows at 60 Hz. The team discovered that exposure for five-and-a-half hours to a 10 kV/m 60 Hz field caused a highly significant, threefold elevation in the production of steroids by the rat's adrenal cortical tissue after in vitro administration of adrenocorticotrophic hormone (ACTH), but that 5, 100 and 1000 kV/m fields had no effect (*Life Sciences, 32,* 691, 1983). Hsieh said that additional papers are planned.

COMPATIBILITY & INTERFERENCE

ISM EMI to Aircraft... In 1982, the FAA signed a $40,000 contract with the Avionics Engineering Center at Ohio University to determine, through calculations and measurements, the risks of EMI to aircraft avionics, especially with respect to instrument landing systems (ILS) and automatic direction finding (ADF) receivers (see *MWN,* September 1983). A final manuscript was sent to the FAA in the spring of 1984 and has been under review ever since. Last May, after the work had been completed, the center's James Nickum told *Microwave News* that he had turned up some interesting findings. For instance, he said that the ground-to-air propagation of ISM radiation is "significantly different" from ground-to-ground propagation. "There is certainly a need to address the issue of radiation interference to aeronautical services," Nickum said. While he did not advocate setting new standards, he did indicate that thought should be given to the advisability of siting ISM equipment near airports. (Last September, Nickum left Ohio to join the Collins Division of Rockwell International in Cedar Rapids, IA.) The FAA now estimates that the Ohio University report will be issued in May.

GOVERNMENT

FCC Steps Up Enforcement... The FCC seized electronic equipment valued at $500,000 late last year, ending a

two-year investigation into the import of "non-type accepted" devices. In a raid on Granada Electronics of Brooklyn, NY, the commission confiscated more than 2,700 items illegally imported from the Far East, including CB radios, walkie-talkies and FM receivers, all of which are potential sources of RF interference. The CB radios, for example, are capable of operating at unauthorized frequencies and at power levels exceeding commission limits. Lawrence Wallach of L.W. Sales in Lynbrook, NY, was arrested for the unlawful sale of illegal CB transceivers. If convicted, the 27-year-old Wallach faces a maximum of 5 years in prison and $5,000 in fines....In a separate action, in January the commission fined three distributors $2,000 each for the repeated sale of cordless telephones that failed to meet the FCC's radiated power limitation. Those fined were TAD Avanti, distributor of the Record-a-Call CAT-100 and CAT-300; Dynascan, distributor of the Cobra CP915B; and Uniden, distributor of the Uniden EX-3100. The 46/49 MHz units were tested as part of the commission's upgraded sampling program.

LITIGATION

VDT Cataract Ruling... The New York State Workers' Compensation Board has ruled in favor of a secretary in what is believed to be the first successful claim of VDT-induced cataracts. Because the board ruled that the woman's cataracts "constitute an occupational disease arising out of and in the course of her employment," the January 2 decision may set a precedent for future claims. In its ruling (Case 0810 8929), the board found that "there is a recognizable link between the claimant's occupation and her disability." The decision was made on appeal after a workers' compensation law judge rejected the secretary's initial claim on August 26, 1983. No financial award was made, but Richard Spillane, the secretary's attorney, told *Microwave News* that the woman plans to file for compensation for lost work time and reduced earnings due to her condition. The secretary, Eileen Maguire of Staten Island, NY, was first diagnosed as having cataracts in August 1980, just seven months after she began working at a VDT. Four months after the diagnosis, she submitted a doctor's note to her employer, Shroder Bank and Trust Co. of New York City, stating that she could no longer work at a terminal. As a result, the company fired her in 1981.

Overviews... Microwave and VDT litigation were the subjects of two long articles in *The National Law Journal.* In the December 10 issue, John Parry advises law firms to do everything possible to integrate terminals properly into their office or risk the legal consequences. On the subject of radiation, he writes: "With regard to allegations of radiation injuries, the need for proximate causation makes recovery highly unlikely, except, perhaps, where a faulty VDT terminal is emitting radiation that exceeds federal limits. Even if scientific opinion in this country were to change and links were established, for example, between VDTs and cancer or birth defects, other elements of proof and employer defenses would substantially limit a firm's liability." Parry is the staff director of the American Bar Association's Commission on the Mentally Disabled and the editor of the *Mental and Physical Disability Law Reporter.* The *Law Journal* article is an abridged version of a 19-page article published in the July-August 1984 issue of the *Reporter:* "Are VDTs Hazardous to Your Legal Health?" Reprints are available for $5.00 (prepaid) from the *Reporter* at 1800 M Street, NW, Washington, DC, 20036, (202) 331-2240. In the January 28 *National Law Journal,* Kirk Victor describes the current state of microwave-related litigation: "Microwaves Stir New Generation of Battles." He writes: "Plaintiffs' lawyers have had their hopes set back by scientific studies that have not uncovered hard evidence of harm....But that lack of hard evidence has not stopped the speculation about the danger of microwaves or the continuing quest by plaintiffs' attorneys to probe the issue through a variety of pending suits — many of which are ultimately resolved by secret settlements."

MEDICAL APPLICATIONS

Kidney Stone Buster... The FDA has approved a shock wave device for the treatment of kidney stones. The "lithotripter" machine focuses shock waves, produced by an underwater high voltage condenser spark discharge, that shatter the brittle stones. Unlike ultrasound, the shock waves are single, sharply peaked impulses in the nanosecond range. The pulverized stones are then easily passed through the urine. A typical treatment involves up to 1,500 shock waves, given in a single session lasting about an hour. FDA estimates that this non-invasive technique could save $2,000 per patient, compared to the $6,700 cost of surgical removal. The treatment could be effective in 80 to 90 percent of the 100,000 cases now treated surgically in the U.S. each year. The $1.7 million lithotripter was developed by Dornier System of West Germany.

MEETINGS

Tokyo EMC Meeting... The *1984 International Symposium on EMC,* held in Tokyo, Japan, October 16-18, attracted more than 500 participants from 23 countries. Nearly 70 percent of the attendees were from Japan, with 15 percent from the U.S. The two-volume conference proceedings of close to 200 papers include the keynote address of Fumio Minozuma of the Ministry of Posts and Telecommunications: an historical review of radio noise activities in Japan. The 956-page proceedings will be available in the U.S. from the IEEE. They have not yet arrived from Japan and their U.S. price has not yet been set. (In Japan, the price is 10,000 yen, approximately $40.00.) For more information, contact the IEEE conference office, 345 East 47th St., New York, NY 10017, (212) 705-7895.

MIT Goes to Scotland... Each year, Professor P. Lele of MIT's Department of Mechanical Engineering has been offering a summer course on the applications and hazards associated with microwaves, UV, ultrasound, lasers and