MICRO WAVE NEWS

Vol. XIX No. 3 A Report on Non-Ionizing Radiation May/June 1999

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# Mobile Phone–Brain Tumor Risk In the Limelight Again

## Focus on Swedish and U.S. Epi Studies

Two studies have brought new attention to concerns about cellular phone use and brain cancer. Both provide some evidence that cellular phone users are more likely to develop brain cancer on the side of the head where they hold the phone.

Neither study, however, found any overall increase in brain tumor risk.

The two studies touched off a flurry of news stories about mobile phones and cancer in late May, and in the U.S. the subject got more prominent coverage than at any time since the 1993 controversy over the Reynard lawsuit (see *MWN*, J/F93). An article in the May 22 *Washington Post* was picked up by newspapers across the U.S.— the *Boston Globe*, the *Los Angeles Times* and others — while the new research was featured in virtually every major newspaper in Britain (see p.2). Television coverage included reports by the BBC and CNN, both on May 24, and stories are in the works at CBS News and ABC's news magazine, *20/20*.

"Increased risk was found for both left- and right-side brain tumors," writes Dr. Lennart Hardell of the Örebro Medical Center in Örebro, Sweden, in a paper that has been accepted for publication in the *International Journal of Oncology*. It will be the first published research on mobile phone users and cancer. "The results were based on low numbers, and must be interpreted with

*(continued on p.6)*

# Canadian Childhood Leukemia Study: No Magnetic Field or Wire Code Link

A major epidemiological study has found no association between childhood leukemia and exposure to electromagnetic fields (EMFs). There also was no observed link between childhood leukemia and the presence of nearby high-current electrical wiring.

"These results provide little support for a relation between power frequency EMF exposure and risk of childhood leukemia," concluded a team of Canadian researchers led by Mary McBride in a paper that appeared in the May 1 issue of the *American Journal of Epidemiology (AJE, 149,* pp.831-842).

"Given the results of our study and those of the NCI, I think the balance of the weight of evidence has definitely shifted towards a conclusion that, if there is a risk, it is undetectable through epidemiological studies," McBride told *Microwave News*. She is with the Cancer Control Research Program at the British Columbia Cancer Agency in Vancouver, Canada.

In July 1997, a National Cancer Institute (NCI) study found "little evidence" that living near power lines is linked to childhood leukemia (see *MWN,*

*(continued on p.10)*

# HIGHLIGHTS

## « Wireless Notes »

On May 24, the **BBC** showed that it was not immune to the **U.K. media**'s love affair with the cell phone health controversy. The influential and respected TV news magazine ***Panorama*** devoted an unprecedented 40 minutes of airtime to the issue in a report titled "The Mobile Mystery." The program highlighted the latest epidemiological results from Sweden's Dr. **Lennart Hardell** and from the U.S.' **Joshua Muscat** (see p.1). To drum up interest, the BBC released some of their discoveries to the newspapers, which rushed them into print the day of the broadcast. MOBILE PHONE RESEARCH ADDS TO SAFETY FEARS warned the *Times*. The *Express* took a more conspiratorial tack: MOBILE PHONE COVER-UP. The same day, the BBC Web site ran its own promo for the show under the headline FEARS RAISED OVER MOBILE PHONES, but, later in the day, that headline had morphed into MOBILE PHONE CANCER STUDY "FLAWED." The change was prompted by a statement from the National Radiological Protection Board (**NRPB**), the government's official advisory group, which argued that the Swedish study "lacks statistical precision to draw conclusions on specific aspects of phone use and tumor location"—largely because it was based on a small number of cases. On the show itself, NRPB Director Dr. **John Stather**, when pressed by *Panorama*'s Paul Kenyon, endorsed the idea that manufacturers should tell consumers about potential radiation exposures. Muscat himself did not appear on the show, but Dr. **George Carlo** of **WTR**, which funded the study, detailed Muscat's results. Kenyon also cited the research by Drs. **Henry Lai** and **N.P. Singh** showing DNA breaks following RF/MW exposures. He asked **Motorola** spokesperson **Norman Sandler** about his now-infamous "War-Gaming" memo, written in anticipation of the release of the Lai-Singh DNA results (see *MWN,* J/F97). "We have never attempted to put a corporate spin on the science," Sandler said. At the end of the program, Carlo said: "The science that we have today clearly shows that this is not black and white, that we have moved now into a gray area. That suggests that there could be a problem that needs to be looked at very, very carefully." Kenyon then returned to **Peter Harrison** of **Nokia**, who opined that mobile phones do not present a health risk: "The scientific consensus is that there is no problem," Harrison said. When Carlo was asked whether he agreed, he replied, "At this stage, that is not a responsible position to take."

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A week later, on June 2, the **BBC** reported that the **Metropolitan Police** force in **London** was advised to limit the length of mobile phone calls to five minutes due to health concerns. Staff were told that, "There would be no harm in using an earpiece." Previously, on May 30, the ***Sunday Telegraph*** printed a copy of a purchase order from the **Ministry of Defense**'s research agency for 20 mobile phone shields from **Microshield Industries** in Enfield. The protective cases attenuate microwave exposures, according to company literature. Microshield said that at least 20 more had been sold to the defense agency.

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The next major **U.K.** event will occur on June 15, when **Phil Willis**, a Member of Parliament, sponsors a briefing on mobile phone towers. The meeting, which is being organized by **Northern Ireland Families Against Telecommunication Transmitter Siting** and the **Friends of the Earth Scotland**, will be held in the House of Commons. Among the scheduled speakers are: Drs. **Gerard Hyland** of the U.K.'s University of Warwick, **Michael Kundi** of Austria's University of Vienna and Dr. **Henry Lai** of the University of Washington, Seattle, as well as Libby Kelley of the **EMR Network** and representatives from the U.K.'s **NRPB**. Willis has been critical of the U.K. goverment's tower-siting policies (see *MWN,* J/F99).

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**Motorola** pays about $100,000 a year for antenna space on the **National Cathedral** in Washington, according to *Wired* magazine (February). Motorola's Sandler confirmed that the cathedral is a cell site, but did not confirm the dollar figure.

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The **CTIA** is planning to fund more research on wireless phone health effects. In an April 26 letter to Dr. **Elizabeth Jacobson** of the **FDA**, CTIA President **Thomas Wheeler** noted that the efforts of CTIA-funded **WTR** were "nearing completion," and affirmed "the industry's commitment to fund appropriate research following up on the work of WTR." Emphasizing that U.S. research must be coordinated with international efforts, such as the **WHO EMF project**, Wheeler asked for the FDA's guidance on how to proceed. A CTIA representative had attended a meeting with the FDA in March, at which WTR briefed federal agencies on its research results (including the **Muscat** study), and Wheeler expressed hope that the FDA and the CTIA could "continue the productive industry/agency relationship we have enjoyed over the past years." At press time, a CTIA spokesperson had no comment on the FDA's response, or on whether there would be a role for WTR in any future CTIA-funded research.

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Representatives from mobile phone companies outnumbered those from electric utilities by a two-to-one margin at the **WHO International EMF Project** Research Coordination Committee meeting, held in Geneva on December 8. Of the approximately 65 attendees, some 18 were from telecom companies, including **British Telecom, Cable & Wireless, Ericsson, France Telecom, Nokia** and **Optus**. **Motorola** was best represented, with four staffers at the one-day meeting. **Jo-Anne Basile** of the **CTIA** and Dr. **Gerd Friedrich** of **FGF** were also there. Interestingly, Americans were selected for all the key positions. At the suggestion of Dr. **Michael Repacholi**, the head of the WHO EMF project, Dr. **Christopher Portier** of the NIEHS was elected chair of the committee, with Dr. **Jon Klauenberg** of the U.S. Air Force as vice-chair. Two different working groups were set up: Dr. **Jack Sahl**, a consultant formerly with Southern California Edison, and Dr. **Leeka Kheifets** of EPRI were selected as chair and rapporteur, respectively, of the Static and EMF Fields Group, while Klauenberg and Dr. **Russell Owen** of the FDA were named as chair and rapporteur of the RF Fields Group. The next meeting of the committee is scheduled for November 26 (see p.18).

# Canada Panel: Nonthermal Effects Exist and Need Study; Some Workplace Limits May Not Protect from Heating

An expert panel convened at the request of the Canadian government has concluded that radiofrequncy and microwave (RF/MW) radiation can have biological effects without causing heating. It also found that the country's current exposure standard may not always protect workers — even against thermal effects.

Last fall, the federal agency Health Canada asked the Royal Society of Canada (RSC) to examine RF/MW safety issues, with a focus on cellular phones (see *MWN,* S/O98). It also requested that the RSC evaluate Canada's RF/MW standard, known as Safety Code 6 (SC6), which Health Canada is now in the process of revising (see box at right).

"There are documented biological effects of RF fields even at low, nonthermal exposure levels, below SC6 limits," stated the RSC panel's report, which was released on May 17. It cited changes in the permeability of the blood-brain barrier, in calcium regulation and in the activity of the growth enzyme ODC.

Cellular phone users may experience some of these nonthermal effects, the RSC panel found. But it concluded that, for two reasons, SC6 should not be changed to take nonthermal bioeffects into account.

First, the panel argued, the nonthermal effects demonstrated to date have not been shown to harm human health. "There is no evidence *at this time* of a health risk," panel member Mary McBride told *Microwave News*. Second, the causes of nonthermal effects are poorly understood. "If you don't know the mechanisms for nonthermal RF effects, then you can't set a limit to avoid them," said panel member Dr. Frank Prato in an interview. "You don't know which parameters to protect from."

For thermal effects, the RSC panelists agreed that the limits presently in SC6 give good protection for whole-body exposure. Whole-body maximum SARs are 0.08 W/Kg for the general public and 0.4 W/Kg for workers.

For partial-body exposures, the panel found that SC6 may not always protect workers against heating, and called for strengthened limits for such exposures in the workplace.

SC6 currently allows workers' partial-body exposures to be as high as 8 W/Kg in the head, neck and trunk, and 20 W/Kg in the extremities — with no time limit. "For a worker, this exposure could be eight or more hours per day," said Prato. This "creates a situation where thermal effects could occur even within the limits of SC6," the panel noted, and "may in some cases lead to adverse health effects." Prato commented that, "We think this may be an issue for safety codes in other countries as well."

The report contrasted the lax time limits for workers with the strict time limits that apply when hospital patients are exposed to high RF/MW levels for diagnosis by MRI, or for anticancer therapy. For example, the report pointed out, in the U.S., patient head exposure can also reach as high as 8 W/Kg — but only for a maximum of five minutes.

In this context, the RSC panel expressed particular concern about exposure of the eye, especially given its limited ability to dissipate heat. "Because of the unique physiological characteristics of the eye," it wrote, "the panel recommends that a lower exposure limit be established." But the panel concluded that there are not enough data to set a precise limit for eye exposures, and therefore identifies research on ocular effects as a top priority. As an "interim measure," the report suggested, the general-public limit for head exposure, 1.6 W/Kg, should also be applied to eye exposure on the job.

It is unclear how widespread the effect of this interim proposal might be — whether, for example, it would apply to workers who use walkie-talkies on the job. "We thought that a real estate agent using a cell phone probably would not fall within SC6's definition of an RF worker," said panel chair Dr. Daniel

## New Canada RF/MW Standard Will Not Set Strict Eye Limit

Health Canada will not include a strict limit on eye exposures from cellular phones and walkie-talkies in its revision of Safety Code 6 (SC6). The federal health agency has abandoned a proposed eye exposure limit of 0.2 W/Kg for the general public, which it had supported as recently as last fall (see *MWN,* S/O98).

The new standard will be released this summer; officials would not comment further on what it might contain. Last year, manufacturers expressed concern that most walkie-talkies would violate the proposed eye exposure rule, though they said that virtually all cellular phones would comply.

"The latest draft of SC6 says that lower exposures are desirable, but 0.2 W/Kg is not required," said Dr. Art Thansandote of Health Canada's Radiation Protection Bureau in Ottawa. In an interview with *Microwave News,* Thansandote cited the RSC's report, which concluded that more research is needed before definite conclusions can be drawn about RF/MW ocular effects.

Thansandote noted that Health Canada is currently carrying out such research in collaboration with the Eye Institute at the University of Ottawa. "It's a study with a corneal construct, a model of the human cornea made from a cell line of the human eye," he explained. Thansandote said that work on the exposure system is almost finished, and that preliminary results should be available in about a year.

The RSC report proposes limiting workplace exposures of the eye to 1.6 W/Kg as an interim measure, but Thansandote would not comment on whether this will be included in the new SC6.

When the revised version of SC6 is published this summer, it will take effect immediately, said Jeff Pender, a spokesperson for Health Canada. "At some point after that, we'll hold consultations with stakeholders like workers, Industry Canada and so on," Pender told *Microwave News,* and those meetings could lead to "some tinkering" with the new standard if it is warranted. The revision of SC6 began in 1993.

The new version of SC6 will be available on the Web at <www.hc-sc.gc.ca/ehp/ehd/catalogue/rpb.htm>.

Krewski. "It might be that only a small number of people would be affected. But our charge was not to survey individual occupational exposures — it was to look at the limits in SC6."

The report was silent on whether a separate eye exposure limit for the general public may be desirable. Health Canada had proposed limiting eye exposures to 0.2 W/Kg for the public, but has now dropped that idea (see box on p.3).

On DNA damage, the report concluded that "most genotoxicity studies conducted to date have been negative." However, it noted that the issue was "reopened" by the work of Drs. Henry Lai and N.P. Singh: "In carefully conducted experiments they report a dose-response for DNA breakage" at nonthermal levels of exposure (see *MWN,* N/D94). The issue is unresolved, the panel stated, since other labs have failed to reproduce these results, and it called for more research.

Similarly, the RSC panel cited Dr. Michael Repacholi's finding of a doubling of lymphoma among RF-exposed mice (see *MWN,* M/J97) as "very interesting," but not as a basis for any firm conclusions until it is replicated elsewhere.

Cellular phone base stations have been a focus of public concern (see p.15). But the RSC panel wrote that since mobile phone towers expose the public only to very low field strengths, "neither biological nor adverse health effects are likely to occur."

The report concluded with a wide-ranging proposal for research on RF/MW safety, calling for "targeted research funds [to] be made available for an extended period of five to ten years." But it is unclear whether such support will be forthcoming.

Jeff Pender, a spokesperson for Health Canada in Ottawa, said that the agency does not yet have a formal response to the RSC report, nor to its proposed research agenda.

A statement from the Canadian Wireless Telecommunications Association (CWTA), a service providers' group based in Ottawa, expressed general support for the RSC panel's call for more research. But CWTA President Roger Porier said in an interview that the group has no plans to help fund any research effort. "We would certainly look at any proposal," said Porier. "But we have always been reluctant to directly fund research, because doing so is often perceived as trying to influence it."

Porier pointed out that the wireless industry already pays the Canadian government $140 million Canadian dollars (about US$95 million) a year in fees for use of the broadcast spectrum. "If the government considers research in this area to be a priority," he commented, "even 10% of that money would make a fairly substantial contribution."

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The members of the RSC Expert Panel on Radiofrequency Fields were: Dr. Craig Byus, University of California, Riverside, U.S.; Dr. Barry Glickman, University of Victoria, British Columbia; Dr. Daniel Krewski (chair), University of Ottawa, Ontario; Dr. Gregory Lotz, National Institute for Occupational Safety and Health, Cincinnati, U.S.; Dr. Rosemonde Mandeville, Biophage Inc., Montreal, Quebec; Mary McBride, University of British Columbia, Vancouver; Dr. Frank Prato, University of Western Ontario, London, Ontario; Dr. Donald Weaver, Queen's University, Kingston, Ontario.

The RSC report, *A Review of the Potential Health Risks of RF Fields from Wireless Telecommunication Devices,* is on the Web at <www.rsc.ca>. Copies may be bought for C$15.00 from: RSC, 225 Metcalfe St., Ottawa, ON K2P 1P9, Canada, (613) 991-6999, Fax: (613) 991-6996.

## New Zealand Drops "Flat" RF/MW Limit; Australia in Limbo

Standard-setting bodies in Australia and in New Zealand have abandoned their frequency-independent 200 $\mu W/cm^2$ limit for public exposures to RF/MW radiation, which was in effect in both countries since 1990. Standards New Zealand has moved to replace the "flat" standard with a new standard based on ICNIRP's less stringent exposure guidelines, while Standards Australia has allowed the flat standard to lapse without reaching consensus on a replacement.

TE/7, a committee jointly formed by Standards Australia and Standards New Zealand, was responsible for developing new rules. When a push to adopt ICNIRP-based limits failed last year, TE/7 did reaffirm the flat standard, but only as an interim measure, through March 5, 1999 (see *MWN,* M/J98).

On March 4, members of TE/7 voted 20-9 in favor of the ICNIRP-based limits — short of the 80% support needed for adoption. But on April 22, New Zealand's TE/7 members separately voted 7-1 to adopt the ICNIRP limits following some revisions, and Standards New Zealand issued them as NZS 2772.1:1999. A similar proposal failed to pass in Australia.

This spring, the Australian Communications Authority (ACA) told Standards Australia that it would continue to use the old, flat standard as the basis for its regulations, despite the fact that TE/7 had allowed it to lapse. In February, the ACA had issued new regulations that made the flat standard legally binding in Australia.

Proponents of the ICNIRP-based standard include various government agencies and radiation labs of both countries, as well as their telecommunications industries. Those opposing the standard include national labor organizations, consumers' groups, Australia's Commonwealth Scientific Industrial Research Organization (CSIRO) and Australia's National Occupational Health and Safety Commission.

In 1998, opponents of an ICNIRP-based standard included Australia's two leading wireless carriers, Telstra and Optus, which were concerned about negative public reaction to higher limits. They have both since changed their position. "Telstra believes that the ICNIRP guidelines should form the scientific basis for a revised Australian RF standard," Telstra's Jack Rowley told *Microwave News* this May.

Speaking for the Australian Mobile Telecommunications Association (AMTA), Dr. Ken Joyner of Motorola said that, "The AMTA strongly supports international harmonization of technical standards in order to reduce costs and break down nontariff barriers to trade."

The TE/7 process has been marked by controversy. According to Stewart Fist, an Australian journalist who has followed the deliberations, there has been a "long and bitter fight."

In TE/7's March ballot, those opposing the proposed standard were required to submit detailed explanations of their votes, while those favoring the proposal were not. Fist called the one-sided requirement "an interesting new trend in making democratic decisions."

After the ICNIRP-based standard failed to win adoption in

March, Standards Australia and Standards New Zealand moved to split TE/7 into two national groups to enable New Zealand to adopt the ICNIRP limits, where they faced less opposition. Dr. Ivan Beale of the University of Auckland in New Zealand, who represented the public on TE/7, objected to this strategy as a possible breach of the standards groups' bylaws.

"I am fed up with this result after ten years of attending the meetings," Beale told *Microwave News*. Beale said that he has resigned from TE/7 and has asked Dr. Neil Cherry of Lincoln University in Canterbury, New Zealand, a longtime advocate of strict exposure limits, to take his place (see *MWN,* M/A97).

The opposition Democratic Party in Australia's Senate is preparing to call for an investigation of the standard-setting process, an aide to Senator Lyn Allison told *Microwave News*.

The flat standard's exposure limits for frequencies from 10 MHz to 300 GHz were 200 $\mu W/cm^2$ for the public and 1 $mW/cm^2$ for workers. The ICNIRP exposure limit for the public is 200 $\mu W/cm^2$ from 10 MHz to 400 MHz, and increases with frequency above 400 MHz to a maximum of 1 $mW/cm^2$ at 2 GHz. ICNIRP's occupational limits are higher than those for the public by a factor of five, and are similarly frequency-dependent.

TE/7 members in both countries who oppose the ICNIRP-based standard consider the ICNIRP exposure limits to be inadequate because they do not protect against possible nonthermal health effects. "While the potential risk to human health remains unknown, it is advisable to set exposure limits as far below levels known to cause adverse biological effects as is technically, economically and socially feasible," CSIRO's Dr. John Hunter told Standards Australia. "Increases in those compliance levels are unwarranted and imprudent."

These opponents are also dissatisfied with the standard's language endorsing precautionary measures. "What we now have in the current draft standard is a 'homeopathic' dose of prudent avoidance, which has been diluted to the extent that virtually nothing is left of the original intent," Australia's Don Maisch, a consultant based in Hobart, told Standards Australia.

Daniel Dwyer of Australia's Communications, Electrical Plumbing Union told *Microwave News* that he would have considered the ICNIRP limits if the precautionary language had been stronger. But, he said, the proposed standard "was basically an ultimatum to accept ICNIRP with a 'feel-good' precautionary approach."

The precautionary language is found in the standard's foreword, which states that, in view of ongoing RF research, "Generally, it is...sensible in achieving service or process requirements to minimize unnecessary or incidental RF exposure."

The flat standard was initially adopted in Australia in 1985 (see *MWN,* M/A86) and renewed in 1990, when it was also adopted in New Zealand (see *MWN,* J/F90). It originally included an endorsement of the "ALARA" principle — that exposures be kept "as low as reasonably achievable" — but TE/7 deleted that wording in 1998, substituting milder language calling for prudent avoidance.

The vote that allowed Standards New Zealand to adopt the ICNIRP limits was cast by Roger Matthews of the City of Auckland, who represents local government. Matthews voted against the proposal in March of this year, but in April he changed sides following revisions that he believes tighten the standard's compliance rules and allow local officials to adopt precautionary measures. Although he admits that he is "not happy with the ICNIRP high frequency numbers," Matthews told *Microwave News* that he stands by his decision: "We now have a standard that we can actually enforce in court if need be."

## IEEE Adopts Some Changes in Standard for RF/MW Exposure

On April 16, the Institute of Electrical and Electronics Engineers (IEEE) published a revised version of its exposure standard for fields of 3 kHz to 300 GHz — a key standard for RF/MW radiation.

IEEE C95.1-1999 reflects changes proposed by the IEEE's Standards Coordinating Committee 28 (SCC-28) on Non-Ionizing Radiation Hazards last September, and approved by the IEEE Standards Board at the end of 1998.

"The full revision of the 1991 standard will take a few more years, but there were some changes that the committee felt should be included now," Ron Petersen, the secretary of SCC-28, told *Microwave News*. The changes affect limits on induced and grasping-contact currents, definitions of radiated power and spatial averaging and some measurement distances. The last major changes were adopted by the IEEE in 1991 (see *MWN,* N/D91), and the standard was reaffirmed in 1997 (see *MWN,* J/A97).

"The induced current limits were relaxed," said Petersen, who is with Lucent Technologies in Murray Hill, NJ. "But now they also have a ceiling, so they can't increase without bound anymore."

Induced currents no longer have to be measured if electric field strength is below certain values. In addition, for the 100 kHz to 100 MHz frequency band, the induced current limit was changed from a simple average over one second to the root-mean-square over any six-minute interval. "For frequencies above 100 kHz, where specific absorption rates are important, it needed to be changed," Petersen said. For these higher frequencies, the six-minute average is supplemented by a 500 mA ceiling on peak exposures. Similar changes were made to the limits on grasping-contact currents.

For hand-held mobile phones, the term "radiated power" is now explicitly defined as "the power radiated into free space in the absence of any nearby objects." (For cellular phones in the U.S., for instance, the FCC limits radiated power to a maximum of 0.6 W.) "When we polled the committee, we found we had ten different definitions among ourselves," Petersen explained. "Everything from antenna input power, to the power radiated by the antenna with the head present, without the head present and so on. I was really surprised — I always thought I knew what 'radiated power' was."

The standard formerly stated that measurements to check compliance must be made at a distance of at least 20 cm from an RF source. "The new standard says that for directly radiating devices you can take measurements no closer than 5 cm, and for objects that cause reflecting and scattering, no closer than 20 cm,"

said Petersen.

Dr. John Osepchuk, chair of SCC-28, said in an interview that the American National Standards Institute is likely to adopt the new IEEE standard sometime later this year.

"There are still some mistakes in it," Petersen remarked. "For instance, in the induced current limits for the general public, the averaging time should have been changed to 30 minutes, but it stayed 6 minutes and nobody caught it."

The changes were drawn up by SCC-28's Subcommittee IV, whose cochairs are Drs. C.K. Chou of Motorola in Plantation, FL, and John D'Andrea of the Naval Medical Research Institute at Brooks Air Force Base in San Antonio. Petersen is the secretary of both the subcommittee and the full SCC-28. Osepchuk, formerly of Raytheon, is now a consultant based in Concord, MA; SCC-28's vice-chair is Dr. Eleanor Adair of Brooks Air Force Base.

## Two Studies Link Mobile Phone Use and Brain Cancer *(continued from p.1)*

caution." Hardell told *Microwave News*.

"I did a similar analysis, looking at where the tumor occurred," Joshua Muscat of the American Health Foundation in New York City said in an interview. "There was a correlation between the hand that holds the phone and tumor laterality — the side of the brain where the tumor occurs." But Muscat stressed that there were "inconsistencies" in the data from his study, and that his analysis was not yet complete.

Until more is known, Sweden's Hardell is recommending that mobile phone users practice "prudent avoidance" by taking steps to reduce their exposure (see p.7). "Use a hands-free earphone," he said. "I always do."

In normal use, the typical mobile phone antenna is positioned just behind the ear; the areas of the brain closest to that spot are the temporal and occipital lobes. Hardell found that cellular phone users were two-and-a-half times more likely to develop tumors in these lobes on the side of the head where the phone was normally held. This was true for both right- and left-side phone users. Hardell found no increased risk for the frontal or parietal lobes, which are farther from the phone's antenna.

Since cellular phone radiation does not penetrate very far into the head, Hardell explained, tumor location may well be a more sensitive indicator of a small increase in risk than the incidence of cancer in the brain as a whole. "Based on our experience, it is necessary to have anatomical tumor localization" to study this issue effectively, he said.

Muscat gave qualified support to this idea: "It could be that you have a very localized exposure, and anything beyond a small area is irrelevant."

On the other hand, Muscat said, it is far from clear that mobile phone radiation is the cause of any of the associations observed in his study. Though his analysis is still unfinished, Muscat said, he found that tumor location also appears to be linked with the side of the head to which a traditional wired phone is held. "The correlation is uneven," said Muscat, but it raises the possibility that the link may be to handedness rather than to the use of mobile phones *per se*.

In the Hardell study, the overall odds of brain cancer were about the same whether or not people had used a cellular phone. How can this finding be reconciled with an increased risk of a tumor near to where the phone is held? Hardell said that the results on tumor location might be due to chance. Alternatively, he said, there may be an increase in overall brain cancer risk, but one that is too small to be detected easily in a study with such a large margin of error. (None of the Swedish risks were statistically significant.)

The Swedish findings on tumor location were due almost entirely to data from people who had used analog NMT (Nordic Mobile Telephone) phones. "There are two ways you can discuss this," said Hardell. "It might be because the analog phones produce higher exposure" — three times higher than do digital GSM phones, according to Hardell. "Or it might be because we don't have enough people or long enough exposures for the digital phones." Hardell's paper states that "few subjects had used the [digital] GSM system, and [for them] the tumor induction period is still short since the digital system was introduced in the

### The Hardell Study

The study by Dr. Lennart Hardell found that:

- The overall chance of developing brain cancer among mobile phone users, as compared to nonusers, was essentially the same (odds ratio = 0.98, with a confidence interval (CI) of 0.66-1.41).
- Cellular phone users who held the phone on the right side were 2.45 times more likely to develop a tumor in the temporal or occipital lobes on the right side of the brain (CI=0.78-7.76). For left-side phone users, such tumors were 2.40 times more likely to occur on the left side (CI=0.52-10.9).
- Mobile phone users showed no increase in the risk of acoustic neurinoma, a benign tumor of a nerve that leads from the brain to the inner ear.

Hardell's study was based on 209 cases, diagnosed in the areas around Uppsala (1994-96) and Stockholm (1995-96), and 425 controls.

### The Muscat Study

The study by Joshua Muscat found that mobile phone users had:

- No overall increase in brain cancer.
- A higher risk of developing a tumor on the side of the cerebellum on which they held the phone. But such a risk was also found for users of traditional wired phones.
- A statistically significant two- to threefold increase in the risk of neuroepithelial tumors. There was no dose-response relationship, however: In fact, the highest risk was among people who spent less time on the phone.

Muscat's research was based on 466 brain cancer cases and 420 controls. Work on the study, which was funded by WTR, began in 1996.

## Advice from Dr. Hardell

"Until this problem is solved, I think it's necessary to be somewhat cautious and reduce exposure," said Dr. Lennart Hardell, following the release of his findings on cellular phones and brain cancer.

In an interview with *Microwave News,* Hardell offered three pieces of advice for users of mobile phones:

• "Use a hands-free device." Using an earphone increases the distance between the phone's antenna and the user; Hardell said that doing so will reduce exposure by about 95%.

• Buy a low-radiation phone. "Ask about the specific absorption rate (SAR) when purchasing a mobile phone," said Hardell, "and buy one with as low an SAR value as possible."

• "Restrict use by children and young adults." Young people have been shown to be more sensitive to ionizing radiation and chemical carcinogens. We do not know whether cellular phones have any effect on growing bodies, noted Hardell, but he thinks it is best to err on the side of caution.

"I think these three points fit well under the idea of prudent avoidance," Hardell explained. "We have the technological ability to reduce exposure — so why not use it?"

Dr. Kjell Hansson Mild, a coauthor of Hardell's brain cancer study, gave qualified support to use of a hands-free device: "If I were to use a mobile phone regularly for an hour or more a day, I would definitely get an earpiece," he told *Microwave News*. "But I do not think that temporary use is of too much interest."

early 1990s."

Hardell's recently completed study included 209 people with brain cancer. His team is now working on a larger study, which will include 1,500 cases and an equal number of controls (see *MWN,* N/D97). "In our first study, the cases came from 1994 through 1996," he said. "The new one will have data from 1997 through 1999, and from two additional geographic areas in Sweden — which adds up to most of the country." Dr. Kjell Hansson Mild of the National Institute for Working Life in Umeå, a coauthor of the smaller Hardell study, said that they hope to present results from the new research at the annual meeting of the Bioelectromagnetics Society (BEMS) in 2000.

Muscat commented that, "Fifteen hundred cases will be a very large study," and will represent a major step forward in statistical power. "Even if you start dividing up the numbers by different lobes and so on," he explained, "that's big enough that if there's a real effect, you might expect to find it."

Also under way is a multicountry study by the International Agency for Research on Cancer, based in Lyon, France, for which Hardell is the main collaborator in Sweden (see *MWN,* J/F98 and S/O98). Results are expected in 2003 or 2004. A brain cancer study by the U.S. National Cancer Institute in Rockville, MD, which is examining a number of possible risk factors, will not be completed until next year, the institute's Dr. Peter Inskip told *Microwave News* (see *MWN,* J/F93 and N/D97). Another U.S. study, by Epidemiology Resources Inc. (ERI) in Newton Lower Falls, MA, has been on hold for a combination of financial and legal reasons (see *MWN,* M/J96 and N/D97).

A May 24 press release from Wireless Technology Research (WTR), an industry-funded group that is sponsoring both the Muscat and the ERI studies (see *MWN,* J/A96 and M/A99), stated that Muscat had found "a statistically significant risk of a rare tumor called a neurocytoma" among cellular phone users as a whole.

In fact, Muscat told *Microwave News,* the significant increase was not in neurocytomas but rather in neuroepithelial tumors — a broader class of which neurocytomas are one type. He said that cellular phone users had a two- to threefold greater risk of neuroepithelial tumors than did nonusers.

Muscat said he was "not inclined to emphasize" the increase in neuroepithelial tumors, for several reasons. "When you start chopping up the data and doing multiple comparisons," he explained, "you increase the odds of a chance finding." Also, he noted, neuroepithelial tumors are a rare form of brain cancer, and his study included an unusually large number: "The number is considerably out of the ordinary, which indicates that there's some ambiguity in the classification of these tumors."

As for the media focus on the fact of a statistically significant increase, Muscat commented that, "This is an isolated finding that's being taken out of context."

"I told WTR that these data were to be kept strictly confidential," Muscat said.

The May 22 *Washington Post* indicated that Muscat had found an association between cell phone use and tumor location for right-handed — but not left-handed — cellular phone users. Muscat told *Microwave News* that while this was an accurate description of his data, it is "not appropriate" to separate the two sides this way, in terms of statistical analysis.

Muscat hopes to submit his study for publication by the end of the summer. He is scheduled to present preliminary results in mid-June at a WTR symposium prior to this year's BEMS meeting in Long Beach, CA.

"Hopefully, when this study and Hardell's are both published," he said, "people will be able look at all the data and make some comparisons." If the results are inconsistent, he added, it would be important to look at differences in types of phone or patterns of use.

## Danish Epi Study Under Way

An epidemiological study of cancer among cellular phone users is now under way in Denmark. It is based on annual use of mobile phones by 550,000 Danish cellular phone subscribers from 1982 through 1995.

"We are ready to begin risk calculations," Dr. Christoffer Johansen of the Danish Cancer Society (DCS) in Copenhagen told *Microwave News*. Partial funding for the study has been obtained from two of the main wireless phone companies in Denmark, TeleDanmark Mobil and Sonofon, as well as from the DCS.

While more funding must be secured before the study can be completed, Johansen is optimistic. He hopes to submit a paper for publication before the end of the summer. The study design is described in a paper in *Radiation Protection Dosimetry (83,* pp.155-157, 1999).

# NAS–NRC Panel Criticizes RAPID Program; Sees No Need for New EMF Health Research Effort

There is no need to fund an EMF health effects research program, according to a National Academy of Sciences-National Research Council (NAS–NRC) committee that reviewed studies conducted under the EMF Research and Public Information Dissemination (RAPID) program. An NAS–NRC report released in May discounted reported EMF bioeffects on the grounds that they have not been replicated.

All replications attempted in the RAPID program had either negative or equivocal results, the committee concluded. It called this lack of confirmation "an important contribution," which has "reduced the credibility of many of the claims of biologic effects of power frequency magnetic fields."

The report also discounted RAPID studies that reported new EMF bioeffects, arguing that unreplicated findings "have little value in answering the basic question of whether there are biologic effects of low-level power frequency magnetic fields." In RAPID's *in vitro* studies, it contended, "the few reported effects were small and their connection to disease processes are speculative at best and irrelevant at worst."

(Dr. Robert Liburdy's work showing that EMFs can block the anticancer action of melatonin, which has been successfully repeated three times since 1992 (see *MWN*, J/A98), is acknowledged in a footnote, with the comment that none of the replications of Liburdy's work have yet been published.)

The RAPID research program, established by Congress in 1992, was intended "to determine whether or not exposure to electric and magnetic fields...affects human health." Congress directed the NAS to "evaluate the research activities under the program," while the National Institute of Environmental Health Sciences (NIEHS) was directed to give Congress an overall report on the program. The latter report is expected to be released in June.

Since the health effects observed in epidemiological studies "range from none to weak," the NAS–NRC panel argued, they cannot be accepted without "evidence that supports the biologic plausibility of such an association."

It acknowledged, however, that:

> People evaluating epidemiologic findings in this field can arrive at different conclusions, depending on their starting viewpoints. Those concerned about protecting public health might lean towards acceptance of a possible association between magnetic fields and cancer risk, whereas others might reject such an association based on the lack of a plausible mechanism and the inability to identify possible confounders.

The NAS–NRC committee was critical of the NIEHS Working Group on EMF health effects, which decided last June that power frequency EMFs should be regarded as a "possible human carcinogen" — based mainly on the epidemiological evidence. According to the NAS–NRC panel, the Working Group's statement "conveys to the public a conclusion that our committee believes is not supported by the underlying research."

The committee conceded that the Working Group's reading of the evidence was "not greatly dissimilar" from that of the NAS-NRC's own committee on EMF health effects in 1997, though it was "differently worded." But the report argued that the NAS–NRC's 1997 formulation — that there was "no conclusive and consistent evidence" for EMF health risks — "more accurately convey[s] the health implications of the underlying research to the public." It blamed the discrepancy mainly on the Working Group's use of the criteria developed by the International Agency for Research on Cancer, which the NAS–NRC panel considered inappropriate for EMFs.

The one member of the NAS–NRC panel who also served on the Working Group, Dr. Walter Rogers, was the only member of the Working Group to vote that the evidence actually showed that EMFs "lack" carcinogenic properties (see *MWN*, J/A98).

The NAS–NRC committee stated that it was "difficult to judge the quality, completeness or significance of the biologic studies funded by the EMF RAPID program" because many of

## NAS–NRC Recommendations on EMF Health Research

*These are the recommendations of the NAS–NRC committee reviewing research conducted under the RAPID program:*

1) The committee recommends that no further special research program focused on possible health effects of power frequency magnetic fields be funded. Basic research on the effects of power frequency magnetic fields on cells and animals should continue but investigators should compete for funding through traditional research funding mechanisms.

2) If, however, Congress determines that another time-limited, focused research program on the health effects of power frequency magnetic fields is warranted, the committee recommends that emphasis be placed on replications of studies that have yielded scientifically promising claims of effects and that have been reported in peer-reviewed journals. Such a program would benefit from the use of a contract-funding mechanism with a requirement for complete reports and/or peer-reviewed publications at program's end.

3) The engineering studies were initiated without the guidance of a clearly established biologic effect. The committee recommends that no further engineering studies be funded unless a biologic effect that can be used to plan the engineering studies has been determined.

4) Much of the information from the EMF RAPID biology program has not been published in peer-reviewed journals. NIEHS should collect all future peer-reviewed information resulting from the EMF RAPID biology projects and publish a summary report of such information periodically on the NIEHS Web site.

5) The communication effort initiated by EMF RAPID is reasonable....There are two limitations to the effort. First, it is largely passive, responding to inquiries and providing information, rather than being active. Second, much of the information produced is in a scientific format not readily understandable by the public. The committee recommends that further material...be written for the general public in a clear fashion....

the results had not yet been published. "Some papers reported to be submitted or in preparation have not appeared," it noted, "raising concerns about the reproducibility or quality of their data." Project summaries provided to the committee were said to be "of uneven quality," with most not giving complete results.

Some observers were surprised that the NAS–NRC issued its report when the NIEHS had yet to submit its own report to Congress. "I am absolutely stunned," Dr. Michael Marron of the Office of Naval Research in Washington told *Microwave News*. "I had been told that the academy could not possibly issue its report so quickly." Marron heads the federal interagency group on EMF health effects research, which is to release its own report on the RAPID program later this year.

"Every report by the academy — including this one — goes through a formal review process," said Dr. Rick Jostes of the NRC, study director for the report. Far from being premature, he said, the release of the report did not occur until months after a December 31, 1998, deadline.

The NAS–NRC report had few positive comments about the RAPID engineering studies. "Many of the engineering studies were of little use," the committee stated. It complained that:

> The projects were commissioned without any convincing evidence of specific linkages between low-level magnetic field exposure and human health effects. As a result...they anticipate all possible field parameters of potential relevance, without good reason to focus on any specific one.

Of the 11 engineering studies conducted under RAPID, "only two are regarded as noteworthy," according to the panel: the Enertech 1,000-person exposure study and an Illinois Institute of Technology study of field-reduction technologies. Overall, the panel felt that the engineering studies were of "questionable" value.

One significant conclusion from the engineering studies, according to the panel, was that most people's EMF exposures at home or at work are "remarkably similar." The panel stated that most people are exposed to 1-2 mG, and "very few" to more than 4 mG. (See also p.19.)

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The members of the NAS–NRC panel were: Drs. John Ahearne (chair), Duke University, Durham, NC; Edwin Carstensen, emeritus, University of Rochester, NY; Raymond Erikson, Harvard University, Cambridge, MA; Maurice Fox, emeritus, MIT, Cambridge, MA; James Hoburg, Carnegie Mellon University, Pittsburgh; Walter Rogers, University of Texas Health Sciences Center, San Antonio; Jan Stolwijk, Yale University, New Haven, CT; and Thomas Tenforde, Battelle Pacific Northwest Laboratories, Richland, WA.

The NAS–NRC panel expressed its thanks to several people, "chosen for their diverse perspectives," who reviewed and commented on a draft of the report. The reviewers were: Drs. Robert Adair, Yale University; Leeka Kheifets, EPRI, Palo Alto, CA; Ross MacDonald, emeritus, University of North Carolina, Chapel Hill; John Moulder, Medical College of Wisconsin, Milwaukee; Richard Saunders, NRPB, U.K.; Herman Schwan, emeritus, University of Pennsylvania, Philadelphia; and Charles Stevens, Salk Institute, La Jolla, CA.

The panel's report, *Research on Power Frequency Fields Completed Under the Energy Policy Act of 1992,* is available on the Internet, and a hard copy can be purchased, at <books.nap.edu/catalog/9587.html>. It can also be ordered for $26.75, plus shipping, from: (800) 624-6242.

## EMFs Protect Chick Embryos Against Cardiac Stress

Weak power frequency EMFs can help chick embryos survive severe cardiac stress, according to Drs. Theodore Litovitz and Andrea DiCarlo of the Catholic University of America in Washington. They attribute the protective effect to the increased production of heat shock proteins in response to EMF exposure.

"There's nothing subtle about the experiment," Litovitz explained. "At the end, the embryos are either alive or dead."

The starting point for the studies was Dr. Reba Goodman's research showing that low-level EMFs can activate gene expression of heat shock proteins in human HL60 cells. Despite their name, heat shock proteins are formed not only in response to heat, but also as a defense against a variety of other stresses. They are known to minimize the damage to cardiac tissue caused by oxygen deprivation and reoxygenation, both of which can be lethal. Litovitz and DiCarlo believe that magnetic fields can prepare chick embryos for such stress.

Litovitz and DiCarlo exposed chick embryos for 20 minutes to 60 Hz EMFs ranging from 40 mG to 100 mG. One hour after the EMF treatment, the exposed eggs and the unexposed controls were placed in sealed containers and deprived of oxygen until at least 60% of the controls' hearts had stopped beating. At this point, the containers were opened, allowing oxygen levels to return to normal.

Writing in the February 16 issue of *Circulation (99,* pp.813-816, 1999), Litovitz and DiCarlo reported that 68.7% of 506 exposed embryos had a heartbeat 30 minutes after reoxygenation, compared to 39.6% of the controls — a highly significant difference ($p<0.0001$).

These new chick embryo results "confirm our cellular studies and extend them to an animal model," Goodman, who is at Columbia University in New York City, said in an interview. "In each case, there are changes in transcription and translation caused by relatively weak magnetic fields."

Interestingly, Litovitz and DiCarlo found that a minor change in the strain of hens was a key variable. In a paper recently published in *Bioelectrochemistry and Bioenergetics (48,* pp.209-215, 1999), they document different results with embryos from two flocks of the same breed of hens.

While embryos from the first flock showed a response after a 20-minute, 80 mG exposure, those from the second flock did not. Litovitz and DiCarlo failed to see a protective effect in these embryos until they extended the exposure to at least 60 minutes.

Litovitz and DiCarlo believe that such genetic variations may explain the inconsistent biological responses seen in EMF experiments. In the "henhouse project," for example, one of six participating labs could not reproduce an experiment by Spain's Dr. Jocelyn Leal in which very weak pulsed magnetic fields impaired the development of chick embryos. That lab used eggs from a different breed of hens (see *MWN,* Mr83 and M/A88).

"In other areas of biology, genetic factors are well known to affect experimental results," DiCarlo told *Microwave News*. But, she added, "When researchers can't replicate an EMF biological effect, people tend to assume that the effect doesn't exist."

J/A97). A number of prior studies had shown such an association, leading a panel at the National Academy of Sciences (NAS) to conclude that children living near high-current power lines did appear to have higher-than-expected rates of leukemia. The NAS panel doubted, however, that EMF exposure was to blame (see *MWN,* N/D96).

"This study is good enough to add evidence against there being a substantial association," Dr. David Savitz, chair of the Department of Epidemiology at the University of North Carolina School of Public Health in Chapel Hill, said in an interview. In the 1980s, Savitz reported increased cancer among children living near high-current power lines (see *MWN,* N/D86).

McBride's study was based on 399 children in five Canadian provinces, who were diagnosed with leukemia at up to 14 years of age between 1990 and 1995. In addition, McBride's team selected 399 matched controls. EMF exposures were estimated with personal measurements over a 48-hour period and with 24-hour EMF measurements in each child's bedroom, both taken with a Positron meter. In addition, the researchers noted local power line characteristics and magnetic field measurements at the perimeter and the front door of both the mother's residence in the year prior to the child's birth and the child's residence from birth to the date of diagnosis, all using an EMDEX-C magnetic field meter. Power line characteristics were classified according to both the wire-coding scheme first devised by Dr. Nancy Wertheimer and Ed Leeper for their landmark 1979 study and the modified scheme developed by Savitz and Dr. William Kaune.

For measured magnetic fields and for high-current wire codes, there were no elevated leukemia risks. For all leukemia and for acute lymphatic leukemia (ALL) alone, the adjusted odds ratios (OR) for personal magnetic field exposures were 0.95 and 0.93, respectively.

"There were no clear associations with predicted magnetic field exposure two years before the diagnosis/reference date or over the subject's lifetime or with personal electric field exposure," McBride wrote in the *AJE*.

The study was the first to ask children to wear an EMF dosimeter for two days. "By looking at personal exposures, we addressed some of the limitations of previous studies," McBride said. She also highlighted the short time between the identification of cases and the measurements.

### *Key Error in* AJE *Paper and Abstract*

One of the few elevated risks reported in the McBride paper turns out to have been an error. In the abstract, published in the *AJE,* the McBride team highlighted an OR of 1.72 for ALL among those children who lived in houses with very high-current wiring configurations two years prior to diagnosis compared to those who lived next to underground wiring. This OR was actually 0.84 (see table, p.11). The error was due to a mistabulation of several columns of numbers, according to McBride.

Most of the children were exposed to EMFs of less than 2 mG (0.2 μT) based on a time-weighted average: Of the 293 children for whom 48-hour personal exposure data were available, 54 were exposed to 2 mG or more. The adjusted OR for these exposures was 1.12, with a confidence interval (CI) of 0.69-1.80, relative to exposures of less than 2 mG. McBride did not calculate risks for those exposed to more than 3 mG.

Only eight children and six controls were exposed to 5 mG or more. This group had an unadjusted elevated risk of 1.48 with a CI of 0.49-4.42 — but after adjustment for the age at which each mother gave birth, maternal education, household income and the child's ethnicity and number of residences, the OR went down to 0.89 (CI: 0.24-3.36).

"The study tells you that kids are not highly exposed. This is reassuring," Dr. Richard Gallagher, a coauthor and the chief cancer epidemiologist at the BC agency, told *Microwave News*.

Gallagher, who was the initial principal investigator on the McBride study, noted that little could yet be said about the cancer risk for exposures over 5 mG: "No study to date has had the statistical power to examine the high-exposure group," he said. "My feeling is that we have not yet demonstrated that there is a risk at high exposures, but we cannot rule it out."

In an interview from her home in Boulder, CO, Dr. Nancy Wertheimer also stressed the importance of looking at the children who are most-highly exposed. "The McBride study has unusual and potentially serious exposure assessment problems, particularly for the highest exposure groups," she said.

## *Japan Set To Begin Childhood Cancer Epi Study*

The Japanese government has approved funds for a three-year epidemiological study of power line EMFs and childhood cancer. The effort will be the first of its kind in Japan.

The Environment Agency's National Institute for Environmental Studies (NIES) in Ibaraki will lead the study, with the institute's Dr. Michinori Kabuto as the principal investigator. Kabuto has been assessing the feasibility of such a large-scale study for over a year (see *MWN,* M/J98).

The institute aims to go beyond measuring power frequency exposures. "The study will evaluate the relationship between children's cancers...and EMF exposures that previous studies have neglected to examine, such as high-level exposures, harmonics and transients," according to the NIES.

Dr. Anders Ahlbom of the Karolinska Institute in Stockholm, Sweden, who is advising the NIES on the study, told *Microwave News* that the study's importance will be enhanced by its large number of highly exposed subjects.

The study will include as many as 1,000 children with leukemia and 500 with brain cancer, with each case matched to three controls, the *Mainichi Shinbun,* a leading newspaper, reported on April 20. The institute has not yet released details of the project's expected cost.

Researchers at the NIES and at Tokushima University will be responsible for the EMF exposure assessment, as well as for the evaluation of other possible risk factors, including air pollution, radon and medical radiation exposures.

The study will be part of a national research effort on the potential health effects of non-ionizing radiation that was launched last year in response to growing public concerns (see *MWN,* M/J98).

The NIES said that it plans to exchange information with the World Health Organization's International EMF Project in Geneva as the study proceeds.

The one remaining elevated risk found by McBride was that for children living near high voltage power lines. The adjusted ORs for those whose homes were within 50 meters of a transmission line of at least 50 kV were 1.31 and 1.65 for all types of leukemia and for ALL, respectively. For children living within 100 meters, the ORs were 1.81 for all leukemias and 1.99 for ALL. These results were not statistically significant and had large CIs — due to the small number of cases. There were seven cases and four controls within 50 meters and 14 cases and seven controls within 100 meters of power lines of at least 50 kV.

McBride pointed out that the cancer risk was higher at distances greater than 50 meters from a power line. But one of her coauthors, Dr. Gilles Thériault, was not swayed by this apparent inconsistency. "When you have so few cases, you expect variation," he told *Microwave News*. "You cannot put much weight on this lack of dose-response." Thériault is the chair of the Department of Epidemiology, Biostatistics and Occupational Health at McGill University's medical school in Montreal.

"A review of the literature shows that those living in houses that were next to high voltage transmission lines have a fairly constant risk," Thériault said. "We keep observing this anomaly."

One of the most important studies to show a link between living near transmission lines and cancer among children is the Swedish, Feychting-Ahlbom study (see *MWN*, S/O92). But Gallagher commented that he prefers his and the NCI's strategy of investigating the myriad possible causes of cancer. "We want to know what is causing childhood leukemia, while the European studies are only looking at EMFs."

In addition to measuring electric and magnetic fields, the Positron dosimeter also captures high frequency transients (see *MWN*, M/A94 and N/D94). The McBride paper did not detail any results based on transient exposures. "We have taken an initial look at the transient data and we plan to publish them," she said. "But there does not seem to be much exposure."

Initial funding for the study came from the Canadian government, through the federal agency Health Canada. Later, the Canadian Electricity Association (CEA) paid for half of the study's total cost, and half of the CEA share was paid by the U.S.' EPRI. "We sent a report to our sponsors a year ago," McBride said.

Two additional papers have been prepared. The first, which addresses exposure variability in the personal measurements, will appear in the June 1999 issue of the *Scandinavian Journal of Work, Environment & Health*. The lead author is Dr. Jan Deadman of McGill University. The second, which is in review at the same journal, looks at the use of statistical modeling to predict lifetime exposures. The lead author of this paper is Dr. Ben Armstrong of the London School of Hygiene and Tropical Medicine in the U.K.

## Multinational Meta-Analysis on Childhood Leukemia Due Next Year

The McBride childhood leukemia data are included in a meta-analysis being carried out by Drs. Anders Ahlbom and Maria Feychting of the Karolinska Institute in Stockholm in collaboration with an international group of researchers.

The meta-analysis combines epidemiological studies from nine countries — Canada, Denmark, Finland, Germany, New Zealand, Norway, Sweden, the U.K. and the U.S. — Ahlbom told *Microwave News*. He said that it should be completed by January 31, 2000.

The National Cancer Institute study headed by Dr. Martha Linet is the single U.S. study to be part of the multinational meta-analysis, which is being funded under a contract from the European Community (see *MWN*, J/F96).

In a separate meta-analysis of 15 EMF–childhood leukemia studies, published at the end of 1998, Dr. Daniel Wartenberg of the Environmental and Occupational Health Sciences Institute in Piscataway, NJ, found "relatively strong and consistent support for a somewhat weak elevated risk" (see *MWN*, J/F99).

At the request of *Microwave News*, Wartenberg added the McBride data and recomputed the risks. He found only small changes. The odds ratio for wire code risks went down approximately 10%, he said, while there was no change in the risk associated with spot measurements. For calculated fields, the odds ratio decreased but the association became statistically significant because of the larger number of cases.

"Unless we get an additional study with either extremely different results or an extremely large sample size, we are unlikely to see a substantial change in the average effect," Wartenberg said.

## Revised Table 6 in McBride AJE Paper

The revised data presented below were provided to *Microwave News* by Mary McBride. The errors in Table 6 of the published paper (*AJE*, p.839) were first pointed out by Dr. Nancy Wertheimer. McBride will be publishing a correction in the *AJE*.

| Wire configuration code of residence two years before diagnosis/reference | Cases | Controls | Odds Ratio | 95% Confidence Interval | Adjusted Odds Ratio* | 95% Confidence Interval |
|---|---|---|---|---|---|---|
| Underground | 59 | 44 | 1.00 | | | |
| Very low current | 57 | 69 | 0.61 | (0.35-1.08) | 0.59 | (0.31-1.09) |
| Ordinary low current | 60 | 60 | 0.75 | (0.42-1.34) | 0.72 | (0.38-1.35) |
| Ordinary high current | 74 | 83 | 0.66 | (0.38-1.17) | 0.69 | (0.37-1.28) |
| Very high current | 24 | 22 | 0.84 | (0.40-1.75) | 0.70 | (0.31-1.56) |

*Adjusted for maternal age at birth of subject, maternal education, household income, ethnicity and number of residences of subject since birth.

*Letters to the Editor*

## Carlo Defends WTR's Record

May 15, 1999

To the Editor:

Enough is enough!

Your pattern of libelous and uninformed commentary, "reporting" and editorializing on the activities of Wireless Technology Research (WTR) over the past six years has reached a new level of absurdity with your most recent attack (see *MWN*, M/A99). While I personally have refrained from dignifying your ad hominem attacks on me with any response, I am compelled to set the record straight as you have now attempted to impugn the reputations of my colleagues Drs. Don McRee and Graham Hook, Joshua Muscat, the American Health Foundation and Integrated Laboratory Systems (ILS).

First, the letter you published from Drs. Lai and Singh in your latest issue is a mesh of innuendo, half-truths and outright lies about WTR, Drs. McRee and Hook, and ILS. That you should publish such a long letter without first allowing those who are mentioned in it a chance to respond takes the letter out of the realm of "letter to the editor" and into the realm of reporting. Further, the reporting over the years in your own newsletter substantiates that you knew or should have known of the inaccuracies before you published it. What is your motive?

Second, your position that I would "dangle" positive results in front of your reporter to induce "a major story" to help secure follow-up funding for WTR is preposterous on its face and self-aggrandizing on your part. In your May/June 1997 issue, you reported that the WTR program would end in the middle of 1999 and that I had been asked by the industry and agreed to stay on until that time. You knew in 1997 that my tenure at WTR would be up this year and that the future of WTR was in the hands of the industry, not mine. Nothing has changed, so why report otherwise?

Third, your implication that the evidence of "genetic damage has been around for a long time, and WTR never seemed too worried before" betrays the fact that no one anywhere in the world has been able to substantiate the peculiar findings of Lai and Singh regarding genetic damage from RF, although many scientists have tried, including Lai and Singh themselves. That your bias in reporting shows through is no surprise, but your pattern of frivolously playing with the emotions and concerns of millions of consumers who use cellular phones borders [on the] criminal.

Fourth, your attempt to create a controversy regarding the interpretation of the Muscat study to support your thesis that WTR is "crying wolf" is ridiculous. When the peer-review process is completed and the study is made public, those data will speak for themselves. Joshua Muscat and I are not in disagreement about the findings, as will be abundantly clear.

Fifth, your assertion that the credibility of WTR rests with funding disclosures to you is outright arrogance. Since its inception, WTR has been subjected to the most rigorous of annual audit procedures, mandated by the industry, implemented by top accounting firms and reported to the industry by an independent audit committee. Furthermore, in your newsletter you have published WTR research expenditure information every year since 1995, and in significant detail. You have repeatedly refused to come to WTR and review our material and learn about our program. Your "reporting" with respect to WTR is therefore uninformed and just plain wrong.

Overall, your treatment of the very important public issue of the potential health impact of wireless technology amounts to theater masquerading as journalism. You have attempted to propagate this controversy in the same manner you have propagated the controversy regarding power lines — all presumably to sell newsletters and to promote yourself as a television news personality.

You have continuously overlooked the important contributions of both WTR and the wireless industry. You have derogated the wireless industry, who, in an unprecedented manner for business, has voluntarily and publicly assumed the responsibility for health impacts from their products and services. The mechanism they chose, including surveillance and research through WTR, was developed in concert with the Food and Drug Administration, the government's Interagency Working Group on RF and the reasoned recommendations of a congressionally mandated report by the General Accounting Office. This is a model that should be emulated.

The process has worked, the necessary science continues to unfold and the public continues to be protected. That should be your bottom line.

George Carlo, PhD, MS, JD
Chair, Wireless Technology Research
1711 N Street, NW, Suite 400
Washington, DC 20036

### Carlo Accuses Lai and Singh of Libel

In a May 14 letter to Dr. Richard McCormick, the president of the University of Washington, Seattle, WTR's Carlo called the Lai-Singh letter to *Microwave News* "libelous." Carlo charged that the two university researchers engaged in "a pattern of slanderous conduct" over the past several years.

In his four-page letter, Carlo disputed the factual accuracy of Lai and Singh's account of their dealings with WTR, and requested a meeting with McCormick "to discuss this very serious problem" in order "to resolve this outside of the courts." Carlo has circulated this letter widely to the press.

An assistant to McCormick told *Microwave News* in early June that a "formal review" is under way and that no meeting has yet been scheduled.

## Chou Issues Clarification

May 27, 1999

To the Editor:

I would like to clarify the statements made in the Lai and Singh letter concerning my involvement with the WTR-sponsored DNA study (see *MWN*, M/A99).

1) Before I left the City of Hope, which was after my three-year WTR contract expired on April 16, 1998, I made all necessary arrangements to ensure that our obligation in exposing animals was fulfilled. I made two trips to the City of Hope during May and June of 1998 to check on the progress of the extended contract. There was no problem with our part of the contract.

2) A WTR representative was our quality assurance [QA] monitor, according to good laboratory practices. Following the contract, the exposure results including the codes were submitted to WTR. John McDougall, who exposed the rats, was the only one from the City of Hope who knew the codes. After he signed the data sheets, they were turned over to the WTR QA monitor. My departure did not alter the submission process.

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## *NAS–NRC Panel Members on Press Release on 1996 EMF Report: "We Had No Input"*

*One of the most controversial aspects of the release of the National Academy of Sciences-National Research Council's (NAS–NRC) report,* Possible Health Effects of Exposure to Residential Electric and Magnetic Fields, *on October 31, 1996, was the academy's press release. At the time, a number of the members of the NAS–NRC panel complained that the press release did not properly reflect the substance of the report (see* MWN, *N/D96). A few weeks later, seven members of the 16-member panel made their views known directly to Dr. Bruce Alberts, the president of the academy (see* MWN, *J/F97). The full text of their letter, which was recently obtained by* Microwave News, *is reprinted below.*

January 2, 1997

Dear Dr. Alberts:

As members of the NAS–NRC Committee on the Possible Biological Effects of Electromagnetic Radiation, we write to express our concern over the press efforts associated with our report and to recommend a strategy to lessen the chance of a similar occurrence with other reports.

Our report addressed a fairly controversial issue of concern to scientists and the public. In our view, the press releases (both hard copy and video) tended to emphasize one aspect of the committee's conclusions rather than providing a more balanced presentation, and the news reports reflected this. Even the headline on the video release misrepresented the results: "New Report Finds No Evidence of Health Hazard from Residential Electromagnetic Fields." Certainly we found evidence; the debate was on the reliability and consistency of these data. The specific wording contained in the report, which we all stand by, was arrived at after careful review, consideration and negotiation. We believe that people not involved in the committee process were not sufficiently sensitive to the careful crafting of the report and the importance of nuance and specific wordings arrived at by the committee. In-depth reporters who compared the report to the press release noted the disparity and, in some cases, questioned the credibility and objectivity of the NAS–NRC on this issue. It has put us as committee members in an awkward position of being asked to explain the contradictions.

Given the concern over the possible misinterpretation of our study, at least three committee members asked to be involved in the review of all public release materials well in advance of the release, in addition to the committee chair and cochair. Two were not involved and one involved only days before the release, and major concerns were not addressed. The result was that nearly half of the 16-member committee was dissatisfied with the final release materials, over which we had no input. Is there some action the NAS–NRC can take to give the public a more balanced understanding of the report? We look to you for suggestions.

In addition, we have one recommendation. For developing press release or public informational documents related to the release of future reports, we urge you to involve any and all interested committee members in the review process at the same time as the committee chairs and cochairs. While this does increase the complexity of the logistics, it will result in better and more accurate press materials.

As the NAS–NRC continues to take on cutting edge, controversial issues, abiding by the fragile consensus carefully crafted by committee members is increasingly important.

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Lynn Jelinski, PhD
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## *"MICROWAVE NEWS" FLASHBACK*

### *Years 15 Ago*

• The EPA delays the release of its proposed RF/MW radiation exposure guidelines, citing an "internal debate." The agency's assistant administrator indicates that the guidance may be abandoned.

• After exposing rats to 2.45 GHz radiation, Drs. Don McRee and H.G. Davis of the NIEHS find that local SARs in the brain can be two-to-three times higher than whole-body SARs.

• Dr. Mays Swicord of the FDA and Dr. Christopher Davis and Glen Edwards of the University of Maryland report that microwave radiation can cause "direct excitation of the DNA molecule" at 8-12 GHz.

### *Years 10 Ago*

• Antoinette Yannon settles with RCA Corp. for $250,000 to conclude a 13-year wrongful death suit. She charged that 15 years of microwave exposure from RCA's relay equipment at the New York Telephone Co. gave her husband, Samuel Yannon, the neurological disease that killed him.

• BC Hydro offers to buy the homes of those living along a right-of-way on which it has built a new 230 kV power line. The Canadian utility says that it will put any property it buys back on the market.

• Paul Brodeur publishes a three-part series in *The New Yorker* addressing health, scientific and political issues related to EMFs from power lines, radar and VDTs.

### *Years 5 Ago*

• Utility companies win three EMF lawsuits in a row, prompting a Georgia Power Co. lawyer to comment that, "The plaintiffs' bar should look long and hard before bringing another one of these cases."

• The U.S. military nears completion of a transmitter in Alaska that will use powerful RF radiation to modify the ionosphere for possible military applications. The project is known as HAARP, or the High Frequency Active Auroral Research Program.

• Digital mobile phone radiation affects the duration of, and the brain waves associated with, REM sleep, German scientists Drs. Klaus Mann and Joachim Röschke discover.

# Hot New Papers

**Christoffer Johansen, Nils Koch-Henriksen, Søren Rasmussen and Jørgen Olsen, "Multiple Sclerosis Among Utility Workers,"** ***Neurology, 52,*** **pp.1,279-1,282, April 12, 1999.**

"Although MS is a relatively common, chronic neurologic disease in young and middle-aged adults, its causes remain largely unknown; nevertheless, the evidence from epidemiologic studies seems consistent with an environmental influence occurring on a background of genetic susceptibility. Our results do not support the hypothesis that EMFs are one of the environmental agents that play a significant role in the etiology of MS."

**Jan Walleczek, Esther Shiu and George Hahn, "Increase in Radiation-Induced *HPRT* Gene Mutation Frequency After Nonthermal Exposure to Non-Ionizing 60 Hz Electromagnetic Fields,"** ***Radiation Research, 151,*** **pp.489-497, April 1999.**

"Our findings should not be linked to the health concerns raised by recent epidemiological surveys, since the flux densities we applied were higher by three orders of magnitude than those ($B_{rms} \approx 0.3$-$0.4$ μT [3-4 mG]) that were found to be associated with small increases in cancer rates. On the other hand, while the flux densities tested here are well above residential exposure levels, they are near or within the recommended safety limits for occupational exposures to magnetic fields. In summary, our results are the first to suggest that moderate levels of at least one type of non-ionizing field, oscillating 60 Hz magnetic fields of about 1 mT [10 G], may enhance mutagenesis in a mammalian cell system. Future studies should investigate whether such magnetic fields can act as an enhancer of *HPRT* gene mutations in conjunction with DNA-damaging agents other than ionizing radiation, such as environmental chemical genotoxins."

**S. Velizarov, P. Raskmark and S. Kwee, "The Effects of Radiofrequency Fields on Cell Proliferation Are Nonthermal,"** ***Bioelectrochemistry and Bioenergetics, 48,*** **pp.177-180, February 1999.**

"Since the changes in cell proliferation due to [GSM] MW radiation [at an SAR of 2.1 mW/Kg] are of the same order of magnitude at both temperatures [35°C and 39°C], there must be another mechanism that initiates the cell cycle reactions. The induction of stress to the cells could be related to an increased release of stress proteins, e.g., heat shock proteins (hsp), which need not be induced by heat only....Others applying RF/MW radiation at much higher power levels and prolonged exposure times did not find a change in hsp level after exposure. However, in these studies very long exposure times were used, in some cases up to one week. EMF exposure causes only transient effects and long exposure times (hours, days) could result in a kind of adaptation, so that small changes may not be detected." (See also p.9.)

**B. Nelson, D. Snyder and P. Shaw, "Developmental Toxicity Interactions of Salicylic Acid and Radiofrequency Radiation or 2-Methoxyethanol in Rats,"** ***Reproductive Toxicology, 13,*** **pp.137-145, March/April 1999.**

"Combined exposure to RF radiation (10 MHz) and the industrial solvent 2-methoxyethanol (2ME) produces enhanced teratogenicity in rats. [See *MWN,* N/D91.] The purpose of the present research was to determine if the synergistic effects noted for RF radiation and 2ME are generalizable to other chemicals. Since salicylic acid (SA) is widely used as an analgesic and is teratogenic in animals, SA was selected to address generalizability. Based on the literature and our pilot studies, 0, 250 or 350 mg/Kg SA were administered by gavage on gestation Day 9 or 13 to rats. Concurrently, rats given SA on Day 9 were exposed to RF radiation sufficient to maintain colonic temperature at 41°C for 60

## Two Assessments: Little Evidence for RF/MW Radiation-Cancer Link

**J.E. Moulder, L.S. Erdreich, R.S. Malyapa, J. Merritt, W.F. Pickard and Vijayalaxmi, "Cell Phones and Cancer: What Is the Evidence for a Connection? (A Review),"** ***Radiation Research, 151,*** **pp.513-531, May 1999.**

"A biophysical evaluation indicates that it is implausible to expect that cell phone RF radiation would have biological activity at the subthermal power levels characteristic of the current generation of cell phones. The published epidemiological studies of RF radiation do not suggest a causal association, but the studies are few and all suffer from deficiencies in exposure assessment. Cellular studies have largely been limited to genotoxicity testing. Although a few of these studies have suggested the possibility of genotoxicity, the weight of evidence is that RF radiation is not genotoxic. Assessment of the epigenetic potential of RF radiation in cell culture has been minimal, and the results are equivocal at best. The studies of long-term exposure of animals present no compelling evidence that long-term exposure has a negative impact on overall health and show no convincing evidence that RF radiation is genotoxic in animals. However, some of the studies of long-term exposure suggest the possibility that RF radiation may have epigenetic activity, particularly at high exposure levels. A weight-of-evidence evaluation indicates that the evidence for a causal association between exposure to RF radiation and cancer is weak. However, relevant data in some areas are sparse. In particular, the epidemiological evidence is limited, and there is little immediate prospect for improvement, since highly exposed populations are relatively small and assessment of exposure remains a serious problem. The studies of long-term exposure of animals are also relatively weak.... It is often stated that the risks from exposure to RF radiation, even if real, are too low to be of significance to public health. However, if the cancer risks suggested by some of the studies were real, then RF radiation could conceivably be a significant environmental cause of cancer."

**Mark Elwood, "A Critical Review of Epidemiologic Studies of Radiofrequency Exposure and Human Cancers,"** ***Environmental Health Perspectives, 107, Supplement 1,*** **pp.155-168, February 1999.**

"The studies individually are weak and, as a consequence, the results cannot be easily interpreted in terms of cause and effect. The major impression from these studies is their inconsistency. There is no type of cancer that has been consistently associated with RF exposures. The epidemiologic evidence falls short of the strength and consistency of evidence that is required to come to a reasonable conclusion that RF emissions are a likely cause of one or more types of human cancer. The evidence is weak in regard to its inconsistency, the weak design of the studies, the lack of detail on actual exposures and the limitations of the studies in their ability to deal with other likely factors, and in some studies there may be biases in the data used. Whereas the current epidemiological evidence justifies further research to clarify the situation, there is no consistent evidence of any substantial effect on human cancer causation."

min (or sham). Those given SA on Day 13 were also given 0 or 100 mg/Kg 2ME (gavage). Dams were sacrificed on gestation Day 20, and the fetuses were examined for external malformations. The data provide no evidence of synergistic interactions between RF radiation and salicylic acid (resorptions and malformations)." (See also B. Nelson et al., "Effect of Environmental Temperature on the Interactive Developmental Toxicity of Radiofrequency Radiation and 2-Methoxyethanol in Rats," *International Archives of Occupational and Environmental Health, 71,* pp.413-423, 1998.)

**G. Boorman, L. Anderson et al., "Effect of 26-Week Magnetic Field Exposures in a DMBA Initiation-Promotion Mammary Gland Model in Sprague-Dawley Rats," *Carcinogenesis, 20,* pp.899-904, May 1999.**

"The present study does not support the hypothesis that magnetic field exposure enhances breast cancer growth in the DMBA rat breast cancer model. In fact, there were fewer rats with tumors in the 1 G, 60 Hz exposure group compared with DMBA controls. When all carcinomas were considered, the total number of carcinomas induced was lower in all magnetic field exposure groups and this was significant for the 1 G, 50 Hz and 60 Hz exposure groups....While this data is not sufficient to establish a definitive protective effect, it does suggest that we are not missing a subtle promoting effect of magnetic fields....These data are, in part, inconsistent with studies suggesting that magnetic field exposure may promote chemically induced breast cancer in rats....The positive effects reported by Löscher and colleagues were often an earlier onset of tumors or an increase in tumor size. There are also differences between the studies of Löscher and colleagues and the present study...." (See also *MWN,* M/A98 and M/J98.)

**Bu-Tian Ji et al., "Occupation and Pancreatic Cancer Risk in Shanghai, China," *American Journal of Industrial Medicine, 35,* pp.76-81, January 1999.**

"The most consistent finding in our study was the positive association between employment as an electrician and pancreatic cancer. Over a sevenfold overall risk was observed and the [odds ratio] rose to 9.3 for subjects with more than 35 years of employment among men. In addition, intensity and probability of EMF exposure, as estimated by a [job exposure matrix], were associated with risk. However, no such consistent excesses were found among women because of the small number of female cases who were electrical and electronics workers or exposed to high levels of EMFs. Electrical or electronics worker was the most frequent job category among those with high intensity of EMF exposure (24 of 28 exposed men and 14 of 15 exposed women had at least one job related to electrical or electronics work). A possible explanation for the increased risk among electricians may be related to EMF exposures, although other exposures related to electrical machinery manufacturing are possible, such as solvents, solder fumes and cutting oils."

**Artnarong Thansandote, Gregory Gajda and David Lecuyer, "Radiofrequency Radiation in Five Vancouver Schools: Exposure Standards Not Exceeded," *Canadian Medical Association Journal, 160,* pp.1,311-1,312, May 4, 1999 (the paper is also available on the Internet at:<www.cma.ca/cmaj/vol-160/issue-9/1311.htm>).**

"Although the purpose of the survey was to determine the actual levels of RF radiation in the analog (first-generation cellular phone) and personal communications services (PCS, the new generation of digital cellular phone) cellular base-station frequency bands, measurements also covered AM, FM and TV broadcast frequencies where possible....The measureed power densities did not exceed the safety code limits. In light of the current scientific understanding of the risks of RF radiation exposures, we conclude that the levels measured during our study posed no health risk to the students, school staff or the general public in or around the five Vancouver schools involved."

## *Clippings from All Over*

"What we don't want to do two, three, four years from now is to say, 'God — this was the tip of the iceberg, and we didn't see it!'"

**— Dr. George Carlo, chair, Wireless Technology Research, Washington, on the need for continued research into possible health effects of mobile phone radiation, quoted by John Schwartz (who notes that Carlo uses a cell phone with a plug-in earpiece, allowing him to talk without holding the phone to his head) in "Study: Cell Phone Use May Have Cancer Link," *Washington Post,* p.E2, May 22, 1999**

What is remarkable is how little public anxiety has been generated by almost a year of health scares about [mobile telephones]. Despite being told that they might give us cancer or cause memory loss, we have just gone out and bought them in record numbers....

**— Matt Ridley, in a column, "Mobile Phones Dangerous. Ah, Well...," *Daily Telegraph* (U.K.), April 12, 1999**

"Concerns have been raised that the precautionary principle may be too simplistic to guide decision makers facing complex choices involving technologies with uncertain risks, benefits and costs to current and future generations."

**— Dr. John Graham, Harvard Center for Risk Analysis, Boston, in a May 1999 press release announcing the center's workshop, *The Precautionary Principle: Refine It or Replace It?,* held June 3-4 in Washington (the featured speaker in a session on EMFs was Dr. Ralph Keeney of Pros and Cons Consulting in San Francisco and the discussants were Drs. Leeka Kheifets of EPRI in Palo Alto, CA, and Timothy McDaniels of the University of British Columbia in Vancouver, Canada)**

One of the prominent features of the recent *Annual Meeting of the Society of Toxicology* in New Orleans was the debate on a hypothetical motion to have the results of mechanistic toxicity studies supersede ambiguous epidemiological data in chemical risk assessments for humans....The motion implies that one should choose either weak epidemiology data or mechanistic information. However, both mechanistic data and epidemiological findings are often suggestive, but not conclusive, when taken alone. With this in mind, it seems imprudent to discard one set of inconclusive data for another set of inconclusive data. Instead, scientists and policy makers should attempt to integrate all of the available data into health risk assessments.

**— Dr. George Lucier, director, Environmental Toxicology Program, National Institute of Environmental Health Sciences (NIEHS), Research Triangle Park, NC, in an editorial, "Why Not Use It All?," *Environmental Health Perspectives* (published by the NIEHS), p.A232, May 1999 (the editorial is also available on the Internet at: <http://ehpnet1.niehs.nih.gov/docs/1999/107-5/editorial.html>)**

"My seven-year-old will start school in the fall, and he's already worried that he'll be the only kid in first grade without a phone."

**— Olli Martikainen, Helsinki University of Technology, Finland, quoted by T.R. Reid in "Letter from Finland: A Cell Phone in Every Pocket," *Washington Post,* p.C3, May 26, 1999**

"I wouldn't let a child sleep up under an old electric blanket or put a motorized alarm clock beside their bed. My feeling is there is no risk here, but there are these little nagging things."

**— Dr. Richard Gallagher, British Columbia Cancer Agency, Vancouver, Canada, quoted by Margaret Munro in "Home, Dangerous Home," *National Post* (Canada), p.A17, April 27, 1999 (see p.1)**

Sir, "Mobile Phones 'Quicken the Brain'," *(Times* headline, April 8, 1999). At last I know how my student son manages to do nothing much but still gets results.

**— Christopher Balkwill, Abingdon, Oxfordshire, U.K., in a letter to the editor, the *Times* (U.K.), April 13, 1999 (see *MWN,* M/A99)**

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# UPDATES

### *EXPOSURE ASSESSMENT*

**EMFs in Transportation...**A new survey of EMFs encountered in various transportation systems includes assessments of both gasoline- and electric-powered cars, trucks and buses, passenger aircraft, ferryboats and self-powered electric commuter trains. Sponsored by the U.S. Department of Transportation (DOT) and the RAPID research program, the study was conducted by Electric Research, a consulting firm based in State College, PA. Interestingly, it concludes that electric cars have field levels "similar to their conventional internal combustion counterparts," based on prototype electric vehicles with technology similar to that of those now coming into mass production. For both gasoline- and electric-powered cars and light trucks, the fields were predominantly below 60 Hz, and "magnetized steel belts in radial tires appeared to be the common dominant source." (See also a letter by Dr. Samuel Milham on EMF exposure from steel-belted radials, *MWN,* M/A98.) Fields above 60 Hz were stronger in some electric cars than in their gasoline-powered kin, but were still "only a minor part of the total field environment" within the car and were largely localized around travelers' ankles. Passenger jets were the only form of transportation that showed substantial fields above 300 Hz, due to the fact that the AC power used onboard aircraft operates at 400 Hz. By far the highest magnetic fields (and the only significant electric fields) were found in the self-powered commuter train, the only type of transit that produced high readings at 60 Hz. In all systems, fields varied widely with both time and location within a vehicle. Electric Research previously assessed EMFs for DOT in subway systems, passenger trains and an experimental maglev train (see *MWN,* J/A93). Its new study, *Survey and Assessment of EMF Public Exposure in the Transportation Environment* (Report No.PB99-130908) can be ordered for $51.00 (or $23.00 for microfiche) from: National Technical Information Service, Springfield, VA 22161, (703) 605-6000, Fax: (703) 605-6900, Web: <www.ntis.gov>.

### *MEETINGS*

**URSI Preview...**Four different sessions will address mobile phone health risks at the International Union of Radio Science's (URSI) general assembly in Toronto, Canada, the week of August 16. On the 17th, speakers from three continents will be featured at "Hazard Assessment for Wireless Communication," chaired by Italy's Dr. Paolo Bernardi and France's Dr. Bernard Veyret. On the 18th, Drs. Ross Adey of the U.S., E. Bonek of Austria and Niels Kuster of Switzerland will present a session titled "Health Effects of Mobile Telephones." On the 19th, Drs. Om Gandhi and Yahya Rahmat-Samii, both of the U.S., will chair "Computation of EMFs in the Human Body." And on the 20th, the U.S.'s Dr. C.K. Chou and Japan's Dr. Masao Taki will host "Exposure Assessment for Cellular and Personal Telecommunications." The emphasis on wireless communications health research follows a resolution adopted by URSI's Commission K on Electromagnetics in Biology and Medicine at the Kyoto, Japan, meeting in 1993 to promote a "broad-based research program" (see *MWN,* N/D93). URSI general assemblies are held every three years. Other noteworthy sessions include two on the bioeffects of EMFs and one on biomedical applications. In ad-

dition, on August 20, there will be a session on EMI with medical devices. The URSI meeting will be held at the University of Toronto. For more information, contact the URSI management office at (613) 993-7271, by E-mail at <ursi99@ nrc.ca> or on the Internet at <www.nrc.ca/confserv/ursi99/welcome.html>.

### PEOPLE

Dr. **James Lin** of the University of Illinois, Chicago, has been elected to the National Council on Radiation Protection and Measurements (NCRP), which is based in Bethesda, MD. Among those reelected were: **Ronald Petersen** of Lucent Technologies/ Bell Labs in Murray Hill, NJ, Dr. **Paul Slovic** of Decision Research in Eugene, OR, and Dr. **Marvin Ziskin** of the Temple University School of Medicine in Philadelphia....Dr. **Ron Cameron** has taken over from Dr. **Colin Roy** as editor of the *Journal of the Australasian Radiation Protection Society*....**Tim Ayers** has left the CTIA, where he was vice president for communications, to become the president of North Light Public Affairs, an offshoot of North Light Communications in College Park, MD. Among the parent group's clients are the American Institute of Physics and the Chemical Manufacturers Association.

### VISIBLE LIGHT

**Myopia and Light-at-Night...**Children who had slept in a room with a night-light before the age of two were more likely to become nearsighted, according to a study by researchers at the University of Pennsylvania Medical School in Philadelphia. Those who slept in a fully lighted room were even more likely to become myopic. " The absence of a daily period of darkness during early childhood" appears to increase the risk of nearsightedness, Dr. Graham Quinn and colleagues reported in the May 13 issue of *Nature (399,* pp.113-114, 1999). The study, based on 479 children aged 2-16, found no link to the level of nighttime light after the age of two. Only 10% of children who had slept in darkness before they were two were later found to be myopic. For children who had slept with a night-light, the figure jumped to 34%. Among those who had slept with a room light on before the age of two, a majority — 55% — are nearsighted today. The data show a strong dose-response relationship. The risk of nearsightedness increased with increasing light, in a trend that is extremely significant (P<0.00001). The University of Pennsylvania team cautioned that these findings do not prove a causal connection: For example, it is not known whether parents' lighting preferences might have been related to known risk factors for nearsightedness, such as socioeconomic status or their parents being nearsighted themselves. But the researchers pointed out that a link between light-at-night and nearsightedness is biologically plausible. Myopia "commonly arises from excessive postnatal eye growth," they explained, and the length of daily exposure to light has been shown to affect eye growth in chicks. Myopia in humans usually does not occur before the age of two, but it has been shown that in various animal species "early neonatal visual experience markedly affects refractive development." Although the case is not closed, Quinn and colleagues wrote, for the time being "it seems prudent that infants and young children sleep at night without artificial lighting in the bedroom."


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—*Steven Milloy, publisher,* Junk Science Home Page, *<www.junkscience.com>, May 25, 1999*

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## More 1999 Conferences

August 13-16: **6th Annual Michaelson Research Conference,** Cloudcroft, NM. Immediately preceding the meeting, August 11-12, the U.S. Air Force will sponsor a **Workshop on Infrared and Millimeter Waves.** For more information, contact: Dr. Eleanor Adair, AFRL/HEDR, 8308 Hawks Rd., Brooks AFB, TX 78235, (210) 536-4698, Fax: (210) 536-3977, E-mail: <eleanor.adair@aloer.brooks.af.mil>.

September 16-17: **Mobile Telephones and Health: An Update on the Latest Research,** Radisson SAS Scandinavia Hotel, Göteborg, Sweden. Contact: Les Wilson, Microshield Industries, 59 Southbury Rd., Enfield EN1 1PJ, U.K., (44+181) 363-3333, Fax: (44+181) 372-3232, E-mail: <microshld@aol.com>, Web: <www.microshield.co.uk>.

October 4-6: **Effects of Electromagnetic Fields on the Living Environment,** Munich, Germany. A seminar hosted by the International Commission on Non-Ionizing Radiation Protection (ICNIRP), the World Health Organization (WHO) and the German Federal Office of Radiation Protection. For more information, contact: R. Matthes, Institut für Strahlenhygiene, Bundesamt für Strahlenschutz, Ingolstädter Landstrasse 1, D-85764 Oberschleißheim, Germany, (49+89) 31603 288, Fax: (49+89) 31603 289, E-mail: <rmatthes@bfs.de>, Web: <www.icnirp.de> or <www.who.int/emf/>.

November 21-24: **Biological Effects, Health Consequences and Standards for Pulsed Radiofrequency Fields,** Erice, Sicily, Italy. A seminar sponsored by ICNIRP and the WHO. On November 26, there will be a **WHO EMF Research Coordination Meeting** and on November 27 a **WHO EMF Standards Harmonization Meeting.** For more information, see October 4-6 above or contact: Dr. Michael Repacholi, WHO, 1211 Geneva 27, Switzerland, (41+22) 791-3427, Fax: (41+22) 791-4123, E-mail: <repacholim@who.int>.

## Keeping Current: Follow-Up on the News

◆ The IEEE's Committee on Man and Radiation (COMAR) has drafted a "Technical Information Statement" on *Possible Health Hazards from Exposure to Power Frequency Electric and Magnetic Fields*. The text and the list of contributors are available at <www.eece.ksu.edu/~rdmiller/COMAR60HZ.html>.

◆ For those who will not be attending the annual meeting of the Bioelectromagnetics Society in Long Beach, CA, June 20-24, the abstracts are up on the Web at <www.bioelectromagnetics.org>. Paper No.15-6 is especially noteworthy.

◆ The May 21 *Wall Street Journal* reports that the FAA is now advising airlines to allow their passengers to use mobile phones "anytime the aircraft is stationary and is going to remain stationary." However, FAA rules still leave the decision on whether to permit cell phone use to the discretion of the captain (see *MWN*, S/O96).

◆ In an editorial in its May 26 issue, the *Irish Times* called for a national research effort on mobile phone safety. "It is not appropriate that this work fall to scientists and institutions working abroad," the paper declared, noting that there are some one million wireless phone users in Ireland. While suggesting that the Irish government "could take a more proactive role" in getting answers to the public, the *Times* called on telecom companies to fund the research.

◆ After issuing mobile phones equipped with earpieces to employees of his company, the Virgin Group (see *MWN*, N/D98), the U.K.'s Richard Branson has decided to sell phones that will include this exposure-reducing device as a standard feature, the U.K.'s *Times* reported on June 7. The phones, which Virgin will market in a joint venture with the U.K. wireless carrier One 2 One, are expected to go on sale before Christmas.

### As We Go to Press

The National Institute of Environmental Health Sciences (NIEHS) has announced that it will release its long-awaited report to Congress on the RAPID EMF health research program on June 15 (see p.8).

The full text of the report will be available on the NIEHS Web site: <www.niehs.nih.gov/emfrapid/home.htm>.

*Microwave News* will present detailed coverage of the report in its July/August issue.

# VIEWS ON THE NEWS

## What About EMF Health Risks Above 5 mG?

We hate to spoil the party being organized by the National Academy of Sciences (NAS) and the electric utility industry, but we are not quite ready to toss EMF cancer risks onto the junk science heap.

We do agree with Canada's Dr. Richard Gallagher that his and Mary McBride's study is good news (see p.1). Most children are not exposed to EMFs of over 5 mG, and below 5 mG, the leukemia risk is small, if there is any risk at all at these low levels.

But we also agree with Gallagher that these childhood EMF studies really don't tell us much about what may be going on above 5 mG. As Dr. Gilles Thériault, who collaborated with Gallagher and McBride, told us: "We keep seeing smoke, but have not yet been able to spot the fire." He was referring to those exposed for long periods of time to higher field levels.

The new NAS report on the RAPID program states that only "very few" people are exposed to more than 4 mG (see p.8). In percentage terms, the number is relatively small, but the absolute number is large: One million Americans are routinely exposed to average fields of more than 10 mG and over 5 million to fields of more than 5 mG (see *MWN,* M/J98). This statistic comes from an Enertech survey, one of only two RAPID engineering reports that the NAS panel singled out as noteworthy.

The focus on childhood leukemia was propelled by mothers around the country who demanded answers to power line health questions. Workers, however, who may be exposed to higher levels, have never organized in the same way about their own risks.

This is surprising because meta-analyses by EPRI, the industry's own research arm, indicate a significant increase in both leukemia and brain cancer among workers (see *MWN,* J/F96 and N/D97). The 1996 NAS study that many interpret as dismissing EMF cancer risks conceded that the workplace studies "have increased rather than diminished the likelihood of an association between occupational exposure to [EMFs] and cancer."

And cancer is not the only potential problem. Despite repeated requests, the NIEHS RAPID program never sponsored any studies into Alzheimer's disease and other neurological effects. Those concerns have been left hanging.

No one should forget that the ICNIRP magnetic field limits, touted by industry and the WHO EMF Project as the model standard to be adopted worldwide, allow children to be exposed continuously to 1,000 mG and workers to 5,000 mG. We wonder how many of those who endorse the standard would allow themselves to be exposed to such levels day after day.

It is welcome news that the McBride study does not show a leukemia risk, but that does not mean we should ignore the millions exposed to higher levels both at home and at work.

## Mobile Phone Radiation Levels Should Be Made Public

The latest study by Sweden's Dr. Lennart Hardell suggests a possible link between mobile phone use and brain cancer. He cautions against jumping to conclusions, however, and is the first to say that more research is needed.

In the meantime, Hardell has some advice for cellular phone users: Do what you can to reduce your exposure (see p.7). "Ask about the specific absorption rate (SAR) when purchasing a mobile phone," says Hardell, "and buy one with as low an SAR value as possible."

But that is easier said than done. When consumers ask how much radiation they will get from a phone, they cannot get an answer.

Mobile phone manufacturers will not disclose SAR values for the phones they sell. When BBC's *Panorama* pressed a Nokia representative to reveal the numbers (see p.2), he bobbed and weaved around the question — and ultimately refused.

So far, only one company has broken ranks. In 1997, the small German company Hagenuk began an ad campaign featuring the slogan "Low Radiation Is Better" (see *MWN,* S/O97). Hagenuk had reason to brag: In tests by Dr. Niels Kuster of ETH in Zurich, the Hagenuk phone scored the lowest out of 16 mobile phones tested — with an SAR one-fifth as large as the highest-exposure model. It was also one of the least expensive (see *MWN,* N/D97).

But Hagenuk met with unified hostility and pressure from other companies. "I feel threatened by representatives of the industry," said a Hagenuk official in Sweden. And today, the Hagenuk low-radiation phone seems to have sunk from sight.

The industry's standard position is that consumers have no reason to know each phone's SAR, because every phone meets legally required safety standards. That misses the point: The current debate is precisely about whether those standards are adequate. People who are curious about how much radiation their phones emit ought to be able to find out.

Consumers can now choose their favorite color or style of mobile phone — but for a choice that might affect their health, they can't get the information they need.

Hundreds of millions of wireless phones have been sold, and the industry has made billions of dollars in profit. Yet the public is not given the results of tests that the government requires before any phone is allowed on the market.

Intelligent people disagree about whether there is any reason to be concerned about mobile phone health effects. That is precisely why the industry should make SAR numbers public — and let consumers decide for themselves.

*MICROWAVE NEWS* is published bimonthly. • ISSN 0275-6595 • PO Box 1799, Grand Central Station, New York, NY 10163 • (212) 517-2800; Fax: (212) 734-0316; E-mail: <mwn@pobox.com>; Web: <www.microwavenews.com> • Editor and Publisher: Louis Slesin, PhD; Senior Editor: Peter Hogness; Associate Editor: Douglas Barnes, PhD; Copy Editors: Jim Feldman, Roy Thomas Jr.; Intern: Robin Marcus; Circulation Associate: Diana Cooper • Subscriptions: $325.00 per year ($350.00 Canada & Foreign, U.S. funds only); Single copies: $60.00 • Copyright © 1999 by Louis Slesin • Reproduction is forbidden without written permission.

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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.*

# *Massachusetts To Propose 200 uW/cm² Population Standard*

The state of Massachusetts will soon propose one of the most stringent general population standards for radiofrequency and microwave (RF/MW) radiation in the country. If adopted as drafted, the frequency dependent standard will be 200 uW/cm² in the 30–300 MHz band, rising to a maximum of 1 mW/cm² for frequencies above 1500 MHz and to 20 mW/cm² for those below 3 MHz. An occupational exposure standard identical to the new American National Standards Institute (ANSI) RF/MW standard will also be proposed. Both standards cover the 300 kHz to 100 GHz spectrum.

Robert Watkins, a radiation scientist with the Massachusetts Department of Public Health, said that the proposal had been developed in response to growing public fears over RF/MW radiation sources, especially antenna farms and the PAVE PAWS radar on Cape Cod. "Municipalities were beginning to set their own standards," he added, "so we decided to act."

While 26 states have enabling legislation to set RF/MW standards, only Texas has a regulation applicable to population exposures—a flat or frequency independent, 10 mW/cm² standard. In 1980, Portland, OR, became the first city to adopt an RF/MW exposure standard: 100 uW/cm² between 30 and 300 MHz and 500 uW/cm² otherwise. And in 1978, New York City's Bureau for Radiation Control proposed a flat standard of 50 uW/cm², which is still pending.

The Massachusetts proposal is now circulating among microwave experts for comment. The state's radiation program office will study their recommendations and issue a revised draft by April 1. A public hearing is scheduled for

*(continued p. 8)*

# *RFI at TMI*

## Portable Radio Confuses Gas Monitor

Workers with two-way radios resurrected fears that combustible gases were accumulating inside the Three Mile Island (TMI) nuclear plant in Middletown, PA. The No. 2 reactor was on alert for eight and a half hours on February 19–20, until TMI officials unraveled what turned out to be a series of equipment and operator errors, including radio frequency interference (RFI) with a gas measuring meter. In March 1979, the plant was crippled in a major accident; at that time there was widespread fear—later judged groundless—that a bubble of hydrogen gas inside the reactor would explode.

In the course of current preparations for a decontamination experiment, the crew found oxygen levels in the reactor building to be below normal. A couple of hours later they returned with a second gas meter that indicated abnormally high levels of combustible gases—hydrogen and hydrocarbons. The workmen also took an air sample for analysis. Gas chromatography of that sample confirmed that the hydrogen level was too high.

Later investigations showed that the oxygen meter had malfunctioned, that

*(continued p. 8)*

# INTERNATIONAL REPORT

## WHO RF/MW Criteria Document

The World Health Organization (WHO) recently published a criteria document on radiofrequency and microwave (RF/MW) radiation (100 kHz–300 GHz). It concludes that continuous occupational exposures in the range from 0.1 to 1 mW/cm² are safe and that population exposures should be kept "as low as readily achievable," at levels generally lower than those for occupational exposure. The full text of the WHO recommendations (Section 1.2) is reproduced below.

The 134-page report, *Environmental Health Criteria 16: Radiofrequency and Microwave Radiation,* was developed by a working group set up by the WHO and the International Radiation Protection Association. Dr. Moris Shore of the US Bureau of Radiological Health was the chairman of the committee, whose other members were Dr. V. Akimenko, USSR; Professor P. Czerski, Poland; Mme. A. Duchene, France; Dr. M. Faber, Denmark; Professor M. Grandolfo, Italy; Mr. F. Harlen, England; Dr. H. Jammet, France; Dr. J. Kupfer, German Democratic Republic; Dr. M. Repacholi, Canada; and Dr. B. Servantie, France.

The text includes reviews and summary tables of bioeffects research and of various exposure standards. Among the other topics are sources of radiation, conditions of exposure, measuring instruments, radiation absorption in biological systems and safety procedures for occupationally exposed personnel. The document contains a bibliography of more than 300 references and a nine-page glossary.

The report is available in the US from: WHO Publications Center USA, 49 Sheridan Avenue, Albany, NY 12210. Elsewhere, contact the nearest WHO regional office or write to WHO, Distribution and Sales Service, 1211 Geneva, 27, Switzerland.

### *Recommendations for Further Studies, Exposure Limits, and Protective Measures*

#### General recommendations

The basic biophysical mechanisms of interaction of microwaves and RF with living systems still need clarification and further studies.

Work on both theoretical and experimental dosimetry, the calculation and measurement of fields and of energy deposited within simulated or actual biological systems, should be continued and refined.

Results of animal studies are difficult to extrapolate to man, and these studies alone do not constitute a satisfactory basis for the establishment of health protection criteria. They should, therefore, be supplemented by appropriate epidemiological studies in man.

The existing data on power, amplitude, and frequency "windows" seem to warrant continued investigations.

The effects of chronic exposure on sensitivity to convulsant and other drugs are potentially useful and may have a direct bearing on the development of exposure standards.

Long-term, low-level exposures combined with such stresses as high ambient temperature and humidity should be investigated.

There is little published information on dose-effect relationships; reports tend to be limited to whether effects are observed at one particular level of exposure rather than over a range. More dose-related information, even covering small subject areas, would be valuable.

Investigations on the genetic effects and effects on development of microwave and RF radiation should have priority.

Attention should be given to investigating the different sensitivities to microwave/RF exposure of subgroups within the general population.

National and international agreements on exposure limits, ways and means of controlling this type of environmental pollution, and concerted efforts to implement such agreements are needed.

#### Measurement techniques

There is a continuing need for the development of microwave/RF measuring instruments that: (*a*) give direct readings of electric or magnetic field strength, or power density; (*b*) are robust; (*c*) are portable, light-weight, and battery-operated; and (*d*) are sensitive and can be used over a wide frequency range.

The problem of the design of personal dosimeters also remains to be solved.

#### Safety procedures

Computation techniques or methods that predict the distribution of fields close to deliberate high-power emitters (in the near field) are needed.

Emphasis should be placed on the development of technology to ensure containment and limitation of radiation to the deliberately exposed object, as well as the reduction of leakage emission from devices.

Personal protection devices should be used only as a last resort.

Adequate medical surveillance of occupationally-exposed persons should be provided.

Once exposure limits have been set, safety guidelines or codes of practice concerning safe use and installation design should be developed as soon as possible.

#### Biological investigations

Reports of experimental work should contain sufficient information describing the exposure conditions to allow an estimation not only of the total absorbed energy but also, as far as possible, of the distribution of the energy deposited within the irradiated biological system.

Systematic investigation of the effects of microwave/RF exposure at all levels of biological organization are to be encouraged. This includes effects at the molecular level on subcellular components; cells, viruses, and bacteria; organs and tissues; and whole animals. Particular attention should be paid to: (*a*) long-term, low-level exposures and possible delayed effects; (*b*) the possibility of differences in sensitivity of various body organs and systems, where specific effects in various animal species are being considered; and (*c*) the influence of microwave/RF exposure on the course of various diseases, including any possible increase in sensitivity to microwaves/RF that may result because of the disease state.

#### Epidemiological investigations

Epidemiological studies should be carried out in a careful manner, paying attention to the relationship between exposure to microwaves/ RF and other environmental factors occurring in the place of work and to the health status of the investigated group. Specific biological endpoints should be selected and adequate examination methods used for such studies. Conventional medical examinations will not provide sufficient information.

Studies should be carried out on (*a*) workers occupationally

exposed to microwave/RF sources; (*b*) patients treated with microwave and RF diathermy; and (*c*) groups within the general population living near high-power microwave/RF sources.

A distinction should be made between occupational and public health protection standards.

**Exposure limits and emission standards**

*Occupational exposure limits:* The occupationally-exposed population consists of healthy adults exposed under controlled conditions, who are aware of the occupational risk. The exposure of this population should be monitored.

It is possible to indicate exposure limits from available information on biological effects, health effects, and risk evaluation. For occupational exposure, values within the range 0.1–1 mW/cm$^2$ include a high enough safety factor to allow continuous exposure to any part of the frequency range over the whole working day. Higher exposures may be permissible over part of the frequency range and for intermittent or occasional exposures. Special considerations may be indicated in the case of pregnant women.

*Exposure limits for the general population:* The general population includes persons of different age groups and different states of health, including pregnant women. The possibility that the developing fetus could be particularly susceptible to microwave/RF exposure deserves special consideration.

Exposure of the general population should be kept as low as readily achievable and exposure limits should generally be lower than those for occupational exposure.

*Emission standards:* Emission standards for equipment should be derived from, and be lower than, exposure limits where this can reasonably be achieved. A class of equipment may be considered safe and exempt from regulations, if hazardous levels of radiation exposure cannot originate from such a source.

*Implementation of standards:* The implementation of microwave and RF occupational and public health protection standards necessitates: the allocation of responsibility for measurements of radiation intensity and interpretation of results; and the establishment of detailed radiation protection safety codes and guides for safe use, which indicate, where appropriate, ways and means of reducing exposure.

*Other protective measures:* Prevention of health hazards related to microwave and RF radiation also necessitates the establishment of rules for the prevention of interference with medical electronic equipment and devices such as cardiac pacemakers, prevention of detonation of electroexplosive devices, and prevention of fires and explosions due to the ignition of flammable material (vapours) by sparks originating from induced fields.

*Studies related to the establishment of limits:* Studies of the frequency and modulation dependence of biological and health effects are of prime importance. The results of such investigations may make it possible to modify the rationales of present day standards and to identify frequencies at which exposure limits should be lower or higher than those suggested in section 11.

*MICROWAVE NEWS* is published monthly, except in January and July • ISSN 0275-6595 • PO Box 1799, Grand Central Station • New York, NY 10163 • (212) 794-9633 • Editor: Louis Slesin, Ph.D., Associate Editor: Martha Zybko • Subscription: $165 per year (overseas $200) • Copyright © 1982 by Louis Slesin • Reproduction in any form is forbidden without written permission.

# Letter From China

Microwave News *has received the following report from the Peoples' Republic of China on two recent microwave bioeffects courses sponsored by the China Microwave Institute in Beijing. We thank Shen Zhi-yuan, a visiting scientist at the Polytechnic Institute of New York, for providing this translation of the original text.*

Two short courses on microwave biological effects sponsored by the China Microwave Institute were held in Shanghai (August 1981) and Chengdu (January 1982). The attendees, numbering 241 in Shanghai and 83 in Chengdu, came from all around the country except for Tibet and Taiwan. Among them were professors and lecturers from universities and colleges, physiotherapists from hospitals, researchers from tumor research institutes, engineers and technicians from labor and environmental protection organizations.

The main topics of the courses were common microwave biological effects, the biological and medical applications of microwaves, and the fundamentals of microwave safety protection. The theoretical and clinical problems associated with local microwave thermotherapy for treating some kinds of malignant tumors and common diseases were also included.

China began developing microwave biological effects research for establishing a safety exposure standard of microwave radiation in 1974. Some health studies on the operators of microwave equipment in large cities have been completed.

Since 1978, active research on local microwave thermotherapy together with chemical and radio therapy for curing malignant tumors have been carried out at Beijing, Shanghai, Nanjing and Henan. The research items include: mechanisms of high temperature affecting cancer cells, optimum temperature, dosage and procedures for treatment, and methods for measuring temperature in microwave fields. Beneficial effects on some advanced cancer patients have been observed. In China, some researchers are trying to use local microwave thermotherapy for birth control.

Topics of Shanghai Short Course: 1. Prospects for microwave power applications. 2. Biological effects of microwaves. 3. Physical mechanisms of interactions between living systems and microwaves. 4. Microwave applications in biology and medicine. 5. Microwave thermotherapy for curing cancers. 6. Microwave effects on the human body. 7. A safety exposure standard for microwave radiation. 8. Safety protection from microwave radiation.

Topics of Chengdu Short Course: 1. Fundamentals of microwaves. 2. Biological effects of microwaves. 3. Techniques of microwave thermotherapy and cancer treatment. 4. Microwave local heating technique for male birth control. 5. Clinical microwave thermotherapy. 6. Microwave thermotherapy. 7. Agricultural applications of microwaves. 8. Temperature measurement in microwave fields. 9. Measurements of electromagnetic near field and leakage energy. 10. Principle, operations and maintenance of microwave therapeutic apparatus. 11. Safety exposure standard and protection of microwave radiation.

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# HIGHLIGHTS

## FCC To Consider RF/MW Hazards

The Federal Communications Commission (FCC) plans to address radiofrequency and microwave (RF/MW) radiation hazards under its environmental protection rules. Applications for facilities exposing workers or the public to radiation levels of more than 10 mW/cm$^2$ or exceeding any relevant emission standard would be added to the list of "major actions" requiring environmental assessment and possibly environmental impact statements.

The rules proposed on January 28 are the response to the FCC's 1979 notice of inquiry on radiation hazards (44 *Federal Register* 37008, June 25). The commission has decided that the National Environmental Policy Act (NEPA) "requires us to evaluate exposure of the public from the facilities we authorize" against potentially harmful radiation. Since no federal population exposure standards exist, the Occupational Safety and Health Administration's (OSHA) occupational guideline has been chosen as the gauge for public exposure "until such time as the appropriate federal agency issues standards." The only relevant and applicable emission level at this time is the Bureau of Radiological Health's new oven standard. The commission noted it had "neither the expertise nor the primary jurisdiction" to set safety levels.

The FCC has refused to become involved in the controversy over local and state exposure standards. In its notice of proposed rule making, the commission states it sees "no significant conflict" between these actions and its responsibility under the Communications Act to make available rapid and efficient communications.

Under the proposed rules, an applicant for a new RF/MW source would be required to point out potential radiation exposure and emission problems in a "narrative statement" submitted to the FCC. This report would trigger an evaluation process. After examining the report, the FCC staff could decide to prepare an environmental assessment for the project. If warranted, the commission would then proceed with an EIS. The rule would apply to applications for equipment authorization, construction permits and licenses to transmit.

The commission anticipates the new rules will affect very few RF/MW sources. Most applicants would be in compliance with the OSHA standard and "thus should be categorically excluded" from the requirements. Currently operating facilities and equipment licensed by the FCC would not be reevaluated.

Commenting on the action, the FCC's Dr. Robert Cleveland and Deputy General Counsel Peggy Reed said they did not expect the rules to result in many EIS's. In fact, since NEPA became law in 1970 the commission has prepared only one EIS and that was for a FM tower in a scenic area.

Comments on the proposed rule are due by June 18, and reply comments by August 18.

## FY83 Budget Proposals

The President's budget has met with considerable resistance in Congress, and it will take some time before a compromise is reached. Who the winners and losers will be and how the changes will filter down to affect non-ionizing radiation programs is anything but clear. In fact, some agencies have yet to have their budgets for FY82, already in its sixth month, approved and are still operating on a continuing resolution. Apart from requests for specific applications, non-ionizing radiation programs are rarely line items in agency budgets. So the details that follow only give a rough indication of what will actually be appropriated and spent.

• *Bureau of Radiological Health:* BRH is still operating on a continuing resolution, so its planning staff was hesitant to discuss FY83 while FY82 is still unsettled. FDA's radiological products line item, which includes ionizing and non-ionizing radiation programs, has been increased by $946,000, but the equivalent of six staff positions have been eliminated. One indication of hard times is the announcement that the *BRH Bulletin* may cease publication next month unless OMB gives its approval for the expenditure.

• *Department of Defense:* $72.7 million for PAVE PAWS, of which $69.4 million is for procurement at the SE site at Robins AFB, GA; $31.3 million for the PAVE MOVER program; $79.1 million for over-the-horizon radar; $79.8 million for the military satellite program; $10 million for EMP work ($3 million for Kirtland AFB and $7 million for RDT&E); $49.8 million for Project ELF (see opposite page).

• *Environmental Protection Agency:* The agency's radiation (ionizing and non-ionizing) program was cut by $27,000 and the equivalent of 14 staffers. EPA's Dave Janes said it was too early to judge the impact on non-ionizing radiation work. While research and development was cut by over $45 million to $108.7 million, EPA's budget report did note that the radiation program "will focus on evaluating health effects information needed for establishment" of a general population guidance.

• *Federal Communications Commission:* The FCC's budget was cut by $2.9 million from its $77.3 million FY82 continuing resolution budget.

• *National Aeronautics and Space Administration:* NASA's 30/20 GHz satcom program has no funds to build a prototype satellite or to start a flight program. About $5.1 million is slated for completing the development process.

• *National Bureau of Standards:* NBS's budget of $104 million is about equal with last year's request if one discounts the transfer of the computer institute from NBS to GSA.

• *National Institute for Occupational Safety and Health:* NIOSH is also on continuing resolution. The FY83 proposal is for $50.5 million, down from $56 million requested for FY82—which is itself much lower than the House or Senate proposals. One major point here is whether the NIOSH budget bill will bar the use of funds to move the agency down to Atlanta (see updates).

• *National Telecommunications and Information Administration:* NTIA's budget was cut by $4 million to $12.4 million for FY83. Most of the cut is in the policy division and administrative support. The agency's satellite program was eliminated.

• *Occupational Safety and Health Administration:* OSHA's budget was increased by about $14 million over the amount allocated in its continuing resolution. OSHA is planning to make 53,000 inspections in FY83, compared to 52,000 projected for FY82.

## NIOSH Criteria Document Nears Completion

The National Institute for Occupational Safety and Health (NIOSH) criteria document on radiofrequency and microwave (RF/MW) radiation will be ready for external review in the late spring. Speaking from Rockville, MD, Dr. Momtaz Wassef, NIOSH's project manager for the document, said that the NIOSH team was in the process of assigning SAR (specific absorption rate) values for the key papers in the literature and picking levels for the new proposed standard.

Sections of the document have already been reviewed by consultants selected by NIOSH. Listed below are the consultants and the biological effect they reviewed: Dr. Ernest Albert, George Washington University, central nervous system; Dr. Russell Carpenter, Bureau of Radiological Health, ocular; Dr. Ronald Jensh, Thomas Jefferson University, reproduction and teratology; Drs. Don Justesen and Virginia Wolf, VA Medical Center, Kansas City, behavioral; Dr. Robert Lebovitz, University of Texas, auditory; Dr. Robert Liburdy, USAF School of Aerospace Medicine, immunology and hematology; Dr. Shin-Tsu Lu, University of Rochester, cardiovascular; Dr. Sol Michaelson, University of Rochester, general physiology; and Dr. Vernon Riley, Hutchison Cancer Research Center, Seattle, neural and endocrine.

## Canadian VDT Ruling: No Loss of Pay for Alternative Work During Pregnancy

A labor arbitration board in Ontario has ruled that a video display terminal (VDT) operator cannot be penalized for transferring to a non-VDT job during pregnancy. Helen Barss, a data processor at the Ministry of Education, filed a complaint last May after her request for alternative work during her last four months of pregnancy resulted in a temporary job demotion with a cut in pay. On January 21, a three-member Ontario Crown Employees' Grievance Settlement Board ruled that Barss must be compensated for the difference in salaries.

In its decision, the board wrote that Barss's "sole reason for making the request was the belief (we think on reasonable grounds) that the change should be made for the protection of her unborn child." Under the Crown Employees' Collective Bargaining Act, a worker is entitled to the same salary while reassigned to a lower paying job for up to six months if the change is for health reasons.

The board emphasized that it lacked "both the authority and the ability" to decide whether VDTs present a health hazard, though it judged Barss had legitimate reasons for her fear. The decision stated that people are entitled to be skeptical of scientists' conclusions and cited changing opinions about the safety of urea formaldehyde, DDT, 2,4-D, contraceptives and other products.

Barss asked to leave VDT work in her fifth month of pregnancy on the recommendation of her doctor. The ministry argued her job posed no health risks but agreed to transfer her for personal rather than health reasons. Barss worked as a records clerk for the remainder of her pregnancy at $267 per week rather than the $286 she regularly earned.

## Electric Fields Heal Fractures

Dr. Andrew Bassett and his colleagues at the Columbia-Presbyterian Medical Center in New York City have concluded that the treatment of non-healing bone fractures with electric fields is safe and effective and that it could now be "the primary treatment for ununited fractures or arthrodeses."

According to their report published in the February 5 *Journal of the American Medical Association* (JAMA), pulsing electromagnetic field (PEMF) therapy has worked for over 77 percent of the 1078 patients treated in the US and abroad during the last seven years. The success rate was unaffected by the age of a patient's fracture, the number of operations prior to PEMF treatment or the presence of infection. No adverse side effects have been reported since the technique began trials at Columbia in 1974.

Bassett's system is non-invasive; coils are placed around the site of the fracture to generate PEMFs, which in turn penetrate the body and induce weak electric currents in the bone. Research at the center has shown that these fields modify cell behavior and promote bone growth.

An editorial accompanying the report in the *JAMA* praises the use of PEMFs and the related, but invasive, direct-current stimulation as "a major advance in traumatic orthopedic surgery." The author, Dr. Clinton Compere of Northwestern University Medical School in Chicago, IL, states that the consensus judgment must be that electric stimulation methods are effective.

In an answer to some critics who have asked for double-blind experiments (see *MWN*, May 1981), Bassett and his team argue, "When 75 percent or more of [the subset of patients disabled for more than two years], and in whom spontaneous healing is unlikely, are healed by PEMFs, there is little room for rational doubt that the method is highly effective."

## Navy Issues Project ELF Plan

The Naval Electronic Systems Command has released a work plan for its ELF submarine communications system. The 34-page, illustrated report, *Extremely Low Frequency (ELF) Communications Program in Wisconsin and Michigan; System and Site Definition, Program Plans, Environmental Summary and Supplementary Information,* December 1981, details the schedule for making the system operational by 1986.

The Wisconsin facility at Clam Lake will be upgraded; new transmitting equipment will be installed by 1984. The existing overhead antenna operating with a current of 300 amperes will stay in use. The navy will build two additional antennas in Michigan, each 28 miles long and mounted on poles, at a site still to be determined. When completed, these will carry a current of 150 amperes and operate synchronously with the 28-mile Wisconsin antenna. The Michigan control center will be located at K.I. Sawyer AFB.

The proposed FY83 budget allocates $49.8 million for Project ELF, of which $32.3 million is for new equipment in Wisconsin and Michigan.

The navy will issue an environmental protection plan and a draft ecological monitoring program for the Michigan site later this year. The IIT Research Institute (IITRI), which is managing this work for the navy, is now in the process of soliciting proposals for relevant environmental studies. A bidder's conference is scheduled for March 18 at IITRI's main office in Chicago, IL. Although the work plan indicates that the navy does not intend to carry out any ecological studies in Wisconsin, IITRI's Marty Abromavage told *Microwave News* that this decision has been reviewed and that some studies may now be funded if they are judged worthwhile. The navy has budgeted $750,000 for ELF ecological studies in FY82 and has proposed to spend $2 million on them in FY83.

The navy intends to protect power and telephone lines against interference in both states and will pay for any mitigation costs.

The report drew criticism from Stop Project ELF (SPE), a group based in Madison, WI. In written comments submitted by SPE, Jennifer Speicher and John Stauber claimed that the navy had reneged on its 1969 commitment to remove the Clam Lake facility once testing had been completed. SPE urged the navy to prepare an environmental impact statement for the Wisconsin site that included analyses of possible interference with airplane equipment and potential effects on the weather.

Copies of past environmental impact statements for Project Sanguine and Seafarer, the previous names of the ELF system, are available from the Environmental Law Institute, 1346 Connecticut Avenue, NW, Suite 600, Washington, DC 20036, at a cost of ten cents per page.

# UPDATES

**Biological Effects**....Some professors at Virginia Commonwealth University's Department of Pharmacology and Microbiology have set up a consulting firm called Quintox and have won a contract from the Office of Naval Research (ONR) to work on drug-microwave synergy. Professor Albert Munson will head the study of synergistic effects of microwaves and amphetamines on the immune system. VCU's Professor Stephen Cleary will serve as a consultant on the project. The first year's award is for $75,000; the project will run for two or three years....Drs. Przemyslaw Czerski and Ewa Manikowska have detected chromosomal abnormalities, cell degeneration and cell death in spermatogenic cells of mice exposed to 0.915, 2.45 and 9.4 GHz microwaves. A full description of this new research from BRH will appear in next month's issue....The workshop on *Behavioral Effects of Microwave Radiation Absorption,* reported as tentatively scheduled in last month's issue, will be held March 16–19 outside Salt Lake City as planned. For more information contact: Professor John D'Andrea at the University of Utah, (801) 581-8590....BRH is seeking a contractor to study the electromagnetic absorption characteristics of biological and simulated biological materials. For more information contact David Ramos at the FDA, (301) 443-4420....A US-Canadian team reports on the measurement of the permittivity of biological tissue with an open-ended coaxial cable in the January *IEEE Transactions on Microwave Theory and Techniques* (p. 82). ...Dr. James Bond of Jaycor in Alexandria, VA, is scheduled to present a seminar on "A Physiochemical Basis for Alterations in Ca Efflux from Cerebral Tissue Exposed to Low Intensity RF Electromagnetic Fields," on March 2 as part of ONR's Washington, DC-area seminar series.

**Communications**....The Office of Technology Assessment (OTA) has issued a report, *Radiofrequency Use and Management: Impacts From the World Administrative Radio Conference of 1979,* which concluded that the US "must begin to develop policies now that will assure that international telecommunication decisions do not jeopardize its political, economic and national security interests." Free summary copies are available from OTA, US Congress, Washington, DC 20510, (202) 224-8996. Or you can order a complete copy from the Government Printing Office, stock no. 052-003-00863-7, $6.50.... Microband Corp. of America, a subsidiary of Tymshare, wants to clear the way for over-the-air delivery of pay TV and other information services in 50 US markets. The company is seeking FCC approval to use multipoint distribution service (MDS) for multichannel systems capable of competing with cable TV. Microband calls its proposed 5-channel system Urbanet....The FCC has approved the first equipment for the Digital Termination Service (DTS). (See *MWN,* October 1981.) Rapac, a radio to transmit digital data within cities, will be available from Local Digital Distribution Co. of Rockville, MD, this summer. The company is a joint venture of M/A-COM Inc. and Aetna Life and Casualty Co....Megapulse Inc. of Bedford, MA, has been awarded $350,000 to perform a radio propagation study for DOE, and GE will do a $396,000 study of "mobile radio alternative systems" for NASA.

**Compatibility and Interference**....The new word processors at the State Department are emitting signals that are disrupting the clocks around the offices, according to an item in the February 5 *Washington Post.* The interference has yet to be controlled....The Lawrence Berkeley Laboratory (LBL) is hosting a two-day conference on *Lighting-Electromagnetic Compatibility* on March 18–19. The focus of the seminar will be the conducted and radiated EM waves from lighting systems operating at high frequencies. LBL will publish the proceedings of the meeting. For more information contact: Rudy Verderber, Room 90-3111, LBL, University of California, Berkeley, CA 94720, (415) 486-5605....The first issue of a new quarterly, *EMC Technology,* appeared in January. The magazine is published by Don White Consultants of Gainesville, VA. Subscriptions are $20 a year. Contact: Circulation Director, *EMC Technology,* PO Box D, Gainesville, VA 22065....Don White Consultants will be running a 4-day course on EMI/EMC grounding and shielding for the Bonneville Power Administration....And the navy has hired A&T Technical Services, Inc., for support in improving EMI/EMC communications. The contract is worth about $1.1 million....The International Special Committee on Radio Interference (CISPR) of the International Electrotechnical Commission has published the third edition of its publication (no. 10) *Organization, Rules and Procedures of the CISPR.* It is available from: Bureau Central de la Commission Electrotechnique Internationale, 1 rue de Varembe, Geneva, Switzerland. The price is 41 Swiss francs....CBS and NBC want the FCC to reconsider its recent decision to allow the Field Operations Bureau to shut down interfering news-gathering equipment. (See *MWN,* January/February 1982.) In its petition, NBC notes that the interference during the first shuttle flight—the impetus for the rule—was caused by out-of-band harmonics from the equipment, even though it was operating well within applicable FCC specifications. NBC states that the rules "address a theoretical situation that...has never occurred." The broadcasters argue that the rules are too broad and unnecessary....The National Association of Broadcasters (NAB) has begun a program of tracking the frequency and power used by Cuban stations, which are interfering with US radio broadcasters. The NAB will use the data to show the urgency of the problem....A group from the naval Research Laboratory in Washington, DC, has measured the spectral noise density, amplitude probability distribution and spectral content of ambient noise from 1.0 to 4.0 kHz at sites in Italy and Norway. The results appear in the January/February *Radio Science.*

**Measurement**....NBS will host this year's *Conference on Precision Electromagnetic Measurements* in Boulder, CO, June 28–July 1. For more information contact: David W. Allan, CPEM '82, NBS, 325 Broadway, Boulder, CO 80303....Canada's Douglas Hill has developed a new way to calibrate miniature probes used to measure electric fields in biological tissues at 2.45 GHz. His description is in the January *IEEE Transactions on Microwave Theory and Techniques.* ...And a team from McGill University in Montreal has published a set of design criteria for absorber-lined chambers used in electromagnetic susceptibility measurements in the February *IEEE Transactions on Electromagnetic Compatibility*....The Naval Surface Weapons Center in Dahlgren, VA, is seeking comments from contractors interested in developing a new and more compact RF/MW hazard meter for use aboard ship.

**Medical Applications**....Phosphorus-31 NMR has been used to observe the energy metabolism of human muscle. A team from England, G.K. Radda *et al.,* reports in the February 18 *Nature* (p. 608) that they have used the technique to measure changes in phosphocreatine and pH during exercise of the forearm of persons with muscular disorders....Two new review articles on the application of NMR were published last month. The potential for imaging and in vivo spectroscopy is reviewed in the February 5 *Science* (p. 619) and a more intro-

ductory piece appears in the January/February *Technology* (p. 32). ...Dr. Richard Heilman of the University of Vermont College of Medicine argues that there is a paradox in the presence of a malaise surrounding imaging technology at a time of its greatest development. In an editorial in the February 25 *New England Journal of Medicine*, *"What's Wrong with Radiology?" he explains the* paradox in terms of an inability to develop a coherent delivery system....M&D Technology Ltd. will start manufacturing NMR imagers in Aberdeen, Scotland. The university's Professor John Mallard will serve as the new company's scientific director....The January 28 *New Scientist* features an article on bioelectricity, "The Electricity That Shapes Our Ends."...RF, microwave and ultrasound hyperthermia for cancer treatment will be the subject of one of the sessions at the *Tenth Annual Northeast Bioengineering Conference* to be held at Dartmouth College, March 15–16. Dartmouth's Dr. Evan Douple will give a keynote speech on hyperthermia....The Association for the Advancement of Medical Instrumentation is holding its annual meeting in San Francisco, May 9–12. Among the sessions are those on hyperthermia cancer therapy, NMR imaging and medical device regulation. For more information, contact: AAMI, 1901 North Myer Drive, Arlington, VA 22209, (703) 525-4890.

**Military Systems**....The air force has decided to expand its experimental over-the-horizon backscatter radar system in Maine to cover a 60 degree sector as the next step in its development. The AF's Electronic System Command at Hanscom AFB, MA, is in charge of the work at the two OTH-B radar sites in Moscow/Caratunk and Columbia Falls, ME. A decision on where to site the full scale system will be made in the next few months. Bangor International Airport is the leading choice....The Naval Surface Weapons Center in Dahlgren, VA, wants to develop a compact, lightweight receiver with a frequency range from 200 Hz to 100 kHz for use on ships and aircraft (*Commerce Business Daily,* February 10).

**Occupational Health**....There is a good chance that OSHA will delete all of its "should" or voluntary standards in the coming months. This would eliminate the 10 $mW/cm^2$ guideline now on the books, and would make it possible to cite RF/MW violators under the OSHAct's general duty clause—possibly for exceeding the new, more stringent ANSI standard....Will NIOSH move to Atlanta or will its director, Dr. J. Donald Millar, come north to Rockville, MD? The drama continues. (See *MWN,* July/August & September 1981.) Congressman David Obey (D-WI) is again pressuring Millar to join the NIOSH staff in the Washington, DC, area. The subject will be aired at House appropriations hearings scheduled for February 25....OSHA is working with the American Electronics Association (AEA), based in Palo Alto, CA, to develop an occupational health and safety program for the more than one million workers in the electronics industry. The agreement calls for the project to start April 1 and to expire September 30 unless renewed....Meanwhile OSHA is closing down 41 of its area offices and laying off some 300 staff members. The agency has also changed its inspection policy so that only those work places which threaten "physical harm or an imminent danger" will be inspected....The American Industrial Hygiene Conference, scheduled for June 6–11 in Cincinnati, OH, will feature papers on non-ionizing radiation.

**Ovens**....Factory shipments of microwave ovens dropped 16% in January compared to last year. According to the latest statistics compiled by the Association of Home Appliance Manufacturers, 304,100 ovens were produced or imported, down from 361,900 in January 1981. Shipments of all major appliances declined 24%....Cober Electronics has published a new four-page brochure describing continuous microwave vulcanization ovens and pre-heaters developed *specifically for rubber processors. For a free copy, contact: Cober,* 102 Hamilton Avenue, Stamford, CT 06902.

**People**....RCA's Howard Johnson will be retiring on April 1 after 35 years with the company. He will be resigning as secretary of IMPI but will serve out his term on TEPRSSC. Johnson said that he might do some consulting. It is not clear if anyone will follow RF/MW issues for RCA when Johnson is gone....Verle Blaha has retired from Litton Microwave and become general manager and vice-president of Holaday Industries in Eden Prairie, MN....Sidney Metzger, a member of FMAC, has retired as chief scientist of Comsat. The company has yet to announce who will replace him....Dan Lynch, vice president of Executive Consultants Inc., has become the new executive director of IMPI. The institute recently moved its office from New York City to Vienna, VA.

**Power Lines**....The New York State Overhead Power Lines Project's Advisory Panel met in New York City over the February 19 weekend to select the winning proposals for studies on the health effects of powerline radiation. Some 15–20 projects will receive $3.5 million. A decision is due by April 1. At a public meeting held during the deliberations, panel chairman Dr. Michael Shelanski of NYU said that "due to funding limitations and the state of the art, the research funded under the program will not yield definitive answers on risk, but will give clear-cut replicable results." The state's Dr. David Carpenter revealed that the project will hire a consultant on dosimetry, who will visit all the funded labs. NYU's Dr. Arthur Upton has resigned from the panel for personal reasons.

**Satellite Communications**....The House Committee on Government Operations has recommended a study be prepared on potential applications of direct broadcast satellites (DBS). Both its report, *International Shortwave Broadcasting and Direct Broadcast Satellites: Voice of America, Radio Free Europe/Radio Liberty, Radio Marti,* December 11, No. 97-398, and the hearing record upon which it is based, *International Broadcasting: Direct Broadcasting Satellites,* are now available from the committee....The FCC is expected to authorize as many as eight interim DBS systems this spring. It decided against reconsidering two rejected DBS applications at a February 18 meeting....Meanwhile, Comsat's Satellite Television Corp. (STC) is gearing up to open a three-channel direct-to-home pay TV service in 1985. A special report on STC appears in the February 22 *Broadcasting*....Ford Aerospace and Communications wants to build one billion dollar's worth of satellites for Intelsat, but the international satcom group plans to negotiate the contract with Hughes Aircraft. This February Ford asked the FCC to block Comsat's participation in the construction project in order to prompt Intelsat to reconsider the bids....Despite the recent bad news, or perhaps because of it, Ford ran two-page ads in the *New York Times* and the *Washington Post* assuring readers "There's a Ford [satellite] in America's Future." ...AT&T has filed with the FCC to start a nationwide satellite distribution system for radio programs later this year....A review article on business use of satellite communications appears in the February 12 *Science*....The January *Microwave Systems News* offers a view of satcom's role in the 1980's....An interview with the army's Project Manager for Satellite Communications, Colonel Charles Lindberg, is featured in the January issue of *Military Electronics/Countermeasures*....RCA has come up with a new scheme for leasing transponders on its Satcom IV satellite since its November auction, bringing in a total of $90.1 million in winning bids, was invalidated by the FCC in January. The company has proposed selling each lease for $13 million, a price it says reflects market demand.

**Standards**....The National Associaton of Broadcasters has awarded Jane Clemmensen of the University of California, Berkeley a grant for a "Report on the Status of Federal Standards on Non-Ionizing Radiation."

***Technology****....The National Oceanic and Atmospheric Administration* has awarded three $850,000 competitive contracts for designing a new weather-radar system to Raytheon, Sperry and a team from Ford Aerospace & Communications and Westinghouse Electric. The government hopes to replace 300 aging radar units with 160 new ones, capable of giving advanced warning of tornados and flash floods, by

the mid-1990's....The worldwide satellite remote sensing market will reach $400 million per year by 1990, according to a study by Metrics Inc. of Atlanta, GA. Metrics estimates this market is the fastest growing area of commercial space activity. For information contact: G. William Spann, Metrics Inc., 290 Interstate North, Suite 116, Atlanta, GA 30339, (404) 955-1975....The IEEE MTT Society has published *Low-Noise Microwave Transistors and Amplifiers,* a book of selected reprints. Cost: $16.95 paper for IEEE members, $33.95 hardcover or $25.45 for IEEE members. Order prepaid from the IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854....An article on the macron accelerator, a device that can accelerate gram-size pieces of matter to high speeds and a relative of the rail gun, appears in the January/February *American Scientist*....In contract news, the Defense Nuclear Agency is seeking a contractor to write guidelines for designing electronic circuits in such a way as to avoid electromagnetic pulse (EMP) damage. Contact Robert Henshaw, (202) 325-7658.... NASA is negotiating with NOVAR Electronics Corp. of Barberton, OH, for an evaluation of SPS sonic simulator development and microwave propagation effects....Texas Instruments Inc. of Dallas, TX, has won a $227,104 contract from the FAA to support the installation of MLS prototype ground equipment at Philadelphia International Airport....The Army Armament R&D Command is negotiating with Geo-Centers Inc. of Newton Upper Falls, MA, to evaluate the theoretical possibilities of microwave absorption for detecting chemicals....Yale University will perform experiments on the interaction of electromagnetic waves with metallic fibers under a $200,000 contract from the Army Research Office.

**VDTs**....Video display terminal (VDT) provisions in the new Newspaper Guild contract with the Montreal *Gazette* include shielding for the flyback transformers of all plastic bodied terminals (see *MWN,* March 1981), annual eye examinations and alternative work for pregnant operators upon request. If reassignment is impossible, a lead apron will be provided....Union official Gary Cwitco of the Communications Workers of Canada estimates 60 to 70 percent of the pregnant VDT operators at Bell Canada take advantage of a labor agreement allowing them to stop VDT work. (See *MWN,* May 1981.)... Results from Mt. Sinai's epidemiological study of VDT health effects are still months away. According to Dr. Arthur Frank, the study's director, the first batch of completed questionnaires from participating Newspaper Guild locals is now being processed. (See *MWN,* March 1981.)...News in the February 9 *Wall Street Journal* that NIOSH's Baltimore *Sun* study found no marked increase in the incidence of cataracts among VDT operators took institute investigators by surprise. NIOSH's Dr. Shiro Tanaka did not refute the *Journal's* report; he told *Microwave News* that no results have been released on the 400 some eye exams performed for the study. The report will take at least a few more months to complete. (See *MWN,* March 1981.)... Commenting on reports of problem pregnancy clusters among clerical workers, Dr. Nancy Binkin at the Center for Disease Control in Atlanta, GA, said "fifty clusters in one year would not be significant, given the large number of workers and VDTs." She warned against lumping together different types of birth defects and miscarriages. (See *MWN,* November 1981 & January/February 1982.)...A sympathetic judge in Frankfurt, Germany, dismissed charges against a bookkeeper who attacked his company's VDT with a chair and then set it on fire. According to the January 29 *Guild Reporter,* the employee was frustrated by system failures that regularly forced him to work overtime.

## *Massachusetts Standard* *(continued from p. 1)*

April 29 in Boston. Since the legislature authorized the state agencies to set a standard for non-ionizing radiation in 1980, the standard becomes official 30 days after its publication in the *Commonwealth Register,* the state's official record. The new rule could be in effect by this summer.

The limits in the population standard are in fact the same as the new ANSI standard except that all values have been reduced by a factor of five. The other major difference is that the averaging time for measuring exposures will be 30 minutes instead of ANSI's six minutes. The variation, Watkins explained, was favored because the standard is designed to protect the public from long-term chronic exposures.

The occupational limits would only apply to medical and educational institutions. The Department of Public Health is, however, working with the state's Department of Labor and Industry, which is likely to issue a similar standard to protect other workers in the state. The averaging time for occupational exposures is six minutes.

In addition, there is a proposed emission standard for microwave ovens: a 5 mW/cm$^2$ leakage limit for ovens made after October 5, 1971, and 10 mW/cm$^2$ for those made before that date.

The proposed standard has an exclusion clause which allows the limits to be exceeded "if the exposure conditions are shown by laboratory procedures approved by the Director [of the Radiation Control Program of the Massachusetts Department of Public Health] to produce a spacial peak specific absorption rate below eight watts per kilogram averaged over any one gram of tissue" and an average, whole-body SAR below 0.08 W/Kg for the public and 0.4 W/Kg for workers. Devices with an input power of seven watts or less are also excluded.

The proposal was drafted by an ad hoc committee on nonionizing radiation chaired by Watkins. Its membership includes Dr. Sol Aronow of Massachusetts General Hospital, Representative Argeo Cellucci of the state legislature, Dr. Samuel Fine of Northeastern University, Dr. Padmakar Lele of MIT, Dr. John Osepchuk of Raytheon and Dr. John Shapiro of Harvard.

The department has published a report which contains an introduction to RF/MW radiation and a rationale for the standard, "105 CMR 122.000: Regulations Governing Machines Which Generate Radio Frequency Electromagnetic Fields." For a copy of the report and the rationale, contact: Robert Watkins, Department of Public Health, Room 770, 600 Washington Street, Boston, MA 02111.

## *RFI at TMI* *(continued from p. 1)*

radio signals had interfered with the combustible gas meter and that the chromatograph analysis had been faulty. A workman's portable radio had confused the hydrogen gas meter, yielding unreliable readings.

A spokesman for General Public Utilities (GPU), the owner of the plant, refused to disclose either the type of meter which had been susceptible to RFI or the type of two-way radio used at the plant. GPU's Doug Bedell did say, however, that the walkie-talkie in question consisted of a microphone in the worker's face mask with a receiver in the belt of his protective suit.

None of the RFI experts contacted by *Microwave News* were surprised by the incident. They acknowledged that such events are possible, though unlikely. Some warned that the absence of federal standards for RFI made potential problems difficult to control. In a staff report released last July, the Federal Communications Commission concluded: "As our society becomes more and more dependent on electronics and electronic communications, societal problems stemming from RFI can only get worse unless significant parallel action is taken."

A spokesman for the Nuclear Regulatory Commission said it could not compel the release of any information on the interfering equipment. The commission is not investigating the "unusual event" at TMI, but it will review the GPU's report on the incident.

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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.*

# New Light on ELF Radiation

## *Leukemia Again Linked to EM Fields*

A statistical analysis of mortality data from England and Wales has "reinforced" recent US findings linking leukemia to occupational exposure to electromagnetic fields. This is the third report published since last summer that identifies an association between cancer mortality and working in electrical environments. In addition, a soon-to-be published study from Sweden implicates extremely low frequency (ELF) fields as a cause of congenital malformations among the children of men who work in high voltage substations. In the last few months there have also been two other papers indicating a connection between cancer and ELF alternating magnetic fields (AMFs) among the general population.

The latest cancer report, published in the January 29 *Lancet* by Michael McDowall of the Office of Population Censuses and Surveys in London, reveals a consistently higher mortality rate from lymphoid and myeloid leukemia among male electrical and electronic engineers and telegraph radio operators aged 15-74 in England and Wales during 1970-1972. The rates of acute myeloid leukemia (AML) were particularly high. The analysis of data on AML among workers in England and Wales in 1973 identifies "consistently increased relative risks for the electrical occupations, the highest risk being for telecommunications engineers."

An editorial in the same issue of *Lancet* cautions that "it is impossible to know what the observations mean," but that "the cluster of reports relating to [AML] is worrisome." It concludes: "Since all of us are exposed to some electrical and

*(continued on p. 2)*

## *Very Weak Pulsed Magnetic Fields Affect Development*

Recent experiments in Spain indicate that extremely weak pulsed magnetic fields at frequencies of 10, 100 and 1,000 Hz can have a "consistent and powerful" effect on the development of chicken embryos. The field exposures were so low that many researchers find the results hard to believe. Nevertheless all agree that the experiment should be repeated. If replicated, the Spanish work would have a major impact on the direction of radiation research.

A group headed by Dr. Jose M.R. Delgado at the Centro Ramon y Cajal Hospital in Madrid has found that extremely low frequency (ELF) pulsed magnetic fields at intensities ranging from 1.2-120 milligauss can upset chick embryonic development. They reported their findings in the *Journal of Anatomy*, a well respected, peer reviewed British journal. The article has been circulating among a small circle of researchers since it was published last May, but has escaped more general scientific and public attention. Richard Tell of the Environmental Protection Agency's (EPA) Office of Radiation Programs called Delgado's findings "amazing." He said that "if it checks out, this could be one of the most significant studies in years."

**Delgado's Experiment**

Delgado placed newly fertilized chicken eggs inside a coil connected to a

*(continued on p. 2)*

## *ELF: Leukemia* *(continued from p. 1)*

magnetic fields, and continuously to low levels of non-ionizing electromagnetic radiation, it is important to know what risks, if any, are entailed." The *Lancet* is a highly regarded British medical journal.

### Congenital Malformations

A soon to be released paper from Sweden also questions the safety of occupational exposures to ELF fields. Dr. Stefan Nordstrom of the University of Umea and co-workers report that children born to men who work in high voltage substations have an increased incidence of congenital malformations. The authors of the retrospective study hypothesize that "as a result of working in electrical fields in the switchyards, the employees' bodies and/or objects in the switchyards are electrically charged and then discharged ...Cell disturbances, including chromosomal aberrations, may be caused by such charges/discharges." They advise that while these results are statistically significant, they are based on only a small number of cases. The paper is scheduled to be published in the next issue of *Bioelectromagnetics*.

Commenting on these studies, Dr. Robert Becker said, "Researchers must start doing epidemiologies." Interviews with many other scientists indicated a growing consensus that more detailed research must now be carried out. Becker, the author of *Electromagnetism and Life* (with Dr. Andrew Marino), believes that ELF fields can act as generalized stressors and as enhancers of cell division. Under certain conditions, these could cause malignancies and developmental aberrations, he argues.

A similar view is held by Dr. Clay Easterly of Oak Ridge National Laboratory in Tennessee, who has written a number of papers on the risks associated with magnetic fields. In 1981, he proposed a hypothesis to explain how magnetic fields could promote cancer (rather than initiate it): magnetic fields may alter cell replication and thus act as a stimulus for the proliferation of latent tumor cells, leading to the development of malignant tumors.

### Other Recent Studies

Last July, Dr. Samuel Milham, Jr., reported an association between leukemia and exposure to electric and magnetic fields among workers (see *MWN*, July/August 1982). Milham's results were then confirmed by a research group at the University of Southern California (USC) with occupational cancer data for Los Angeles (see *MWN*, December 1982). The USC study identified an increased risk of developing AML, especially among power linemen.

With respect to the general population, in 1979, Dr. Nancy Wertheimer and Ed Leeper reported a correlation between exposure to electric power lines and childhood cancer. A similar study in Rhode Island failed to show such a relationship, however. Wertheimer and Leeper recently extended their results, finding that AMFs were also associated with cancer in adults (see *MWN*, January/February 1983). And last year, a Swedish group found support for Wertheimer's original study using cancer statistics from Stockholm (see *MWN*, November 1982).

In a speech delivered last May before the new series of cancer reports appeared, Dr. J.A. Bonnell concluded that there was no evidence to contradict the view that electric fields were harmless up to transmission voltages of 400 kV, and probably for voltages as high as 800 kV. Dr. Bonnell, a medical adviser to the Central Electricity Generating Board in London, published his speech in the December issue of the *Journal of the Royal Society of Medicine*.

Phone calls to the Electric Power Research Institute in Palo Alto, CA, which sponsors some research on the biological effects of ELF fields for a consortium of electrical utilities, were not returned.

### NY Sponsors Research

The New York State Department of Health's Power Lines Project is in the midst of planning an epidemiolgical study of the relationship between 60 Hz electromagnetic fields and cancer in the general population. Pre-proposals are due March 22. For more information, see the notice in the February 18 *Science* (p.893) or call (518) 474-4170.

Last year the project announced an award to SRI International for an epidemiological study of electric utility workers but the effort was suspended after questions were raised about the way the cohorts were defined (see *MWN*, November 1982).

The New York project's Scientific Advisory Panel is also looking into the possibility of re-analyzing Wertheimer's data on childhood and adult cancer. The expert panel has hired Dr. Annemarie Crocetti, a New York-based consultant in epidemiology, to advise them on the status of the data.

The panel will meet March 27-28 in Albany to review pre-proposals for the epidemiological study, consider Crocetti's report and evaluate the state's entire $3.5 million research program.

## *ELF: Magnetic Fields* *(continued from p. 1)*

generator of rectangular waves with a pulse duration of 0.5 milliseconds. Eggs were exposed to magnetic fields of 0.12 micro Tesla (uT), 1.2 uT and 12 uT. (1 uT = 0.01 gauss, so these fields are equivalent to 1.2, 12 and 120 milligauss) for 48 hours at frequencies of 10, 100 and 1,000 Hz. At the two higher frequencies and for each of the three intensities, Delgado reports significant malformations, especially in the nervous system and the heart. While exposures to 10 Hz magnetic fields were not free of abnormalities, he notes that a "trend toward normality was evident."

Delgado found the "most marked and uniform effects on embryological development" at 100 Hz and 1.2 uT. Under these conditions, microscopic analysis indicated "drastic" changes in tissue structure: "There was little cellular differentiation, and a lack of organization of cells, without mutual cohesion, resulted in a fragile tissue..." He deduces that the mechanism of action of the ELF magnetic fields is "slow and cumulative," and that "embryonic organs reacted with different sensitivity" to the different parameters of the field. He finds that any thermal effects were "minimal and may be disregarded." Delgado also maintains that he observed frequency and power windows because embryos exposed to fields of 100 Hz and 12 uT were less developed than those exposed to higher and lower frequencies and intensities.

### Skepticism Until Replication

Most scientists interviewed about Delgado's paper found it difficult to believe that such weak magnetic fields could have so profound an effect. For instance, Dr. Lionel Jaffe of Purdue University said that he viewed the results with extreme skepticism

*MICROWAVE NEWS* is published monthly, except in January and July • ISSN 0275-6595 • PO Box 1799, Grand Central Station • New York, NY 10163 • (212) 794-9633 • Editor: Louis Slesin, Ph.D., Associate Editor: Martha Zybko • Subscription: $200 per year (overseas $235) • Copyright © 1983 by Louis Slesin • Reproduction in any form is forbidden without written permission.

because the fields were so small. "I don't believe it, I can't believe it," he said. In a paper published in 1979, Jaffe reported measuring *natural* currents inside chick embryos that were much larger that those induced by the magnetic field applied by Delgado.

In contrast to Delgado's fields of 1-200 milligauss, the earth's magnetic field is about 0.5 gauss or 500 milligauss, though it is neither an alternating nor a pulsed field.

Dr. Ezra Berman, an expert in teratology at EPA's Health Research Laboratory in Research Triangle Park, NC, said Delgado's results were "very interesting" but Berman was not sure "what was going on." There appears to be a "very strong effect," he said, but the data do not support the conclusion that there is a frequency or intensity window. Berman said that he would like to see the experiment run with more eggs in order to clarify the statistics; in addition, he wants more details about the way the eggs were handled in the course of the study.

Another teratologist, Dr. Joe Lary of the National Institute for Occupational Safety and Health (NIOSH) also expressed concern over Delgado's findings, but added that he was not convinced Delgado had observed abnormalities. The fields might have caused a retardation in development, he said. "The only way to be sure," Lary added, "is to allow the chicks to hatch."

All the teratologists contacted by *Microwave News* agreed that there were very few studies on the effects of *pulsed* fields on embryonic development. The vast majority of experiments have used continuous wave radiation -- most at 27 MHz and 2450 MHz. One exception is an experiment by Czech researcher Dr. Hana Pafkova, who found "an unfavorable effect" on the embryonic development of mice after exposing them to a pulsed 300 Hz field (see *MWN*, January/February 1983).

Dr. Whit Athey of FDA's National Center for Devices and Radiological Health said that he would be dubious about Delgado's results until they are replicated. But, he added, "they must definitely be followed up." Athey said no one at the center was doing any similar experiments.

Dr. Carl Blackman, one of Berman's colleagues at the EPA lab who is well known for his work that shows window effects in the efflux of calcium from brain tissue at ELF frequencies, said that a definitive view would have to wait until another lab repeated Delgado's experiment. But he said that very low level effects were possible: "People in this field tend to think that biological effects are caused by intensities that are comparable to those caused by gross heating; yet biological systems, in their natural state, seem to be sensitive to very low electrical and magnetic fields." As examples, Blackman cited the extreme sensitivity of newts, mice and salamanders to magnetic fields and sharks and skates to electric fields.

### Pulse Rise Time

EPA's Tell wonders why more scientists are not attempting to repeat Delgado's experiment. In a telephone interview, he said that one of his colleagues in Sweden has tried but failed to obtain the same results. Although Delgado does not cite the rise time of the pulses he used, Tell has discovered them to be very sharp: 1.5 microseconds. The Swedish researcher used a longer rise time and that may have been an important difference, Tell said. Meanwhile, frustrated by the inaction of others, Tell has a student trying to replicate the experiment as part of an independent study course.

Tell points out that if Delgado's findings are true, their significance is enormous. They would affect a host of different technologies: examples range from nuclear magnetic resonance (NMR) imagers to light dimmers, he said.

Before becoming the chairman of the Department of Physiology at the Centro Ramon y Cajal Hospital in Madrid, Delgado was a professor at Yale Medical School in New Haven, CT.

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# HIGHLIGHTS

## FY84 Budget Roundup

The Reagan Administration's proposed fiscal year 1984 (FY84) budget was released in early February. Outlined below are the requests for the federal agencies which have non-ionizing radiation bioeffects or compatibility programs. Not included here are budget items for the Department of Defense's R&D and procurement programs; these will be covered next month. One note of caution: many agencies still do not even have an approved FY83 budget (FY83 began last October 1), so all the numbers below should be considered approximate.

***Air Force:*** The RF/MW bioeffects research budget at the AF School of Aerospace Medicine will remain at last year's level in FY84, about $2 million.

***Department of Energy:*** The Division of Electrical Energy Systems has been cut from $21.3 million in FY83 to $12.6 million in FY84, with the electric field effects program reduced from $2.6 million to $2.0 million.

***Environmental Protection Agency:*** As we reported last month, EPA is seeking to eliminate its health research program on non-ionizing radiation. The rationale given in the EPA program request is: "No resources have been requested for the non-ionizing radiation health effects program in 1984. This program has been focused on research to support the issuance of the 1984 federal radiation protection guidance for [RF/MW] radiation. Since development of these environmental exposure guidelines will be completed in 1984, no additional health research will be needed for incorporation in the guidelines and the program will be closed out." EPA's Office of Radiation Programs FY84 budget remains at approximately the FY83 level: $10.8 million.

***Federal Communications Commission:*** A request of $86.159 million for FY84, an increase of $6.34 million over FY83.

***Navy:*** The Office of Naval Research's projected FY84 non-ionizing radiation bioeffects budget shows an increase to $2.75 million from $2.26 million in FY83, although it is already clear that the budget will be cut to about $2.5 million for FY84. Most of these funds are part of ONR's special focus program. The Naval Medical R&D Command will operate at about the same level as FY83, approximately $1.1 million – not including the ELF studies at the Naval Aersopace Medical Research Laboratory in Pensacola, FL.

***National Bureau of Standards:*** While the bureau's FY84 request is down $19.2 million to $98.7 million due to cut backs in building, fire and computer research, the Electromagnetic Fields Division will remain at approximately the FY83 level of $5.0 million.

***National Institute for Occupational Safety and Health:*** $54.62 million for FY84 down from $57.48 million in FY83.

***National Telecommunications and Information Administration:*** $12.2 million for FY84, down from $27.2 million in FY83. The administration is once again trying to delete the public telecommunications facilities program; Congress reinstated the funds in the FY83 budget. Otherwise, the budget is about the same.

***Office of Radiological Health (FDA):*** The ORH program (including its inspectors in the field) is projected to increase by $902,000 to $28,796,000. ORH handles both ionizing and non-ionizing radiation.

## NIOSH Scraps RF/MW Criteria Document; Plans Shorter Rationale for Safety Standard

After nearly six years of work, the National Institute for Occupational Safety and Health (NIOSH) has abandoned its criteria document on radiofrequency and microwave (RF/MW) radiation. The agency now intends to issue a much briefer report to serve as a rationale for a new occupational safety standard.

NIOSH officials in Cincinnati, OH, say they soon expect to complete a brief review of the RF/MW bioeffects literature through mid-1978 and have a rough draft of a recommended standard by the end of June. At that time, they will assess how long it will take to update the review to include research published through the end of 1981 and 1982.

According to present plans, the *Recommended Standard and Rationale* will be similar to the rationale included in the American National Standards Institute's (ANSI) new RF/MW standard (C95.1-1982) issued last year. A NIOSH spokesman said that the new NIOSH rationale document will be longer and more comprehensive than ANSI's, however.

The decision to scrap the old criteria document came after many NIOSH employees quit the agency when it moved out of Rockville, MD. The criteria development division was transferred to Cincinnati -- the rest of NIOSH went to Atlanta, GA (see *MWN*, January/February 1983). Responsibility for developing a recommended standard has now been assigned to the physical agents effects branch, which has been without a chief since Dr. Wordie Parr retired in December.

Last year, the Occupational Safety and Health Administration (OSHA) stopped enforcing its 10 mW/cm$^2$ RF/MW standard (see *MWN*, April 1982). The standard was only advisory, and last May OSHA proposed deleting all its voluntary standards (47 *FR* 23477, May 28, 1982). The agency had planned to issue an advanced notice of proposed rule making (ANPRM) for a new RF/MW safety standard last September (see *MWN*, October 1982), but an OSHA official said that the "ANPRM is still pending."

NIOSH announced its intention to issue a criteria document on RF/MW radiation in 1977. A 500-page draft document was released for review in April 1979, but it was heavily criticized and later withdrawn.

NIOSH staffers in Cincinnati are also working on a report describing a step-by-step approach for controlling radiation emissions from RF sealers. No publication date has yet been set, since the rationale document has top priority.

## Industry Asks EPA to Act Quickly on RF/MW Guidance

The communications industry has once again urged the federal government to set a national "guidance" for exposure to radiofrequency/microwave (RF/MW) radiation. In comments submitted to the Environmental Protection Agency (EPA) last month, several companies have asked the agency to act quickly to preempt potentially restrictive state and local standards. The advice came in response to EPA's announced plan to recommend a general population exposure limit later this year. (See *MWN*, January/February 1983.)

The comments underscore the need to, as AT&T put it, "quell the public's anxiety over the issue of RF exposure" and to "ease the burden of RF equipment operators having to deal with different standards in different communities." The TV Broadcasters All

Industry Committee, the National Association of Broadcasters (NAB) and GTE Service Corp. all made similar pleas.

The companies are also united in suggesting that EPA base its recommendation on the American National Standards Institute's (ANSI) revised standard. GTE, for example, recommended ANSI's work because it is "the consensus of experts in this country who represent all of the disciplines concerned with this issue."

Massachusetts' Radiation Control Program manager Robert Watkins explained in his comments that the absence of a national non-ionizing radiation limit prompted the state to propose its own standard, which is five times stricter than ANSI's.

Specific questions posed in EPA's advanced notice of proposed recommendation elicited the following responses:

- Many filers asked EPA to cover frequencies down to at least the low kHz range, with the American Satellite Co., GTE and Massachusetts' Robert Watkins advising that the guidance include extremely low frequency (ELF) radiation. AT&T proposed starting at 10 kHz and NAB at 500 kHz.
- A frequency dependent guideline received overwhelming support. (See AT&T's comments, below.)
- Opinion is mixed as to whether the guidance should address partial body exposures, but comments tend to support a whole body approach. American Satellite Co. said partial body exposure rules should be developed at a later date, but AT&T maintained only a whole body rule is needed for the general public. GTE recommends following ANSI's approach.

The Office of Radiation Programs' criteria document on RF/MW bioeffects has not yet been made public. An ad hoc committee to the agency's Scientific Advisory Board has been formed to review the document, which will be the basis for the guidance. It is expected to be released in April at the group's first meeting. The tentative membership of the committee is: Professor Charles Susskind, University of California at Berkeley, Chairman; Dr. Eleanor Adair, John Pierce Foundation (New Haven): Professor Stephen Cleary, Virginia Commonwealth University, Richmond; Professor Carl Durney, University of Utah, Salt Lake City; Professor Arthur Guy, University of Washington, Seattle; Professor Abraham Lilienfeld, Johns Hopkins University; Professor Sol Michaelson, University of Rochester; and Professor Mary Ellen O'Connor, University of Tulsa.

## *Excerpts from Comments on EPA RF/MW Guidance Development*

*The extracts below are from submissions received by EPA on its advanced notice of proposed recommendation appearing in the December 23 Federal Register (47 FR 57338). A review of more comments will appear next month. Included here are comments from: American Satellite Co., AT&T, GTE Service Corp., Massachusetts Radiation Control Program, Professor Sol Michaelson, the National Association of Broadcasters, Dr. Herbert Pollack and the TV Broadcasters All Industry Committee.*

***American Satellite Co.:*** ASC feels that it is important to establish maximum acceptable exposure levels for all frequency bands from ELF to EHF [extremely high frequency]....Initially, [the guidance] would only be necessary for whole body exposure. Partial body exposure levels should be developed as a follow-on effort....The exposure limits should vary with frequency to account for body resonances and maximum absorption bands....It is ASC's opinion that limits should be placed on maximum as well as average exposure....ASC also feels that limits should be placed on instantaneous as well as time-averaged specific absorption rates.

***AT&T:*** It is necessary for certain radio facilities to generate strong RF fields in inaccessible areas in order to serve the public. If a guideline which is appropriate for an area that is accessible to the public is applied in these situations, it will inhibit the operation of these facilities without any benefit to the public health. Therefore, the EPA guidelines should take such situations into account by making it clear that the exposure limits apply only to publicly accessible areas....In order to establish a single exposure limit that would be an acceptable health level for all frequencies, the EPA would have to select a limit that was sufficiently strict to cover the frequencies that produce the most adverse effects. This limit would be much more than is necessary for frequencies that produce less adverse effects. Such a strict limit would inhibit use of these frequencies. Clearly, this waste of a natural resource – the spectrum – would not be in the public interest.

***GTE Service Corp.:*** GTE suggests that [the frequency range of the guidance] ought to cover, on the low frequency end, services like very low frequency (VLF) communication and navigation, low frequency (LF) navigation systems and various proposed military utilizations of the spectrum below 550 kHz. Thus the standard should start at least at 10 kHz. There should also be an attempt to establish a standard for frequencies around 50-400 Hz, to include the ubiquitous power lines and certain harmonics. GTE includes 400 Hz because the ambient 400 Hz fields inside an aircraft are not low....EPA's promulgations should make it clear to the public that there are whole classes of installations of which the general public need have no fear: microwave relay dishes on towers or tall buildings, satellite earth stations and mobile radios. To minimize operator exposure, EPA may wish to direct equipment manufacturers to include warning labels.

***Massachusetts Radiation Control Program:*** The range of frequencies included in the Massachusetts proposed regulation are in the range of 0.3 to 100,000 MHz. This range was selected primarily due to the work done by the ANSI C95 committee. However, there is increasing concern over extremely low frequency ELF radiation sources. Thus, I suggest that your recommendations include frequencies as low as 50 Hz....

***Professor Sol Michaelson:*** I would strongly recommend that EPA adopt the ANSI 1982 recommended standard with modifications suggested in the Commonwealth of Massachusetts recommended standard....It incorporates a large enough margin of safety to encompass the requirements of the general population as well as the worker. Adoption of this protection guide would provide a uniformity of standards which would obviate the need for local standards such as recently considered by Massachusetts and Portland, OR.

***National Association of Broadcasters:*** Prompt issuance of an EPA standard would work in two important ways insofar as the public's reception of communication service is concerned: (1) it would provide the FCC with the guidance needed for its carrying out of statutory obligations under the terms of both the National Environmental Policy Act of 1969 and the Communications Act of 1934; and (2) it would provide non-federal authorities a uniform federal standard which could be applied to local regulation or, preferably, could be used to justify non-federal forebearance from regulation....NAB urges that the frequency range extend at least between 500 kHz and 50 GHz....It would appear that a "whole body" rather than "partial body" focus would be appropriate....NAB would have no difficulty were a reasonable frequency-dependent standard, such as ANSI C95.1-1982, be adopted by EPA.

***Dr. Herbert Pollack:*** You refer to residential exposure in your notice. It is my impression that measurements were made in the streets or on the exterior of the buildings. Have you calculated the attenuation of the signal within the buildings or homes?... Your statistical residential exposure may be much higher than the actual one.

***TV Broadcasters All Industry Committee:*** There is a pressing need for EPA to establish sound and reasonable radiofrequency radiation standards as promptly as possible....As EPA moves forward with its efforts to formulate sound federal standards, the committee believes the agency would be greatly aided by soliciting and facilitating the input of experts from other affected agencies and industries such as the FCC and its radio communications licensees.

# UPDATES

**Biological Effects**...Drs. A.F. Lawrence of Hughes Aircraft and W.R. Adey of the VA Hospital in Loma Linda, CA, are organizing an *International Conference on Nonlinear Electrodynamics in Biological Systems*, June 5-9 at the Jerry L. Pettis Memorial VA Hospital in Loma Linda, CA. Over the last few years, researchers have made considerable progress towards developing new models of energy transfer mechanisms in cellular systems. The conference will provide an opportunity to examine the relevance of nonlinear phenomena to the medical and biological sciences. According to Adey, "the meeting will be an interdisciplinary forum for industry and government researchers to set an agenda for a national research program." There will be no registration fee, but space is limited and applications will be treated on a first come, first served basis. For more information contact Barbara Kruggel at the hospital, 11201 Benton St., Loma Linda, CA 92357....Those who plan to attend and want to brush up on nonlinear interactions and soliton research should take a look at *Nonlinear Phenomena in Physics and Biology*, edited by Richard Enns *et al.* (New York: Plenum Press, 1981, 610 pp., $75.00). The book is a collection of papers presented at a NATO conference held in Alberta, Canada, in August 1980. The uninitiated will find Dr. Alwyn Scott's "Introduction to Nonlinear Waves" especially useful. Scott, who is based at the Center for Nonlinear Studies at the Los Alamos National Laboratory in New Mexico, provides a history of soliton research beginning in 1844 when John Scott Russell first described a solitary wave moving through the Union Canal in Scotland. (A solitary wave, or soliton, does not dissipate as it travels; instead it is able to keep its original shape.) Scott outlines Davydov's hypothesis that solitons can form in biological systems, allowing the transport of energy over long distances; Davydov has used the alpha helix protein as an example....A new group of researchers is looking into the question of calcium efflux, according to the abstracts of papers for the Biophysical Society meeting held in San Diego, CA, February 13-16, and published in the February issue of the *Biophysical Journal*. J.L. Schwartz of the National Research Council of Canada and his co-workers report on the effects of ELF amplitude modulated RF fields on calcium efflux from frog hearts. They tried CW radiation as well as that modulated at the heart's natural beating frequency and at 16 Hz – at SAR's between 0.15-3.0 mW/Kg. Only 16 Hz modulated radiation increased the calcium efflux. They note that the "absorbed power levels seem to exclude possible gross heating of the hearts."...A team from the University of Pennsylvania in Philadelphia have determined the dielectric permittivity and electrical conductivity of fluid saturated rat bone over the frequency range 10 Hz to 100 MHz. The results are in the February issue of the *IEEE Transactions on Biomedical Engineering*.

**Communications**...Residents from Vernon, Ringwood and Rockaway, NJ, met with state officials in February to discuss their concern over broadcast radiation. A spokeswoman for Assemblyman Dean Gallo said that state officals will look into citizen fears of radiation hazards. Proposed RF/MW facilities have generated community opposition in all three towns. Ringwood recently turned down an ITT proposed relay tower, which had already failed to win siting approval in South Nyack, NY. And Vernon's citizen group opposing a proposed RCA Americom point-to-point tower is organizing a national network of like-minded groups. According to Elise Kreindler, one of the leaders of Vernon's Citizens Against the Tower (CAT) people in about 20 areas want to join....AT&T Long Lines has taken its new communications network for the Northeast corridor underground. Last month the Washington, DC, to New York City leg of a planned 776-mile fiber optics system began operation. The company will finish the project by 1984 and expects this technology to save about $50 million in construction and operating costs by 1990. A similar link between Sacramento and San Diego, CA, should be finished by 1985. Japan is stepping up its already substantial investment in fiber optics. The FCC's A.M. Rutkowski reports in the December 1982 *Telecommunications* that the Japanese envision a "potentially enormous" international market as well as extensive domestic networks. In a paper prepared for the FCC's 1985 WARC advisory committee meeting, Rutkowski explains that fiber optics, fast becoming cost-effective, could take a big bite out of the future demand for satellite links....The FCC has published proposed rules for reallocating fixed service users in the 12 GHz band (48 *FR* 6730, February 15, 1983) and plans to issue a report and order in September. The commission discusses policy plans for utilization of fixed and mobile bands between 947 MHz and 40 GHz in the same notice....Brazil, China, Pakistan and Saudi Arabia are among the nations targeted as future markets for digital microwave radio (DMR). International Resource Development's report No. 533 states DMR markets in industrializing countries could reach $200 million by 1995. On the domestic front, the company predicts heavy demand for cordless phones (report No. 536). Both publications cost $985 and are available from IRD, 30 High Street, Norwalk, CT 06851, (203) 866-6914....MCI is after people on the go. The company recently won FCC permission to provide radio paging services in several major markets; it already provides paging and mobile communications services in 52 cities....An article on present and future paging technology appears in the March *High Technology*.

**Compatibility & Interference**...Last December we reported that state policemen were having RFI problems from their walkie talkies to Breathalyzer units, which are widely used to check the sobriety of suspected drunk drivers. The accuracy of the units took on added importance as the Supreme Court ruled on February 22 that a driver's refusal to submit to a blood alcohol test could be held against him in a trial. So, those worried that their tests might be inaccurate may have to submit to them anyway. Smith & Wesson, the manufacturer of the Breathalyzer units, has issued a customer advisory, *Guidelines for Radiofrequency Interference Testing*. For more information, contact S&W's Herb Belin, 2100 Roosevelt Avenue, Springfield, MA 01101....NBS' Electromagnetic Fields Division has delivered a high dynamic range, tunable EMI antenna system to the US Army at Ft. Huachuca, AZ. The antenna is designed for use with a Singer Stoddart NM-17/27 EMI/field intensity meter or with a spectrum analyzer. The antenna operates in the frequency range of 250 kHz to 32 MHz and was developed because the army was having EMI problems from background noises in the 10 kHz to 10 MHz range....The *New York Times* ran an item on cordless phones on February 12 and reported that household appliances like vacuum cleaners could interfere with the phones. Also the *Times* noted the theoretical possibility of "telephone raiders": people could drive through a neighborhood with a handset until a dial tone is heard and make long distance calls that would be billed to the owner of the base station....With the new Congress in session, Radio Marti is under discussion again. Senator Paula Hawkins (R-FL) has filed the first Radio Marti bill (S.602) and the NAB, many of whose members are worried about RFI to US AM radio stations, has announced its opposition to it....Electro-Metrics' William Lambdin is organizing a session on "Developments in Electromagnetic Compatibility Design and Testing" on April 19 at *Electro/83* in New York City. For a copy of the program call (800) 421-6816....James Hill of EMXX Corp. of Springfield, VA, is organizing three three-day short courses on (1) *Design of Digital Circuitry*, (2) *Grounding and Shielding Techniques*, and (3) *Achieving Compliance with FCC and VDE Standards*. The courses will be held in Washington, DC, April 26-28; Dallas, TX, May 3-5; and San Diego, CA, May 24-26. The fee is $225/day. For more information contact Hill at (703) 451-4619....The Institution of Electrical Engineers in the UK is holding a vacation school on *Designing Against RF Emission*, at the University of Sussex, July 10-15. For more information contact: IEE, Savoy Place, London WC2R 0BL.

**Government**...Bernard Wunder, Jr., the administrator of NTIA has resigned and left Washington for Texas. He is the second senior NTIA official to leave the Reagan Administration this year; last month, Associate Administrator Donald Jansky quit to open a consulting firm. Wunder's deputy, Susan Stuebing, is now filling in as the acting head of NTIA....OSHA Administrator Thorne Auchter has appointed Patrick Tyson as his second in command, replacing Mark Cowan who is now Secretary of Labor Raymond Donovan's chief of staff.

**Measurement**...The Institution of Electrical Engineers in the UK is sponsoring a week-long "vacation school" on *Microwave Measurements* at the University of Kent in Canterbury, September 18-24. Fees range from about $300 for IEE members not requiring accommodations to about $450 for non-members who intend to stay at the University (assuming one pound equals one and a half dollars). For more information contact Carole Richards at the IEE Science, Education and Technology Division at Savoy Place, London WC2R 0BL.

**Occupational Health**...OSHA and the National Society to Prevent Blindness are planning a national campaign to improve worker protection against eye injuries. For more information contact a local OSHA regional office or the society at 79 Madison Avenue, New York, NY 10016....And the American Optometric Association has published a pamphlet, *A Guide to Eye Safety in the Work Environment*. Single copies are available at no charge; send a self-addressed, stamped business-sized envelope to: Communications Division, American Optometric Association, 243 N. Lindbergh Blvd., St. Louis, MO 63141....A large team of researchers headed by Anthony Sances, Jr., of the Medical College of Wisconsin in Milwaukee describes its studies on "Current Pathways in High-Voltage Injuries" in the February *IEEE Transactions on Biomedical Engineering*. The group applied voltages of 10-2000 volts (60 Hz) to hogs.

**Ovens**...The Office of Radiological Health's (ORH) Division of Compliance is investigating a leaking microwave oven. An oven was discovered in Norfolk, VA, that was emitting 40 $mW/cm^2$. According to a division spokeswoman, the door on the oven was improperly positioned, leaving a break in the seal between it and its frame. ORH receives about four reports a year which warrant oven testing....The mother of a Michigan baby girl allegedly burned by a microwave oven has been indicted for child neglect. After a number of tests, state officials have ruled out oven malfuction as a possible cause of injuries. (See *MWN*, December 1982.)...The American Society of Mechanical Engineers Committee K-19 is sponsoring a special session on Heat Transfer Measurements in Microwave Systems at its winter annual meeting in Boston, November 13-18. For information, contact Dr. Maurice Berry, Jr., FDA, 1090 Tusculum Avenue, Cincinnati, OH 45226, (513) 684-8653....Microwave oven shipments in January reached 312,000, a 16.7 percent increase over last year, according to the Association of Home Appliance Manufacturers....Magic Chef sees a strong market for its new line of "Little-Big" microwave ovens among builders and remodelers if the housing industry picks up as expected. The ovens require significantly less space for installation than other ovens with the same size cooking cavity.

**Satellite Communications**...NASA procurement requests for its 30/20 GHz communications program were expected out early this month. The scaled down effort is now under the Advanced Communications Technology Satellite Program (ACTS). As the US continues its on again - off again support for 30/20 GHz development, Japan is already offering four Ka-band transponders on its CS-2A satellite. Japan spent 1,126 percent more than America on satellite-link research last year, according to the January 31 *Aviation Week*. In the same issue, an article describes the strong competition that fiber optic technology may pose for some types of satellite service....MCI is growing with both technologies. The company recently purchased 24 transponders on the Hughes Communications Galaxy 2 and 3 satellites, which combined with MCI's expanding fiber optic network will increase the company's capacity for data and voice service by nearly 50 percent....Prudential Insurance Co. has invested $45 million in direct broadcast satellite service (DBS) through an agreement with United Satellite Communications (USC) (formerly United Satellite Television Corp.). USC plans to beam entertainment programs directly to homes this fall. Because USC will use Japanese equipment, Orrox Corp. of Santa Clara, CA, has announced suspension of its manufacturing for DBS: it estimates no other US company will require equipment within the next two years. Meanwhile, various DBS license holders and earth station manufacturers scheduled a meeting in Washington, DC, last month to form a standards development group, according to the February 21 *Broadcasting*. In January, United States Satellite Broadcasting asked the FCC to develop DBS earth station standards.

**Standards**...The TLV Physical Agents Committee of the American Conference of Governmental Industrial Hygienists (ACGIH) is set to meet March 23-24 in San Antonio, TX. On the agenda is consideration of proposed changes to the RF/MW radiation (TLV) standard. In 1981 the committee suggested that the standard be revised in a manner similar to the ANSI safety standard (though the ACGIH proposal is less strict than ANSI's) and extended down to 10 kHz (see *MWN*, September 1981). Last year the committee proposed allowing exceptions to the exposure limits under certain conditions (see *MWN*, July/August 1982). Both sets of revisions are still listed under ACGIH's "Notice of Intended Changes." The committee wants to resolve any remaining objections to the proposed changes at the meeting so that the new RF/MW TLV can be approved. ...ANSI has published the 1983 issue of its *Catalog of American National Standards*, which lists some 10,000 approved ANSI standards. The catalog is available for $10.00 from the ANSI Sales Office, 1430 Broadway, New York, NY 10018. Buyers will receive all 1983 supplements at no charge.

**VDTs**...Radiation tests have not resolved the controversy surrounding a cluster of pregnancy problems among VDT workers at Surrey Memorial Hospital, BC, reported last year. (See *MWN*, July/August and October 1982.) Consultants hired by the hospital and by the worker's union have come up with different results. Professor A.W. Guy of the University of Washington, Seattle, tested a Surrey VDT at the request of the hospital and concluded that it produced no harmful radiation. Commenting on his results, Guy said he detected weak signals from 60 Hz to 1 GHz, with most emissions at 15 - 20 kHz: the levels never exceeded a few volts per meter. On the other hand, Dr. Hari Sharma of University of Waterloo, Ontario, who took measurments for the Hospital Employees Union, said that he had found some "pretty high" pulsed fields at 15 kHz; peak power levels near the case of one unit went to 1,000 V/m. Sharma has measured a number of sets in Canada for radiation emissions, including those at the Ontario legislative library in Toronto. (See *MWN*, November 1982.) Earlier this year, scientists at the Canadian Center for Occupational Health and Safety hypothesized that the pulsed, low frequency radiation emitted by VDTs may produce adverse effects and recommended terminals be shielded until more research is done. (See *MWN*, January/February 1983.)...M.M. Weiss of Bell Laboratories in Murray Hill, NJ, takes a different view. In a recently published paper, Weiss states that "radiation emissions from VDTs either do not exist or are not measurable. In any case their intensity is less than that to which the population in general is exposed from other sources. It is the unanimous conclusion of all studies conducted thus far that VDTs do not represent a health hazard from any radiation exposure casued by their use. It is apparent that factors other than radiation must be sought to determine the cause for the health or comfort complaints reported by various investigators." Weiss's review along with papers by Bell's S.J. Starr and R.C. Petersen and by Professor W. Ham from Virginia Commonwealth University were orginally presented at the October 1981 *Joint Conference on Occupational Health* in Nashville, TN, and are published in the February *Journal of Occupational Medicine*....Similarly, E.A. Cox of the UK's Health and Safety Executive recaps a number of radiation surveys in the January issue of *Displays: Technology and Applications*, and concludes that "there are no radiation emissions from VDTs that approach levels that could be considered to be of concern to the normal individual." Most emissions detected in the surveys are in the low kHz range. *Displays* is published by Butterworth Scientific Ltd. in Gilford, UK....Moving up in the spectrum, a letter in the February 24 *New England Journal of Medicine* takes issue with the potential X-ray doses from old color TVs estimated by Dr. David Nashel and co-workers and reported in the journal September 30. Stanley Savic calls the Nashel estimates "erroneous and misleading" and up to 200 times too high. Nashel based his numbers on 12 out of 1,124 sets with the highest emissions. Savic states that calculating the average from all 1,124 sets would be more accurate. (See *MWN*, October 1982.)...McGill University in Montreal and CWA Local 7200 in Minneapolis, MN, both plan to investigate VDTs. An ad hoc committee has been set up at the university to review available information and make recommendations for the safe use of some 375 terminals at McGill. Concerned over potential reproductive hazards, CWA will conduct a survey of 4,500 women VDT operators. According to a report in the Minnesota Public Interest Research Group's January *Statewatch*, the union plans to discuss VDT work issues, including the

*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. (US funds please. If your check is not drawn on a US bank, please add $3.00 per order.)

right to alternative work for pregnant VDT users, in contract bargaining next summer. In Canada, many union workers have already won this option....A hearing on Connecticut's proposed VDT study bill was set for March 1 and Massachusetts plans to discuss its study bill at an April 20 hearing. For information, contact the Connecticut Committee on Labor and Employee (203) 566-5299 and the Massachusetts Joint Committee on Commerce and Labor (617) 722-2030. The Connecticut legislature's General Law Committee scheduled a March 7 hearing on a consumer bill with a little more punch: VDT sellers would be responsible for informing buyers about potential hazards and for ensuring that terminals do not emit hazardous levels of radiation....A conference on *VDTs/CRTs & New Technology* was held at the University of Connecticut Health Center last month. For information, contact Jane Fleishman at the center, School of Medicine, Farmington, CT 06032....American Optometric Association in St. Louis, MO, has made a number of recommendations for easing eye problems associated with VDT work. The association recommends regular rest breaks, annual eye exams and indirect office lighting....Ophthalmologists at the University of Laval Medical Center in Quebec have completed a five-year study of over 100 VDT users and non-users. In an eight-page summary report from the Association of Ophthalmologists of Quebec (No. 82-11-29), Drs. Ide Dube and Rollande Michaud conclude that long-term, full-time VDT work "does not cause any harmful effects on the ocular and visual systems." Canadian union officials have questioned the wisdom of drawing conclusions from so small a study....A case of video-game epilepsy in the US is the third to link the onset of seizures with an electronic game's flickering lights. Writing in the February 11 *Journal of the American Medical Association*, Dr. Neil Dahlquist and colleagues at the Mayo Clinic in Rochester, MN, report that a 15-year old boy experienced seizures after playing "Combat" and "Pac-Man." The doctors call this response "similar to television-induced seizures, which have been well recognized in epileptic patients who are sensitive to flickering lights or geometric patterns." Game screens flicker at about 15 Hz. (See *MWN*, April 1981 and September 1982.)...A VDT hot line has been set up by NYCOSH's New Technology Committee. You can phone in your questions about VDTs from 5:30 to 7:30 PM on the first and third Wednesday of each month. Call (212) 674-1595....The February 21 *Computerworld* zeroed in on the electronic gadgetry of special cars at the recent New York International Automobile Show. Ford's Concept 100 Electronic Car sports a CRT screen which, through a Navy satellite communications link and a microprocessor, would display the car's location on an appropriate map. There is also a screen in the back seat – Donkey Kong anyone?

**Etc...**Do ELF and VLF emissions warn of an impending earthquake? Writing in the February 3 *Nature*, Chi-Yu King of the US Geological Survey in Menlo Park, CA, reviews some of the recent findings which suggest that such signals may one day aid in predicting major earthquakes. For instance, one set of measurements taken in Japan detected anomalously high electromagnetic emissions half an hour before a magnitude seven earthquake. The radiation was localized in two different frequency bands, at 10-1,500 Hz and at about 81 kHz. Others have reported similar emissions in the USSR and China. At this point, there are no satisfactory explanations for the signals, but King does believe that these phenomena "must be taken seriously."

# CONFERENCE CALENDAR

• March 8-10: *Microwave Systems Applications Technology*, Sheraton Washington, Washington, DC. Contact: Richard Hartman, EW Communications, 1170 East Meadow Drive, Palo Alto, CA 94303.

• March 8-10: 5th *Electromagnetic Compatibility Symposium and Technical Exhibition*, Zurich, Switzerland. Contact: Dr. T. Dvorak, EMC-83, ETH Zentrum-IKT, 8092 Zurich, Switzerland.

• April 6-7: Annual *Meeting of the National Council on Radiation Protection and Measurements*, Washington, DC. Contact: NCRP, 7910 Woodmont Avenue, Bethesda, MD 20814.

• April 10-13: 61st Annual *Convention of the National Association of Broadcasters*, Las Vegas Convention Center, NV. Contact: NAB, 1771 N Street, NW, Washington, DC 20036.

• April 12-15: 3rd Annual *International Conference on Antennas and Propagation*, University of East Anglia, Norwich, UK. Contact: IEE, Savoy Place, London WC2R 0BL, United Kingdom.

• April 25-27: *Satcom '83: 3rd Annual Satellite Communications Conference and Exhibition*, Hyatt Orlando, Orlando, FL. Contact: International Association of Satellite Users, 6845 Elm Street, PO Box DD, McLean, VA 22101.

• May 2-5: 2nd Annual *Test & Measurement World Expo*, Convention Center, San Jose, CA. Contact: Meg Bowen, Conference Director, 215 Brighton Avenue, Boston, MA 02134.

• May 15-19: 15th Annual *Meeting of the Conference of Radiation Control Program Directors*, Eldorado Hotel, Reno, NV. Contact: Charles Hardin, CRCPD, 65 Fountain Place, Frankfort, KY 40601.

• May 22-25: 18th Annual *Meeting of the Association for the Advancement of Medical Instrumentation*, Loews Anatole, Dallas, TX. Contact: AAMI, Suite 602, 1901 N. Fort Myer Drive, Arlington, VA 22209.

• May 23-26: *International IEEE/APS Symposium and National Radio Science Meeting*, University of Houston, TX. Contact: Professor Liang Shen, Department of Electrical Engineering, University of Houston, Houston, TX 77004.

• June 1-3: *IEEE/MTT-S International Microwave Symposium*, Sheraton Boston Hotel, Boston, MA. Contact: Frank Leith, Alpha Industries, 20 Sylvan Road, Woburn, MA 01801.

• June 5-9: *Conference on Nonlinear Electrodynamics in Biological Systems*, VA Hospital, Loma Linda, CA. Contact: Research Service (151), Jerry L. Pettis Memorial Veterans Hospital, 11201 Benton Street, Loma Linda, CA 92357.

• June 12-16: 5th Annual *Bioelectromagnetics Society Meeting*, University of Colorado, Boulder, CO. Contact: BEMS, 1 Bank Street, Gaithersburg, MD 20878.

• June 19-23: 28th Annual *Health Physics Society Meeting*, Baltimore Hilton Hotel and Convention Center, Baltimore, MD. Contact: HPS, 4720 Montgomery Lane, Suite 506, Bethesda, MD 20814.

• June 21-23: *International Aerospace and Ground Conference on Lightning and Static Electricity*, Fort Worth, TX. Contact: Nick Rasch, FAA Technical Center, ACT-340, Atlantic City Airport, NJ 08405.

• July 3-8: 7th *International Congress of Radiation Research*, Amsterdam, Netherlands. Contact: Dr. J.J. Broerse, Radiobiological Institute TNO, PO Box 5815, 2280 HV Rijswijk, Netherlands.

• July 18-22: 20th Annual *IEEE Conference on Nuclear and Space Radiation Effects*, Sheraton Gatlinburg Hotel, Gatlinburg, TN. Contact: E.F. Hartman, Div. 9336, Sandia National Laboratories, Albuquerque, NM 87185.

• July 18-22: 18th Annual *Microwave Power Symposium*, Franklin Plaza Hotel, Philadelphia, PA. Contact: International Microwave Power Institute, Tower Suite 520, 301 Maple Avenue West, Vienna, VA 22180.

• July 18-22: 7th *International Symposium on Bioelectrochemistry and Bioenergetics*, Stuttgart, West Germany. Contact: Professor M. Blank, Department of Physiology, Columbia University Medical School, 630 West 168th Street, New York, NY 10032.

• August 23-25: *IEEE International Symposium on Electromagnetic Compatibility*, Hyatt Regency-Crystal City, Arlington, VA. Contact: Aaron Sullivan, Jr., 7121 Wolf Tree Lane, Rockville, MD 20852.

• August 23-26: *URSI International Symposium in Electromagnetic Theory*, Santiago de Compostela, Spain. Contact: Dr. J.L. Sebastian, Dept. of Electricidad y Electronica, Facultad de Ciencias Fisicas, Ciudad Universitaria, Madrid (3), Spain.

• September 12-14: 36th Annual *Conference on Engineering in Medicine and Biology*, Hyatt Regency Hotel, Columbus, OH. Contact: Alliance for Engineering in Medicine and Biology, 4405 East-West Highway, Suite 210, Bethesda, MD 20814.

• October 3-5: 3rd Annual *Meeting of the Bioelectrical Repair and Growth Society*, San Francisco, CA. Contact: Dr. Lorraine Day, San Francisco General Hospital, 1001 Potrero, San Francisco, CA 94110.

• October 16-20: *Conference on Electrical Insulation and Dielectric Phenomena*, Buck Hill Inn, Buck Hill Falls, PA. Contact: Professor Markus Zahn, High Voltage Research Lab, MIT, Cambridge, MA 02139.

# MICRO WAVE NEWS

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*Microwave News* invites contributions to *From the Field*, our regular column featuring news and opinions from the RF/MW community. Letters from readers are also welcome.

## Navy Appeals ELF Decision

The US Navy has asked a federal court to reconsider its decision to stop all work on the Navy's Project ELF communications system until a new environmental impact statement (EIS) is prepared. Although the Navy has agreed to comply with the court's order to write a new EIS, it wants to continue construction.

On January 31, US District Judge Barbara Crabb ruled in favor of the state of Wisconsin and Marquette County, Michigan, requiring the Navy to revise its 1977 EIS to include "the significant new information on biological effects of electromagnetic radiation that has been generated since 1977." Until the new EIS is completed, Judge Crabb has barred the Navy from building the new ELF facility in Marquette County, upgrading the existing facility at Clam Lake, WI, or supplying submarines with ELF receivers.

Project ELF is designed to use 72-80 Hz extremely low frequency (ELF) signals to communicate with submarines without requiring them to come to the surface.

In a motion filed with the US District Court for the Western District of Wisconsin on February 10, US Attorney John Byrnes asked Judge Crabb to allow the Navy to resume construction pending the completion of the revised EIS. Byrnes contended that "the potential harm to the national

*(continued on p.6)*

## OSHA Keeps RF/MW Limit; No Enforcement Possible

The Occupational Safety and Health Administration (OSHA) has decided to retain its voluntary standard limiting exposures to radiofrequency and microwave (RF/MW) radiation. As a result of this and past decisions, there are no enforceable occupational standards for RF/MW radiation in the United States.

The Occupational Safety and Health Review Commission and the courts have ruled that OSHA's voluntary standards cannot be enforced either directly or under the general duty clause of the Occupational Safety and Health Act (see *MWN*, April 1982). Under these decisions, OSHA can enforce a RF/MW safety limit only by deleting the voluntary 10 mW/cm$^2$ standard, and thereby allowing the use of the general duty clause, or by setting a new mandatory standard.

In final rules published in the February 10, 1984 *Federal Register*, OSHA revoked 153 of the 194 voluntary or duplicative standards originally targeted for deletion on May 28, 1982 (47 *FR* 23477). The RF/MW 10 mW/cm$^2$ standard was among those originally slated to be revoked, but was retained at the request of the Federal Communications Commission (FCC), according to OSHA.

Last October, OSHA disclosed that it had suspended work on a mandatory RF/MW health standard (see *MWN*, November 1983). The reasons

*(continued on p.6)*

## Three States Consider RF/MW Actions

Three states are considering radiofrequency and microwave (RF/MW) radiation safety measures. In Wisconsin, an advisory group has urged the state to establish a non-ionizing radiation program. In Connecticut and New Jersey, officials have proposed exposure standards for the general public based on the 1982 American National Standards Institute (ANSI) guidelines.

Recent developments in these states are summarized below.

### Wisconsin

After two years of study, a special committee of the Wisconsin Radiation Protection Council has concluded that "there is an urgent need" for research on the effects of long-term, low-level RF/MW exposures and that little data are available for evaluating non-ionizing radiation health risks. In a February 1 final report, the group recommends that the state take a number of steps to address RF/MW radiation safety issues.

Noting that no state authority oversees RF/MW radiation safety, the committee has advised that the state develop a program to monitor radiation levels, provide public information and educate health care professionals. The group has also recommended that non-ionizing radiation be covered under Wisconsin's right-to-know labor law.

The committee's final report and recommendations were accepted by the council on February 17 and will be forwarded to the state Department of Health and Social Services. The department is responsible for making recommendations to the legislature.

Council staff scientist Teri Vierima told *Microwave News* that advice from the council carries a great deal of weight with the legislature. She added, however, that the proposals are unlikely to be considered in the current session, which ends in April.

In urging that public and private institutions in the state begin RF/MW bioeffects research, the committee stressed that little is known about non-thermal effects, which are of primary interest in terms of the general population. They state that, "while there is little evidence that current levels of exposure are hazardous, there is also little evidence that current levels of occupational, medical and public exposures do not produce long-term effects."

The eight-member Non-Ionizing Radiation Committee was set up in 1982 when the legislature began drafting Wisconsin's right-to-know law. The group has recommended that it become a permanent advisory committee under the Radiation Protection Council.

### Connecticut

Connecticut's joint Environment Committee has scheduled a March 8 hearing to consider a bill establishing a state RF/MW standard at least as restrictive as ANSI's guidelines. House Bill 5675 would allow state regulators to follow either Massachusetts, which last year adopted a standard five times more stringent than ANSI's (see *MWN*, September 1983), or New Jersey, which has proposed using ANSI levels (see *MWN*, January/February 1984).

Connecticut's bill, introduced in committee by Rep. Moira Lyons in late February, mandates that the state Commissioner of Environmental Protection adopt a standard for public exposure to 300 kHz – 100 GHz radiation and that the department set up a registration and monitoring program. Operators of RF/MW sources would have to demonstrate compliance with the standard before receiving operating permits. Certain sources, including mobile radios and consumer products, would be exempt from the rule.

In an interview with *Microwave News*, Lyons reported that the bill has a good chance of passing before the legislative session ends on May 6. Lyons said hearings held last year indicate that the broadcast community supports a standard (see *MWN*, November 1983).

Lyons expects the committee to forward the bill to the House soon after the March 8 hearing.

The state Department of Environmental Protection would have one year to comply with the measure after it became law. Lyons said the department's radiation section would probably be responsible for drafting the standard and conducting public hearings.

### New Jersey

The New Jersey Commission on Radiation Protection is expected to vote on its proposed RF/MW standard this month. The group, which has the authority to establish state radiation guidelines, has recommended adopting ANSI guidelines (see *MWN*, January/February 1984).

After evaluating testimony from two public hearings and about a dozen written comments, the commission met on February 22 to discuss final revisions in the standard. According to RCA's Dr. Fred Sterzer, a commission member and the chairman of its non-ionizing radiation advisory committee, the only significant change was the exclusion of mobile RF/MW sources. (At one of the hearings, a representative from the state police warned that the use of police radios and other emergency communications systems could be affected by the ANSI standard.)

Sterzer said minor changes included a clarification of the standard's emission limits for microwave ovens. Emissions from ovens manufactured after 1971 would be limited to 5 $mW/cm^2$ measured at a distance of 5 cm.

At present there are no plans for further public hearings, though the state Department of Environmental Protection could decide that the revisions are extensive enough to require another meeting.

## New Industry Alliance for Policy and Standards

A new industry alliance was founded last month to push for federal safety standards for non-ionizing radiation. Manufacturers and users of radiofrequency and microwave (RF/MW) technology will use the organization to focus their lobbying and educational efforts and to sponsor independent research in areas related to radiation safety.

The Electromagnetic Energy Policy Alliance (EEPA) is an outgrowth of the RF/MW industry's concern over state and local radiation standards, such as those already adopted by Massachusetts, and over costly siting disputes generated by public apprehension about radiation hazards. EEPA believes that national exposure guidelines would go a long way in eliminating these problems.

Barry Umansky of the National Association of Broadcasters (NAB) told *Microwave News* that EEPA will be run by a private management firm in Washington, DC, with a start-up budget of about $100,000. NAB, the Electronic Industries Association (EIA) and the Association of Home Appliance Manufacturers (AHAM) were early supporters of the organization, which was initially called the Alliance for Responsible Non-Ionizing Radiation Policy.

The organization's founding members are AT&T, GTE, MCI Telecommunications, Motorola, NAB, Raytheon, RCA and Rockwell/Collins.

According to Raytheon's Dr. John Osepchuk, chairman of the EEPA organizing committee, the alliance's first year will be largely devoted to building up membership. Member contributions will vary but the the precise formula has not been worked out. Asked what research areas might receive funding, Osepchuk said "it could be anything from 60 Hz fields to millimeter waves."

Work to set up the alliance started in late 1982, after a private conference held at the Homestead resort in Hot Springs, VA. That meeting, sponsored by NAB, EIA and AHAM, provided an intimate forum for industry representatives to discuss RF/MW policy and legal issues (see *MWN*, October 1982). The press was barred from the conference and no minutes were prepared.

EEPA's first board meeting is tentatively scheduled for March 9 in Washington, DC. The board's chairman is Dr. Daniel Walters of MCI. Also serving are Howard Rosenthal, RCA; Morton Topfer, Motorola; Edward Fritts, NAB; John Whittaker, GTE; Dr. Howard Sobol, Rockwell/Collins; and Dr. Joseph Shea, Raytheon. An eighth appointment will be made later.

## Workshop on Space Shuttle EMC

A *Workshop on Payload Susceptibility to Space Shuttle Ku-Band Radiated Fields* will be held at the Johnson Space Center in Houston, TX, on May 30.

The workshop was prompted by concern that the relatively high fields radiated by the shuttle orbiter's Ku-band antenna might interfere with the payloads deployed from the spacecraft.

"A lot of people are worried," according to Ralph Lawton of McDonnell Douglas, who is organizing the workshop, "and we want to clear up any technical confusion that may exist."

Among the topics to be discussed are the susceptibility of integrated circuits and general avionics to Ku-band (11-18 GHz) radiation. Lawson said that there has already been so much interest in the workshop that it may be expanded into a two-day meeting.

When asked if there was any possibility that the loss of the two satellites launched from the space shuttle Challenger last month could have resulted from a failure in electromagnetic compatibility (EMC), Lawton answered with a quick and emphatic "No."

For more information, contact Lawton at McDonnell Douglas Technical Services Co., 16441 Space Center Blvd., Houston, TX 77058, (713) 488-5660, ext. 468.

## IRPA Approves Interim RF/MW Exposure Guidelines

The International Radiation Protection Association (IRPA) has approved limits for occupational and public exposures to radiofrequency and microwave (RF/MW) radiation. After ten years of deliberations by a working group that became the International Non-Ionizing Radiation Committee (INIRC) in 1977, the interim exposure guidelines were approved by the IRPA Executive Council on July 8. The guidelines are scheduled for publication in the April issue of *Health Physics*.

The limits for occupational exposures are similar to — but stricter than — the safety levels adopted by the American National Standards Institute (ANSI) in 1982.

Like ANSI, IRPA's most stringent occupational exposure limit is 1 mW/cm$^2$. But IRPA mandates this level over a wider range of frequencies. While ANSI specifies a maximum exposure of 1 mW/cm$^2$ in the 30-300 MHz band, rising to 5 mW/cm$^2$ at 1.5 GHz, the IRPA band is 10-400 MHz and the 5 mW/cm$^2$ limit takes effect at 2 GHz.

IRPA's guidelines are also much stricter at lower frequencies: in the 100 kHz-1 MHz band, IRPA's exposure limit is 10 mW/cm$^2$, as compared to ANSI's 100 mW/cm$^2$ limit for 300 kHz-3 MHz.

For the general population, the IRPA limits are five times more stringent than its occupational limits; thus, for 10-400 MHz the limit is 200 uW/cm$^2$. ANSI recommends the same limits for workers and the general public. Above 2 GHz, the public would be exposed to a maximum of 1 mW/cm$^2$ under the IRPA guidelines.

The IRPA and ANSI limits for frequencies above 10 MHz are based on the same conclusion: that exposures should not exceed a whole-body specific absorption rate (SAR) of 0.4 W/Kg when averaged over six minutes.

In its appended rationale for the guidelines, the IRPA committee cautions that present knowledge on biological effects is limited and that its guidelines should be "subjected to periodic revisions" as more information becomes available. For instance, "The emerging evidence for non-thermal mechanisms of biological effects cannot be ignored and has to be considered in establishing exposure limits" and "For frequencies below 10 MHz, very little information on biological effects exists."

Unlike all other RF/MW standards, the IRPA guidelines include a maximum exposure level for pulsed fields: instantaneous peak values for all frequencies should not exceed 100 times the six-minute averaged limits.

The IRPA committee recommends that radiation in the

extremely low frequency (ELF) range be considered separately. According to Dr. P. Czerski, a member of the IRPA committee, an ELF document is now in preparation by a joint IRPA and World Health Organization (WHO) working group. Its report should be published next year.

The members of IRPA's INIRC group were: H.P. Jammet, Chairman (France), B.F.M. Bosnjakovic (Netherlands), P. Czerski (Poland), M. Faber (Denmark), D. Harder (Germany), J. Marshall (Great Britain), M.H. Repacholi (Australia), D.H. Sliney (USA) and J.C. Villforth (USA); A.S. Duchene (France) served as Scientific Secretary.

## Labor Group Reports Ninth VDT-Pregnancy Problem Cluster

Half of the pregnancies among VDT operators at a San Francisco airline reservations center ended in miscarriages, birth defects or other abnormal outcomes, a survey of VDT users by a women office workers' group has revealed. This is the ninth cluster of pregnancy problems identified among VDT operators (see *MWN*, November 1981 and January/February, April, May and July/August 1982).

The group, 9 to 5, the National Association of Working Women, which surveyed 873 VDT operators nationwide, said it had located 14 other possible clusters. The results of the survey were made public February 16 at a press conference in New York City.

Among 48 pregnancies at the United Airlines office in San Francisco between 1979 and 1984, 24 ended abnormally, according to 9 to 5. There were 15 miscarriages; the other nine pregnancies ended in still births or neo-natal deaths, premature births, birth defects or other irregular outcomes. Approximately 300 people operated VDTs at the United office during the period in which the cluster occurred.

Employees at United have asked the National Institute for Occupational Safety and Health (NIOSH) to do a Health Hazard Evaluation (HHE), and 9 to 5 has asked to observe the NIOSH investigation.

Dr. Jim Melius, chief of NIOSH's Hazards Evaluation and Technical Assistance Branch, said that NIOSH will make an initial site evaluation in mid-March. In a telephone interview, Melius told *Microwave News* that the investigation will be limited to gathering basic data, such as air quality and lighting intensity. This information will be used to determine whether further work is needed.

Joseph Hopkins, speaking for United Airlines, said the company would try to cooperate fully with NIOSH, but cautioned that company lawyers might advise otherwise. United had "no prior knowledge" of the February 16 release of the reported cluster, he said, and "we feel that we were singled out...without any chance to defend ourselves."

Between 75,000 and 100,000 VDTs are used by air carriers, including United, according to the Air Transport Association, a trade group. Most of these are operated by reservations clerks.

The United Airlines cluster was identified using data gathered last year by 9 to 5 from a "VDT Hotline" which received more than 6,000 calls (see *MWN*, June 1983). A self-selecting sample of callers completed questionnaires. Karen Nussbaum, 9 to 5's executive director, said that the survey "confirms that the health complaints of VDT operators are widespread and serious."

The eight previous clusters remain unexplained. Government officials have maintained that the clusters are chance events resulting from the widespread use of VDTs. 9 to 5's Nussbaum urged that research be focused on resolving the uncertainty about the nine clusters.

When it released the survey data, 9 to 5 also recommended that:

- NIOSH establish a national tracking system to monitor reported VDT-related health problems;
- Employers provide properly designed and maintained equipment, allow adequate rest breaks and generally adopt policies that reduce stress among their employees;
- Manufacturers produce equipment with standardized safety features and provide training and information to purchasers to lessen user risks.

NIOSH is considering these requests, according to Melius.

The 9 to 5 survey also found that a majority of questionnaire respondents "often or daily" experienced eyestrain (53.5 percent), exhaustion (51.6 percent) or muscle pain (56.2 percent) as a result of working at a VDT. Nearly half (48.6 percent) reported treatment by eye doctors for vision problems or changes in eyesight, and 43.6 percent said they experienced tension or anxiety.

More than 62 percent of the respondents are clerical or secretarial employees, and among the entire group the greatest number (38.7 percent) have worked at VDTs for between one and three years.

The reported cluster has renewed the controversy about VDT health and safety risks. For example, an editorial in the February 27, 1984 *Computerworld* criticized 9 to 5 for making broad charges and acting "in a manner designed to raise fear" among VDT operators. The group lacked sufficient data, the editorial charged, but added that, "This is not to shrug off the possibility of a long-range health hazard from VDTs," particularly from radiation; but it urged that this possibility "be studied coolly, rationally and thoroughly to prevent VDT radiation from becoming, like asbestos, a hazard that is discovered too late."

Copies of 9 to 5's report on the survey can be requested from the group at 1224 Huron Road, Cleveland, OH 44115.

## VDT Hearings Resumed by Congressional Subcommittee

A congressional subcommittee continued its study of health and safety problems associated with video display terminals (VDTs) at a hearing held in Washington, DC, on February 28. At the first of several hearings planned for this year, the subcommittee on health and safety of the House

Committee on Education and Labor was urged to enact VDT safety rules by a representative of the Service Employees International Union (SEIU), District 925.

The subcommittee had met in October 1983 to consider the results of the Newspaper Guild/Mt. Sinai VDT study (see *MWN*, November 1983). A subcommittee spokesman said that scientists from the National Institute for Occupational Safety and Health (NIOSH), representatives of computer manufacturers and other union officials are scheduled to testify at three hearings planned for March and April.

District 925 Executive Director Jackie Ruff called for legislation to protect all VDT workers, not just those who belong to unions. She urged the subcommittee to require metal shielding and periodic testing for X-ray radiation and to guarantee the right to alternative work during pregnancy for VDT operators. No legislation on VDT health and safety is now pending in Congress.

Ruff also presented the results of the VDT hotline survey completed by 9 to 5, the National Association of Working Women (see preceding story). Among the findings were a possible cluster of pregnancy problems at a United Airlines reservations office in San Francisco and 14 other possible clusters which the group is investigating. At a press conference after the hearing, Ruff said that it is "very likely" that some of these clusters will be publicly identified in the near future.

Testifying with Ruff, Rebecca Alford, a VDT operator at the Equitable Life Assurance Society in Syracuse, NY, said that she "cannot help but think there is a connection" between her work and the multiple birth defects suffered by her recently-born child. The introduction of VDTs at Equitable three years ago "enslaved us to the new machinery and subjected us to health and safety hazards," according to Alford.

At the hearing, subcommittee Chairman Joseph Gaydos (D-PA) said that he will "proceed in a persistent manner" to evaluate possible risks of VDT use. The ranking minority member of the panel, Rep. Steve Gunderson (R-WI), added that, "If we can prove there is clearly a problem, then this subcommittee wants to act."

SEIU represents more than 90,000 clerical workers in the public and private sectors. Its District 925 is affiliated with 9 to 5.

## Cable TV RFI

The National Cable Television Association (NCTA) has urged its members to ensure their systems are not potential sources of radiofrequency interference (RFI). This message follows stepped-up inspections of cable TV systems by the Federal Communications Commission (FCC), which resulted in thousands of dollars in fines to operators in 1983.

Though the commission is primarily interested in enforcing its rules for protecting aeronautical communications, FCC staffers report that interference to amateur radio is also a major problem.

In a special January 20 letter to its members, NCTA underscored that the FCC is taking a "tough stand" on noncompliance with its technical standards, "especially in areas of prior clearance for aeronautical frequency and signal leakage." The commission requires that cable operators report the use of all signals which fall into the aeronautical band.

Though there are relatively few reports of cable TV RFI with ground-to-air communications, the commission levied approximately $200,000 in fines last year for noncompliance with its rules to protect this service. For the most part, operators had failed to comply with FCC requirements for reporting the use of frequencies in the aeronautical communications bands. According to FCC spokesmen, the commission has not imposed any fines for actual interference.

The FCC's efforts have apparently impressed cable TV operators. For example, a recently fined cable systems owner fired off a memo to its managers explaining the importance of compliance with FCC rules and requesting that they monitor for leaks on a regular basis.

Airplane communications can be very sensitive to interference. For example, two years ago the commission discovered that planes landing at Andrews Air Force Base were picking up stray signals from a store's cash register scanner, a device that reads standardized bar codes on product labels.

In contrast to aeronautical RFI, interference to amateur radio has elicited scores of complaints but only one FCC fine of $6,000 against Sonic Cable TV of California in 1982 (see *MWN*, November 1982 and January/February 1984). Although amateur radio is a much lower FCC priority than safety services like ground-to-air communications, the American Radio Relay League (ARRL) maintains this RFI is a major problem among its 400,000 members.

Discussions between the league and NCTA on how to handle ham operator complaints became so heated last year that talks between the two groups broke down altogether. Insiders say the organizations have now reached a truce. NCTA's Wendell Bailey reports that "there is now a spirit of mutual cooperation" as the two groups "look into the boundaries of the problem."

ARRL and NCTA have been bickering over a January 1982 league petition asking the FCC to bar cable TV systems from using any amateur radio frequencies (see *MWN*, October 1983). Because hams use sensitive receivers to pick up very weak signals, amateur radio is susceptible to all kinds of interference. Jeff Young of the FCC's Field Operations Bureau explained that almost all complaints are resolved without FCC intervention.

*MICROWAVE NEWS* is published monthly, except in January and July • ISSN 0275-6595 • PO Box 1799, Grand Central Station • New York, NY 10163 • (212) 725-5252 • Editor: Louis Slesin, Ph.D., Associate Editors: Martha Zybko, Mark Pinsky • Subscription: $200 per year (overseas $235) • Copyright © 1984 by Louis Slesin • Reproduction in any form is forbidden without written permission.

## OSHA *(continued from p.1)*

for that action have not been made public, but, at the time, OSHA officials said that non-ionizing radiation was not a high priority and that they intended to use the agency's limited resources to develop other health standards.

In a series of interviews, OSHA officials suggested that the agency had not intended to stop its efforts to control worker exposures to RF/MW radiation. The reason work on a new RF/MW standard had stopped while the voluntary standard remained in place was that two different offices within OSHA were involved and each thought that the other would cover RF/MW hazards. The staff at OSHA's Health Standards Programs believed that the voluntary 10 mW/cm$^2$ standard would be revoked, allowing enforcement under the general duty clause, while those writing the rules deleting the voluntary standards thought that a new standard was being prepared.

### FCC Changes Its Mind

In the preamble to its February 10 rules, OSHA said that it retained the RF/MW standard to comply with a request from the FCC. Although the FCC had asked OSHA to keep the 10 mW/cm$^2$ standard, it later reversed its stand. But by then, OSHA would not consider the FCC's new position.

In order to understand what happened between the two federal agencies, a brief review of the events of 1982 is necessary. On January 28, 1982, the FCC proposed rules to control potential RF/MW radiation hazards (see *MWN*, March 1982). The commission planned to base its rules on OSHA's 10 mW/cm$^2$ standard: those projects which would result in occupational or public exposures in excess of 10 mW/cm$^2$ would be considered "major actions" under the National Environmental Policy Act (NEPA), which requires federal agencies to prepare an environmental impact statement for such projects.

Then, on May 28, OSHA proposed deleting the 10 mW/cm$^2$ standard. The FCC responded on July 27, saying that, "If OSHA removes the only existing federal non-ionizing radiation standard from its rules without adopting a replacement standard, the FCC will not have the means by which to fulfill its obligation to assess the environmental significance of its actions with respect to [RF/MW] radiation hazards."

Meanwhile, the FCC was receiving comments on its own proposal. Many of the responding companies asked the commission to rely on the American National Standards Institute (ANSI) guidelines, which were approved on July 30, 1982 (see *MWN*, September 1982). Robert Cleveland of the FCC's Office of Science and Technology told *Microwave News* that when he reviewed these comments and discovered an industry preference for the ANSI limits, he relayed the news to OSHA, only to be told it was too late because OSHA's comment period had closed on July 27. The FCC's comment period closed on August 18.

OSHA's Tom Seymour, who developed the rules deleting the voluntary standards at the Office of Fire Protection, confirmed that he knew the FCC had changed its mind. But, he said, the agency could not take this into account because "it would jeopardize the public record."

Thus, OSHA stated in the preamble to its final February 10 rules that standards like the 10 mW/cm$^2$ RF/MW limit, though advisory, "are used by other federal agencies, such as the FCC in exercising its own statutory obligations. OSHA believes that revocation of these provisions would have deleterious effects and would not accomplish the purposes of the revocation as expressed in the proposal."

### OSHA's Other Rationale

In addition to responding to what he perceived to be FCC needs, OSHA's Seymour said that his agency had decided to keep the 10 mW/cm$^2$ standard because it was referred to in another set of OSHA regulations.

Section 1910.268(p)(2) of OSHA's health and safety rules requires the posting of a warning sign in "accessible areas associated with microwave communication systems where the electromagnetic radiation level exceeds the [10 mW/cm$^2$] radiation protection guide..." Section 1910.268(p)(3) requires employers to "institute measures that insure that the employee's exposure is not greater than that permitted by the radiation guide." But these regulations only apply to "microwave transmission" for telecommunications, which is defined as the 1-300 GHz frequency band. The 10 mW/cm$^2$ protection guide, Section 1910.97, covers 10 MHz-100 GHz.

No one interviewed for this article, other than Seymour, had ever heard of these OSHA rules.

In the introduction to its February 10 rules, OSHA noted that the National Advisory Committee on Occupational Safety and Health (NACOSH) had advised the agency to turn the voluntary standards into mandatory ones. OSHA said it "agreed with NACOSH that rule making action might be warranted in the future..." and later added that a revision of the RF/MW standard is "planned in the future."

Seymour expressed his confidence that work on a new RF/MW standard would begin soon.

OSHA Administrator Thorne Auchter has announced that he will resign effective March 30 to join a construction company in Kansas. No replacement had been named at press time.

## ELF Decision *(continued from p.1)*

defense caused by a delay in implementing Project ELF substantially outweighs any potential environmental effect."

Byrnes stated that if the Navy's motion is denied, an appeal to the US Court of Appeals is "highly likely."

In support of his motion for reconsideration, Byrnes submitted affidavits from Secretary of the Navy John Lehman, Jr., and Ronald Koontz, the Navy's program manager for the ELF communications system. According to Koontz, a one-year delay in completing the system, originally scheduled for April 1986, would increase the cost of the project by an estimated $10-15 million. The full text of Lehman's declaration is reprinted on p.9.

On February 23, the state of Wisconsin asked Judge Crabb to clarify whether her January 31 decision stopped the Navy from using the ELF facilities, already installed and

operational, at Clam Lake until a new EIS is completed.

Briefs from each side will be submitted to the court by the middle of March, with Wisconsin's final reply brief due on March 20.

### Work on EIS Begins

The Navy has announced that it will write a new EIS and has asked the IIT Research Institute (IITRI) in Chicago, IL, to collect bioeffects data published since 1977 as a first step in its preparation. IITRI's Dr. Anthony Valentino told *Microwave News* that the Navy has not asked IITRI to evaluate the data or to write the EIS. A decision on who will prepare the EIS had not been made at press time. Valentino recently rejoined IITRI as manager of electromagnetic and environmental effects after five years at Argonne National Laboratory.

In her 69-page decision, Judge Crabb presents a history of Project ELF and recent developments in research on the bioeffects of ELF radiation, with special emphasis on studies linking ELF to leukemia, on Dr. Jose Delgado's experiments on the teratological effects of low frequency pulsed magnetic fields and on Drs. Ross Adey and Carl Blackman's demonstration of frequency and power windows. Excerpts from her decision are reprinted on pp.8-9. ●

# SHORT COURSES

***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: Continuing Engineering Education, George Washington University (GWU), Washington, DC 20052, (800) 424-9773, or (202) 676-6106 in DC.

***April 10-11: Radar Principles for the Non-Specialist,*** Washington, DC. Fee: $625. Contact: GWU, see April 9 above.

***April 10-12: Grounding & Shielding,*** Philadelphia, PA. 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. Repeated ***May 8-11:*** Honolulu, HI; ***June 19-22:*** Chicago, IL.

***April 16: Applying Military Electromagnetic Compatibility Specifications,*** Chicago, IL. Fee: $295. Contact: Jean Tucker, ECOS Environmental Solutions, 205 W. Harrison St., Oak Park, IL 60304, (312) 383-2505.

***April 23: Electrostatic Discharge Control,*** San Antonio, TX. Fee: $275. Contact: EMXX Corp., 6766 Deland Dr., Springfield, VA 22152, (703) 451-4619. Repeated ***May 18:*** Boston, MA.

***April 23-26: Modern Microwave Measurements,*** Palo Alto, CA. Fee: $895. Contact: Continuing Education Institute (CEI), 5410 Leaf Treader Way, Columbia, MD 21044, (301) 596-0111 or (213) 824-9545.

***April 24-27: Phased Array Antenna Technology,*** Boulder, CO. Fee: $675. Contact: Linda Billard, Technology Service Corp (TSC), 8555 16th St., Suite 300, Silver Spring, MD 20910, (800) 638-2628, or (301) 565-2970 in MD.

***April 26-27: Cellular Radio Communications,*** Washington, DC. Fee: $625. Contact: GWU, see April 9 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 April 10 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.

***May 1-3: Mutual Design of Natural Gas Pipelines and Electric Power Lines,*** Palo Alto, CA. Fee: $75 (EPRI members), $275 (non-members). Contact: John Dunlap, Electric Power Research Institute (EPRI), PO Box 10412, Palo Alto, CA 94303, (415) 855-2305.

***May 7-11: Microwave Circuits Design: Linear Circuits,*** Palo Alto, CA. Fee: $895. Contact: CEI, see April 23 above. Repeated ***June 4-8:*** Boston, MA.

***May 7-11: Electromagnetic Interference and Control,*** Washington, DC. Fee: $875. Contact: GWU, see April 9 above.

***May 8-11: Modern Antennas,*** Washington, DC. Fee: $675. Contact: TSC, see April 24 above.

***May 14-18: Fundamentals of Communication Satellite Systems,*** Washington, DC. Fee: $875. Contact: GWU, see April 9 above.

***May 15-17: Seminar on Mutual Design of Overhead Transmission Lines and Railroad Communications and Signal Systems,*** Chicago, IL. Fee: $100 (approx.). Contact: EPRI, see May 1 above. Repeated ***June 19-21:*** Washington, DC; and ***September 11-13:*** Atlanta, GA.

***May 15-17: Design Methods for Emission and Susceptibility Control,*** Boston, MA. Fee: $695. Contact: EMXX, see April 23 above. Repeated ***June 25-27:*** Sunnyvale, CA.

***May 15-17: An Introduction to EMI/RFI/EMC,*** Los Angeles, CA. Fee: $815. Contact: DWCI, see April 10 above.

***May 21-23: Hazardous RF Electromagnetic Radiation,*** Washington, DC. Fee: $695. Contact: GWU, see April 9 above.

***May 21-25: Microwave Circuit Design I: Linear Circuits,*** Los Angeles, CA. Fee: $895. Contact: UCLA Extension Short Course Program, PO Box 24901, 6266 Boelter Hall, Los Angeles, CA 90024, (213) 825-1295.

***May 21-25: Radar Systems & Technology,*** Washington, DC. Fee: $875. Contact: GWU, see April 9 above.

***May 21-25: Radiation Safety Officer's Course,*** San Antonio, TX. Fee: $650. Contact: Medical School Continuing Education Services, University of Texas Health Science Center, 7703 Floyd Curl Dr., San Antonio, TX 78284, (512) 691-6295.

***May 22-25: MIL-STD-461/462 & System-Level EMI Testing & Procedures,*** Washington, DC. Fee: $995. Contact: DWCI, see April 10 above.

***May 24-26: European Workshop on Nuclear Resonance in Medicine,*** Wiesbaden, West Germany. Fee: $260. Contact: Dr. Peter Rinck, PO Box 2149, D6200 Wiesbaden 1, West Germany.

***June 4-5: Lightning Protection,*** Washington, DC. Fee: $625. Contact: GWU, see April 9 above.

***June 12-14: Transmission Line Design Optimization,*** Schenectady, NY. Fee: $100 (EPRI members), $600 (non-members). Contact: B. Gnat, Power Technologies, Inc., PO Box 1058, Schenectady, NY 12305, (518) 374-1220. Repeated ***June 26-28:*** Haslet, TX; ***July 10-12:*** Palo Alto, CA.

***June 13-15: Biological Effects of Transmission Lines and Substations,*** Chicago, IL. Fee: $685. Contact: Ms. Hargett, Professional Development Services (PDS), 4 Professional Dr., Suite 148, Gaithersburg, MD 20879, (301) 926-2797.

***June 18-19: Electrical Accidents Involving Power Lines,*** Washington, DC. Fee: $475. Contact: PDS, see June 13 above. Repeated ***June 21-22:*** Denver, CO.

# EXCERPTS

## Project ELF Decision

*Reprinted below are portions of District Judge Barbara B. Crabb's decision in* State of Wisconsin v. Caspar W. Weinberger, the US Department of Defense, John F. Lehman, Jr., and the US Department of the Navy, *decided on January 31, 1984.*

*I begin with the threshold question whether the information on* biological effects generated since 1977 is significant enough to impose upon the Navy the duties of evaluation and explanation....

In 1977, there was little or no evidence to contradict the findings and conclusions of the 1977 National Academy of Sciences study and the Navy's 1977 environmental impact statement that extremely low frequency electromagnetic radiation had no effect upon animal fertility, growth and development or behavior. Scientific studies undertaken since then have produced results that raise questions about the validity of prior assumptions of the safety of extremely low frequency electromagnetic radiation.

In the areas of cellular function, enzymatic function, animal behavior, and growth and development, researchers such as Delgado, those at UCLA, and Adey and Blackman have found evidence that the biological effects of extremely low frequency electromagnetic radiation occur in a nonlinear dose-response relationship. These researchers and others have identified both the phenomenon of frequency and power intensity windows and the probable existence of two such windows at 15 Hz and 75 Hz.

Researchers at Battelle Laboratories have found teratogenic effects, as well as effects on animal behavior and on neurophysiology from exposure to electromagnetic fields at 60 Hz. Goodman at University of Wisconsin-Parkside has observed alterations in basic cell functions and in oxygen consumption in slime mold exposed to extremely low frequency electromagnetic radiation....

The primate studies at Pensacola and at UCLA reveal effects upon growth rate and behavior from exposure to electromagnetic radiation.

In addition, epidemiology studies raise the possibility that there may be a correlation between the incidence of cancer and the magnetic fields associated with electric power lines. Although they are only suggestive at this time, the 1977 epidemiology studies, such as those by Wertheimer-Leeper, provide quantified data and descriptions of control group characteristics and selection criteria sufficient to allow outside evaluation of their merit, in contrast to the earlier epidemiology studies from Eastern Europe and the USSR.

These studies provide new information that was not available to the Navy or to the public in 1977. Although the research results do not prove that biological effects will result from exposure to extremely low frequency electromagnetic radiation, neither are they mere reconfirmations of the Navy's 1977 assessment of the negligibility of any potential environmental effects.

The merit of the new information has been attested to by the expert witnesses....

The new information was accessible to the Navy. It derives entirely from Navy-sponsored studies or from published articles.

The new information raises questions about long-term exposure to ELF electromagnetic radiation that should be taken into consideration by the decisionmakers. For example, the window studies cast doubt on the Navy's reliance on long-term hazard-free experience with electric power lines as well as the Navy's discounting of research performed at frequencies and intensities different from those of the ELF facility. The studies demonstrate that the nature of the relationship between exposure and effect is not yet sufficiently understood to permit extrapolation from the presence or absence of effects at any one frequency. Moreover, the observation of a frequency window effect within the range at which the ELF antennae will operate is information that is highly relevant to an assessment of the environmental impact of the project.

The 1977 environmental impact statement is no longer adequate as a source of information necessary to a rational decision on the relative risks and benefits of Project ELF....

I conclude that the scientific information on biological effects generated since 1977 is significant enough to require careful review by the Navy. I refrain expressly from finding that any one of the studies, or all of them taken together, invalidate the Navy's previous assertion that long-term exposure to ELF electromagnetic radiation will produce no adverse biological effects. The research results remain equivocal. the scientists do not agree on the import of that research, and I am not prepared to evaluate the substance of the individual studies or to weigh the relative merits of the various scientific opinions in this complex area....

Despite the continuing uncertainty over the potential biological effects of electromagnetic radiation, those effects must be taken into account by the Navy because they represent significant new information relevant to the environmental consequences of the proposed action. This does not mean that the Navy must postpone operation of Project ELF until all uncertainty has been resolved. It does mean that the Navy must undertake a considered review of all that is known to date and evaluate the relative risks and benefits before proceeding with Project ELF.

Defendants contend that the Navy's establishment of an Environmental Review Committee and an ecological monitoring program, the various research projects it funded and its contract with IIT Research Institute for literature reviews and other work demonstrate a high degree of concern for keeping abreast of the relevant developments in the field of electromagnetic radiation effects and a careful consideration of those developments.

However, my view of the Navy's efforts is that they are of relatively little use in assessing the potential danger of electromagnetic radiation on animal life. By themselves, the activities do not show a high degree of care and, in any event, they are not a substitute for a thorough review of the relevant information and a careful weighing of the risks and benefits of Project ELF.

For example, the Environmental Review Committee focused primarily on the impact of Project ELF on the physical environment....

Similarly, the Navy's ecological monitoring program was devoted essentially to the environmental consequences of Project ELF. Only one of the thirteen research projects that made up the program was concerned with potential biological effects of extremely low frequency electromagnetic radiation and that was the Goodman slime mold field study at Clam Lake, for which there are no results as yet.

In addition to the slime mold study, the Navy has sponsored several animal studies. Of these, the Pensacola primate growth study and the UCLA monkey behavior study appear to be the most substantive. The Pensacola study was reviewed by a National Academy of Sciences panel and the UCLA study has been referred to frequently in other literature on biological effects of extremely low frequency electromagnetic radiation. However, other Navy studies such as the bird migration study, the multigenerational mice study and the review of the physical condition of Navy workers at the Clam Lake site produced inconclusive results or merely confirmed earlier findings. Moreover, the Navy never subjected any studies other than the Pensacola primate study to peer review and it never attempted a comprehensive review of the pieces of information generated by the studies it had sponsored.

With respect to the contract with IIT Research Institute for literature reviews, the evidence shows that IIT Research Institute evaluated articles and provided the Navy with studies and summaries of articles only on a sporadic basis and only after the decision had already been made not to supplement the 1977 environmental impact statement....

I conclude that the record does not demonstrate that the Navy fulfilled its duty of conducting a thorough and comprehensive review of the new scientific information on the biological effects of extremely low frequency electromagnetic radiation and the significance of that information....

In summary, I find and conclude that in proceeding with the reactivation of Project ELF without undertaking a thorough and comprehensive review of the significant new information on biological effects of electromagnetic radiation that has been generated since 1977 the Navy abused its discretion. In so proceeding, the Navy acted in violation of the National Environmental Policy Act....

I am not in a position to determine the full significance of the new information on biological effects. It may be that the significance of the new information is such that the Navy could have fulfilled its obligation of explanation in some way other than by filing a supplemental environmental impact statement. However, at this time it would not be in the public's interest or in the Navy's to permit the Navy to go forward with Project ELF without requiring it to file a supplemental environmental impact statement. The public has displayed an interest in this case and in the human health implications of Project ELF. A supplemental environmental impact statement will allow the public to address the issue of biological effects, as well as serving to advise the public that the Navy has taken the issue into consideration....

## Declaration of John F. Lehman, Jr.

*Reprinted below is the declaration of John F. Lehman, Jr., Secretary of the Navy, in support of the Navy's motion for reconsideration of Judge Barbara B. Crabb's decision to require a new environmental impact statement for Project ELF.*

1. I, John F. Lehman, Jr., am the Secretary of the Navy.

2. The Trident and Poseidon submarines of the Navy's submarine force represent an integral part of the nation's strategic nuclear deterrence and are the nation's most survivable strategic deterrent.

3. In my capacity as the Secretary of the Navy, it is my responsibility to ensure the effective operation, safety and survivability of the Navy's submarine force. The survivability of the Trident and Poseidon submarines depends on their ability to remain undetected. They must also maintain continuous communication with the President and Secretary of Defense.

4. With current systems, continuous communication is possible only when submarines deploy a receiving antenna while operating at or near the surface. This requirement imposes an enormous restriction upon the submarine's operating depth and its speed, as well as increasing its exposure to detection. The ELF system permits submarines to receive communications without reducing speed, operating at the surface, or trailing an antenna. Thus, the ELF system represents a critical safeguard against a scientific breakthrough in submarine detection by another nation using aircraft or satellite systems that exploit nonacoustic phenomena such as kelvin wakes and internal waves near the surface.

5. The Soviets are devoting considerable time and money to anti-submarine research and to new techniques and systems of submarine detection. Any potential Soviet anti-submarine breakthrough that might result from this research can best be countered by assuring that US submarines have the ability to operate independent of depth and speed restrictions. Only ELF provides this capability.

6. Intelligence reports indicate that the Soviets have the ELF capability. In order to ensure the effectiveness of our own submarine forces, a comparable ELF capability is imperative.

7. We have long been aware of concerns about possible effects of extremely low frequency electromagnetic fields on human health. Our studies and research have revealed no human health hazards from the Navy's ELF Communication System. Nevertheless, it has been and remains the policy of the United States Navy that, in the event significant and serious human health hazards are shown to exist, the operation of the ELF Communication System will be discontinued.

8. In my judgment, the ELF system is essential to the national defense, and, therefore, any delay in its construction is contrary to national defense interests.

9. I certify under penalty of perjury pursuant to 28 USC 1746 that all of the above statements are true, complete and correct to the best of my knowledge and belief.

John F. Lehman, Jr.
February 9, 1984

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# UPDATES

## BIOLOGICAL EFFECTS

**Non-Thermal Effect in Plants...**A research group headed by Dr. Andrew Marino of LSU Medical Center believes it has identified the first electric field effect in plants caused by a non-thermal mechanism. Writing in the December issue of the *IEEE Transactions on Biomedical Engineering*, Marino and co-workers report that an applied electric field of 5 kV/m at 60 Hz, producing an internal E-field of 0.00075-37.5 V/m in sunflower seeds, caused a statistically significant decrease of five percent in the germination rate. (The internal E-field is strongly dependent on moisture content and is hard to characterize.) An applied field of 1 kV/m (0.00015 V/m inside the seed) had no effect. In a telephone interview from his office in Shreveport, LA, Marino said that he did not intend to continue studying E-field effects on plants because they are extremely dependent on temperature and humidity. "They are too sensitive to changes in the microenvironment," he added.

**Health Along a DC Line...**People living near a 400 kV DC power line did not report more health complaints than those living far away from it, according to a survey of 438 Californians published in the January issue of the *American Journal of Public Health*. Drs. Roy Haupt and James Nolfi caution that the population used in their study was too small to rule out the "possibility of low incidence effects." Haupt, who now works for the state of Vermont, told *Microwave News* that one of the strengths of the study was that those responding to the survey were unaware that they were living near the power line and thus their perception of its effects did not come into play.

## COMPATIBILITY & INTERFERENCE

**Computing Aboard Eastern...**Eastern Airlines has changed its policy and will now allow passengers to use computers aboard its aircraft (see *MWN*, October 1983). In a statement released January 31, Eastern said that the decision was reached "after extensive testing" which showed no evidence of electronic equipment interference with aircraft navigation and communications equipment. No reports or other documentation on the tests are available. The policy shift follows the retirement of D.W. Crosby, Eastern's chief engineer, who wrote to RTCA last August, prompting a new investigation into the potential problem of RFI by the commission's Special Committee 156. That committee held its second meeting on February 28-29, and new measurement data on path loss were presented. Details next month.

**Resources...**The February 1984 issue of the *IEEE Transactions on Power Apparatus and Systems* features an article on "Television Interference Due to Electromagnetic Scattering by the MOD-2 Wind Turbine Generators." K.H. Cavcey of the University of Missouri in Columbia and L.Y. Lee of BPA in Portland, OR, report supporting data for their thesis that at ground level the near field scattered component is an amplitude modulated secondary signal....KeyTek has published *Electrostatic Discharge (ESD) Protection Test Handbook*. The 64-page booklet, complete with index, is available for $5.00 from KeyTek Instrument Corp., 12 Cambridge St., Burlington, MA 01803.

## INTERNATIONAL

**Canadian Diathermy Guidelines...**The Non-Ionizing Radiation Section of the Canadian Radiation Protection Bureau has issued guidelines to limit occupational exposures to stray radiation emitted by shortwave (27 MHz) diathermy equipment. The guidelines stem from surveys of diathermy operator exposures, which indicated a pattern of over-exposures (see *MWN*, September 1981 and *Health Physics*, March 1982). A copy of *Safety Code 25 — Shortwave Diathermy Guidelines for Limited Radiofrequency Exposure* (No. 83-EHD-98) is available from the Public Affairs Directorate, Department of National Health and Welfare, 5th Floor, Brooke Claxton Bldg., Ottawa, Canada K1A 0K9.

## MEASUREMENTS

**Resources...**Two new publications from NBS' Electromagnetic Fields Division: (1) *Approximate Formulas for the Far Fields and Gain of Open-Ended Rectangular Waveguide* (NBSIR 83-1689), by Arthur Yaghjian, describes two methods that significantly reduce the previous limits of uncertainty for calculated probe characteristics when making near field antenna measurements. It is available for $8.50, prepaid, from the National Technical Information Service, Springfield, VA 22161. Order No. PB 83-233999. (2) *Eigenmodes and the Composite Quality Factor of a Reverberating Chamber* (TN 1066), by a team from the University of Colorado in Boulder and NBS, describes a theoretical basis for the design of a metal chamber to contain a localized, homogeneous and isotropic EM field for EMI/EMC tests on electronic products and components. Available for $4.00, prepaid, from the Government Printing Office, Washington, DC 20402. Order No. 003-003-02510-1.

## MEDICAL APPLICATIONS

**Hyperthermia Notes...**The January 1984 issue of the *IEEE Transactions on Biomedical Engineering* is devoted to hyperthermia and cancer therapy. The 21 papers, edited by Drs. John Strobehn, Thomas Cetas and George Hahn, cover electromagnetic and ultrasound applicators, dosimetry and modeling. Hahn leads off the special issue with an introduction to hyperthermia for the engineer....A host of recent articles on hyperthermia applicators: FDA's Dr. Gideon Kantor and Donald Witters describe the performance of one operating at 915 MHz with reduced leakage in the June 1983 issue of the *Journal of Microwave Power*. A team from the University of Illinois, Urbana, has published "Frequency Optimization of Focused Microwave Hyperthermia Applicators" in the February 1984 *Proceedings of the IEEE*. Two researchers from Shimane Medical University in Japan have designed an inductive applicator, which

they claim "produces much less heat in the fat layer than in the muscle layer." And Dr. J.J.W. Lagendijk from Utrecht, the Netherlands, describes a simple and cheap applicator for deep body heating. These last two papers are in the most recent issue (December 1983) of the *Journal of Microwave Power*....A "Diagnostic and Therapeutic Technology Assessment" of whole-body hyperthermia for the treatment of solid tumors, which appears in the January 13 *Journal of the American Medical Association,* concludes that this type of therapy is still investigational: "The clinical use of whole-body hyperthermia in combination with radiation therapy or chemotherapy is still in an early stage of investigation, although there is good in vitro evidence that a synergism with heat may exist with the other treatments."...The *4th Annual Meeting of the North American Hyperthermia Group* (NAHG) will be held at the Sheraton Twin Towers Hotel in Orlando, FL, March 23-27 — immediately before the *32nd Annual Meeting of the Radiation Research Society.* Last year some 250 hyperthermia experts attended the NAHG meeting, and the attendance promises to be as high this year, with about 125 papers scheduled for presentation. For more information, contact Sherry Phillips, NAHG, 925 Chestnut St., Philadelphia, PA 19107, (215) 574-3153.

**Ultrasound Risks...**A panel of experts has warned that the use of ultrasound imaging during pregnancy should be limited to situations in which there is an "accepted medical reason for the procedure." The experts, who met at NIH in Bethesda, MD, February 6-8, said that they could not endorse routine ultrasound screening of pregnant women because there is not enough evidence that "routine screening benefits either the mother or the fetus." The panel concluded that ultrasound could be useful in risky or complicated pregnancies but warned that many of the studies on the safety of ultrasound in humans have been "inadequate" and that there is not enough information to "reliably assess" the risks of ultrasound imaging.

## MILITARY SYSTEMS

**Latest from Clear...**The AF's Office of the Surgeon General has completed its review of the radar accident at Clear AF Station and presented it to Congressman Don Young (R-AK) (see *MWN,* November 1983 and January/February 1984). The AF has concluded that a reenactment of the accident is not warranted. A spokesman for Young said that the report "was totally unacceptable." As we go to press, OSHA's regional office in Seattle has decided to send OSHA's Health Response Team, based in Salt Lake City, UT, to Clear to run a new simulation of the accident and to determine the exposure levels experienced by the eight workers. Details next month.

## OCCUPATIONAL HEALTH

**Resources...**Dr. Samuel Milham's report *Occupational Mortality in Washington State 1950-1979* (No. 83-116) has been published by NIOSH. The report contains the data with which he linked leukemia with workers exposed to ELF electric and magnetic fields (see *MWN,* July/August 1982). Contact: Division of Surveillance, Hazard Evaluations and Field Studies, NIOSH, 4676 Columbia Parkway, Cincinnati, OH 45226....OSHA has published a booklet *Controlling Electrical Hazards* and a report *An Illustrated Guide to Electrical Safety.* The 12-page booklet is available free from OSHA's Publication Office, Room N-4101, Washington, DC 20210 (send a self-addressed mailing label). The 172-page guide is available for $5.50, prepaid, from the Government Printing Office, Dept. 36-CV, Washington, DC 20402. To order with Visa or Mastercard, call (202) 783-3238.

## POWER LINES

**EPRI Seminars...**The Electric Power Research Institute (EPRI) is organizing a series of seminars on methods of analyzing the effects power lines have on gas pipelines and railroad equipment when they share a common right-of-way. *Mutual Design of Natural Gas Pipelines and Electric Power Lines* will be held in Palo Alto, CA, May 1-3. The fee is $75 for EPRI members and $275 for non-members. A *Seminar on Mutual Design of Overhead Transmission Lines and Railroad Communications and Signal Systems* will be held in Chicago, IL, May 15-17; in Washington, DC, June 19-21; and in Atlanta, GA, September 11-13. The fee for each seminar in this series has not yet been set but is expected to be about $100. For more information about the seminars contact John Dunlap, EPRI, PO Box 10412, Palo Alto, CA 94303, (415) 855-2305. The railroad seminar will be taught by staffers at IITRI, who recently published a two-volume report (EL-3301) for EPRI on the potential interference of power line radiation with railroad systems (see *MWN,* September 1983). Volume 1, *Engineering Analysis,* ($29.50) describes the interaction of power lines and railroads and develops a methodology for siting them together. Volume 2, *Appendices* ($25.00) documents the results of the study and is designed for the in-depth reader. They are available from EPRI's Research Reports Center, PO Box 50590, Palo Alto, CA 94303, (415) 965-4081.

**1985 Meetings...**This year has hardly begun, but it's not too early to start planning for 1985. The Institution of Electrical Engineers, based in London, England, is hosting two conferences: The *8th International Conference on Electricity Distribution* (CIRED) will be held in Brighton, May 20-24. And the *International Conference on AC and DC Power Transmission* will be held in London, September 23-26. CIRED meetings are held every two years, alternately in England and in Belgium. The 1983 meeting attracted nearly a thousand participants from 35 countries. The AC-DC conference was last held in 1980. For more information on both these meetings, contact: Conference Services, IEE, Savoy Place, London WC2R 0BL, England.

## VDTs

**Legislation...**The push for state VDT laws continues. Hawaii has passed a bill that directs the state Bureau of

# UPDATES

Labor Standards to study VDT health and safety risks and, if necessary, to develop regulations. In Maine, the Bureau of Labor Standards is holding a public hearing on March 15 as part of its consideration of possible VDT safety rules, in keeping with the law passed in that state last June. The Ohio Health and Retirement Committee held a series of hearings on House Bill 552, which began January 25 and continued with three meetings in February. The Rhode Island House Labor Committee has scheduled a hearing for March 8 on Bill H7012, which is modeled on legislation drafted by the Newspaper Guild. And in Massachusetts, five more bills have been introduced, bringing to nine the number of proposals that will be under consideration when the Committee on Labor and Commerce meets March 14. California Assemblyman Tom Hayden has introduced the "Video Display Terminal Operator Occupational Safeguards Act of 1984": Assembly Bill 3175 would require employers to meet minimum office standards for lighting, furniture, radiation protection and terminal maintenance. Pregnant employees would be entitled to non-VDT work, and all VDT operators would be provided 15 minutes away from terminals for each hour of work. Free annual eye examinations and free eyeglasses (when necessitated by VDT work) would be available to all employees, to be payed for by their employers. In Connecticut, where legislators are awaiting the results of a study they ordered last June, Rep. William Kiner has prepared a new bill and hearings are planned for the spring. Kiner's proposal, which has yet to be introduced, would require annual eye examinations, regular monitoring and testing of all VDTs and ongoing evaluation of possible radiation risks from VDTs.

**Resources...**Measurement of X-ray radiation from VDTs has led two Canadian researchers to conclude that levels are "extremely low." In fact, the measurements indicated there was "no difference whether the VDT is switched on or off." C. Pomroy and L. Noel of the Radiation Protection Bureau in Ottawa estimate that the annual dose from working at 5 cm from a VDT for 2,000 hours over one year is 0.0006 mR. The current FDA standard is 0.5 mR/hr. Their report appears in the February 1984 *Health Physics*....In our last issue, we reported the results of an ongoing investigation of VDTs at Ontario Hydro, a Canadian electric utility. The company has now also released "Analysis of Operator Exposure to Electric Fields From Video Display Units" (Report No. 83-503-K). Written by Dr. S.M. Harvey of the company's Electrical Research Department, the report can be requested from Ontario Hydro, 757 McKay Road, Pickering, Ontario L1W 3C8, Canada....The Library of Congress has published a white paper on VDTs. *Video Display Terminals: The Controversy About Health and Safety Issues* summarizes major research to date and discusses possible causes of VDT operator health complaints. Written by Christopher Dodge, a specialist in the library's Science Policy Research Division of the Congressional Research Services, the white paper can be obtained from him at the Library of Congress, Washington, DC 20540.

# CONFERENCES

***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 9-13: International Magnetics Conference,*** Hamburg, West Germany. Contact: T.S. Nelson, PO Box 480, Murray Hill, NJ 07974.

***April 10-11: Satcom'84,*** Sheraton Washington, Washington, DC. Contact: International Association of Satellite Users, PO Box DD, McLean, VA 22101, (703) 759-2094.

***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: Workshop on Payload Susceptibility to Space Shuttle Ku-Band Radiated Fields,*** Johnson Space Center, Houston, TX. Contact: Ralph Lawton, McDonnell Douglas Technical Services Co., 16441 Space Center Blvd., Houston, TX 77058, (713) 488-5660, ext. 468.

***May 30-June 1: IEEE MTT-S International Microwave Symposium,*** San Francisco, CA. Contact: Dr. Ferdo Ivanek, Harris Corp., Farinon Division, 691 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.

# 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.

## Polish Epidemiological Study Links RF/MW Exposures to Cancer

Polish researchers have identified a tripling of the incidence of cancer among military personnel exposed to radiofrequency and microwave (RF/MW) radiation as compared to unexposed servicemen. The observed cancer risk was greatest for the blood-forming organs, the lymphatic tissues and the thyroid gland.

The study, one of the first to link cancer to RF/MW radiation in a human population, provides independent confirmation of recent animal data that indicate that RF/MW radiation may act as a cancer promoter.

According to the new Polish results, the odds of developing cancer increase with the length of exposure and are greatest for younger age groups.

In a personal communication to *Microwave News*, Dr. Stanislaw Szmigielski of the Center for Radiobiology and Radioprotection in Warsaw said that he had found "a definite increased risk of neoplasms resulting from occupational exposures to RF/MW radiation for the tested population."

Szmigielski and a large team of collaborators spent two years compiling and analyzing all cancer cases reported from 1971 to 1980 in the total population of career servicemen in the Polish military. They also ascertained the length of time each patient was exposed to RF/MW radiation and the location of each type of tumor. This is by far the largest epidemiological study of the effects of non-ionizing radiation ever completed.

The exposed population was limited to those personnel with "sure, long-lasting and massive exposures to RF/MW radiation," according to Szmigielski. Just three percent of the career military personnel fit into this category but they accounted for about nine percent of the total number of cancer cases (see Table I).

*(continued on p.2)*

## FY86 Bioeffects Research: ELF Budget Outlook Bleak

President Reagan's 1986 fiscal year (FY86) budget would wipe out all research at the Environmental Protection Agency (EPA) on the bioeffects of non-ionizing radiation and would severely reduce the electric field effects program at the Department of Energy (DOE).

Research on power line, or extremely low frequency (ELF), radiation would be particularly hard hit by the President's proposal.

Dr. David Carpenter, director of New York State's Division of Laboratories and Research, said that he is "very worried about the funding situation" and that it is "an impending catastrophe." The public is anxious about ELF fields, he explained, and even if there is no real risk, research is needed to settle the question.

*(continued on p.3)*

# Polish Cancer Study (continued from p.1)

### Greatest Risk for the Young

Statistical analysis revealed that the relative incidence of cancer was highest for the youngest age group: 20-29 year-olds who were exposed to RF/MW radiation had a 550 percent greater chance of getting cancer than those in the same age who were not exposed. Cancer risks for the exposed group decreased with age but were still statistically significant for all age groups, especially for those under 50.

Breaking down the cancer data by the location of the tumor indicated that the blood-forming organs and lymphatic tissue were the most likely to develop cancer. Those soldiers exposed to RF/MW radiation had a 6.7 times greater chance of contracting these types of tumors than those in the control group. The thyroid was the next most vulnerable, with a 4.3 risk factor (see Table 2).

Overall, servicemen who worked with RF/MW radiation were 3.1 times more likely to get cancer than those in other military occupations — significant at the 0.01 level (see Table 3). Szmigielski's research team also found a "high correlation" between the chance of developing cancer and the number of years of exposure.

Interestingly, the exposed and non-exposed servicemen had essentially the *same* rate of lung cancer, the most common type of cancer in the Polish military.

The research team is planning to present their results at a symposium later this year.

### Consistent with Guy Study

The Polish findings are consistent with the experimental data presented last summer by Dr. Bill Guy's research team at the University of Washington in Seattle. Guy reported a generalized increase in tumors among rats exposed to radar-type radiation, with the endocrine system particularly vulnerable to pulsed microwave radiation (see *MWN*, July/August 1984 and story on p.4). In addition, last October Dr. Ruey Lin of the Maryland Department of Health and Mental Hygiene reported a link between exposure to electromagnetic fields and the incidence of brain tumors among workers (see *MWN*, October 1984).

Szmigielski told *Microwave News* that "I am very surprised with the results we obtained," adding that the observed differences were much greater than he had suspected at the beginning of the study. He concluded: "There is an urgent need to repeat this study, using another well-defined and well-controlled population."

Internationally known for his studies on the effects of RF/MW radiation on the immune system, Szmigielski was a member of the editorial board of *Bioelectromagnetics* from 1980-1983. He has previously reported a synergy in the carcinogenic action of benzopyrene when coupled with exposure to 2450 MHz microwaves (see *MWN*, May 1981). Szmigielski can be contacted at the Center for Radiobiology and Radioprotection, 128 Szaserow, 00-909 Warsaw, Poland. ●

**TABLE 1**
**CANCER INCIDENCE**
**(percent)**

| | Exposed | Non-Exposed |
|---|---|---|
| Population Size | 3 | 97 |
| Cancer Incidence | 8.8 | 91.2 |

**TABLE 2**
**TUMOR RISK FACTORS**
**(Exposed v Non-Exposed)**

| Tumor Type | Risk Factor |
|---|---|
| Esophageal & Stomach | 3.2 |
| Skin (including melanoma) | 3.1 |
| Thyroid | 4.3 |
| Blood-Forming Organs & Lymphatic Tissue | 6.7 |

**TABLE 3**
**INCIDENCE OF ALL TUMORS**
**(per 100,000 subjects per year)**

| Age Group | Whole Population | Exposed | Non-Exposed | Chi-Square | p | Risk Factor |
|---|---|---|---|---|---|---|
| 20-29 | 9.2 | 44.2 | 8.0 | 15.49 | < 0.01 | 5.5 |
| 30-39 | 19.4 | 81.7 | 17.2 | 25.86 | < 0.01 | 4.7 |
| 40-49 | 90.4 | 348.8 | 82.9 | 63.06 | < 0.01 | 4.2 |
| 50-59 | 364.7 | 558.6 | 353.4 | 6.74 | < 0.05 | 1.6 |
| Total | 68.2 | 192.2 | 64.2 | 79.11 | < 0.01 | 3.1 |

The New York State Power Line Project has been a major source of funds for ELF bioeffects research for the last few years. Carpenter said that his program has enough money to complete on-going projects but is otherwise "essentially broke" with "no realistic possibility for more funds."

The other major source of ELF research funds is the Electric Power Research Institute (EPRI), which is supported by member utilities. Dr. Robert Patterson of EPRI's Environment Assessment Department said that this year's funding level would be about the same as last year, $1.5 million. He added that there are no plans to increase the research effort in light of the federal cuts.

Dan Van Atta, EPRI's manager of public information, said that the electric field effects program is "not a high priority" at this time, compared with other research areas such as acid rain.

Dr. Michael Marron of the Office of Naval Research voiced concern about the cutbacks in both ELF and radiofrequency and microwave (RF/MW) radiation research. In a telephone interview, Marron said, "I'm disturbed that civilian agencies are not more concerned about the bioeffects of non-ionizing radiation." He added that the perception that the problem is solved is "a long way from the truth."

Marron said that there was no basic research going on in any part of the Department of Defense on ELF. The Naval Aerospace Medical Research Lab had been doing studies, but these ended in this year's (FY85) budget (see *MWN*, September 1984). Some research is continuing on specific projects, like the Navy's ELF submarine communication system, but this is not considered to be basic research.

### Zeroed Out at EPA

The non-ionizing radiation group at the Health Effects Research Laboratory in North Carolina will be dissolved next October 1, at the start of FY86, unless Congress intervenes and restores at least some of the cut funding.

Few EPA staffers would talk on the record about the budget, but informed sources told *Microwave News* that the Office of Management and Budget (OMB) had eliminated the request for non-ionizing radiation research in EPA's budget. Apparently, EPA officials did not contest this decision, and many observers believe the program is doomed without agency support.

These cuts come at an awkward time. EPA recently initiated a program on ELF bioeffects under orders from Congress, following a similar proposal two years ago to close down the EPA research program (see *MWN*, January/February 1983). In restoring funds, the House Committee on Science and Technology specifically directed EPA to look into the health impacts of power lines (see *MWN*, June 1983).

EPA research on higher frequency radiation would also be hurt. For instance, the agency was planning to begin a major lifespan study of rats exposed to 500 MHz radiation later this year. One objective of that study would have been to investigate the findings reported by the University of Washington (see story on p.4 and *MWN*, July/August 1984).

The EPA non-ionizing radiation research budget for FY85 was about $2 million, approximately evenly divided between extra- and intra-mural projects.

Dr. Richard Phillips, who took charge of the non-ionizing radiation program only a few months ago after leaving Battelle Pacific Northwest Labs, said in a telephone interview that he was surprised by the cuts but would not comment until he knew more about them.

A further complication arose after the President announced his budget: Joseph Cannon, EPA assistant administrator for air and radiation, resigned to practice law in Washington, DC. Cannon was responsible for the development of non-ionizing radiation standards and could have argued that EPA needed continued research to complete that mission. Indeed, there are rumors circulating in Washington that EPA might close down the Office of Radiation Programs and farm out its duties to other parts of EPA or transfer the responsibilities to other federal agencies like the Nuclear Regulatory Commission.

### ELF and EMP Research at DOE

Ken Klein, acting director of DOE's Electric Energy Systems Division, which sponsors research on power line health effects and on electromagnetic pulse (EMP) impacts, reports that his budget would be cut in half compared to FY85 — $10.0 million, down from $20.7 million.

The electric field effects work would be reduced from $4.7 million to $3.0 million under the President's proposal. EMP research would be cut from $3.0 million to $1.8 million.

In his FY85 budget proposal, Reagan had requested $3.7 million for electric field effects research, but Congress later added $1 million.

While the new budget is being considered by Congress, the Energy Engineering Board at the National Academy of Sciences will conduct its own review. Fred March, the board's staff officer, is arranging a workshop for April 24-26 to review the DOE program. Among those invited to present papers on electromagnetic effects are Drs. Don Justesen, Richard Phillips and Tom Tenforde. The workshop will be closed to the public, though March said that the board may later publish the proceedings.

### FDA and NIEHS

At the Food and Drug Administration's (FDA) Center for Devices and Radiological Health, Dr. Mays Swicord said that the budget for his Electromagnetics Branch is still uncertain, though he expects his FY86 program to be comparable to that in FY85.

Similarly, Dr. Don McRee, who heads the Non-Ionizing Radiation Working Group at the National Institute of Environmental Health Sciences (NIEHS), said that his FY86 budget would be about the same as last year. In FY85, the NIEHS budget was $485,000. Swicord's and McRee's combined research budgets are less than $1 million. ●

## Guy Study: New Tumors Found, Replication Attempt Unlikely

Researchers at the University of Washington in Seattle have identified two new primary tumors among rats chronically exposed to microwave radiation and one new tumor among the control group. The new finding adds further support to the well-publicized results from Professor Bill Guy's Bioelectromagnetics Research Lab that pulsed microwaves may act as a cancer promoter in experimental animals (see *MWN*, July/August 1984). At this time, there are no indications that a replication study will be funded.

The revised total tumor count is 18 to 5, exposed to controls. The two new malignancies among the exposed rats were in the endocrine system, increasing the incidence of this type of tumor from seven to nine as compared to only two among the controls.

"The corrected Guy results in no way diminish the reliability of the original findings, in fact their statistical significance is increased," according to Dr. Don Justesen of the VA Hospital in Kansas City, MO, who has been closely following developments related to the University of Washington study.

Professor Guy, the principal investigator on the $4.5 million study funded by the U.S. Air Force, said that he knows of no plans to replicate his experiment or to further investigate the statistically significant increase in tumors among the exposed rats. "We're assuming we are not replicating," Guy told *Microwave News* in a telephone interview.

Guy said that he was uncomfortable about leaving the study as it is: "There are unresolved issues and I feel uneasy about them."

The Air Force has refused to comment on the new results or on the likelihood of funding for a replication study. Numerous phone calls over a two-month period to John Mitchell, chief of radiation physics at the School of Aerospace Medicine at Brooks Air Force Base in San Antonio, TX, and to Dr. Jerome Krupp, the project officer for the Guy study, were not returned.

A spokeswoman for Air Force Surgeon General Max Bralliar said that he was aware of the University of Washington study but would not comment until the final report had been received and evaluated.

Guy and co-workers exposed 100 male rats to 0.48 mW/cm$^2$ of 2450 MHz, 8 Hz amplitude modulated pulsed microwaves (10 microsecond pulses, 800 pulses per second) for 21 hours a day for up to 25 months. The rats received a maximum average specific absorption rate of 0.4 W/Kg. One hundred rats served as controls.

Guy explained that the three new tumors were identified when members of his research group reviewed the experimental data and found a number of metastatic tumors that were not associated with any primary tumors. On reanalyzing the slides, the missing tumors were located.

He added that the previously reported finding of an increase in adrenal weight among the exposed rats was a direct result of the mass of the adrenal tumors and was no longer significant in itself.

Some time ago, the Air Force asked Guy's group to look into one positive result that was found halfway through the study: after 13 months, the exposed animals had a significant increase in splenic B and T cells as compared to controls. After 25 months, no difference was detected.

Guy reports that the replication of this part of the experiment did not support the original finding but did turn up abnormal concentrations of B lymphocytes in the bone marrow. These results will be reported at next June's Bioelectromagnetics Society meeting in San Francisco.

The Air Force has now issued seven volumes of the final report on the Guy study. Still to come is Volume 8, which contains the tumor data that researchers are waiting for. A complete list of the tumors identified by the Guy team appears in "From the Field" on p.7. Guy has sent the final manuscript of Volume 8 to Brooks and expects it to be published soon. A final summary volume will be completed in March, Guy said.

For a copy of Guy's reports, write to Jerome Krupp, USAF School of Aerospace Medicine, Brooks AFB, TX 78235.

## NBS Asked To Set Up Program for EMC Testing

Five companies have asked the National Bureau of Standards (NBS) to establish a laboratory accreditation program (LAP) for electromagnetic compatibility (EMC) and telecommunications testing. If the LAP is approved, it would become part of NBS's National Voluntary Laboratory Accreditation Program (NVLAP).

Walter Poggi, president of Retlif Testing Laboratories in Ronkonkoma, NY, urged NBS to set up the LAP in order "to better control the quality of electromagnetic compatibility testing laboratories in this country and to help to promote better acceptance of U.S. generated test data overseas." (The complete text of Poggi's letter appears on p.6.)

In his January 23 letter, Poggi wrote that the "lack of a national accreditation program has seriously hurt laboratories." Without some type of program, he explained, "it is going to continue to be difficult to have U.S. generated data accepted by foreign government agencies."

In a telephone interview with *Microwave News*, Poggi cited examples of the problems faced by U.S. labs: For testing to be acceptable in Canada, a lab must have a licensed Canadian engineer on staff. In Japan, rules can force a lab to disclose technical *and* financial data. These are trade barriers, Poggi said, making it nearly impossible for small manufacturers to enter foreign markets.

The U.S. has an open door policy, Poggi said, so American labs need a LAP to ensure an "equitable and efficient" system.

Joining Retlif in the letter to NBS were: Met Electrical Testing Co., Inc., of Baltimore, MD; Hyak Laboratories, Inc., of Springfield, VA; Timco Engineering, Inc., of

Miami, FL; and Emaco, Inc., of San Diego, CA. All five companies are members of the American Council of Independent Laboratories.

NBS has invited comments on the need for the LAP. Submissions should be sent to the Director, Office of Product Standards Policy, NBS, ADMIN A 603, Gaithersburg, MD 20899 before April 9. For further information, contact NBS's Peter Unger at (301) 921-3431.

## Operator Exposures to Induction Heaters

The majority of induction heaters expose operators to magnetic fields above 2.3 A/m, the plane-wave equivalent of greater than 200 mW/cm$^2$, according to a recent Canadian survey. Officials at the Radiation Protection Bureau in Ottawa believe that the high intensity of these stray fields may pose a potential health hazard.

Dr. Maria Stuchly and David Lecuyer measured the magnetic fields near 76 induction heaters operating at frequencies from 180 Hz to 27 MHz and with output powers often exceeding 100 kilowatts — two were over one megawatt.

More than 55 percent of the heaters caused maximum worker exposures of more than 2.3 A/m, the highest field intensity that could be measured with the available equipment. Averaged over a 6-minute period to allow for the unit's on-off cycle, operator exposures exceeded 2.3 A/m for 38 percent of the units. Nearly 60 percent exceeded 1.6 A/m, the plane-wave equivalent of approximately 100 mW/cm$^2$. (Note that the operators are in the near field, so the concept of power density does not strictly apply.)

In general, the lower the operating frequency, the higher the power output, which results in larger stray fields. For low frequency heaters, Stuchly and Lecuyer found that the intensities can be very high, up to 1000 A/m. These results are in line with those from surveys conducted in the early 1980s in Poland and Sweden.

A limited number of electric field measurements were also made. These confirmed theoretical predictions that the electric fields associated with the heaters were much weaker than the magnetic fields.

Induction heaters have a wide range of applications in processing metals, such as hardening, welding, melting and sealing. In their on-off cycle, the units are on for 2 to 60 seconds and then off, so that the metal target can be replaced. Operators generally stand one meter or less from the heater's energized coil.

Stuchly presented these results in a poster paper at the July 1984 *Annual Meeting of the Bioelectromagnetics Society* in Atlanta, GA, and in an address to the URSI symposium on the *Interaction of Electromagnetic Fields with Biological Systems,* held in Florence, Italy, last August. They will be published in a forthcoming issue of *Health Physics*.

In Florence, Stuchly pointed out the difficulties in assessing the health impacts of these fields because of the lack of bioeffects research at low frequencies and the absence of applicable standards. She concluded by posing the question: "What do these exposure levels mean? Is there a risk?"

In a telephone interview with *Microwave News,* Stuchly said that "a potential health hazard" may exist. Interestingly, she pointed out that at low frequencies, the fields would not violate current Russian and Polish standards. Stuchly also noted that the fields produced by the heaters are likely to be amplitude modulated at extremely low frequencies, which may have additional biological consequences.

Stuchly said that she has no information on the number of Canadian workers exposed to electromagnetic fields from induction heaters, or on the total number of units now in operation.

## SHORT COURSES

April 22: **Tutorial on Part 15 and Part 68 FCC Regulations,** at Electro/85, New York, NY. Fee: $170 (IEEE members), $210 (others). Contact: IEEE METSAC, 614 Hammond St., Chestnut Hill, MA 02167, (800) 833-3613 or (617) 232-4193 in MA.

April 24: **FCC/VDE Commercial Applications,** Portland, OR. Fee: $295. Contact: EMXX Corp., 6706 Deland Dr., Springfield, VA 22152, (703) 451-4619. **Repeated** May 8: Boston, MA.

April 29-May 3: **Antennas and Arrays: Analysis, Synthesis and Applications,** Washington, DC. Fee: $920. Contact: Continuing Engineering Education, George Washington University (GWU), Washington, DC 20052, (800) 424-9773 or (202) 676-6106 in DC.

May 1-2: **EMP Design & Test,** Orlando, FL. Fee: $595. Contact: Greg Gore, R&B Enterprises, 20 Clipper Rd., West Conshohocken, PA 19428, (215) 825-1960. **Repeated** May 6-7: Philadelphia, PA; May 8-9: Boston, MA; June 12-13: Chicago, IL.

May 6-10: **Radiation Safety,** Evanston, IL. Fee: $895. Contact: Continuing Engineering Studies, 2804 Technological Institute, Northwestern University, Evanston, IL 60201, (312) 492-3365.

May 7-10: **Near-Field Antenna Measurement Techniques,** Atlanta, GA. Fee: $715. Contact: Technology Service Corp., 962 Wayne Avenue, Suite 600, Silver Spring, MD 20910, (800) 638-2628 or (301) 565-2970 in MD.

May 13-17: **Adaptive Antenna Signal Processing for Interference Rejection,** Los Angeles, CA. Fee: $945. Contact: UCLA Extension, Dept. of Engineering & Science, 10995 Le Conte Ave., Rm 637, Los Angeles, CA 90024, (213) 825-1047.

May 14-15: **Grounding, Bonding & Shielding,** Philadelphia, PA. Fee: $545. Contact: R&B, see May 1 above. **Repeated** May 16-17: Boston, MA; June 18-19: Chicago, IL.

May 14-16: **Military Uses of High Frequency Spectrum,** Washington, DC area. Fee: $360-510. (Classified U.S. Secret) Contact: Armed Forces Communications & Electronics Association/Professional Development Center, 5641 Burke Centre Parkway, Burke, VA 22015, (800) 336-4583 or (703) 425-8535 in VA.

May 20-24: **Millimeter-Wave Engineering and Applications,** Washington, DC. Fee: $835. Contact: GWU, see April 29 above.

May 21-23: **Digital Design for Interference Specifications,** Clearwater Beach, FL. Fee: $800. Contact: Ms. Jean Whitney, TKC, 8609 66th Street N., Pinellas Park, FL 33565, (813) 544-2594.

June 10-14: **EPRI High Voltage Transmission Line Design Seminar,** Lenox, MA. Fee: $150 (EPRI members); $1150 (others). Contact: L.D. Anzivino, HVTRF (Mail Code H63), GE, 100 Woodlawn Ave., Pittsfield, MA 01201, (413) 494-3320.

## Retlif's Request for an EMC LAP

*Reprinted below is the complete text of Walter Poggi's letter to the National Bureau of Standards (NBS) requesting the establishment of a laboratory accreditation program (LAP) for electromagnetic compatibility (EMC) and telecommunications testing Poggi is president of Retlif, Inc., an independent testing lab.* *See story on p.4.*

January 23, 1985

Office of the Director
National Bureau of Standards
ADMIN A1134
Gaithersburg, MD 20899

Sir:

I, Walter A. Poggi, representing Retlif, Inc. Testing Laboratories and authorized in the matter to represent Met Electrical Testing Company, Inc., Hyak Laboratories, Inc., Timco Engineering, Inc., and Emaco, Inc., hereby request the development of a Laboratory Accreditation Program (LAP) under the National Voluntary Laboratory Accreditation Program (NVLAP) of the National Bureau of Standards (NBS) in the *Test Technology: Electronics,* covering the *Test Disciplines:* Electromagnetic Compatibility (Military Standards), Electromagnetic Compatibility (FCC Standards) and Telecommunications Testing (FCC Standards). It is our desire that this LAP will cover testing services provided under military standard MIL-STD-461 and Federal Communications Commission Standards Part 2, Part 15, Part 18 and Part 68.

In an effort to better define the areas covered and to present a logical breakdown of the areas, we have attached for your review (Appendix A) our suggested outline for such a LAP.

It is the opinion of the group that a LAP is required in this area to better control the quality of electromagnetic compatibility testing laboratories in this country and to help to promote better acceptance of U.S. generated test data overseas. As I am sure you are aware, at this time there is not a national accreditation program in this country covering this type of laboratory. Although many laboratories in this area are listed or recognized by the FCC this does not represent an approval by the FCC and certainly does not attest to the quality of the measurements and procedures used by such laboratories. This lack of national accreditation program has seriously hurt laboratories such as ours in international matters. It is now evident that without some type of an accreditation program it is going to continue to be difficult to have U.S. generated test data accepted by foreign government agencies. This is most evident at this time in regards to the acceptance of telecommunication equipment manufactured in the country by Japan. Without acceptable U.S. generated test data the ability to export to Japan becomes a difficult problem mandating testing of U.S. manufactured products in Japan. This situation certainly will force most small to mid size manufacturing companies out of the Japanese marketplace because of cost and logistics. We can see the type of problems occurring with most European countries as well. Unfortunately most, if not all, foreign marketplaces are nowhere near as open as ours and we therefore must have such items as laboratory accreditation programs in place so that we have viable and reputable tools to use in international negotiations regarding testing of products.

We assume that additional independent as well as in-house laboratories will avail themselves of this LAP. Obviously, our group as listed above would immediately be involved and we would estimate that an additional 10 to 15 laboratories may take part. As far as the users of such laboratories, we would feel that each laboratory should, on the average, maintain a customer file of approximately 300 customers evenly divided between military and commercial work. Certainly we would look forward to being involved and supporting the development of this LAP. This support would be in the form of both personnel and funding. However, we would feel that it would be unfair for the laboratories alone to fund such a program which will aid manufacturers and even governmental agencies when it comes to international trade. We would hope that the funding required would be so as to not be overbearing for the involvement of independent laboratories which for the most part can be classified as small business.

We look forward to your timely action on this request and certainly stand ready to be of assistance to you in any way we can.

Very Truly Yours,

Walter A. Poggi
President
Retlif, Inc.

### Appendix A

- *Test Technology:* Electronics.

- *Test Disciplines:* Electromagnetic Compatibility (FCC Standards), Electromagnetic Compatibility (Military Standards), Telecommunications (FCC Standards).

- *General Requirements:* (A) Company History; (B) Staffing; (C) Instrumentation FCC/CISPR: — Mil-spec: —; (D) Applicable Documents (Calibration and QC Manuals); (E) General Laboratory Practices; (F) Facility Layout (Including FCC Listed Outdoor Site).

- *Electromagnetic Compatibility (FCC Standards) Requirements:*
Line Conducted Emission: 20 Hz-10 kHz, 10 kHz-150 kHz, 150 kHz-30 MHz, 30 MHz-200 MHz;
Radiated Emissions: 20 Hz-10 kHz, 10 kHz-150 kHz, 150 kHz-30 MHz, 30 MHz-1000 MHz, 1 GHz-400 GHz;
Antenna Conducted Emissions: 10 kHz-18 GHz;
Frequency Stability (Temperature): 10 kHz-1 GHz, 1 GHz-18 GHz;
Frequency Stability (Voltage): 10 kHz-1 GHz, 1 GHz-18 GHz;
Occupied Bandwidth;
Modulation Characteristics;
Power Output.

- *Electromagnetic Compatibility (Military) Requirements:* Line Conducted Emissions: MIL-STD-461 A and B all notices;
Line Conducted Susceptibility: MIL-STD-461 A and B all notices;
Radiated Emissions: MIL-STD-461 A and B all notices;
Radiated Susceptibility: MIL-STD-461 A and B all notices;
High Level Radiated Susceptibility: 200 V/m, 10 kHz-40 GHz.

- *Telecommunications (FCC Standards) Requirements:* Environmental Simulation;
Leakage Current Limitations;
Hazardous Voltage Limitations;
Signal Power Limitations;
Longitudinal Balance Limitations;
On Look Impedance Limitations;
Billing Protection.

## Primary Malignant Tumors Among University of Washington Rats

To The Editor:

Here is a breakdown of the primary neoplastic lesions in our Air Force rats, diagnosed by Dr. Larry Kunz.

Sincerely yours,

C.K. Chou, Ph.D.
Research Associate Professor
Bioelectromagnetics Research Laboratory
University of Washington
Seattle, WA 98195

### Primary Malignant Tumors in Animals

***Exposed***

| Animal | Tissue | Lesion |
|---|---|---|
| A14 | thyroid | c-cell carcinoma |
| B06 | lymph node | myelomonocytic leukemia |
| B14 | thyroid | c-cell carcinoma |
| B19 | urin/bladder | transitional cell carcinoma |
| C11 | adrenal | cortical carcinoma |
| D15 | subcutaneous tissue | fibrosarcoma |
| E10 | adrenal | cortical carcinoma |
| E14 | skin | basal cell carcinoma |
| E19 | pituitary | carcinoma |
| G05 | blood vessel | hemangiosarcoma |
| G06 | pituitary | carcinoma |
| G11 | peritonium | liposarcoma |
| H01 | adrenal | cortical carcinoma |
| H05 | thymus | lymphocytic lymphoma |
| H10 | stomach | squamous cell carcinoma |
| H15 | thymus | myelomonocytic leukemia |
| J05 | bone marrow | malignant lymphoma |
| J11 | skin | auditory sebaceous gland squamous carcinoma |

***Sham Exposed***

| | | |
|---|---|---|
| B09 | liver | carcinoma |
| B12 | cervical lymph node | lymphocytic lymphoma |
| C12 | lymph node | myelomonocytic leukemia |
| G04 | adrenal | carcinoma |
| H12 | thymus | malignant lymphoma |

*MICROWAVE NEWS* is published monthly, except in January and July • ISSN 0275-6595 • PO Box 1799, Grand Central Station • New York, NY 10163 • (212) 725-5252 • Editor: Louis Slesin, Ph.D., Associate Editor: Mark Pinsky • Subscription: $200 per year ($235 overseas) • Copyright © 1985 by Louis Slesin • Reproduction in any form is forbidden without written permission.

# CONFERENCES

April 9-11: **Electrical Overstress Exposition,** Hynes Auditorium, Boston, MA. Contact: EOE, 2504 N. Tamiami Trail, Nokomis, FL 33555.

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.

April 22-24: **47th Annual American Power Conference,** Palmer House, Chicago, IL. Contact: Illinois Institute of Technology, IIT Center, Chicago, IL 60616.

April 24-27: **3rd European Workshop on NMR in Medicine,** Copenhagen, Denmark. Contact: Dr. S.B. Petersen, Dept. of Neurology 2082, State University Hospital, Rigshopitalet, Blegdamsveg 9, DK 2100 Copenhagen 0, Denmark.

April 29-May 2: **23rd International Magnetics Conference,** Radisson-St. Paul Hotel, St. Paul, MN. Contact: R.O. McCary, GE, Corporate R&D, Schenectady, NY 12345, (518) 385-5436.

April 30-May 4: **International Conference on Magnetic Resonance in Cancer,** Banff, Alberta, Canada. Contact: Mrs. H.D. Milligan, Division of Continuing Medical Education, 12-103 Clinical Sciences Bldg., University of Alberta, Edmonton, Alberta T6G 2G3, Canada.

May 4-7: **5th Annual Meeting of the North American Hyperthermia Group,** Biltmore Hotel, Los Angeles, CA. Contact: NAHG, 925 Chestnut St., Philadelphia, PA 19107, (215) 574-3153. Held in conjunction with the Radiation Research Society Meeting.

May 5-9: **33rd Annual Meeting of the Radiation Research Society,** Biltmore Hotel, Los Angeles, CA. Contact: RRS, 925 Chestnut St., Philadelphia, PA 19107, (215) 574-3153.

May 6-9: **IEEE 1985 International Radar Conference,** Washington, DC. Contact: J.Q. Adams, ITT-Gilfillan, M/S 45, 7821 Orion Ave., PO Box 7713, Van Nuys, CA 91409, (818) 988-2600, ext. 6903.

May 6-10: **2nd Annual Magnetic Resonance Imaging 1985: National Symposium,** MGM Grand, Las Vegas, NV. Contact: Educational Symposia, PO Box 17241, Tampa, FL 33682, (813) 879-8765.

May 14-16: **3rd Transmission & Distribution Expo,** O'Hare Expo Center, Chicago, IL. Contact: Conference Management Corp., 17 Washington St., PO Box 4990, Norwalk, CT 06856.

May 14-16: **Test & Measurement World Expo,** Convention Center, San Jose, CA. Contact: Meg Bowen, T&M Expo, 215 Brighton Ave., Boston, MA 02134, (617) 254-1445.

May 14-17: **1st Annual Meeting of the Electromagnetic Energy Policy Alliance,** Hotel Intercontinental, San Diego, CA. Contact: Richard Ekfelt, EEPA, 1800 M St., NW, Washington, DC 20036, (202) 452-1070.

May 19-23: **17th Annual Meeting of the Conference of Radiation Control Program Directors,** Milwaukee, WI. Contact: CRCPD, 71 Fountain Place, Frankfort, KY 40601, (502) 227-4543.

May 20-24: **8th International Conference on Electricity Distribution,** Brighton, UK. Contact: IEE, see April 16 above.

May 26-31: **30th Annual Meeting of the Health Physics Society,** Chicago, IL. Contact: HPS, Suite 300, 1340 Old Chain Bridge Rd., McLean, VA 22101, (703) 790-1745.

June 4-6: **1985 IEEE MTT-S International Microwave Symposium,** St. Louis, MO. Contact: John Bogdanor, McDonnell Aircraft, Dept. 313, St. Louis, MO 63166, (314) 232-3936.

# UPDATES

## BIOLOGICAL EFFECTS

**Lightning Injuries...**Doctors at the Army Institute of Surgical Research's Burn Center at Fort Sam Houston, TX, have been studying injuries caused by lightning. Writing in the January 11 *Journal of the American Medical Association (JAMA),* they present five case studies of patients who survived lightning strikes. The degree of injury depended on the power, duration, sites of entry and exit of the lightning bolt and the position and grounding of the victim. Of the five, two showed signs of cardiac abnormalities — including one who also suffered ear damage (bilateral perforated tympanic membranes). Another patient developed peripheral neuropathy. In some lightning injuries, cataracts can develop over time: as of 1972, there were 90 examples in the literature. For the five cases reported in *JAMA,* the doctors observed no "visual aberrations," though they note that cataracts could have developed after the patients left the hospital.

**Resources...**In a letter published in the December 8 issue of the British medical journal, *Lancet,* J.A. Bonnell of the Central Electricity Generating Board (CEGB) in London presents preliminary results of a health survey of workers exposed to 50 Hz power line electric fields. According to Bonnell, the study did not identify any ill effects. A paper describing the findings will be published in the *British Journal of Industrial Medicine....* Dr. Stuart Lindsay, a physicist at Arizona State University in Tempe, has won a two-year, $66,811 contract from EPA to investigate observed resonances in DNA at 600 MHz. Lindsay will try to determine possible molecular bases for the effect, using a multipassed vernier tandem interferometer. This work should complement that being done by the University of Maryland, FDA and NCI in testing the theories of Dr. Earl Prohofsky of Purdue University (see *MWN,* May and November 1984). There are still skeptics who do not believe that this work will lead to a better understanding of the interaction of microwaves with living systems. For instance, Dr. Kenneth Foster of the University of Pennsylvania in Philadelphia is convinced that the observed DNA resonances are at best "a startling spectroscopic finding about the behavior of DNA in solution," rather than a possible mechanism for bioeffects of low-level microwaves. In a letter published in the January 26 *Science News,* Foster repeats the well-known argument that the energy of the microwaves is much smaller than that of DNA's random motion....M.F. Diprose and F.A. Benson of the University of Sheffield's (UK) Department of Electronic and Electrical Engineering and A.J. Willis of the university's Department of Botany have published an extensive review paper, "The Effect of Externally Applied Electrostatic Fields, Microwave Radiation and Electric Currents on Plants and Other Organisms, with Special Reference to Weed Control," in the April-June 1984 *The Botanical Review.* Copies are available from the Scientific Publications Office, New York Botanical Garden, Bronx, NY 10458, for $10.75 (U.S.), $11.50 (elsewhere), prepaid, postage included. Ask for issue 50(2)....Dr. Jonathan Charry, formerly with Rockefeller University and now at the Institute for Basic Research in Developmental Disabilities on Staten Island in New York City, has published a 38-page review article on the bioeffects of small air ions, such as those from high voltage DC power lines, in *Environmental Research, 34,* 351, 1984. He concludes that "small air ions are likely to have biological effects, that these effects may be related to polarity and that where effects occur they are likely to be small in magnitude and difficult to detect reliably."

## INTERNATIONAL

**U.S.-U.S.S.R. Cooperation...**Exchanges between American and Soviet scientists continue. In March, three Soviet researchers will visit Dr. Don McRee's lab at the National Institute for Environmental Health Sciences (NIEHS) in Research Triangle Park, NC. The following month, McRee will head a delegation to Kiev for a meeting with Professor Mikhael Shandala at the A.N. Marzeev Research Institute of General and Communal Hygiene. Traveling with McRee will be Drs. Clifford Mitchell (NIEHS), Jack Monahan (FDA), Mays Swicord (FDA), Bill Guy (University of Washington), William Kaune (Battelle) and Don Justesen (VA); EPA's Richard Phillips may also go. On the agenda in Kiev are a review of the duplicate experiment (see *MWN,* July/August 1982 and June 1983) and the development of a research plan for the next two years. NIEHS recently released a two-volume report, *Proceedings of U.S.-U.S.S.R. Workshop on Nervous System Effects of Electromagnetic Waves,* which was held in Research Triangle Park in May 1982. Volume 1 includes a review of the U.S. and U.S.S.R. literature (for exposure in the 0-300 GHz frequency range) by Dr. Richard Lovely and Professor Shandala and co-authors, respectively. Volume 2 includes 14 papers by researchers from both countries and the protocol for the duplicate experiment (see *MWN,* July/August 1982 and October 1983.) A limited number of copies are available free from McRee, NIEHS, PO Box 12233, Research Triangle Park, NC 27709.

**German Exposure Standard...**West Germany has set its own exposure standard for the frequency range 10 kHz-3000 GHz. The standard applies to workers and the general public. Dr. Tom Rozzell of the Office of Naval Research outlines the standard in the December 1984/January 1985 issue of the *Bioelectromagnetics Society (BEMS) Newsletter.* The following average values are set for six-minute or greater exposures (f = frequency in MHz). 10 kHz-30 kHz: 2,000 V/m (E-field), 500 A/m (H-field); 30 kHz-2 MHz: 1,500 V/m (E), 7.5/f A/m (H); 2 MHz-30 MHz: 3000/f V/m (E), 7.5/f A/m (H); 30 MHz-3 GHz: 100 V/m (E), 0.25 A/m (H) or an average power density of 2.5 $mW/cm^2$; 3 GHz-12 GHz: $100(f/3000)^{1/2}$ V/m (E), $0.25(f/3000)^{1/2}$ A/m (H), or an average power density of $2.5(f/3000)$ $mW/cm^2$; 12-3000 GHz: 200 V/m (E), 0.5 A/m (H), or an average power density of 10 $mW/cm^2$. The standard (DIN 57 848, Teil (Part) 2 or VDE 0848 Teil 2) was adopted in July 1984. For a copy of the BEMS newsletter,

send $1.50 and a self-addressed, stamped envelope to BEMS Newsletter, PO Box 3651, Arlington, VA 22203. For more information, contact: Dr. J.G. Bernhardt, Institut fur Strahlenhygiene des Bundesgesundheitsamtes, Ingolstadter Landstrasse 1, 8042 Neuherberg, West Germany.

## MEASUREMENT

**New from NBS...**Researchers at the National Bureau of Standards have been busy. Here is a list of some of their recent papers and reports and how to get them: • "Calibration of Flat 60 Hz Electric Field Probes" by Martin Misakian appears in *Bioelectromagnetics, 5,* 447, 1984. • "Multiple-Source, Multiple-Frequency Error of an Electric Field Meter" by Drs. J. Randa and M. Kanda has been published in *IEEE Transactions on Antennas and Propagation, 33,* 2, 1985. • "An Electromagnetic Near-Field Sensor for Simultaneous Electric and Magnetic Field Measurements" by Kanda is in *IEEE Transactions on Electromagnetic Compatibility, 26,* 102, 1984. • *Theory of Near-Field Phased Arrays for Electromagnetic Susceptibility Testing* by David Hill, Technical Note 1072. Order No. 003-003-02559-3, $4.50, prepaid, from U.S. Government Printing Office (GPO), Washington, DC 20402. • *An Error Analysis for the Use of Presently Available Lunar Radio Flux Data in Broadbeam Antenna-System Measurements* by William Daywitt, Technical Note 1073. Order No. 003-003-2555-1, $2.00, prepaid, from GPO. • *Building Penetration Project,* No. NBSIR 84-3009, by J.C. Wyss, W.J. Anson and R.D. Orr, describes electromagnetic properties of various building materials and a computer program that calculates building attenuation in the frequency range 10 kHz-10 GHz. The 310-page document is available, prepaid, for $25.00 from the National Technical Information Service (NTIS), Springfield, VA 22161. Order No. PB 85-126001. • *Comparison of Measured and Calculated Mutual Coupling in the Near Field Between Microwave Antennas* by Carl Stubenrauch and Michael Francis, No. NBSIR 84-3010. Order No. PB 85-105963, $10.00, prepaid, from NTIS. • *Metrology for Electromagnetic Technology: A Bibliography of NBS Publications* edited by R.A. Kamper and K.E. Kline, No. NBSIR 84-3014. (This volume covers the period between 1970 and 1983.) Order No. PB 84-112985, $10.00, prepaid, from NTIS. • *A Preliminary Investigation into Using the Sun as a Source for G/T Measurements,* No. NBSIR 84-3015. (Useful for antennas 4-6 meters in diameter; G/T is gain-to-system noise temperature.) Available for $7.00, prepaid, from NTIS. Order No. PB 85-128148. Single copies of the following NBS papers are available from Fred McGehan, Division 360.2, NBS, Boulder, CO 80303: • *Some Problems Associated with Interpreting Shielding Effectiveness Measurement Results* by P.F. Wilson and M.T. Ma; and • *Preliminary Investigations into Shielding Effectiveness Measurement Techniques* by J.W. Adams and A.R. Ondrejka (discusses five methods for lossy materials).

## MEDICAL APPLICATIONS

**Electricity in Medicine...**Margaret Rowbottom, formerly with the Wellcome Historical Medical Museum in London, UK, and Professor Charles Susskind of the University of California, Berkeley, are the authors of *Electricity and Medicine: History of Their Interaction.* The 303-page illustrated volume, complete with extensive footnotes, covers a host of treatments, including diathermy. It is available for $30.00 (cloth) or $12.50 (paper) from the San Francisco Press, Box 6800, San Francisco, CA 94101, (415) 524-1000.

**New Hyperthermia Journal...**Taylor & Francis will begin publishing the *International Journal of Hyperthermia* in 1985. The new quarterly, which costs $80.00 in the U.S. and 40 pounds in the U.K., will cover biological and clinical studies, as well as techniques for delivering heat and measuring temperature. Its editors are Drs. S.B. Field (U.K.), G. Hahn (U.S.), J. Overgaard (Denmark) and T. Sugahara (Japan). This is the official journal of the North American Hyperthermia Group, the European Cooperative Hyperthermia Society and the Japanese Hyperthermia Society. For subscriptions or sample copies, contact Taylor & Francis, Inc., 242 Cherry St., Philadelphia, PA 19106, (215) 238-0939.

## MEETINGS

**Bologna Meeting...**The Office of Naval Research (ONR) is sponsoring a "mini-symposium" on the influence of electromagnetic fields on organized biological structures, such as membranes, at the *8th International Symposium on Bioelectrochemistry and Bioenergetics,* which will be held in Bologna, Italy, June 24-29. The Bologna meeting is being sponsored by the Bioelectrochemical Society (BECS) and the Italian Group of Bioenergetics. The Bioelectromagnetics Society (BEMS) is helping arrange the mini-symposium — which should allow for discussions among BECS and BEMS members. For more information about the mini-symposium, contact Dr. Tom Rozzell, ONR London, Box 39, FPO, NY 09510; and for the main symposium, contact Dr. C. Bonfiglioli, c/o Institute of Botany, Via Irnerio 42, 40126 Bologna, Italy, (051) 234276.

**T&D Expo...**The *3rd Transmission and Distribution Expo* will be held at the O'Hare Expo Center in Chicago, May 14-16. Among the scheduled seminars are "Lightning Protection of Distribution Lines and Equipment," "Locating Radio and TV Interference," "Transmission Siting and the Regulatory Agency" and "Future Role of HVDC." See Conference Calendar for details on whom to contact.

**URSI...**The next General Assembly of the International Union of Radio Science (URSI), its 22nd meeting, will be in Tel Aviv, Israel, August 24-September 4, 1987....URSI has released a *Review of Radio Science 1981-1983,* which was prepared for the participants at last year's assembly, held in Florence, Italy, in September. The summary papers, with a huge number of accompanying references,

cover a wide range of subjects, including EMI, bioeffects, metrology, propagation, remote sensing, etc. The volume, edited by S.A. Bowhill of the University of Illinois at Urbana-Champaign, is available for $20.00 (including surface postage) from: URSI, Avenue Albert Lancaster 32, B-1180 Brussels, Belgium.

### MILITARY SYSTEMS

**Navy EMC...**The U.S. Navy is accepting proposals for assistance in establishing an Electromagnetic System Environment Design and Engineering (EMSEDE) program. The new initiative is "to institutionalize EMC in the design of ships," explained Dr. Bob Haislmaier, who coordinates EMC activities in the Office of the Chief of Naval Operations. EMSEDE should help avoid EMI problems before they arise, he added. The successful bidder will require a security clearance. For a copy of RFP No. N00039-85-R-0207(Q), call NAVALEX at (202) 692-6050; closing date at the end of March.

**Project ELF...**The AIBS report on ELF bioeffects should go to the Navy in mid-March and be available to the public soon afterwards (see *MWN* July/August and September 1984). ELF Program Manager Capt. Ronald Koontz at the Naval Electronics Systems Command in Arlington, VA, told *Microwave News* that the Navy has not yet decided whether or not it will write a new environmental impact statement for Project ELF. That decision, he explained, will depend on the comments received on the AIBS report....In other developments, the Navy announced that it will not prepare an EIS for the construction of ground systems for the transmitter facility in Republic, Michigan. The finding of "no significant impact" appears in the January 7 *Federal Register* (50 *FR* 875)....In Wisconsin, "Stop Project ELF," a group that has actively tried to prevent the Navy from building the submarine communication system, has lost two of its leaders. John Stauber and Jennifer Speicher have turned over the project to Madge Micheels-Cyrus, who will continue grass roots organizing against Project ELF out of Hayward, WI....Progress is being made on an alternative communication system using lasers. The January 21 *Aviation Week* reports that the wavelength of the laser has been shifted to the deep blue part of the spectrum (from blue-green) and preliminary tests are overcoming previous skepticism about its reliability. DOD estimates that the laser system and submarine receivers would cost about $1 billion.

**EMPRESS II...**The Navy has extended the deadline for comments on its draft environmental impact statement on the second Electromagnetic Pulse Radiation Environment Simulator for Ships (EMPRESS II) until December 1 (see *MWN*, October 1984). The extension was granted at the request of Maryland Governor Harry Hughes to allow for the inclusion of new test data being collected at the University of Maryland. (This is the second delay; comments were originally due on November 5, 1984, but that date was extended until December 1, 1984.) In late January, the governor said that the Navy had reassured him that "if the studies indicate there will be adverse environmental effects, EMPRESS II testing will *not* be conducted in the Chesapeake Bay."

### OCCUPATIONAL HEALTH

**Supermarket Rashes...**It might have been a case for a medical detective when employees at an Ohio supermarket reported a high incidence of a mysterious rash. Luckily, recent findings on the activation of drugs and chemicals by light provided the answer. It all started last July, when a 33-year-old supermarket cashier went to an Ohio clinic with a serious rash on her forearm. It turned out that several of the woman's co-workers had similar rashes. NIOSH representatives examined a cross section of the workers and found that 27 percent had developed the rash, but they also observed that the condition struck only certain kinds of employees — cashiers, baggers and produce clerks. What these workers all had in common was contact with fresh produce and flowers. Putting the pieces of the puzzle together, NIOSH made a diagnosis of phytophotodermatitis, a condition caused by contact with certain plants followed by exposure to sunlight. These plants — such as celery, dill, parsley and chrysanthemums — contain psoralens, which can rub off on skin and cause rashes if stimulated by long-wave UV light (350 nm). Sunlight is usually enough to provoke phytophotodermatitis; however, in this case, NIOSH found that workers who had used tanning salons were more likely to develop rashes. NIOSH urged employees who handle produce to wash exposed areas regularly and to avoid tanning salons and excessive exposure to sunlight. A report on this episode is described in the January 11 *Morbidity and Mortality Weekly Report* — but it is not the first such report: NIOSH had investigated similar episodes in supermarkets throughout the midwest in 1980 and 1981.

### POWER LINES

**Studies...**The Florida study on the health and safety of power lines, headed by Professor H.B. Graves of Pennsylvania State University, did not meet its January 1 deadline. But because the state Department of Environmental Regulation will not be taking any action until the fall, the pressure to complete the report has abated. William Palmer of the Florida Electric Power Coordination Group in Tampa estimates that the report should be out by early April. The price of the report has not yet been set....A team at Carnegie-Mellon University in Pittsburgh, PA, headed by Professor M. Granger Morgan has published a paper on its risk assessment studies, "Power Line Fields and Human Health," in the February *IEEE Spectrum*. A longer paper on the perception of the risks associated with ELF electric and magnetic fields will appear in a forthcoming issue of *Risk Analysis*, the journal of the Society for Risk Analysis, based in McLean, VA. One of the group's conclusions cited in the *Spectrum* article is that "Im-

provement is needed in the way many states site and approve power-transmission facilities."

## STANDARDS

**C95 Changes its Name...**The ANSI C95 committee on RF Radiation Hazards, best known for its 1982 RF/MW exposure standard, is proposing to change its name to "Non-Ionizing Radiation Hazards," and to change its purview to: "Hazards to mankind, volatile materials and explosive devices which are created by man-made sources of electromagnetic radiation. It is not intended to include infrared, X-rays or other ionizing radiation." C95 members are voting on the two proposals, as well as on new procedures to accredit the committee. Ballots are due by April 15.

**Surge Arresters...**The new ANSI/IEEE C62.1-1984 standard, *Surge Arresters for AC Power Circuits,* was approved on December 17. The new standard, which has not yet been printed, is a revision of the 1981 standard. Meanwhile, NEMA and IEEE have requested that the C62 committee be accredited as an American National Standards Committee with the following scope: "Definitions, classifications, ratings, methods of test, performance characteristics, physical characteristics and application of surge arresters of all types." For more information, contact NEMA, Suite 300, 2101 L St., NW, Washington, DC 20037.

## TECHNOLOGY

**EPRI on Industrial MW Applications...**EPRI has published *Microwave Power in Industry,* an overview and assessment of microwave drying and heating applications. According to R.D. Smith of Thermo Energy Corp. in Palo Alto, CA, who wrote the report, sales of industrial microwave heating equipment amount to only $4 million a year, compared with an annual domestic market for microwave ovens of about $1.6 billion. Of the 24 megawatts (MW) of presently installed industrial capacity for microwave drying and heating, food processing accounts for 19 MW and rubber manufacturing for 3.2 MW. Because microwave heating is relatively expensive, it is only suitable for certain processes. The report examines case studies of the jobs microwaves do well: frozen food tempering, rubber vulcanization, bacon cooking and pasta drying. It is available for $13.00 from the EPRI Research Reports Center, Box 50490, Palo Alto, CA 94303, (415) 965-4081. Ask for Report No. EM-3645.

## VDTs

**Marha on VDT Radiation...**In a paper presented at the first international conference on VDTs and reproductive risks held in London, UK last November (see *MWN,* January/Feburary 1985), Karel Marha of the Canadian Center for Occupational Health and Safety (CCOHS) suggested that VDT radiation emissions might have a biological effect and recommended directions for further research. Citing the differences in field characteristics (repetition rates and wave shapes) between published studies and those associated with VDTs, he concluded that "it is imperative to experimentally evaluate any biological effects of the actual fields or simulated fields identical to those emitted by some VDTs." In the meantime, Marha advocated using copper foil and grounding wire to shield against the pulsed VLF electric fields (see *MWN,* December 1983). He cautioned that his studies indicate that lead aprons do not absorb or reflect VLF emissions. One way to protect workers, Marha said, was to use the fact that the fields decrease rapidly with distance. He recommended that operators should not sit or stand close to the side or rear of the units. Shielding against the pulsed ELF and VLF magnetic fields is much more difficult, and Marha concluded that the solution to the problem probably lies with flat screen displays replacing CRTs. Marha can be contacted at CCOHS, 250 Main Street East, Hamilton, Ontario L8N 1H6, Canada, (416) 523-2981.

**Legislative Affairs...**A published transcript is now available from last year's congressional hearings on VDT health and safety (see *MWN,* May 1984). Single copies of the 623-page document, *OSHA Oversight – Video Display Terminals in the Workplace,* can be requested from the subcommittee on health and safety of the House Committee on Education and Labor at Room B345A, Rayburn Building, U.S. House of Representatives, Washington, DC 20515, (202) 225-6876. At least two other congressional subcommittees are reportedly studying the VDT issue, but it is unclear whether either will hold hearings....Meanwhile, as expected, the list of states considering VDT legislation is growing. In one state, **Oregon,** the senate has already approved a bill. Oregon SB57 (sponsored by Sen. Margie Hendriksen) is now pending before the house labor committee, which is expected to act soon. Other bills awaiting action are: **California** Assembly Bill No. 687 (Assemblyman Tom Hayden), **Connecticut** Bill No. 6011 (Rep. Irene Favreau) and Bill No. 6012 (Rep. Joe Adamo), **Maine** Legislative Document No. 318 (Rep. Edith Beaulieu), **Maryland** House of Delegates Bill No. 1258 (Delegate Anne Perkins), **Minnesota** House File 2333 (Rep. Karen Clark), **Missouri** House Bill No. 406 (Rep. Ron Auer), **New Jersey** Assembly Concurrent Resolution 132 (Assemblywoman Jacqueline Walker), and **Washington** state House Bill No. 468 (Rep. Janice Niemi).

**Seizures...**Epileptic seizures induced by the flicker of computer displays are rare, though reported cases continue to raise concern. A letter in the February 2 *Lancet* from researchers at the U.K.'s University of Aston in Birmingham suggests that VDTs are so unlikely to induce epileptic seizures in photosensitive people that "for practical reasons [the risk] can probably be ignored." Television sets used as computer monitors may be slightly more likely to cause seizures in photosensitive users. The researchers are all members of the Department of Vision Sciences at the university.

# CLASSIFIEDS

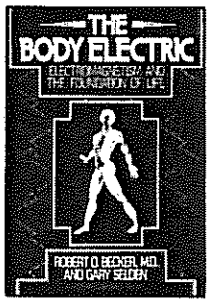
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# MICRO WAVE NEWS

Vol. I No. 5 | A Monthly Report on Non-Ionizing Radiation | May 1981


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## *ANSI News:* The Search for Consensus

Work on revising the American National Standards Institute (ANSI C95.1) safety standard for exposure to radiofrequency and microwave radiation (RF/MW) continues, with no firm completion date yet in sight. A new draft of the C95.1 standard is scheduled to be circulated among the full C95 Committee on Radio Frequency Radiation Hazards membership in June, by-passing a separate C95.IV subcommittee vote. "The committee may be able to achieve consensus without another meeting, but if not, the members will assemble again," Professor Saul Rosenthal, chairman of C95, said.

When no agreement on the standard could be reached at last February's C95 meeting, Rosenthal asked Professor Bill Guy's C95.IV subcommittee to try to agree on a new standard. According to a number of sources, a new draft is ready, though no one was sure which changes have been made. Guy has been travelling in Europe and the USSR, and could not be reached for comment.

The current, proposed revision represents some major changes: the standard is 1 mW/cm² from 30–300 MHz, rising to a maximum of 5 mW/cm² at 1500 MHz to 100 GHz. For lower frequencies, the standard reaches a maximum of 100 mW/cm² at 3 MHz. (See p. 5 for full text of the standard, as proposed to the C95

*(continued p. 4)*

## *HOUSE SCHEDULES HEARINGS ON VDTS AND RF SEALERS*

Congressman Albert Gore, Jr., democrat from Tennessee and chairman of the Subcommittee on Oversight and Investigations of the House Committee on Science and Technology, is planning to hold hearings on the potential health effects of VDTs and RF sealers and heaters on May 12–13.

Gore said that he was "troubled" that a recent FDA report on radiation from VDTs (see p. 7) "failed to recognize the agency's own scientific conclusion that research information on health effects for the range of frequencies emitted by VDTs is lacking."

With respect to the millions of workers exposed to RF radiation in industry, Gore said that they may suffer blood and central nervous system disorders as well as birth defects.

The hearings will be held in room 2325 of the Rayburn House Office Building, beginning at 2 pm on both May 12 and 13. Among those testifying are the new head of OSHA, Thorne Auchter, John Villforth, director of BRH, Sheldon Samuels, and Drs. Milton Zaret and Paul Tyler.

The complete list of invited witnesses in tentative order of appearance is: **May 12 on VDTs:** Charles Perlik, Jr., Newspaper Guild; Dr. Paul Tyler, Armed Services Radiobiology Research Institute; Dr. Milton Zaret, Zaret Foundation; John Villforth, BRH; Dr. Joe Elder, EPA; Vico Henriques, Computer and Business Equipment Manufacturing Association; George Mine and Dr. Bruce Dickerson, IBM; and a representative of newspaper management, still be be announced. **May 13 on RF sealers and heaters:** Howard Samuel and Sheldon Samuels, IUD/AFL-CIO; Dr. Joe Lary, NIOSH; Drs. Ezra Berman and Ralph Smialowicz, EPA; Dr. David Conover, NIOSH; Thorne Auchter, Dr. Bailus Walker, and Robert Curtis, OSHA; Angelo Vassallo, Solidyne Corp.

# GOVERNMENT

## Reagan Reactivates Project ELF

The Reagan Administration, reversing the recommendation of the Secretary of the Navy, has decided to reactivate the ELF Project antenna in Clam Lake, Ashland County, WI. Last month, there were reports that the Navy had advised abandoning the Project (see *Microwave News*, April 1981). No clear reasons for the reversal have emerged, though Eliot Marshall in *Science* (May 8) suggests that the Navy had "put their efforts into getting new airplanes and let others make the case for the unpopular old ELF." The decision drew immediate criticism from Senators Proxmire of Wisconsin and Levin of Michigan.

The Clam Lake facility, deactivated in January 1979, should be operational by the end of the year. The ELF antenna consists of two 14-mile underground grids. Designed for communicating with submerged submarines, the Project has a budget of $5.2 million in FY81 and $34.9 million in FY82.

Reagan's ELF decision is the congressionally mandated report due last April 1, according to a Pentagon spokesman.

Secretary of Defense Caspar Weinberger deferred a decision on a larger 130-mile antenna at K.I. Sawyer AFB in Michigan until later this summer, after a complete review of DOD's overall strategic command and control systems. The two antennas are designed to operate in sync.

Meanwhile, Walter Sullivan of the *New York Times* reported that the Navy and the Defense Advanced Research Projects Agency are investigating the possible use of blue-green lasers as an alternative to the ELF system (April 22). The announcement was made by DARPA's Dr. Douglas Tanimoto at the American Physical Society meeting in Baltimore.

## Two More PAVE PAWS?

The Air Force is considering building two more PAVE PAWS radar installations in the southeastern and southwestern US, and has tentatively budgeted $75 million for FY83 and $100 million a year for FY84-86 for the project, according to a report in *Aviation Week & Space Technology* (April 13, 1981). Two phased array radars are already in operation: one on Cape Cod, Massachusetts (Otis AFB), and one in California (Beale AFB); they monitor the Atlantic and Pacific oceans respectively.

The PAVE PAWS radars (PAVE is an AF code word and PAWS stands for Phased Array Warning System) are designed to detect and track submarine launched missiles at distances as great as 3,000 miles.

A spokesman for the AF Systems Command HQ at Andrews AFB in Maryland said that a decision on whether or not to proceed will be made by the Secretary of Defense this summer, and any funding request would then be forwarded to the Congress this fall. No particular sites have yet been surveyed, he added.

## BRH Reconsiders Oven Amendment

The Bureau of Radiological Health is reconsidering a recent amendment to its microwave standard. (*Federal Register*, April 24, 1981, p.23233 and p.23266.) The amendment, dealing with instruments to measure leaks, was promulgated last November (45 *FR* 79028), and would have become effective on November 30, 1981. The comment period has been reopened.

Last December, the Association of Home Appliance Manufacturers (AHAM) petitioned BRH to review its decision, partly because the new rule would change the rejection level of new ovens, according to a BRH spokesman. While the Bureau did not agree with AHAM, it decided that "there was enough disagreement and misunderstanding to open it up again," he said.

## EMP News

The Defense Department continues to seek contractors for electromagnetic pulse (EMP) work. The Defense Nuclear Agency has scheduled a May 19 briefing at Kirtland AFB, NM, on needed support for the advanced research EMP simulator (*Commerce Business Daily*, April 17). The Air Force has already sought R&D proposals for its EMP weapons lab (*CBD*, April 16) and decided to extend its EMP contract with the Mission Research Corp. in La Jolla, CA (*CBD*, April 17). Meanwhile, *Aviation Week & Space Technology* (April 13) reports that the AF wants to spend $20 million on EMP hardening for B-52's.

## *BRIEFS*

EPA's Dave Janes has been appointed acting director of the Surveillance and Emergency Preparedness Division in the Office of Radiation Programs, and is now working out of Crystal City, VA (703) 557-8217. Roger Mattson, the past director, has returned to the NRC. Ric Tell is now acting branch chief, but is still in Las Vegas.... The *BRH Bulletin* has changed to a monthly publication schedule as an economy measure.... The FCC has opened the way for the rapid development of cellular mobile telephone systems. In an April 9 ruling, the Commission assigned 40 MHz (825-845 and 870-890) for the new communications system.... On April 21, the FCC ruled that direct broadcast satellite service is in the public interest and will now review COMSAT's application.... NASA scheduled a second industry briefing on its Advanced Communications Satellite program (30/20 GHz) May 6-7 in Washington, DC.... NASA Lewis Research Center is looking for a contractor to study the role of satellites in wide-area land mobile radio services.... The Office of Naval Research is negotiating a contract with Scientific Research Associates of Glastonbury, CT, for research on computer modeling of microwave devices and one with Research Triangle Institute of Research Triangle Park, NC, for additional study of "pulsed radiation effects in contemporary devices and integrated circuits".... Hanscom AFB is soliciting R&D proposals for a system for "automatic network analysis of microwave devices and antennas".... NTIA has awarded $93,763 to Booz, Allen and Hamilton, Inc. of Bethesda, MD, to analyze common carrier microwave communications systems.

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# AT THE WORLD TRADE CENTER

The Port Authority (PA) of New York and New Jersey has released some monitoring data on the non-ionizing radiation levels atop the World Trade Center (WTC) in downtown New York City. Robert Silliman, from Silliman and Silliman of Washington, DC, made the measurements for the PA. (See *Microwave News*, March 1980, for a detailed report on the WTC.)

The monitoring reports were released to Joyce Feldman, a radiation specialist in the Environmental Protection Agency's (EPA) New York office, in a March 17 letter from Robert Linn, deputy director of the PA for world trade. The reports were also made available to *Microwave News*.

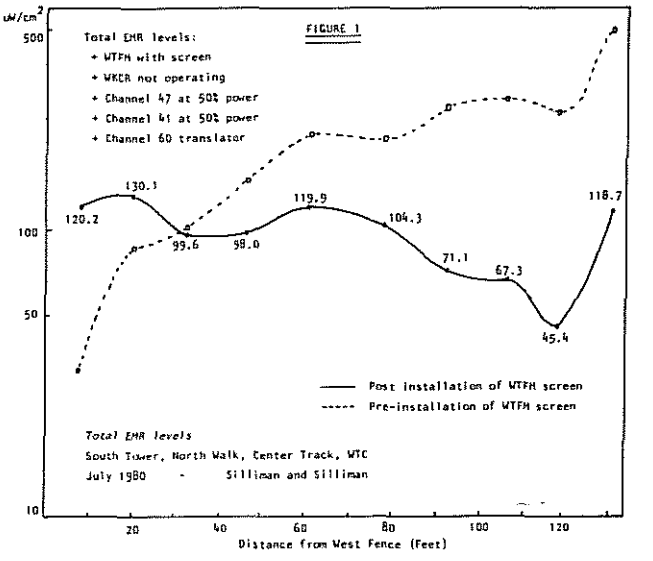
The readings were taken on the south tower while two UHF TV stations were broadcasting at 50% power from the north tower, and one FM station (WTFM—operating with 3.9 kW ERP) and one TV translator (W60AI) were transmitting from the south tower. Two VHF TV stations (WCBS-2 and WNEW-5) were also in operation but were not included in the PA survey because, according to Silliman, their contribution was insignificant. Another FM station (WKCR—0.76 kW ERP) was located on the same mast as WTFM, but was not on the air. (The monitoring methodology used by Silliman is explained in the Linn letter, which is excerpted below.*)

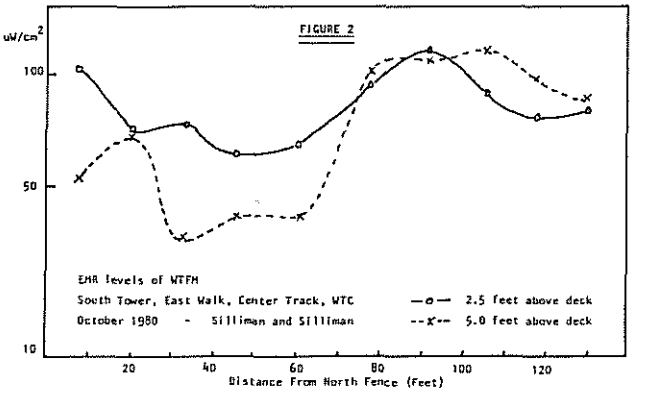
When WTFM was turned on, Silliman found radiation levels as high as 540 uW/cm² on the WTC roof. The PA installed a 22-foot protective "wagonwheel" shield between WTFM and WKCR in order to eliminate such hot spots. Figure 1 compares the total radiation levels with and without the wagonwheel shield. Figures 2 and 3 show the radiation levels from WTFM and WKCR respectively with the shield in place. (WKCR was turned on for testing purposes only, and its signal is not included in Figure 1. These are only two of eight figures released.) While the shield reduced the WTFM radiation levels, WKCR radiation increased from about 130 uW/cm² to 1200 uW/cm² on the roof.

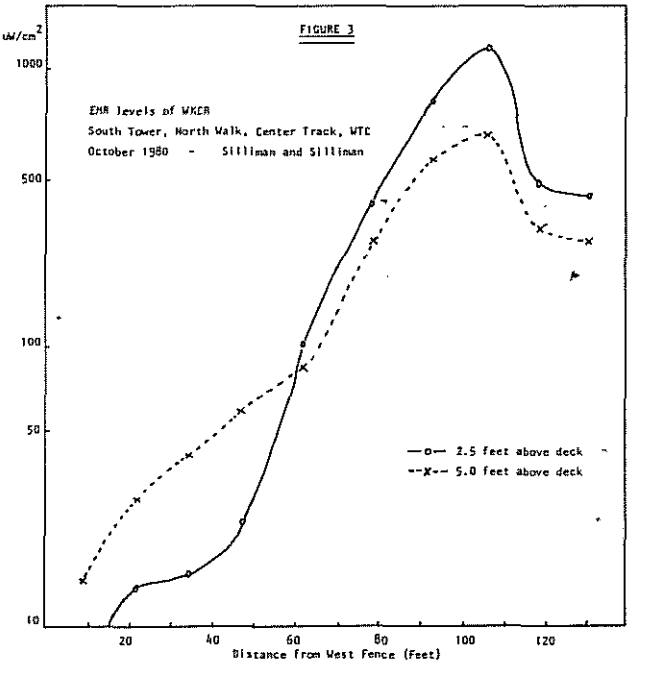
In his letter, Linn calls the WKCR radiation levels "unacceptably high," and states that "despite WKCR's desire to go on the air, they will not be permitted to commence operations until this problem is rectified.... The [PA] is presently going through the final engineering required to implement the necessary changes to WKCR to reduce the EMR levels in this area to within the 100 microwatt interim standard adopted" by the PA.

Asked about the error margins associated with these measurements, Silliman said that his instruments were accurate to within ±1 dB, but agreed with an EPA estimate that an accuracy of ±3 dB (a factor of 2) was a fair estimate under field conditions.

Tom Sorensen, broadcast coordinator at the PA, said that two more TV stations (WOR-9 and WPIX-11) would begin broadcasting from the main mast by the end of May, and that WNET-13 would be on the air from the WTC by the fall. (WABC-7 is already broadcasting from the WTC.) No work on the other FM stations is now going on, he said.




*The [chart] recorder and field intensity meter are set up for one station and the receiving antenna carried over the path oriented for maximum sensitivity in one receiving direction.... Next, the process is repeated for an orthogonal direction....Then a third pass is made, oriented for vertical polarization....The analysis of the chart is made by segments such as from the start to the first checkpoint and from one checkpoint to the next checkpoint. The highest response is noted within the span and its position within the span noted. The EMR levels for the other two components are observed at the same point in the span and added to give the EMR level from one source.

When it comes to adding the EMR level from two or more stations, the following procedure is followed. 1. For each sector and measurement height, the analysis of each station is scanned and the source having the highest analysis for the sector noted together with the position within the sector at which the highest level occurred and its value. 2. The values for the other stations to be added are then determined for the same height and the position within the sector at which time the highest level for the highest source was determined. Once again, the levels for the three orthogonal orientations were added.

The sum so determined is reported as the estimated peak EMR level to be expected for the several stations for the particular segment analyzed. Each additional segment of the path is analyzed in the same manner.

committee last February.) The 1966/1974 exposure standard is not frequency dependent, and only specifies a maximum exposure of 10 mW/cm² for frequencies between 10 MHz and 100 GHz.

The C95.IV subcommittee has been revising the old 10 mW/cm² standard for a number of years. The original standard, which was adopted by the Occupational Safety and Health Administration, was established in 1966, and revised with only minor changes in 1974. (According to the ANSI charter, all standards must be revised or reaffirmed every five years. Note that while the subcommittee number is C95.IV, the standard number is C95.1.)

Earlier this year, the full C95 committee voted on the new RF/MW standard: of 43 voting members, 32 returned ballots, with 25 ayes, 5 nays, and 2 abstentions. While a clear majority favored the new standard, some leading organizatons—including the Bureau of Radiological Health (BRH), the Environmental Protection Agency (EPA), and the Electronic Industries Association (EIA)—did not approve it. Some votes have been recently added and changed, but the next official tally will come with a new vote this summer.

A number of unresolved issues must be settled before the standard can be approved:

• **Population v Occupational Standard:** The proposal now applies to "non-occupational as well as occupational exposures." Many officials from federal, health-oriented agencies would prefer to limit the standard to the workplace. Last September, John Villforth, director of BRH, did not approve the standard, writing, in part, "If interpreted literally, the standard could endorse non-occupational exposures of any number of members of the general public for indefinite durations, even continuously, at the proposed guide levels. It seems incongruous that the greatest risk and stress, if any, could be exerted on members of the community who might be least qualified to take the risk, under circumstances having the least control." Indeed, in 1973, BRH's Henry Rechen and EPA's Dave Janes both refused to endorse the ANSI 10 mW/cm² standard because of an absence of cautionary language regarding its application to the general public.

In an effort to satisfy these objections, some new language has been introduced—this is italicized in the full text. Now, some parties on both sides are unhappy. For instance, Morris Shore of BRH still favors an additional safety margin for population exposures while others believe that the standard provides safety for all and that the new language unduly undermines the standard.

How BRH will finally vote is still an open question, but Dave Janes will abstain as long as the standard includes the general population.

• **Exclusion Clause:** (also italicized in the text) The standard excludes sources that have a maximum input power of seven watts or less. This was introduced, among other reasons, so that the millions of handheld radio users would not be in violation of the standard. Allan Eckhaus of Consumers Union finds this exemption "confusing." "The standard is an exposure standard, so why are emissions from certain electronic products excluded?" he asks.

A second element in the exclusion clause is also problematic: the standard can be exceeded if the exposure conditions can be shown to produce whole body specific absorption rates (SARs) below 0.4 W/Kg and peak SAR's below 8 W/Kg. As one C95 member complained at the last meeting: "Where do I find a SAR meter?" Some members of EIA voted against this new addition to the exclusion clause because "it necessitates the use of a laboratory procedure for making measurements in the field." Only a couple of labs across the country are believed to have the expertise to make the measurements necessary to grant the exemption. Dr. Quirino Balzano of Motorola, on the other hand, is pleased with the SAR clause: "The standard now recognizes that, in the near field, high electric field readings do not necessarily cause biological effects," he said in an interview. He stressed that it is easy to produce near field levels which exceed the exposure guides, even for very low power devices. The SAR language was inserted to deal with the near field problem, he added.

Others are uncertain about the basis for the 20:1 ratio between the peak to whole body average SAR's, and the lack of specificity about the absorbing organ—especially the eye.

• **Averaging Time:** The standard's six-minute averaging time is causing some confusion. "If you allow 8 W/Kg for six minutes, you can allow 16 W/Kg for three minutes, 32 W/Kg for a minute and a half and so on," CU's Eckhaus argued. He went on to object to the standard's failure to specifically deal with pulsed sources. At the last C95 meeting, no one was really sure about the origin of the six-minute averaging time. At issue here is the thermal basis for the standard.

### Other Objections

On a more general level, there are disagreements about the overall scientific basis for the standard—some say the numerical exposure limits are too high, others say too low, and still others disagree with the complex frequency dependency.

RCA's Howard Johnson, the EIA representative on C95, does not think that ANSI should be in the health standard setting business at all. "I believe that the government, not a voluntary standards setting organization, should establish public health standards," he said. (EIA representatives will meet to consider its vote when the new draft arrives.)

Even the "voluntary" nature of ANSI participation has been called into question. Given the budget cuts for travel, many interested parties can no longer attend all the meetings, and most public interest organizations simply cannot afford to participate in the lengthy and expensive process.

Finally, some members have found inconsistencies in the "Rationale Document," which accompanies the ANSI standard. These too will have to be cleared up.

### Administrative Notes

For a history of the C95.IV work on the new standard, through summer 1979, see Guy's testimony before the Subcommittee on Natural Resources and Environment of the House Committee on Science and Technology, July 12, 1981: *Research on Health Effects of Nonionizing Radiation*. The minutes of the last two subcommittee meetings, in San Antonio in September 1980 and Bethesda in October 1980, have not yet been distributed. The minutes of the February C95 meeting will be sent out as soon as they are completed. All those who attended the meeting will be receiving a copy. Others should contact the C95 secretary Stephen Caine, Dept. of Navy, Naval Electronics Systems Command, ELEX 832, Washington, DC 20360.

Guy has announced his intention to resign as the chairman of C95.IV as soon as the new standard is approved.

### NIOSH & ACGIH

In other standard setting news, the National Institute for Occupational Safety and Health (NIOSH) continues to work on its RF/MW criteria document. According to its latest schedule, it should be released for review in the early fall.

The American Conference of Governmental Industrial Hygienists (ACGIH) is also in the process of revising its 10 mW/cm² standard. Proposals will be discussed at the annual American Industrial Hygiene Conference, to be held in Portland, OR, May 25-29, 1981.

**Some recent developments among the other C95 subcommittees include:**

• **C95.I:** A new "Recommended Practice for the Measurement of Hazardous Electromagnetic Fields—RF and Microwave" (C95.5-1981) was approved on March 16, 1981, and is in the process of being published. This document discusses the problems associated with measuring RF/MW in the near field. The subcommittee now intends to combine the far field standard (C95.3-1979) with C95.5 into one document.

• **C95.II/III:** Glenn Heimer has retired as chairman and been replaced by Dr. John Osepchuk. The comment period for the new RF radiation hazard symbol (C95.2) runs until June 2, 1981. For more information contact: Ms. M. Lynch at the IEEE, 345 East 47 Street, New York, NY 10017.

• **C95.V:** Florian Janoski has resigned as chairman due to work pressures and has been replaced by Ramie Thompson. The subcommittee is continuing its work towards a standard for electro-explosive devices.

• **C95.VI:** At the February C95 meeting, the subcommittee was retired.

• **C95.VII:** In the absence of an agreed set of early indicators for RF/MW hazards, the subcommittee is still trying to develop some guidelines. Dr. Tyler, the chairman, was looking forward to seeing the new OSHA report on medical surveillance (see *Microwave News*, February 1981).

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# Draft C95.1 Standard—February 1981

### Safety Level with Respect to Human Exposure to Radio Frequency Electromagnetic Fields (300 kHz–100 GHz)

**1. SCOPE AND PURPOSE**

Recommendations are made to prevent possible harmful effects in human beings exposed to electromagnetic fields in the frequency range from 300 kHz to 100 GHz. These recommendations are intended to apply to non-occupational as well as occupational exposures. These recommendations are not intended to apply to the purposeful exposure of patients by or under the direction of practitioners of the healing arts.

**2. DEFINITIONS**

Radio frequency protection guide (RFPG): The radio frequency field strength or equivalent power density ($mW/cm^2$) which should not be exceeded without (1) careful consideration of the reasons for doing so, (2) careful estimation of the increase energy deposition in the human body, and (3) careful consideration of the increased risk of unwanted biological effects. Measurements to determine adherence to the recommended protection guides shall be made at distances 5 cm or greater from any object (refer to ANSI C95.3-1979 for RF measurements).

**3. RECOMMENDATIONS**

For human exposure to electromagnetic energy of radio frequencies from 300 kHz to 100 GHz, the radio frequency protection guides, in terms of equivalent plane wave free space power density, and in terms of the mean squared electric ($E^2$) and magnetic ($H^2$) field strengths as a function of frequency, are given in Table 1.

For near field exposure, the only applicable radio frequency protection guides are the mean squared electric and magnetic field strengths given in Table 1, columns (3) and (4). For convenience, these guides may be expressed in equivalent plane wave power density.

For both pulsed and non-pulsed fields, the power density and the squares of the field strengths, as applicable, are averaged over any 0.1 hour period and should not exceed the values given in Table 1. For mixed or broadband fields consisting of a number of frequencies for which there are different values of radio-frequency protection guides,

**TABLE 1**
**RADIO FREQUENCY PROTECTION GUIDES**

| (1) Frequency Range (MHz) | (2) Power Density ($mW/cm^2$) | (3) $E^2$ ($V^2/m^2$) | (4) $H^2$ ($A^2/m^2$) |
|---|---|---|---|
| 0.3–3 | 100 | 400,000 | 2.5 |
| 3–30 | $900/f^2$ | $4{,}000\ (900/f^2)$ | $0.025\ (900/f^2)$ |
| 30–300 | 1.0 | 4,000 | 0.025 |
| 300–1500 | f/300 | 4,000 (f/300) | 0.025 (f/300) |
| 1500–100,000 | 5.0 | 20,000 | 0.125 |

Note: f is the frequency, in Megahertz (MHz)

*(continued p. 6)*

### FDA Wants More Data on Hyperthermia Unit

The Food and Drug Administration did not approve a pre-market application for a hyperthermia unit for use in cancer therapy, according to Dr. Lillian Yin, director of the FDA's Division of OB-GYN and Radiology Devices in the Bureau of Medical Devices. The FDA action came after an advisory panel sought additional safety and efficacy data. The unit, developed at UCLA Medical School and to be marketed by Henry Medical Electronics in LA, is the first tumor heat treatment device for which pre-market approval has been sought.

At its April 3 meeting, the Radiology Section of the OB-GYN and Radiological Device Panel decided that it wanted more information on potential exposures of clinical personnel to electric and magnetic fields from the RF device and on the distribution of heat in tumor and healthy cells. The minutes of the meeting are being prepared and will be available soon.

F. Kristian Storm, assistant professor of surgery at UCLA Medical School, a developer of the hyperthermia unit, said that the data requested by FDA are already available and must simply be rewritten for submission. "The FDA is playing this one strictly by the book," he said in a telephone interview. "They are being extraordinarily careful and we agree that they should. We have no qualms about the FDA request." Storm expressed concern that the new therapeutic device be used only by qualified personnel.

Storm said that a new application for pre-market approval would be submitted within 90 days. Similarly, a spokeswoman for Henry Medical Electronics said that she had no doubt the unit would gain approval soon.

The UCLA-Henry unit, trademarked Magnetrode, operates at 13.56 MHz and induces an electrical field inside the body by imposing an external magnetic field with a single turn loop.

### Questions About Healing with Pulsed EM Fields

In a lead editorial titled "Electromagnetism and Bone," the prestigious British medical journal, *Lancet* (April 11, 1981), called for more rigorous study of the healing of non-union bone fractures with pulsed electromagnetic fields. After noting the absence of firm experimental data on the efficacy of this increasingly popular type of treatment, the editorial makes three points: "First, despite the published reports on the therapeutic efficacy of electromagnetism in persistent non-union, opinion remains divided; second, the healing of fresh fractures in animals is not comparable with healing of established non-union in man; third, some experimental electric fields may delay rather than encourage fracture healing." The editorial goes on to argue for a double-blind controlled study of the effects of electromagnetism on healing of non-union in man, as distinguished from the effects of immobilization, and for the definition of more precise laboratory methods and indices for research in this area.

In so arguing, the editorial challenges past assertions by Dr. Andrew Bassett, professor or orthopedic surgery at Columbia University medical school in New York City and one of the field's leading researchers. Bassett did not return numerous calls for comment from *Microwave News*.

## *BRIEFS*

The Space Shuttle used the Microwave Scanning Beam Landing System (MSBLS) during its smooth touchdown last month. MSBLS supplied positon information to the astronauts and the Autoland Guidance System, which could have achieved a "hands-off" landing ....Papers on the latest developments in microwave aquametry, a method for measuring the water content of solids and liquids, are featured in a special issue of the *Journal of Microwave Power* (December 1980)....An April 21 article in the *Wall Street Journal* describes the latest anti-shoplifting devices which use radio-frequency and microwave technology. One manufacturer said there are over 600,000 potential US customers for electronic article-surveillance systems.... John Strohbehn, from Dartmouth's Thayer School of Engineering, discussed his work on a microwave heating system for treating tumors at the New York Academy of Sciences on April 8....IEEE Microwave Theory and Techniques Society will publish a special Transactions issue on microwave filters in September 1981. Papers should be submitted by November 30, 1981 to: A.E. Williams and A.E. Atia, Guest Editors, MTT Special Issue, COMSAT Laboratories, 22300 Comsat Drive, Clarksburg, MD 20734.

## *ANSI News* *(continued from p. 5)*

the fraction of the radio-frequency protection guide incurred within each frequency interval should be determined, and the sum of all such fractions should not exceed unity.

*Exclusion: At frequencies between 300 kHz and 1 GHz, the protection guides may be exceeded if the maximal input power of the radiating device is seven watts or less. Furthermore, at frequencies between 300 kHz and 100 GHz, the protection guides may be exceeded if the exposure conditions can be shown to produce specific absorption rates (SARs) below 0.4 W/Kg as averged over the whole body, and peak SAR values below 8 W/Kg as averaged over any one gram of tissue.*

**4. EXPLANATION**

Exposure to electromagnetic fields in the range of frequencies under consideration is but one of several sources of energy input into the body, which requires wide ranges of energy production and dissipation in order to function. For situations involving exposure of the whole body, the radio-frequency protection guide is believed to result in energy depositon (as averaged over the entire body mass for any 0.1-hour period) of about 144 joules per kilogram (J/Kg) or less. This level is equivalent to a specific absorption rate (SAR) of about 0.40 watts per kilogram (W/Kg) or less, as spatially and temporally averaged over the entire body mass.

Biological-effects data applicable to human beings for all possible combinations of frequency and modulation do not exist. The radio-frequency protection guide, therefore, has been based on the best available interpretations of the literature and it is intended to eliminate adverse effects on the functioning of the human body.

*However, because of the limitations of the biological effects data base, these guides are offered as upper limits of exposure, particularly for the general population, and are not recommendations of levels for exposures of indefinite duration.*

The exclusion to the protection guides can be used in relation to fields from low power devices such as hand-held, mobile, and marine radio transceivers. These devices may emit localized fields exceeding the protection guides, but will result in a significantly lower rate of energy absorption than allowed for the whole body. Thus, exposure to fields emitted by devices operating at 1 GHz or less and at less than 7 watts of output power would not be restricted unless focal absorption of energy exceeded a time-averaged SAR of 8 W/Kg for any given gram of tissue. Devices with output powers in excess of 7 watts require a case-by-case analysis, and exposure to any device that exceeded the maximal localized absorption stipuated by the exclusion would not be permitted.

Where exposure conditions are not precisely known or controlled, reduction of exposure should be accomplished by reliable means to values as low as are reasonably achievable. Exposures slightly in excess of the radio-frequency protection guides are not necessarily harmful; however, they are *not* desirable and should be prevented whenever possible.