is only a guideline that can be used or not used as deemed appropriate?

An appropriate starting point for discussion would be this common assessment of the significance of ANSI standards. Does the fact that ANSI is a private organization that facilitates the generation of voluntary standards limit the responsibility that C95 must assume, particularly its legal responsibility? I believe that a very convincing case could be made that would argue otherwise and that your committee and its subcommittees may not be as far removed from responsibility as is commonly assumed.

C95 members cannot be ignorant of the fact that C95.1 has been widely used for making judgments about the safety of exposure to RF radiation. Moreover, such use has frequently been at the urging of prominent C95 members who have, when giving advice, listed among their credentials their membership on C95 or C95.IV. In other words, your membership knows that its judgments about standards are used for setting public policy and have recommended that this is appropriate. Can there be any doubt, therefore, that C95.IV and C95 must bear some responsibility when questions are raised about the adequacy of present standards, even when such questions are raised in legal settings?

Is C95 ready to accept this responsibility? Are you ready to defend in court all of the activities that have taken place under your chairmanship? Are you prepared to explain and defend the relationships between ANSI, its members, and their activities, as for example between ANSI, EPA, EEPA, and recent pressure brought to bear on EPA to adopt ANSI's standard and not a more conservative one generated within EPA? Are you satisfied that ample consideration was given to the issue of target population when C95.1-1982, breaking with past tradition, was applied to general populations and not limited to occupational exposure?...

2. Broadening ANSI's approach to setting standards. Our legislative bodies and our legal systems in this country have made very clear their expectations regarding exposure standards for the general public and working populations. The requirements for responsive standards have been discussed at length by policy experts, philosophers, social scientists and public interest groups. As a consequence of these activities, setting standards has become a relatively sophisticated process, demanding of those who set standards broad abilities and sensitivities, not only in the sciences but in the social sciences and humanities as well.

In comparison to the methods used in government and elsewhere to set standards, the methods used by C95.IV are primitive at best. Government and the courts have mandated that cost-benefit analysis be used to set standards that affect the public. C95.IV has steadfastly ignored cost-benefit analysis. None of its members has expertise in this area, making it impossible for such an analysis to be planned or undertaken....

3. Eliminate obvious conflicts of interest. As I am sure I do not have to bring to your attention, there is no such thing as an absolute scientific exposure standard. The advice you give when you issue and revise C95.1 reflects judgments that are made under the pressure of competing interests. Two interests in particular are of importance when considering RF radiation— health interests and development interests. Either interest could be maximized by ignoring the other. Health interests could be maximized by forbidding any exposure to RF radiation. Development interests could be maximized by outlawing RF exposure standards. Hopefully, the task C95.IV sets for itself is reaching a fair and equitable compromise between these competing interests.

Now ask yourself, what are the chances that C95.IV will reach a fair and equitable compromise? How much confidence should the public have in the ability of this subcommittee to act fairly? The scientist who heads the [sub]committee is one whose primary interest is technological development. Within his own field, his approach to the control of a particular disease, cancer, is interventionist, not preventionist. C95.IV's secretary works for industry. The person who will select the scientific literature that will be used to set standards is under contract from the Air Force, a development conscious organization. The two scientists who oversee the evaluation of the literature selected for review have worked for the military and have testified for industry. And so it goes.

Keep in mind, I am not seeking to undermine the integrity of the persons above by mentioning their affiliations. Each is engaged in activities that are recognized as important to the vitality and well-being of US society. However, I am questioning the wisdom of staffing a committee that will make judgments that affect the public with persons who so consistently are allied with only one of the groups that has an interest in RF exposure standards....

4. More openness in disseminating information. If, when all is said and done, you feel that C95 and its subcommittee, C95.IV, are doing the best they can, it would seem reasonable to explain your satisfaction and rationales more fully. The rationale document added to C95.1-1982 was a positive step in the direction of disclosure, but only a small step. It provides partial explanation of the scientific methods used, but completely ignores all of the other decisions that were made in setting C95.1-1982.

C95.IV members know that many of the judgments they made involve complex sets of assumptions. The decision to use average SARs, thereby ignoring hotspots, has important ramifications, most of which were raised in C95.IV meetings. The use of SAR itself as the basic unit of the standard also has ramifications. If you do not mention these ramifications, pointing out for example that the use of average SAR could perhaps fail to take into account a localized effect, they will become the topic of intense discussion and a source for skepticism when raised by persons who are wondering whether to accept your judgments or reject them.

If C95.IV members are confident that their judgments are the best that can be made, then explain fully, especially to the public, why this is the case. If it is decided that cost-benefit analysis is not important, give reasons for eliminating such considerations. If the factor-of-ten safety factor is adopted, explain why....

• • •

These suggestions may be difficult to implement. I am aware of this fact. They call for increased complexity, more work and additional members. You are working with a volunteer organization and no real budget. It may be unrealistic to expect C95 and C95.IV to do more.

But if more cannot be expected, what course of action should follow? My own feeling is that it is irresponsible and possibly immoral to continue with the status quo. If C95 cannot do the job required to set responsible standards, then perhaps it should not set standards, or even issue guidelines, since it can reasonably be assumed that ANSI's recommended guidelines will be used to set public policy.

ANSI's departure from this field would most likely result in a temporary state of confusion. Without ANSI's judgments, industry would have no reference point for demonstrating to the public the safety of proposed facilities. But maybe complete chaos is what is needed to once and for all force responsible decision making. It is in allowing irresponsible decision making to continue that I see the immorality of C95 and C95.IV actions....

Sincerely,

Nicholas H. Steneck
Department of History
University of Michigan
Ann Arbor, MI 48109

UPDATES

COMPATIBILITY & INTERFERENCE

FCC Rules for ISM... Be on the lookout for FCC action on ISM equipment RFI. Docket 20718 has been dormant since the commission proposed rules in 1978 and 1979, but a notice covering all ISM devices, including RF lighting, should appear in the *Federal Register* in December. It is likely that the FCC action will address the concerns of the National Electrical Manufacturers Association (NEMA) regarding requirements for test marketing RF lighting devices. In two petitions filed last February, NEMA asked the commission to relax labeling and reporting requirements for lights sold under a waiver of Part 18 Subpart H rules (see *MWN*, September 1983).

Computer RFI Rule Exemption... The FCC has proposed exempting "one-of-a-kind" large computers and similar equipment from existing RFI rules. The proposed rule comes in response to a petition from Electronics Associates Inc., which argues that testing some of its products for verification of compliance with Part 15 Subpart J rules is costly and very difficult. In a notice published in the August 30 *Federal Register* (49 *FR* 34370), the commission noted that it may be more cost effective to handle any RFI from these units on a case by case basis and proposed exempting large systems built in quantities of 10 or less. For information, contact the FCC's Julius Knapp at (202) 653-8247.

ANS C63... American National Standards Committee C63 on EMC and its subcommittee 1 will meet on November 15-16 at the FCC offices in Washington, DC. According to the current schedule, subcommittee 1 will meet on the afternoon of the 15th and the full committee will assemble on the morning of the 16th. For more information, contact IEEE's Fred Huber at (212) 705-7960.

GOVERNMENT

FDA and Guy Experiment... Some consumers have expressed concern over the safety of their microwave ovens after hearing about the University of Washington study that found an increase in malignant tumors among rats exposed to microwave radiation (see *MWN*, July/August 1984). To calm these fears, the FDA released a *Talk Paper* on August 28, stating that such concerns are "unwarranted" in light of the agency's performance standard for microwave ovens and the actual operation of the units in tests. The FDA notes that "even persons making extensive use of a microwave oven" would be exposed to levels far below those used in the University of Washington study. A number of newspapers carried editorials expressing the same opinion about ovens, after running news stories about the study. For instance, the August 21 *Kansas City Star* proclaimed, "Don't Throw It Away Quite Yet."

MEDICAL APPLICATIONS

Reporting Serious Injuries... Beginning December 13, the FDA will require manufacturers of medical devices to report deaths or serious injuries caused by their products. Malfunctions that *could* cause death or serious injury should they recur must also be reported. FDA Commissioner Dr. Frank Young explained that the new rule will formalize what has been a largely voluntary reporting system. For details, see the September 14 *Federal Register* (49 *FR* 36326), see also correction on September 19 (49 *FR* 36644), or call Robert Forst at (301) 443-4874.

MEETINGS

Proceedings... The record of the *7th International Wroclaw Symposium on EMC*, which was held last June, is now available. Printed in two volumes, the proceedings contain about 100 papers. Many of the papers are in Russian, with abstracts in English. Copies are available for $40.00 (prepaid) from: EMC Organizing Committee, Box 2141, 51-645 Wroclaw 12, Poland. A limited number of copies of the records of the 1976, 1980 and 1982 symposia are still available. Ask for details....The proceedings of the August workshop on *Electromagnetic Waves and Neurobehavioral Function*, held in Corsendonk, Belgium, will be published by Alan Liss, Inc. Though the price of the volume has not yet been set, you can get a 30 percent discount off the regular price if you order before December 10, 1984. Contact: Alan Liss, Inc., 150 Fifth Ave., New York, NY 10011.

MILITARY SYSTEMS

OTH-B Radar Developments... The USAF has released a final EIS for its west coast over-the-horizon backscatter (OTH-B) radar (see *MWN*, May 1983). Components of the mammoth system, including transmitter, receiver and control center, will be located at four sites in California, Idaho and Oregon. For information, contact Ro Raffa, Electronic Systems Division, Hanscom AFB, MA 01731, (617) 271-7976....As construction begins in the West, the AF will use some of its $60 million-plus budget for OTH-B development in FY85 to expand its eastern radar in Maine, which is scheduled to reach full 180-degree coverage in FY86. The Navy is also studying the possibility of building one or more OTH-B radars in the South. Development of a transportable system will begin soon, under a $18.5 million contract recently awarded to Raytheon....Australia has decided to upgrade its Jindalee experimental OTH-B radar to an operational system.

New DEW Line EIS... The USAF's Electronic Systems Division has announced that it will prepare an EIS for the planned upgrading of the Distant Early Warning (DEW) Line radars into the North Warning System, designed to detect airborne missiles heading towards the US. The system will consist of short and long-range radars at 52 sites in Alaska and Canada; it will be able to protect against high flying bombers as well as low flying cruise missiles. The AF estimates that a draft EIS, covering five or six sites in Alaska, will be issued in late 1985. In August, the Sperry Corp. of Great Neck, NY, won a $79.7 million contract to design and develop 39 short-range radars. Although no contract has yet been awarded for the long-range radars, negotiations are underway with GE of Syracuse, NY. GE is already working on 13 similar units, AN/FPS-117s, in Alaska, which are part of the AF's Seek Igloo program. Deployment of the new North Warning radars will begin in the summer of 1986 and the whole system should be operational in 1992.

OVENS

Resources... Gerling Laboratories has issued two reports: (1) *A Listing of Microwave Patents Associated with Industrial Processing and Domestic/Commercial Microwave Ovens*, updated edition dated August 22, 1984; and (2) *Index to the Gerling Laboratories Technical Library*, May 30, 1984. The library has catalogued more than 1500 patents. Reference materials listed in the latter report are broken down into five categories: bioeffects, food processing, industrial applications, microwave ovens and standards and specifications. Each report is available for $25.00 from Gerling Labs, 1628 Kansas Ave., Modesto, CA 95351, (209) 521-6549.

STANDARDS

IEC on MW Therapy Equipment & RF Measurements for Satcom Stations... The International Electrotechnical Commission (IEC) has released *Publication 601-2-6: Medical Electrical Equipment. Part 2: Particular Requirements for the Safety of Microwave Therapy Equipment*. The standard covers devices which use radiation in the 300 MHz-30 GHz band to treat patients, but does not apply to hyperthermia equipment. Under the new standard, leakage shall not exceed 10 mW/cm^2 at 5 cm from the equipment, 1 m from the front of the applicator or 25 cm from the rear of the applicator. In addition, the equipment must comply with the requirements of CISPR Publication 11 which specifies RFI limits from ISM equipment. The IEC has also published a new world standard, *Publication 510-1-2: Methods of Measurement for Radio Equipment Used in Satellite Earth Stations. Part 1: Measurements Common to Sub-Systems and Combinations of Sub-Systems. Section 2: Measurements in the RF Range*. It covers both transmitting and receiving equipment and establishes test methods for frequency, impedance and a host of other parameters. The medical equipment standard costs $30.00 and the satcom standard is $40.00, both from ANSI, International Sales Dept., 1430 Broadway, New York, NY 10018.

Now Available...• New Jersey's RF/MW standard is published in the August 6 *New Jersey Register* (16 *NJR* 2120). The state adopted the 1982 ANSI guidelines this spring (see *MWN*, April 1984)....• The Underwriters Laboratories has issued a review draft of the 13th edition of *Safety Standard for Television Receivers and Video Products*, No. UL1410, which covers power-operated sets intended for household or commercial use. Comments are due by October 30. Order from Carolyn Dobrei, UL, 333 Pfingsten Road, Northbrook, IL 60062....• The Association for the Advancement of Medical Instrumentation (AAMI) has released a proposed revision of *Safe Current Limits for Electromedical Apparatus*. A copy is available for $10.00 for AAMI members and $16.00 for others from Dawn Boots, AAMI, 1901 N. Fort Myer Dr., Arlington, VA 22209....• IEEE Standard 81-1983, *IEEE Guide for Measuring Earth Resistivity, Ground Impedance and Earth Surface Potential of a Ground System*, is under review before becoming an American National Standard. A copy is available for $8.50 from Ms. M. Lynch, IEEE, 345 East 47 St., New York, NY 10017....• ANSI has printed a collection of four speeches presented at a conference earlier this year. Single copies of *Standards and the Law* are available free from Marie Brown, ANSI, 1430 Broadway, New York, NY 10018.

VDTs

UK Cluster... An apparent cluster of problem pregnancies among VDT operators has been reported in England. Preliminary results of a study of workers at the Department of Employment at Runcorn, Cheshire, indicate that 36 percent of the 55 pregnancies among VDT users ended abnormally, compared to 16 percent among controls. The cluster was uncovered during a study of pregnancies at the site by the Civil Service Medical Advisory Service of the Council of Civil Service Unions. In response, the council has urged the Central Computer and Telecommunications Agency to permit workers to be reassigned to non-VDT work during pregnancy. The agency has rejected the council's request. A final report on the cluster has not yet been released, but union officials already are calling for a "large-scale study to disentangle the effects of VDTs from other factors."

Radiation... In last month's story on very low frequency (VLF) pulsed fields, we mentioned a new set of measurements completed by Dr. Hari Sharma of the University of Waterloo in Ontario, Canada. That study has now been released. Sharma tested terminals at the Surrey Memorial Hospital in Vancouver, British Columbia, where one of the reported cluster of problem pregnancies occurred (see *MWN*, July/August 1982), and at seven other hospitals in British Columbia. The report concludes that, "The data on adverse pregnancy outcomes...indicated that there might be linkage between exposure to the [electromagnetic] fields and adverse pregnancy outcomes." Noting that both electric and magnetic components of VLF fields can be biologically active, Sharma found peak electric field values at 30 cm from the screen ranging from 19-170 V/m at approximately 16 kHz. Maximum magnetic fields along the surface of the terminal casings approached 20 A/m. He recommends maximum limits of 25 V/m and 2 A/m for 16 kHz pulsed electric and magnetic fields and for 60 Hz magnetic fields at the terminal surface. In the report, Sharma states that the data, which had been questioned when released in preliminary form (see *MWN*, April 1983), are consistent with other researchers' findings....The congressional Office of Technology Assessment (OTA) has released *Potential Office Hazards and Controls*, September 1984, which concludes that further radiation testing of VDTs is unnecessary. While acknowledging that there is insufficient evidence with which to assess radiation risks and there now exists "nearly epidemic proportions of fear among pregnant VDT operators," the report recommends better education and training of employers and employees as the primary response to worker concerns. "Due to the complexity of studying radiation effects, laboratory research does not appear to offer a feasible approach to dealing with the issue of fear of radiation," according to the report. Field testing, it adds, "is difficult and expensive. The value of such testing is questionable." A copy of the report can be obtained from the OTA, Washington, DC 20510, (202) 226-2070.

EMPRESS II (continued from p.1)

Any significant EMI at Calvert Cliffs could have far-reaching implications for U.S. defense policy involving a "survivable" nuclear war. The Nuclear Regulatory Commission (NRC) ended its investigation of EMP hazards this year and concluded that reactors would safely shut down after exposure to much higher levels of EMP than EMPRESS II will produce at the plant (see story on p.12). But the exposure of Calvert Cliffs, which would begin with the startup of EMPRESS II in late 1986, may test the commission's conclusion and reopen the debate on the feasibility of hardening reactors against EMP. The cost of protecting all U.S. nuclear plants would probably exceed one *trillion* dollars.

The potential for EMPRESS II-induced EMI was initially raised by Maryland state officials and by engineers at the Baltimore Gas and Electric Company (BG&E), one of the operators of Calvert Cliffs. The Chesapeake and Potomac (C&P) Telephone Company is also concerned about EMI to its equipment, which is scattered throughout the coastal area.

Experts Advise Caution

Two prominent experts on EMP believe the situation warrants extreme caution even though the EMI risks to Calvert Cliffs from EMPRESS II are small. Both Dr. Conrad Longmire of Mission Research Corp. in Santa Barbara, CA, and Demetrios Basdekas of the NRC in Washington, DC, told *Microwave News* that it is impossible to calculate what effect even relatively low-intensity EMP will have on a system as complex as a nuclear power plant.

In a draft environmental impact statement (EIS) released this September for EMPRESS II, the Navy devotes only two paragraphs to Calvert Cliffs. It estimates that a pulse from the preferred site for the EMP antenna at Bloodsworth Island would produce an electric field of approximately 100 V/m at the nuclear plant, which is 26 nautical miles away. "This value is only 0.2 percent of the full threat value of 50 kV/m," the Navy reasons, and "EMP has never been observed to affect any electrical or electronic system at field strengths this low."

Even though the EMPRESS II pulse at the plant would be relatively weak and lack other potentially significant characteristics of a real EMP, Longmire and Basdekas both said EMPRESS II would provide an "interesting" full-scale test.

Basdekas noted that one must take all types of coupling into account in evaluating potential effects. As an example, he hypothesized that additional energy could enter the plant via transmission lines. Although the pulse's extremely short duration limits its energy, through conductive coupling with an energized system, such as an operating power line, the pulse could be reinforced.

In a telephone interview, Longmire noted that "our understanding of EMP coupling is still in the research stage," and that EMPRESS II offers a chance to gather basic information. Nevertheless, he stressed that interference problems are very unlikely, estimating that "the odds are 100 to 1 that nothing will happen."

In fact, one of the Navy's chief arguments for building the $10 to $20 million EMPRESS II is that analysis and computer modeling are not capable of determining a complex system's vulnerability to EMP. The draft EIS notes that scale model and component testing are insufficient by themselves "without validation with empirical data from full-scale EMP testing of the ship. Such a data base does not exist."

In support for the Navy's plans, the National Academy of Sciences' study on EMP, released on August 8, concluded that because there is "no way to base an analytical estimate of EMP vulnerability on first principles, there can be no

CLASSIFIEDS

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Books from San Francisco Press

Three books on RF exposure policy: Clemmensen, **Nonionizing Radiation: A Case for Federal Standards?** ($7.50); Steneck, **Risk/Benefit Analysis: The Microwave Case** ($15); Marha *et al.*, **EM Fields and the Life Environment** ($10). Prepaid orders to San Francisco Press, Inc., Box 6800, San Francisco, CA 94101-6800. (Californians add tax.)

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Research Query — Researcher seeking verification of reported "hangovers" from radar/MW exposure. Citations, references or other information requested. Send to: William J. Callahan, 63 Main Street, PO Box 0000, Southampton, NY 11968.

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VDT News offers bimonthly news reports on the latest developments for $35.00 a year. Our *VDTs: 1983 Health and Safety Update* ($7.50) summarizes the important news from last year in thorough detail. And our booklet, *VDTs: Health and Safety,* ($6.95) covers 1981-1982 and is an important resource for anyone concerned about VDTs. Orders must be prepaid and sent to: *VDT News,* PO Box 1799, Grand Central Station, New York, NY 10163.

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substitute for the best physical simulations possible" (see *MWN*, September 1984).

Longmire suggested that the Navy proceed very carefully with the startup of EMPRESS II, working closely with the utility to monitor the effect of increasingly powerful pulses.

EMPRESS II

EMPRESS II is a barge-mounted antenna designed to submit Navy ships to repeated EMPs. The firing rates would vary from one pulse every three minutes at an antenna voltage output of 4 megavolts (MV) to one pulse every 30 minutes for a maximum voltage output of 7 MV, the pulse which produces a 50 kV/m electric field 100 yards away.

The antenna would operate in the bay for 30 to 40 days of its first year in operation and about 20 days each subsequent year. Its barge would be pulled out to an ocean site in the summer months for testing of aircraft carriers.

The EMPRESS II pulse is very similar to an EMP generated by a nuclear blast in several respects, including its rise time of 10 nanoseconds (nsec), or billionths of a second. It cannot, however, duplicate the lower frequency components of an actual EMP. Because of the finite height of the antenna, 128 feet, the pulse has a fast decay of approximately 100 nsec as compared to 1000 nsec for real EMP. This results in decreased field strengths for frequencies below 1 MHz. There is a corresponding shift in energy to higher frequencies.

Baltimore Gas and Electric

"Informal coordination" between the Navy and BG&E began in late April, according to the addendum to the draft EIS. Engineers from BG&E and the DELMARVA Power and Light Company are now working on the EMI issue through a joint task force.

Neither BG&E nor the Navy would discuss specifics, but an internal BG&E memorandum obtained by *Microwave News* outlines the scope of the utility's initial concerns. It states: "We are interested in the effects of EMP primarily from the standpoint of possible false-trips. The result of a false-trip will depend on the equipment involved; however, a single false-trip could well result in the tripping of one of the two 850 MW units. Multiple false-trips could result in tripping both units and in the temporary loss of all off-site power to the plant."

NRC's Basdekas believes that it is possible that a nuclear reactor will not shutdown safely after false-trips. In the worst case, a core meltdown could occur even for an EMP "well below 50 kV/m."

A BG&E spokesman confirmed that two sets of questions had been submitted to the Navy, but added that "there is no particular concern because there really isn't any problem." The Navy would only comment that the utilities "are addressing the question of whether EMPRESS II poses a problem to their equipment," and that "pending a determination to that end, we have jointly agreed not to speculate on the matter."

Sandia Report for the NRC

The major study on EMP and nuclear power plants was completed for the NRC by Sandia National Laboratories in 1982. Based on an analysis of the susceptibility of the Watts Bar nuclear plant in Tennessee, the report, *Interaction of Electromagnetic Pulse with Commercial Nuclear Power Plant Systems*, February 1983, concluded: "In view of the similarities in the design and construction of nuclear power plants, and based upon the conservatisms in the analyses," a 50 kV/m EMP would not affect the safe shutdown of nuclear reactors.

Both Longmire and Basdekas believe the Sandia analysis is too limited to be of great value, however. For example, Basdekas told the NRC in May 1982 that Sandia's preliminary draft conclusion "is not supported by the available information, is based partly on unwarranted assumptions and is contradicted by existing information."

One example he cited was the "significant localized upset conditions in several plants," including Three Mile Island's reactor 2, caused by EMI from walkie-talkies. At Three Mile Island, interference caused hydrogen detection instruments to malfunction, prompting the utility to declare an emergency (see *MWN*, March 1982). Basdekas noted that "the near field strength of such devices is about 1 V/m."

In its response to Basdekas's comments on the final Sandia report, the NRC noted that most of his recommendations "are predicated upon the assumption that EMP is a problem," but that the "evidence available supports the study team position that damage is unlikely to result from EMP." Further, it stated that Basdekas's recommendations "are not supported by the technical evidence and weight of technical judgment generated to date on this topic."

Telephone EMI

EMPRESS II has prompted C&P Telephone as well as the utility companies to look into potential EMI effects. C&P is currently attempting to calculate EMI thresholds for its equipment, some of which is likely to be within 10 to 15 miles of any EMPRESS II site.

Company engineer Mark Oliver anticipates that problems would be limited to "upsets" resulting in brief interruption of phone signals and perhaps switching equipment problems which could result in dialing errors. The only major consequence of the upsets would be for digital data transmission, where one glitch can be disastrous. Oliver told *Microwave News* that there may also be an accumulated effect from exposure to repeated EMPRESS II pulses, but added, "no one really knows very much about what EMP can do."

C&P Telephone has already had one experience with interference from EMP radiation. In 1978, a simulator at the Patuxent River Naval Air Station caused EMI on telephone cables entering one of the station buildings. The company would not discuss what kind of fields caused the problem nor how it was solved.

A Navy booklet issued in January 1979 for workers at the Patuxent River station reported that the Strike Aircraft Test Directorate's sophisticated computer facilities were affected by the station's EMP Simulator for Aircraft (EMPSAC). Computer memory was erased and automatic typewriters ejected pages midway through typing. The peak field strength in the area of the affected building was about 2000 V/m.

The draft EIS provides an interesting list of other EMI incidents, all of which occurred at field strengths well in excess of 100 V/m. The Navy concludes that damage to electrical/electronic systems should not occur below 5 kV/m, though that threshold should be halved for sensitive electronic/digital systems. The interference threshold for upsets to sensitive digital systems should be 1.5 kV/m.

Information on EMP effects on aircraft was initially requested by the air traffic manager at the Norfolk International Airport, but airspace near the simulator will be restricted. Therefore, the Navy addresses the possible routing and scheduling impact of EMPRESS II on aircraft rather than interference issues in the draft EIS.

(A review of the draft EIS discussion of EMP interference with cardiac pacemakers and EMP biological effects will appear in our next issue.)

State Opposition

Maryland state officials are most concerned over the potential biological effects of EMP, with Calvert Cliffs an important but secondary issue. Among the things they have questioned is whether the EMPRESS II pulse will affect aquatic and bird life near the barge-mounted antenna.

The state is very sensitive to the environmental and commercial importance of the bay and early on told the Navy that its draft environmental assessment presented an "unrealistic" evaluation of the overall impact of EMPRESS II. For example, it stated that "impacts on biota could range from an electrocution to long-term behavioral changes." An environmental assessment precedes the decision on whether an EIS is required.

State officials have also expressed concern over the biological effects of EMP on the public, even though the people receiving repeated, high intensity exposure will be Navy personnel. During each test, a ship with four full-time technicians and a crew of 50 to 100 would receive numerous pulses over a three to ten-day period. In addition, eight crew members would man the barge.

In a September 20 letter to Secretary of the Navy John Lehman, Jr., Governor Harry Hughes stated, "I am distressed and dismayed by the Navy's handling of the environmental impact statement process concerning its electromagnetic pulse projects in Maryland." Citing the September 13 Department of Defense agreement with the Environmental Protection Agency "which purported to represent a strong commitment by the Defense Department to environmental protection of the Chesapeake Bay region," Hughes said "the Navy's actions regarding the environmental assessment of its electromagnetic pulse projects raise basic questions about the sincerity of this agreement."

Hughes referred to a new land-based TACAMO EMP Simulator (TES) as well as to EMPRESS II. TES is scheduled to replace the EMPSAC simulator at Patuxent River in 1985. The Navy has prepared a brief environmental assessment for TES but will not prepare an EIS for it.

The Governor's relationship with the Navy over EMPRESS II has been stormy from the start, and it appears that state pressure contributed to the Navy's decision to complete an EIS (see *MWN*, July/August 1984).

In Virginia, Charles Ellis of the state Council on the Environment told *Microwave News* that after responding to a "scoping letter" for the project in 1983, the state didn't hear from the Navy again. Virginia has not come out against EMPRESS II, but its July 27 response to the Navy's environmental assessment stressed the need for a detailed study.

The Navy expects to hold hearings on the draft EIS in November and to complete a final version by April 1985. Both Maryland and Virgina plan to submit comments after the hearings. If the project goes ahead as planned, EMPRESS II would begin operation in late 1986.

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NRC Ruling on EMP

This June, the Nuclear Regulatory Commission (NRC) decided that measures to protect nuclear power plants against EMP interference "are unnecessary for the protection of public health and safety." With this decision to deny three 1982 petitions for rule making, the commission terminated its evaluation of EMP hazards. The ruling was published on July 12, 1984 (49 *FR* 28409).

The notice of denial concluded that, "there is no reason to believe that an EMP would prevent any commercial nuclear power plant from achieving a safe shutdown condition." The NRC's technical assessment was based in large part on the Sandia National Laboratories report, *Interaction of Electromagnetic Pulse with Commercial Nuclear Power Plant Systems*, NUREG/CR-3069, February 1983 (see *MWN*, April 1983).

The petitioners, including the Ohio Citizens for Responsible Energy, maintained that in the event of nuclear war, EMP from high-altitude nuclear blasts could wreak havoc on nuclear power plant electronic and electrical systems and result in core meltdowns. They argued that the commission's rules (10 CFR 50) should be amended to require protective measures against EMP interference in all nuclear plants in the interest of public safety. (The NRC rules were written before much was known about EMP.) The petitions were filed in connection with the licensing of the Perry, Limerick and Midland nuclear plants.

The NRC's current position on EMP hazards was laid out in a September 6, 1983 policy paper prepared by commission staff. The SECY-83-367 report concluded that "no further resource allocation is now justified by public health and safety considerations," and therefore "at the present time, the commission need not take any further action to evaluate the potential effect of an EMP on the safe operation of nuclear power plants."

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Our 20th Year

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Leading Epidemiologists See Childhood Leukemia Risk at 4 mG

A pooled analysis of raw data from nine different electromagnetic field (EMF) studies has found that children exposed to 4 mG or more were twice as likely to develop leukemia. There was no excess risk at lower exposures.

"The level of [statistical] significance that we see for the excess risk at high exposure makes chance an unlikely explanation," an international team of leading epidemiologists writes in the September issue of the *British Journal of Cancer (83,* pp.692-698, 2000).

Led by Dr. Anders Ahlbom of the Karolinska Institute in Stockholm, the study team includes Drs. Nicholas Day of the U.K., Maria Feychting of Sweden, Martha Linet of the U.S., Mary McBride of Canada, Jörg Michaelis of Germany, Jørgen Olsen of Denmark, Tore Tynes of Norway and Pia Verkasalo of Finland, each of whom has led an important study in his or her own country.

The new findings are similar to those announced last year by Dr. Sander Greenland of the University of California, Los Angeles (see *MWN,* S/O99), in an analysis that combined data from many of the same studies. "It's a pretty consistent picture. It's more consistent than one would have any right to expect, given the differences in how these studies were carried out," Greenland told *Microwave News* this September. "The main point is, you don't see anything until you get into the higher categories." Greenland's findings will be published in the November issue of *Epidemiology.*

The Ahlbom and Greenland papers reflect a growing consensus on the apparent association between magnetic fields and childhood leukemia. But there is no consensus on what those data mean. The question of causation — that is, whether EMF exposure is actually responsible for the observed increase — is

(continued on p.11)

Views on the News

What 4 Milligauss Means

A consensus is emerging on EMFs and childhood leukemia that is nothing short of remarkable. Not long ago many people, including well-informed researchers, would have characterized the existing epidemiological studies as a muddle — some finding a health risk, others finding nothing at all. But when the data are pulled together, a different picture emerges: a clear and consistent pattern of significant risks for average exposures above 4 mG.

You wouldn't know it from the mass media, but the evidence for an association between magnetic field exposure and childhood leukemia is now stronger than ever. In particular, it is far stronger than it was in the early 1990s, when newspapers covered the story on the front page.

(continued on p.19)

HIGHLIGHTS

Baltimore Doctor Files Cell Phone–Brain Cancer Lawsuit; His Lawyer Plans a Dozen More by December

Dr. Christopher Newman, a 41-year-old Baltimore neurologist, has filed a lawsuit charging that his brain tumor was caused by use of a cellular phone. The defendants include Motorola, Verizon, Cellular One and the Cellular Telecommunications Industry Association (CTIA).

Newman's suit is the first mobile phone–brain tumor case since several were filed in the early 1990s (see *MWN,* M/J92, J/A93, J/F94, S/O94, N/D94 and M/A95), and it could signal the beginning of a new wave of legal actions. His lawyer says she plans to file 12 more such cases soon.

In a written statement, Motorola argued that, "The claim of a link between wireless phone use and adverse health effects is groundless." CTIA President Tom Wheeler declared, "There is no public health threat from the use of wireless phones." Verizon, a new company formed through the merger of Bell Atlantic and GTE, did not respond to repeated requests for comment.

"The science just doesn't support these claims," said Curt Renner of Watson & Renner in Washington, attorneys for Cellular One's parent company SBC Communications, Inc. In an interview, Renner observed that, "All previous suits of this type have been dismissed or withdrawn" (see *MWN,* M/J96, S/O97, N/D97 and J/A00).

But Newman's attorney, Joanne Suder of Baltimore, thinks his case is different. "As far as medical opinion goes," she told *Microwave News,* "the work that's been released in the last year is much more definitive than anything that came before it." Suder declined, however, to cite specific studies.

Suder pointed out that Newman's brain tumor is a primary cancer, which is unusual: Most brain cancers have metastasized from elsewhere in the body. Suder also emphasized that, "There's no family history of cancer, or any other cause for it." The complaint, which was filed in state court on August 1, states that Newman used a cellular phone regularly from 1992 until his diagnosis with cancer in March 1998.

Suder noted that many of Newman's calls were in areas of poor signal quality, which she said caused his phone to operate at the higher end of its power range. In an August 9 appearance on CNN's *Larry King Live* (see p.6), Newman said he often used his phone "until the phone got hot...and my ear turned red."

The defendants in the case have petitioned the U.S. District Court in Baltimore to move the suit to federal court. In papers filed August 28, they point out that virtually all of the defendants are based outside of Maryland. Suder said she will fight the effort to remove the case from its current venue, Maryland's Circuit Court for Baltimore City.

In a September 6 interview, Suder said that the other brain cancer suits would be filed "in the next 90 days." She added that she does not plan to combine them into a class action: "Right now we're looking at them one case at a time."

One of these plaintiffs will be Michael Murray of Chicago, a former employee at a Motorola production facility who tested cellular phones. Robert Gordon, a consultant to Suder's firm, told *Microwave News* that the 32-year-old Murray tested 40 phones a day over a nine-year period. Another lawsuit is planned by the widow of Scott Muntean, a Baltimore businessman who died recently at the age of 45. Gordon emphasized that Muntean, Murray and Newman all developed tumors of the same type and that all the tumors were located near the phones' antennas.

Baltimore trial lawyer Peter Angelos, who has won hundreds of millions of dollars in suits against the tobacco and asbestos industries, told *Business Week* (August 14) that he has been approached by several mobile phone users who have developed brain cancer. Angelos said he is now looking at the issue "very intensively," but that he will not take these cases unless he felt he was "90% sure" to win. Angelos did not respond to requests for further comment.

Suder's law office is far smaller than the Angelos firm, and she has far less resources than the wireless companies and industry groups she is suing. "Our clients are seeking help with their expenses," she told *Microwave News,* "and all contributions are welcome." While Suder said she had not been actively searching for a legal partner, "we *have* been talking to people who are interested in bringing their cases to *us*."

In April, Suder won a $2.5 million judgment against Johns Hopkins Hospital in a case brought by the parents of a college student who died from an overdose of antidepressants.

No Money for RF/MW Programs at EPA

For the last five years, the Environmental Protection Agency (EPA) has not allocated any money for radiofrequency and microwave (RF/MW) radiation programs. The only EPA budgetary expense has been to assign one staff member, Norbert Hankin, to work on RF/MW radiation half time.

The EPA disclosed details of its RF/MW budget to Sen. Joseph Lieberman (D-CT) after the senator wrote to EPA Administrator Carol Browner on May 9 seeking details of the agency's RF/MW activities.

In a July 5 response, Assistant Administrator Dr. Norine Noonan stated that, at present, "EPA has no current or pending research studies on RF radiation health effects."

Five years ago, a Senate panel cut $350,000 from EPA's budget with instructions that "EPA should not engage in EMF activities" (see *MWN,* S/O95). While the Senate panel appears to have been targeting work on power frequencies, the agency also stopped spending any more money on RF/MW radiation programs. (Staff and financial allocations are treated as separate items in agency budgets.)

"My primary job is to keep the agency's managers and policymakers aware of what's going on with EMF and RF/MW issues," Hankin told *Microwave News*.

Lieberman, who is now a candidate for the U.S. vice presidency, asked the General Accounting Office to investigate the status of mobile phone safety research last October (see *MWN,* N/D99). In 1992, Lieberman chaired a hearing on the health risks of police radar guns (see *MWN,* S/O92).

New Tests Show Hands-Free Sets Do Reduce SARs, But U.K. Consumer Group Admits No Error

The use of hands-free sets with mobile phones does in fact lead to much lower radiation exposures in the head, according to tests commissioned by the U.K. Department of Trade and Industry (DTI) and the Australian Consumers' Association (ACA). Hands-free sets "offer very substantial reductions in [specific absorption rate (SAR)] compared to the normal use of a mobile phone held against the ear," concluded SARTest Ltd., in its report* for the DTI, released in early August.

The new test results are the latest to cast doubt on the well-publicized warning from the U.K. Consumers' Association (CA) that hands-free sets can triple the radiation exposure from a hand-held mobile phone. The CA announced its concerns in the April issue of its magazine, *Which?* (see *MWN*, M/J00).

The ACA assessment,† carried out by EMC Technologies Pty. Ltd. in Melbourne, found that hands-free sets reduce SARs by 92%. Even though its results conflict with those of its U.K. counterpart, the ACA did not say its approach was the correct one. Rather, it emphasized "the need for ongoing study."

The U.K. CA itself is not making any concessions. "We stand by our original test results," said Helen Parker, the editor of *Which?*

Kate Levine of the CA's media office in London pointed out that the CA and the ACA had used different phones, different hands-free kits and different testing methods. "It's not possible to compare like with like," she told *Microwave News*. "It is clear, therefore, that more research is needed to help resolve the differences," she said.

Some observers are speculating that the probes used by ERA Technology Ltd. to measure the electric fields in the CA tests were inappropriate — which led to the erroneous conclusion that hands-free sets magnify radiation exposures. This possibility is now being explored in various U.K. testing labs.

Patricia Hewitt, DTI's Minister for e-Commerce, called for "clear and unambiguous advice" on the use of hands-free sets when she released the SARTest report. But plenty of confusion persisted.

MOBILE PHONES SAFETY MUDDLE blared the *Daily Mail*'s front-page headline on August 8. That same day, the *Guardian*'s science correspondent wrote: "If mobile manufacturers, the Consumers' Association and the government had got together to work out how they could sow the greatest possible confusion in the public's mind about the safety of mobile phones, they could not have done a better job."

And in Germany, the consumer-products testing magazine *Öko-Test* issued its own warning on the use of hands-free sets in August. Without disclosing precisely what had been measured (electric fields or SARs), *Öko-Test* reported that there was enough radiation being channeled into the ear that it would not advise their use.

The CA has asked ERA Technology in Leatherhead, U.K., which did the CA's original measurements, to repeat them. The new tests should be completed soon, according to Thalia Thomas, CA's services manager in London.

CA's Levine said that due to the intense interest in the safety of hands-free sets, the findings will be released to the public as soon as they are ready, even before they are published in *Which?*

In its report, SARTest notes that the SARs can be reduced even further when a ferrite suppressor is clipped onto the hands-free set's cable. Such suppressors are the same as those fitted onto the cords of computer monitors and digital cameras, according to SARTest's Dr. Mike Manning, who did the measurements for DTI with Dr. Camelia Gabriel. SARTest is located in Newdigate, just south of London.

Mobile Phone Worn at Waist Can Exceed SAR Limits

Limits for exposures to mobile phone radiation can be exceeded when a hands-free set is used and the phone is worn on the waist, according to measurements done for the Australian Consumers' Association.

A Nokia 252 analog phone had an SAR of 4.42 W/Kg at the waist when measured over 1g of tissue (SAR_{1g}) and 2.69 W/Kg when averaged over 10g. These SARs are approximately twice those found in the head if the phone is used without a hands-free set. They exceed the Australian, U.S. FCC and ICNIRP limits.

In its July 14 report to the association, EMC Technologies explains that, "The high SAR values are due to the very close proximity of the phone antenna to the body."

Chris Zombolas, EMC Technologies' technical director, told *Microwave News* that these SARs are worst-case estimates which would be lower if the phone were attached to a belt clip and thus moved away from the body. But, he added, "Even when a belt clip is used, the phone antenna will often be touching the body when the wearer is bending and not upright."

The U.K. report from SARTest recommends that phones be placed with the keypad facing the body to reduce the user's SAR. Dr. Mike Manning of SARTest told *Microwave News* that this orientation would ensure that the antenna is furthest away from the user's body. He noted that in most cases this is true whether the phone has an external or internal antenna.

EMC Technologies also tested two GSM digital phones. An Ericsson A1018s had an SAR_{1g} at the waist of 1.56 W/Kg, which was nearly twice as high as when the phone was placed next to the head. A Nokia 5110 had a waist SAR_{1g} of 1.38 W/Kg, compared to 1.14 W/Kg in normal use. The uncertainty of the measurement system is ±23.5%.

*The SARTest report, *SAR Tests on Mobile Phones Used With and Without Personal Hands-Free Kits* (No.0083), is available at: <www.dti.gov.uk/cii/sartest.pdf>. Similar SARTest reports commissioned by Vodaphone and by One2One are also on the Internet, at <www.sartest.com>.

†The EMC Technologies report, *SAR Measurements on Mobile Phones With Hands-Free Kits* (No.M000515R), is available from the ACA for Aus$8.25 (approximately US$4.50). For ordering information, go to <www.choice.com.au/articles/a100378p1.htm> and click on "Is Hands-Free Safer?"

Problems associated with measurement and testing will be addressed at a November 16 conference at Blenheim Palace, organized by the U.K. EMC Test Labs Association and *Approval* magazine. For more information, contact Adrian MacLeod at *Approval,* (44+1732) 746616, Fax: (44+1732) 746617, E-mail: <sar@approval.co.uk>. The program for the meeting will be posted at: <www.approval.co.uk>.

Case Reports of Cancer Among Radar-Exposed Workers in Israel

Six case reports of cancer among radar technicians and radar operators in Israel are presented in the July issue of the *International Journal of Occupational and Environmental Health (6,* pp.187-193, 2000), in a paper by Dr. Elihu Richter and colleagues at Hebrew University in Jerusalem.

Dr. Arthur Upton, former head of the U.S. National Cancer Institute, told *Microwave News* that Richter's case reports "underscore what would appear to be a glaring problem, one that deserves further attention and study." Upton is currently with the Consortium for Risk Evaluation with Stakeholder Participation in New Brunswick, NJ.

Richter writes that, "There was a striking degree of consistency in the preliminary information we received from these individuals on their high exposures [and] the absence of monitoring and safeguards." Technicians reported working directly in the path of a radar beam "for periods lasting several minutes," or even working directly on top of a radar dish while it was transmitting.

One radar technician examined by Richter who was diagnosed with non-Hodgkin's lymphoma at the age of 26, after eight years of high exposure, told Richter that several other people at the same work site also had cancer. From interviews with this worker and his supervisor, Richter learned that seven out of the 25 workers in this unit had developed cancer. All had been employed there for more than three years; most were younger than 30. Five workers had leukemia or lymphomas. One had brain cancer, as did another who was not included because of incomplete information.

Studies of radar-exposed personnel in the Polish military by Dr. Stanislaw Szmigielski have found significantly higher rates of leukemia and lymphoma (see *MWN,* M/J95). Among young men, these risks were eight times higher than expected. Szmigielski also found a significant increase in the risk of brain cancer, compared to unexposed personnel.

Szmigielski later reported that his data indicate such cancers may "develop faster, with a shorter latency period," as a result of RF/MW exposure (see *MWN,* J/F98). Richter suggests that the same may be true of the cases he describes.

On the Newsstand: Recommended Reading

• Electrosmog will continue to intensify as engineers find new ways to make more efficient use of the available radio spectrum. In the August 19 ***New Scientist*** (pp.34-37) Justin Mullins looks at such a system: the use of multiple broadcast antennas and receivers to significantly speed up data transmission in urban areas. For instance, he describes how using a dozen antennas at each end makes it possible to send data up to 20 times faster. The article is titled RADIO BLAST, short for Bell Labs layered space-time.

• Dr. Elaine Scarry is still on the EMI beat. Two years ago, the Harvard literature professor called for an investigation into the possibility that electromagnetic radiation from military sources caused the explosion of TWA 800 (see *MWN,* M/A98). Scarry has now looked into two more jet crashes and sees disquieting parallels with TWA 800. Writing in the September 21 ***New York Review of Books*** — SWISSAIR 111, TWA 800 AND ELECTROMAGNETIC INTERFERENCE — she lists parallels between the two catastrophes: "(1) they took off from the same airport; (2) they took off on a Wednesday at 8:19; (3) they travelled along the [same] route; (4) they both had their first signs of trouble in the same region of airspace between 12 and 14 minutes into the flight; (5) they both appear to have suffered an electrical catastrophe; (6) they both suffered a catastrophe whose cause remains mysterious, even after years of rigorous inquiry; (7) they both flew during a week when extensive military exercises were being conducted; (8) they both flew when certain specific transmitters (submarines, the Navy P3s) appear to have been in the region." Scarry highlights the little-known fact that Swissair 111 had an unexplained 13-minute radio blackout at the same time and place as the explosion of TWA 800. In the October 5 issue of the *Review,* Scarry addresses THE FALL OF EGYPTAIR 990 and argues that a number of adverse events, including the disconnection of the autopilot and the plane's steep dive, are "consistent" with EMI. Scarry, who is best known for her book, *The Body in Pain,* presents no evidence of any specific EM signals that could have damaged the electronics of either of the jets. At minimum, Scarry wants a "comprehensive review of the external electromagnetic environment," which she writes, "has still to be carried out for the three planes that have since July 1996 crashed after leaving JFK Airport." The full text of Scarry's two-part series, complete with copious footnotes, is also at <www.nybooks.com/nyrev>.

• ***The Economist,*** September 9, has an update on the continuing tensions between telecom companies and astronomers over light pollution (GOING, GOING, NEARLY GONE, pp.99-100). The astronomers won a round with the financial death of the Iridium system (see *MWN,* J/A98). The article contains the following startling fact: "A single cell phone on the moon...would broadcast the fourth-strongest signal among all those that are beamed out by astronomical sources."

• With cell phone lawsuits back in the courts, three articles in the summer 2000 ***Issues in Science and Technology*** on science and the law are of special relevance. Especially informative is EXPERT TESTIMONY: THE SUPREME COURT'S RULES by Margaret Berger, a professor at Brooklyn Law School in New York City, on the *Daubert* ruling and other key decisions. The articles are available online at: <www.nap.edu/issues>.

Standards Watch

Cell Phone Test Protocol Gets Closer

The IEEE subcommittee that has been developing a standard protocol for measuring SARs from wireless phones is coming into the home stretch — or so its members hope. At a meeting at FCC headquarters in Washington, September 25-26, SCC-34/SC-2 worked toward an agreement on a long list of technical issues. The most important debates focused on the correct design for a "phantom head," within which a probe is moved to take radiation measurements, and on the proper position for phones during testing. "Everyone seemed to be reasonably happy about what came out," said Kwok Chan of the FCC's labs in Columbia, MD, "but it all needs to get put down on paper." The various changes will be combined at an editorial meeting scheduled for October 13-14, with a revised draft protocol sent out for balloting ten days later. Ballots will be due by November 7, and the next full meeting of the subcommittee will be held December 7-8.

SCC-28/SC-4 Okays Ear as "Extremity"

By a vote of 48-1, with 3 abstentions, subcomittee 4 of SCC-28 has agreed to reclassify the human ear as an "extremity." This increases the exposure limits for the ear from a mobile phone from 1.6 W/Kg averaged over 1g to 4.0 W/Kg averaged over 10 g. The move to change the limit was prompted by measurements showing that, under current definitions, many phones violated the FCC standards (see *MWN,* N/D99). The proposed change must now be approved by the full SCC-28 membership.

NEMA Wants IEEE–ICNIRP Joint Standard

The U.S. National Electrical Manufacturers Association (NEMA) wants ICNIRP and the IEEE to develop common standards for exposures to EMFs and RF/MW radiation. NEMA representatives spelled out their concerns about the ICNIRP limits at a July 14 meeting with Charles Ludolph, a senior official at the U.S. Department of Commerce, and in "talking points" submitted to Ludolph soon afterwards. Specifically, NEMA contends that ICNIRP's limits are too stringent. According to its newsletter, *electroindustry* (August 15), NEMA wants the European Union (EU) to support a "standards harmonization collaboration" between ICNIRP and the IEEE and asked Ludolph to present its case during an upcoming visit to Brussels. Noting that the EU's 1999 recommendation chose ICNIRP's limits as the basis for a common European standard (see *MWN,* J/A99), NEMA sought a delay in implementing the recommendation "until a harmonized standard can be completed." The talking points argue that comparable IEEE limits are "significantly less restrictive" than ICNIRP's, which it warns "will raise trade barriers." But, in an interview with *Microwave News,* Steinar Dale, one of those who met with Ludolph, downplayed U.S. industry's problems with the ICNIRP limits. "Our main concern is to harmonize standards," he said, speaking from his office at ABB Power T&D Co. in Raleigh, NC. Asked whether ICNIRP or the IEEE should give ground to achieve common limits, he replied that, "There will have to be a meeting in the middle somewhere." Dale heads NEMA's EMF task force, which decided earlier this year to push for a joint ICNIRP–IEEE standard.

Belgians Favor Precautionary Limits for Tower Radiation

The regional government of Brussels is moving toward a 3 V/m standard for radiation exposures from telecom towers. This would be even lower than comparable rules in Italy and Switzerland, currently the strictest in Europe (see *MWN,* J/F00).

The Ministry for Health and Environment of Brussels announced a "preliminary draft ordinance" for GSM mobile phone base stations and "similar" sources, including radio and TV transmitters, on July 13. The proposed limit (equivalent to 2.4 $\mu W/cm^2$) is based on the precautionary principle, according to the ministry's press release. Officials conceded that it is "extremely strict" and stressed that it is intended to provide a "basis for discussion."

A week later, the government of Belgium's Walloon region adopted a 3 V/m limit as part of a "code of good practice" for the siting of GSM antennas.

Initially, the Brussels ordinance was to apply only to mobile phone towers. That changed, however, after officials asked the WHO International EMF Project in Geneva to review the proposal. "It seemed incomplete to single out base stations when they are low-level emitters," Dr. Michael Repacholi, director of the EMF project, told *Microwave News*. Repacholi has argued against setting standards on the basis of the precautionary principle (see *MWN,* M/J00).

At present, Belgium has no legally binding RF/MW exposure rules. Regional and federal governments are engaged in a "dialogue" to clarify who has regulatory authority, a spokesperson for the Belgian Institute for Postal Services and Telecommunications told *Microwave News*.

International Standards Council

Discussions are under way to bring IEEE's committees SCC-28 and SCC-34 under one umbrella group. They may soon be part of the International Council on Electromagnetic Safety (Standards). Ronald Petersen of Lucent Technologies in Murray Hill, NJ, who plays a major role in each group, told *Microwave News* that this new name would be "more descriptive of the things we do," but added that the change is still under discussion. Petersen noted that the IEEE Standards Board would have to approve any such changes.

SCC-28 Closes Meeting to the Press

The leadership of SCC-28 refused to allow *Microwave News* to attend a September working group meeting convened to revise its RF/MW exposure limits. Drs. C.K. Chou of Motorola and John Osepchuk, formerly of Raytheon, argued that, "The presence of the press is detrimental to free discussion."

« Wireless Notes »

In early 1999, WTR's Dr. **George Carlo** began issuing public warnings about genetic changes from cell phone radiation. Researchers from **Integrated Laboratory Systems** (ILS) in Research Triangle Park, NC, provided details that March at a meeting of the Environmental Mutagen Society, and again at a WTR workshop three months later (see *MWN,* M/A99 and J/A99). A year ago, the **FDA** and the **CTIA** announced that they would work together to follow up these results (see *MWN,* N/D99). In June 2000, a formal FDA–CTIA agreement was signed, and on August 1-2 the **RF Micronucleus Working Group** met to plan further studies (see *MWN,* J/A00). The ILS research has been drawing media attention for over a year and a half and has now become the subject of a legally binding agreement between the wireless industry and the U.S. government — so some eyebrows were raised when ILS' Dr. **Ray Tice** told the FDA–CTIA working group that the first paper on the micronucleus findings had only been submitted for publication "at the end of last week." When asked about the delay, Dr. **Graham Hook**, the paper's lead author, replied that, "Too often experimental data is rushed into publication." Hook noted that, "Appropriate efforts and time must be taken to assure that work that is submitted for publication be of top quality, reproducible and as complete as possible." Hook, formerly with WTR, is now at ILS. It will be some time before the paper is actually available — the paper was submitted to *Bioelectromagnetics,* which is not known for a speedy publication schedule.

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The Food and Drug Administration's (**FDA**) Center for Devices and Radiological Health (**CDRH**) has long been reticent about making public statements on radiation health risks. So it was somewhat surprising that Dr. **David Feigal**, director of the CDRH, agreed to be on **CNN**'s ***Larry King Live*** to talk about cell phones and brain cancer. (CNN was so eager to have him that the show was delayed from an original July air date until August 9 to accommodate Feigal's schedule.) Dr. Christopher Newman and his attorney, Joanne Suder, were also on the show that night to discuss their lawsuit alleging that cell phones caused Newman's brain tumor (see p.2). But Feigal had insisted that he appear separately and the last ten minutes of the show were devoted to a one-on-one exchange with King. Feigal is no stranger to controversy, having previously headed up FDA's work on antiviral drugs (such as AIDS treatments), and he managed to dodge most of King's questions. For instance, when King asked "Are we spending enough" on health research, Feigal answered, "It's a difficult answer to say what's enough." Feigal said that he used his cell phone about 20 minutes a day, and in closing the interview, King asked: "And you would use yours again for 20 minutes tomorrow?" to which Feigal responded: "I certainly — I need to do that, yes."

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FDA's wireless research effort has drawn fire from an unusual source. In an August 14 commentary, ***Business Week*** called the FDA–CTIA initiative "flawed." The magazine argued that, "It's troubling that the industry is picking up the bill and will choose which projects receive funding" (see *MWN,* J/A00). *Business Week* closed with: "Only well-designed and supervised science will tell us whether and how cell phones affect human cells — and calm consumers' increasingly frayed nerves" (see also p.15). Those frayed nerves were in evidence in Australia, where just a few days earlier, the **Australian Consumers' Association** issued a press release titled MORE RESEARCH NEEDED ON MOBILE PHONE SAFETY (see p.3).

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California state Senator **Tom Hayden**'s bill calling for a review of research on possible health effects of mobile phones is dead. "It's toe-tag time," Hayden aide Rocky Rushing told *Microwave News*. The bill, SB1699, which passed the Senate in May, was placed on hold by the Appropriations Committee of the Assembly in August. Any further action must now wait until the legislature's next session — but by then, Hayden will no longer be in the Senate. (Under California's term limit law Hayden cannot run again.) SB1699 originally would have required stores to post

Controversy Before Release of German Cell Tower–Cow Study

Controversy has flared in Germany over a study of the health of dairy cattle housed near mobile phone antennas.

The study's findings are "explosive," the nationally broadcast TV news magazine *Report Mainz* claimed on August 21. The program said it had obtained partial results which showed that, "There were clearly more deformities and the animals behaved differently" at the farms with antennas nearby than at the other sites. The behavioral effects are similar to those associated with chronic stress, it reported.

The Bavarian state Ministry for Land Development and the Environment, which is in charge of the investigation, responded the next day that the broadcast was "not credible" since the study was not yet complete. The ministry said that it expects to have final results in late October.

A knowledgeable source told *Microwave News* that a confidential draft of the report details behavioral effects similar to those described on TV and that the investigators had found a higher rate of reproductive problems in the exposed herds.

The study, which began in 1998, probed the behavior, milk output and reproductive health of herds at 38 farms, some near wireless base stations and others not (see *MWN,* J/A98). It was projected to cost approximately 700,000 marks (US$ 300,000).

Dr. Jutta Brix of the Federal Radiation Protection Office in Oberschleißheim declined to comment to *Microwave News*. A statement on wireless phone systems issued by the office earlier this year maintains that, based on current evidence, there is no danger of negative health effects from exposures within Germany's ICNIRP-based limits.

health advisories and offer earpieces with phones (see *MWN,* M/A00). When it reached the assembly, however, these provisions had been cut (see *MWN,* M/J00). The California Council on Wireless Technology Impacts is looking for another sponsor for the bill.

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Citizen groups are asking the U.S. **Supreme Court** to restore state and local authority to adopt strict RF/MW exposure standards. They argue that the **1996 Telecom Act**'s preemption clause violates the Constitution and should be set aside. "The Tenth Amendment precludes Congress from treating state and local legislative bodies as puppets on a federal string," write **Whitney North Seymour Jr**. and Peter Clines of Landy & Seymour in New York City in a brief filed on September 7. They also ask the court to overturn the FCC's RF/MW exposure limits. Noting the lack of any funding for RF/MW research at the EPA (see p.2), they argue that the federal government has not fulfilled its responsibility to ensure that such limits are based on adequate research. Seymour, formerly a U.S. District Attorney for New York, is representing Citizens for the Appropriate Placement of Telecommunications Facilities. The group (previously known as the Ad Hoc Association) lost its last round in court when an appeals panel upheld federal preemption and the FCC exposure rules (see *MWN,* M/A00). Seymour will be among the speakers at a forum on health questions and zoning issues related to cellular tower siting in Litchfield, CT, on December 2. Others expected to participate include EPA's Dr. **Carl Blackman** and FCC's Dr. **Robert Cleveland**, according to **Blake Levitt**, an author who is helping to organize the event. The target audience is planning and zoning officials; attendance costs $35.00. For more information on *Cell Towers Forum: State of the Science/State of the Law,* contact the Berkshire-Litchfield Environmental Council at (860) 435-2004.

WHO Director Has a Watchful Eye On International EMF Project

Dr. Gro Harlem Brundtland, the director-general of the World Health Organization (WHO), is "personally interested" in possible health effects of non-ionizing radiation. That's what Dr. Michael Repacholi, director of the WHO International EMF Project in Geneva, told the Australian Senate in Canberra on August 31 (see also p.15).

At the hearing, Sen. Lyn Allison, chair of an inquiry into possible health effects of mobile phones (see *MWN,* J/F00), suggested that the EMF project had been "premature" in issuing fact sheets on radiation effects. "There remains quite a lot of uncertainty" in this area, Allison said.

Repacholi responded that Brundtland had personally reviewed the fact sheet on mobile phones and base stations released in June (see *MWN,* J/A00) and had approved the statement, but had done so "begrudgingly on some points."

When asked by *Microwave News* about Brundtland's reservations, Repacholi replied that she felt "the EMF project should progress further before issuing the fact sheet" but, in the end, she realized that "governments need to have current information" on possible hazards. Brundtland "is concerned that there may be a problem with EMFs and is keen to see the issue properly resolved," he added.

In his testimony, Repacholi said Brundtland is satisfied that the fact sheet represents "the international consensus" on the question. To date, Brundtland has not made any public statement on non-ionizing radiation, according to a WHO spokesperson.

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Four representatives of the **Australian Mobile Telecommunications Association** (AMTA) appeared before a panel of the Australian Senate when it held a second hearing on September 8. (This is the same committee that heard testimony from Dr. Michael Repacholi on August 31; see box at left.) David Havyatt outlined three recent AMTA initiatives: (1) the creation of a national collocation task force; (2) the release of a "code of conduct" for the siting of wireless towers "to reinforce the precautionary principles that already apply"; and (3) the development of a *Know Your Rights* booklet on tower siting for the public. Alex Gosman, the chair of AMTA's Electromagnetic Energy Committee, said that the association had engaged Dr. **John Moulder** of the Medical College of Wisconsin to present the scientific evidence relating to cancer to the Senate. Moulder played a similar role for the **Federation of the Electronics Industry** (FEI) in the **U.K.**, preparing FEI's submission to the Stewart inquiry on mobile phones (see *MWN,* M/J00). The full transcripts of the August 31 and September 8 hearings are available at: <www.aph.gov.au/hansard/senate/commttee/s-ecita.htm>.

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Drs. **Bruce Hocking** and **Rod Westerman** have reported that a 72-year-old businessman developed **dysaesthesiae** — a tingling sensation — on his scalp after using a GSM mobile phone. Writing in the July issue of *Occupational Medicine (50,* pp.366-388, 2000), the two Australian physicians argue that the occurrence of this type of neurological abnormality "questions the current view that all health effects of [RF] radiation are due to thermal (heating) effects." They believe this case is "evidence for non-thermal mechanisms of injury in humans." Hocking, an occupational health doctor, was the first to publish a paper on headaches and other types of symptoms among mobile phone users (see *MWN,* N/D98; also p.16). Westerman is a clinical neurophysiologist.

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Dr. **George Carlo** has teamed up with syndicated columnist **Martin Schram** to write what their publisher calls a "gripping narrative of scientific detection that chronicles an unprecedented journey of discovery...into the impact of cell phones on human health." ***Cell Phones: Invisible Hazards in the Wireless Age: An Insider's Alarming Discoveries About Cancer and Genetic Damage*** is due out in January from Carroll & Graf in New York City. The book will give details of industry's "whispering campaign" that sought to discredit Carlo and of Carlo's "plea that cell phones not be marketed to children." Carroll & Graf promises that Carlo and Schram's opus "is destined to be placed alongside such classics as *Silent Spring*."

EMF Exposure May Lead to Dramatic Change in Heart Rate

Magnetic field exposure during sleep can cause a dramatic decrease in heart rate and changes in heart-rate variability (HRV), according to new experimental results from the Midwest Research Institute (MRI) in Kansas City, MO. The study is the latest to focus on how EMFs may affect the electrical activity of the human heart.

Five hours into the experiment the nine men in the EMF-exposed group had an average heart rate of 50.7 beats per minute, compared to 60.3 beats per minute among the nine controls.

The researchers — Drs. Antonio Sastre, Charles Graham and Mary Cook — have previously linked EMF exposure to significant changes in HRV, which reflects the interaction of reflexes controlling blood pressure, body temperature and breathing (see *MWN,* J/A98). Reductions in HRV are associated with certain types of heart disease, and HRV measurements are used by cardiologists as a diagnostic tool.

The reduction in heart rate is a new observation, which the MRI team attributes to the lower frequency of the field used in this experiment. Their previous work used 60 Hz fields, but in this study they used a 16 Hz magnetic field — a frequency produced by the brain itself, in a band associated with regulation of blood pressure and body temperature.

In a paper detailing the new results, to be published soon in *Clinical Neurophysiology,* Sastre and colleagues write that their data "rule out a direct effect" on the heart itself, and that, "Biophysical calculations of the intensity of the electric fields induced" by magnetic field exposure also "argue for a central nervous system site of action rather than a cardiac one."

"One thing that's interesting about our findings at 16 Hz," Sastre told *Microwave News,* "is that in some parts of Europe, trains run at 16.6 Hz — in Sweden, Norway, Germany, Switzerland and part of Italy. So conductors and other train workers have extremely high exposures to the very fields that we studied."

The MRI researchers caused a stir two years ago when they predicted, based on their earlier HRV studies, that EMF exposure could increase the risk of certain specific types of heart disease — a prediction that was borne out in a utility worker study by Dr. David Savitz (see *MWN,* J/A98). Almost immediately thereafter, Dr. Jack Sahl began work on a comparable study of workers at Southern California Edison (SCE) (see *MWN,* S/O98). In an interview this September, Sahl said he expects to submit his results for publication soon, but declined to discuss what he had found. Formerly employed by SCE, Sahl is now a consultant based in Upland, CA.

In a paper published in *Environmental Health Perspectives (108,* pp.737-742, 2000), as well as two papers in the September *Bioelectromagnetics (21,* pp.413-421 and 480-482, 2000), the MRI researchers examine some apparent inconsistencies in their past results. They conclude that 60 Hz EMFs only affect HRV when sleep is disturbed.

"We have been telling funding agencies for years that we should do a study during the day," Sastre told *Microwave News*. The MRI researchers have proposed both a study of workers in a high-EMF environment, using halter monitors, and a study of people awake but at rest in a laboratory setting. While such research could be especially relevant to epidemiological findings on occupational EMF exposure and cardiac disease, Sastre said that, "So far there's been interest — but no money."

Stronger ALS–EMF Connection; New Link to Epilepsy Observed

A new Danish study strengthens the case for a link between EMF exposure and amyotrophic lateral sclerosis (ALS), commonly known as Lou Gehrig's disease. The study also presents the first epidemiological evidence of a connection between EMFs and epilepsy.

Dr. Cristoffer Johansen of the Danish Cancer Society in Copenhagen examined the incidence of neurological diseases among all workers in Denmark's electric power industry employed between 1900 and 1993. He found that motor neuron diseases — mainly ALS — were about twice as common among the 24,850 male utility workers as in the general population. As in previous studies, there were also more cases of senile dementia than expected, Johansen reports in the September issue of *Epidemiology (11,* pp.539-543, 2000).

"This is the first epidemiological study to show that epilepsy may be associated with EMF exposure," Johansen told *Microwave News*. Male workers with average EMF exposures estimated over 10 mG were twice as likely to develop epilepsy as those with average exposures below 1 mG — a statistically significant difference. The overall incidence of epilepsy among utility workers was lower than in the general population, but Johansen attributes this to a "healthy worker effect." He writes that, "Most cases of epilepsy are diagnosed during childhood, and this condition is not compatible with employment in electric utilities."

Johansen also found a greater-than-expected incidence of cerebral palsy and other neurological diseases among the 5,781 women workers in the study, but these estimates are "unstable" because of the small number of cases.

The findings on ALS in male workers confirm Johansen's earlier study of the same population (see *MWN,* J/A98), as well as another by Dr. David Savitz (see *MWN,* M/J97). But Johansen's latest study is the first to be based on incidence rather than mortality. "An incidence study, based on nationwide figures, has a very high quality compared to a study based on death certificates," Johansen said. This is particularly true for rare central nervous system (CNS) disorders, he added, since these will generally not be listed on a death certificate.

Dr. Eugene Sobel, of the University of Southern California in Los Angeles, commented that incidence data on many neurological disorders are not very precise. "Community-based physicians often do not diagnose Alzheimer's disease or even dementia very well," he said.

Although Johansen concludes that the rate of Alzheimer's disease (AD) was "essentially unrelated to exposure to EMFs," Sobel pointed out that under the classification of different disorders used by Johansen, all of the cases listed as AD were "presenile" — that is, they occurred in people younger than 65. "There

is no reason to suspect that early-onset AD is caused by anything other than genetics," he noted.

On the other hand, Sobel said, "Most of Johansen's senile dementia cases are probably cases of AD." Johansen found that the risk of senile dementia increased with increasing magnetic field exposure. Thus, Sobel argued, Johansen's data are "not inconsistent" with a link between late-onset AD and EMF exposure, which Sobel has observed in several previous studies (see *MWN,* J/A94 and J/F97).

As in his last paper, Johansen states that he could not distinguish between the possible effects of EMFs and electric shocks. But he has begun a new study which may shed some light on this question.

Since the early 1900s, Denmark has maintained a national register of electrical accidents. It is mandatory to report not only the person's name, but the current and voltage involved. "The idea," Johansen explained, "is to use this register to evaluate the risk of CNS disorders among survivors after electrical accidents." He expects to begin analyses this fall and submit a paper to a journal by early next year.

New Support for U.K. Aerosol Hypothesis: More Lung Cancer Found Downwind of Transmission Lines

Preliminary findings on the distribution of cancer cases around high-voltage power lines lend support to the theory that electrically charged pollutants may be responsible for an excess of lung cancer.

Dr. Alan Preece of the U.K.'s University of Bristol is assessing the relative risk of various cancers for people living within 400 meters of high-voltage transmission lines in southwest England. Initial results show that those who lived near the lines had an elevated risk of lung cancer — but more striking is how that risk was distributed.

"You are likelier to get cancer there, but *only* if you live downwind," Preece told the BBC's Radio Four, on the September 21 broadcast of *Costing the Environment*. Those living downwind were significantly more likely to develop lung cancer, while those who lived upwind of the lines showed no increase in risk. Preece called this "almost proof, or very strong supporting evidence, for the effect of aerosols driven by the wind."

Physicist Dr. Denis Henshaw, also of the University of Bristol, has proposed that a high-voltage line may influence cancer rates by ionizing molecules in the surrounding air (see *MWN,* M/A96, N/D99 and J/F00). "It splits the air up into positive and negative electrical charges, which are blown away from the power line by the wind," Henshaw told the BBC. "They attach themselves to particles of pollution in the air and put an electrical charge on them." The result, he maintains, is that, "When you inhale these small particles, they have a much higher probability of sticking to the lung." Preece undertook his current study as a test of Henshaw's theory.

"If substantiated," Henshaw told *Microwave News,* "these results are bound to have important public health implications, because they involve adult cancers which are far more prevalent" than childhood leukemia. The BBC reported that if Henshaw's hypothesis is correct, the effects of power lines could account for "more than 3,000 premature deaths" a year in the U.K. — comparable to the annual toll from automobile accidents.

"There is a clear case for a moratorium on building houses near high-voltage power lines," Henshaw contends. He added that a policy of placing all lines underground should be considered for the future.

The BBC and U.K. newspapers reported that Preece had found lung cancer rates downwind of the lines to be 29% higher than expected. But Preece told *Microwave News* that this figure should not be taken as definitive. He cautioned that it was based on the first of four possible methods of estimating the exposed population. "All I can say at this point," he said, "is that we have now tried all four approaches, and all point to a statistically significant elevation in lung cancer risk."

Preece is currently enlarging the study and taking measurements to check for bias in his method of analysis.

Dr. John Swanson, scientific advisor to the U.K.'s Electricity Association, said that Henshaw "has done some good experiments, which show that the fields power lines produce do affect airborne particles. What he has not done," Swanson told the BBC,

Tory Leader Backs EMF Studies, Opposes Planned Power Line

The man who may be the next prime minister of Britain is a long-time supporter of funding EMF health research and has opposed plans to build a 400 kV power line through the area he represents in Parliament.

William Hague, the leader of the Conservative Party and a member of Parliament from Yorkshire, has campaigned for years for more health research, according to the BBC. Last May, Hague called for a government inquiry on power lines similar to the panel on mobile phones headed by Sir William Stewart, reported the Sunday *Express* (May 5).

Hague has voiced concern about a local cancer cluster near an existing transmission line. These cases "make people extremely suspicious" about proposals for new transmission lines, he told the BBC's Radio Four this September. As long ago as 1992 Hague spoke in Parliament against the National Grid's plan for new lines, citing their "environmental cost."

"I've often brought up the health risks" to ministers of both Conservative and Labor governments, Hague told the BBC. "They've always replied...that there's been no evidence so far of any firm link between power lines and cancer. But of course new evidence is coming in all the time," said Hague, "and there's a lot of circumstantial evidence locally."

Britain's Conservative Party is ahead of Labor in recent opinion polls, for the first time since 1992.

"is show that this has a consequence for health." These comments were more conciliatory than Swanson's remarks last December, when he accused Henshaw of engaging in "speculation about the health effects of power lines which is not supported by his data" (see p.15 and *MWN,* J/F00).

The Electricity Supply Board (ESB) in Ireland was more dismissive, calling the Bristol work "highly speculative." An ESB spokesman told the *Irish Times* (September 21) that Henshaw's "theories have not been approved by other scientists and fly in the face of other research in this area."

Dr. Luciano Zaffanella of Enertech Consultants in Lee, MA, commented that a good way to test the Henshaw hypothesis would be to look at cancer rates next to high-voltage DC lines. "Unlike AC power lines, DC lines do not switch polarity 100 or 120 times a second," he told *Microwave News*. "This means that the ions would be better able to move with the prevailing wind and, if Henshaw is right, you would see even more lung cancer near DC lines."

« Power Line Talk »

The idea that power lines may be linked to cancer is one of TWENTY OF THE **GREATEST BLUNDERS** IN SCIENCE IN THE LAST TWENTY YEARS. So says Judith Newman in the October issue of ***Discover*** magazine, which is published by the Disney Co. "Currents That Don't Kill" is #9 on the list, which also includes Chernobyl, cold fusion and the Iridium project. Newman states that the Clinton administration "estimates that American taxpayers have paid $25 *billion* to determine that power lines don't do anything more deadly than deliver power" (emphasis added). She explains that, "After several enormous epidemiological studies in Canada, Britain and the United States, the danger was completely discounted" (see p.1). Her source is Dr. **Robert Park**, the physicist-lobbyist, whom she quotes as saying that power frequency fields can't be associated with cancer because they can't break chemical bonds and, more generally, that the whole business is "preposterous."

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IEEE Spectrum turns to another physicist, Dr. **Richard Coren**, to quell any fears about the safety of power line EMFs. In the July issue, Dr. **Robert Ashley** expressed his concern that electric fields might present a health risk (see *MWN,* J/A00). In the September issue, Coren of Drexel University in Philadephia responds that Ashley is all wrong and that there is really nothing to worry about. After giving the reader an introduction to epidemiological research, Coren states: "Today, there is a more definitive consensus [than six years ago] that the statistics, combined with the lack of a credible mechanism, yield no indication of an effect on humans of very low-frequency [EMFs] from power lines. This has been stated unequivocally by several authoritative sources," such as the provincial government of British Columbia, Canada.

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The inability of different labs to replicate EMF experimental effects has engendered many bitter disputes, often ending with each side alienated from the other. So there is some measure of surprise when two labs jointly publish a paper exploring why they were unable to get similar results. In a series of animal studies carried out in Dr. **Wolfgang Löscher**'s laboratory at the School of Veterinary Medicine in Hannover, **Germany**, Löscher and Dr. **Meike Mevissen** have shown that 50 Hz magnetic fields can increase the growth and development of breast tumors. These experiments were deemed so important by the National Institute of Environmental Health Sciences (**NIEHS**) that Drs. **Larry Anderson** and **James Morris** of the **Battelle** Pacific Northwest Labs in Richland, WA, were asked to repeat them. They could not (see *MWN,* M/A98). The ensuing controversy often got heated and at times tempers flared (see, for instance, *MWN,* N/D98). In the process, it became clear that NIEHS managers had decided to reject the German data. But the Hannover and Battelle groups continued to work together. As a result, in the September issue of *Environmental Health Perspectives (EHP, 108,* pp.797-802), they spell out the numerous differences between the two sets of studies which could explain the lack of agreement. *(EHP* is published by the NIEHS.) Both teams agree that the issue is not closed. "The fact that tumor incidence in MF-exposed groups in the six experiments carried out by the Hannover group...was above controls in five experiments argues against chance as a likely explanation." They conclude that the EMF–breast cancer risk issue is an "important" one that has yet to be resolved.

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The **Interagency Committee** (IAC) set up to monitor the **EMF RAPID** program may submit a report to Congress after all. Though this report is required by law, work came to a standstill last year as IAC members disagreed over much of its contents (see *MWN,* N/D99). Sources told *Microwave News* that representatives from the eight participating federal agencies on the IAC have now approved the report — which had already gone through four or five drafts by late 1999 — and committee staff are finalizing it. The report will then be sent to the White House Office of Science and Technology Policy, prior to being forwarded to Congress. Dr. **Imre Gyuk** of the DOE, the chair of the IAC, did not return calls for comment.

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In the August 4 issue of *FEBS Letters* (p.304), Dr. **Robert Liburdy** officially retracts two figures detailing his experimental results on calcium signaling, which he had published in the journal in 1992. This complies with Liburdy's agreement with the **Office of Research Integrity** (see *MWN,* J/A99). Nevertheless, Liburdy goes on to state that, "The raw data for these figures are valid and the scientific conclusions stand as published." Liburdy told *Microwave News* that he is putting the finishing touches on papers detailing his calcium research over the last three years. "My previously published findings are substantiated and these new calcium data fully support my scientific conclusions as originally published," Liburdy said.

still very much at issue. Ahlbom and colleagues note evidence of selection bias in some of the studies, and conclude only that, "The explanation for the elevated risk estimate is unknown."

"We rule out chance and say that selection bias could explain some of the excess," Ahlbom said in an interview with *Microwave News* (see p.12). "That leaves us with the options of causation or other possible kinds of bias....We may not be able to resolve this in the near future."

The question of causation has important public health implications. While 4 mG is considered unusually high for a residential exposure, present international limits allow for exposures up to 250 times higher. According to a 1998 study by EPRI, between 6 and 12 million Americans live with average exposures above 4 mG (see *MWN,* M/J98).

Day, of Cambridge University, told *Microwave News* that, "Interpretation of the finding of an excess risk above 4 mG has to be cautious." Day headed up the EMF component of last year's U.K. Childhood Cancer Study (UKCCS; see *MWN,* N/D99 and J/F00). "The U.S. study makes a large contribution to this excess, so a lot depends on how one interprets that study," he said.

Linet, who led the U.S. study, does not think the new combined analysis strengthens the case for an EMF-cancer connection. *"All* of this increase may be due to bias," she said in an interview. "We've shown in our own study that some of it has to do with who participates and who does not."* Linet is at the National Cancer Institute (NCI) in Bethesda, MD, which sponsored her study (see *MWN,* J/A97).

Does bias play this big a role? "You've had this relatively consistent pattern, across different countries and across studies that were conducted in different ways," Greenland said. "It's hard for me to see how selection bias would operate in the same way in all these cases."

Day stands somewhere in between. "Bias and confounding may be the main factors in operation," he said. On the other hand, Day said, "an excess was seen which is very unlikely to be due to chance, and is consistent with a causal role for EMFs at these high levels. It cannot just be dismissed."

The new paper notes that leukemia in children is not well understood, so "one cannot exclude" a potential confounding effect from some as-yet-unidentified risk factor. It does conclude that "mobility, traffic exhaust, type of dwelling and urban/rural residency are not important confounders" in these studies — but Greenland thinks this may be premature.

"Many of these things are not well-measured," Greenland observed. "Traffic exhaust is one of the most controversial. The data on potential confounders is pretty weak, overall."

"It is frustrating that, with all these studies, you can't say all that much yet," commented Greenland. "It's true that bias or confounding might explain the excess risk. But it's also true that it could be a real effect."

In Michaelis's view, "The main problem is that there is so far no plausible explanation of the observed association." In the absence of a specific mechanism, he told *Microwave News,* we cannot conclude that EMF exposure leads to childhood leukemia — even above 4 mG. Michaelis is at the University of Mainz.

Ahlbom sounded a similar theme. "If we had supporting experimental data," he said, "the epidemiology would have been strong enough for a causal interpretation quite some time ago." But without that, "the requirements on epidemiological data become rather strong."

"Wire-Code Paradox" Rejected

The 1996 EMF report from the National Academy of Sciences–National Research Council concluded that childhood leukemia was linked to proximity to power lines — as measured by a system of "wire codes" — but not to measured magnetic fields (see *MWN,* N/D96). Greenland and Ahlbom each conclude, however, that this so-called "wire-code paradox" does not exist.

Both pooled analyses show that at higher levels of exposure, measured field levels are in fact linked to increased risks. Ahlbom and colleagues also question whether the wire-code studies are valid at all: They note that the two North American studies they included — by Linet and McBride — "show no evidence of increased risk...in high wire-code categories." It is "unclear" why previous wire-code studies found the opposite, they write, but there may have been "considerable potential for bias."

Day takes an even stronger view. "What does emerge clearly," he said, "is that the results of the early studies, from which interest in the [EMF–childhood leukemia] hypothesis developed, were the result of bias." He cited both the NCI data and the pooled analysis led by Ahlbom. "If there is any relationship with magnetic fields," Day argued, "it is not the one put forward on the basis of wire codes."

Greenland disagreed: "That may be true, but we can't conclude that yet." He pointed out that the pooled analysis by Ahl-

Italians Also See Childhood Leukemia Link

An association between living near power lines and developing childhood leukemia has also been reported in Italy.

Writing in the May-June issue of *Tumori (86,* pp.195-198), a leading Italian cancer journal, a team from northern Italy estimates that children exposed to a calculated magnetic field of more than 1 mG had a 4.5-fold increased risk of leukemia. This result is based on only three cases and three controls and is not statistically significant.

Dr. Nadia Bianchi and coworkers conclude that of the 127 cases of leukemia occurring in the Lombardy region, 6.48 may be attributable to EMFs from power lines.

Dr. Maria Feychting of the Karolinska Institute in Stockholm told *Microwave News* that there were problems with the study's design, selection of controls and exposure assessment. "This study does not change the overall picture of this problem," she said.

*The pooled analysis notes that controls were "generally characterized by higher socioeconomic status than cases," particularly in the U.S. study. The UKCCS found some connection between lower status and higher levels of magnetic fields, and an analysis of the NCI data by Linet and Dr. Elizabeth Hatch found that people with lower socioeconomic status were more reluctant to participate fully, especially as controls (see *MWN,* M/A 00). The NCI researchers concluded that selection bias "led to a slight overestimate of effect in our study."

bom, Day and colleagues only included "the two most negative of the wire-code studies." While Greenland's own analysis found that wire-code studies were less consistent than studies based on measured fields, the data from the eight wire-code studies he examined do show a significant excess risk for children living near "very high-current configuration" power lines.

The original plan for Ahlbom's pooled analysis (see *MWN*, J/F96 and M/J99) was to include all European studies of EMFs and childhood leukemia that used either calculated fields or 24- or 48-hour magnetic field measurements. Three others were added later: the NCI study, Dr. Mary McBride's research from Canada and a New Zealand study by Dr. John Dockerty of the U.K.'s University of Oxford (see *MWN*, M/J99 and N/D99). "We felt that if we could also incorporate new studies from non-European countries, this pooled analysis would be up to date and presumably stay current for several years," the paper states.

Ahlbom and colleagues analyzed raw data for 3,247 children with leukemia and 10,400 controls. The children's magnetic field

Sweden's Dr. Anders Ahlbom Talks with Microwave News

***MWN*:** There have been a number of previous meta-analyses of magnetic field exposure and childhood leukemia. What does your new one add to our understanding of this association?

AA: I believe this is the first published study based on primary data from the individual studies. Another such study by Sander Greenland, Asher Sheppard and others will be published soon. Using raw data enabled us to make the data across the studies more consistent. For instance, with respect to cutoff points, exposure periods, geometric means. This in turn made it possible for us to investigate higher levels of exposure than had been possible or meaningful in past individual studies. Our combined data set was large enough to look at exposures of 0.4 μT [4 mG] and greater.

***MWN*:** Why did you set the cutoff for the high-exposure group at 0.4 μT?

AA: The 0.4 μT level was chosen at an early stage of the study. We were trying to strike a balance between having a "high" exposure level and having a large enough number of subjects above that level.

***MWN*:** You conclude that chance is an "unlikely explanation" for the observed doubling of the childhood leukemia risk for exposures of 0.4 μT and greater. How comfortable are you with the idea that such weak magnetic fields could be linked to cancer?

AA: Simply stated, the competing explanations are causation, chance and various types of bias. We rule out chance and say that selection bias could explain some of the excess. That leaves us with the options of causation or other possible kinds of bias. I don't believe there is any way of knowing and I am beginning to suspect that we may not be able to resolve this in the near future.

***MWN*:** You do not sound optimistic that epidemiology may have much more to say about the EMF-cancer question. Does this mean that the ongoing Japanese study is not likely to clarify some of the uncertainties?

AA: The Japanese study may provide the type of population that is needed. That is, one with a large number of highly exposed subjects. If they can do a study that is not subject to other problems it may be very informative. I do indeed hope this will be the case. There are also other studies in the pipeline: from California, Germany and Italy — so there are still opportunities for new data to resolve the issue.

***MWN*:** Does the absence of supporting animal and *in vitro* studies make you suspect that the epidemiological findings are spurious?

AA: If we had supporting experimental data, the epidemiology would have been strong enough for a causal interpretation quite some time ago. In the absence of supporting experimental data, the requirements on epidemiological data become rather strong for a firm positive conclusion.

***MWN*:** On the other hand, there are a number of epidemiological studies, and associated meta-analyses, that also show an increased risk of cancer among occupationally exposed workers. How do these fit into the magnetic field risk equation?

AA: Since the types of cancer are different I keep these issues somewhat separate and evaluate the childhood leukemia case by itself. At the same time, of course, if there were strong data that some other cancer was caused by EMFs, that would certainly increase the credibility of the hypothesis. That is one reason to focus on childhood leukemia, because that is where the data are strongest.

***MWN*:** Does this mean that you do not consider the meta-analyses showing that EMF-exposed workers have higher rates of leukemia and brain cancer to be "strong"?

AA: This is certainly of great interest but, in my opinion, these results are weaker than those for childhood leukemia. There are fewer high-quality occupational studies and in addition there are some variations in the specific diagnoses for which the excess risks are seen.

***MWN*:** What do you make of the new analyses of the Ontario Hydro occupational data from Canada showing that electric fields can increase leukemia risks by eight-to-ten times the expected rate?

AA: This is of interest too, but not backed up by other studies.

***MWN*:** In the U.S., many people are now saying that all the attention to EMFs has been a waste of time and money. You have been working on this problem for close to 15 years now. How do you respond to this argument?

AA: I believe that we have learned a lot. The bottom-line question may still be unresolved. My understanding, however, is that the possibility of a cancer effect at around 0.2 μT is rather unlikely, while there is still a possibility for an excess risk at higher levels, say 0.4 μT. Only a few people are exposed above 0.4 μT, so this qualification is rather important from a public health perspective. Scientifically it is of course equally interesting with an effect above 0.4 μT as above 0.2 μT.

***MWN*:** Long ago, largely based on your and Maria Feychting's childhood leukemia study, the Swedish government adopted a policy of prudent avoidance. That is, whenever possible, siting power lines away from schools and residential areas. If asked, would you advise the government to continue to practice prudent avoidance?

AA: I try to stay away from these issues because so many factors other than science come into play. I do think, however, that in Sweden with all the space and other resources, one should still exercise prudent avoidance.

exposures were based on in-home measurements. They used geometric means — "because they are less affected by outliers" — to gauge average exposure in the year prior to diagnosis.

Previous EMF-cancer studies "have sometimes been criticized on the grounds that the findings might be a consequence of so-called data dredging," Ahlbom's team writes. To avoid this, "We specified which primary analyses we planned to do and how to do them before we commenced the analysis," doing so "before the results of several of the individual studies were known."

There have been other meta-analyses besides Ahlbom's and Greenland's, but these have not combined the raw data from different studies (see *MWN,* S/O94, J/F99 and J/F00). Ahlbom writes that access to the raw data "gave us two substantial advantages." First, it allowed his team to make the data from different studies "as compatible as possible," especially with respect to the categories for exposure assessment. Second, by analyzing a larger number of cases together, it became "possible to analyze...higher cutoff points than the commonly used 2 mG" for the high-exposure category.

Ahlbom's pooled analysis includes 44 cases and 62 controls with average exposures of 4 mG or more, a far greater number than in any of the individual studies.

Greenland's study does not have data from the UKCCS, and Ahlbom's does not include several of the 15 studies used by Greenland — from Mexico and others from Norway, the U.S. and elsewhere. "But none of this seems to matter much in terms of the results," commented Greenland. "We found in our analysis that the results don't depend much on any one paper." Thus, he said, "it's not surprising that the conclusions of these two pooled analyses came out about the same."

Neither pooled analysis has data from the recent study by Dr. Lois Green of the University of Toronto, which found significant increases in risk, especially among younger children (see *MWN,* J/A99). Ahlbom's paper explains that Green's "exposure information...was not similar enough to justify inclusion," and Greenland said that Green's data were not available in time.

Both Linet and Day emphasized that neither combined analysis showed a risk for most children. "There is no evidence of any appreciable risk below 4 mG," stated Day. "These are the exposure levels of relevance to the great majority of people in this country, and so this confirms the findings from the U.K. study."

"There is no risk for the 99.2% of kids with exposures under 4 mG," said Linet. For this reason, she does not view further EMF studies as a priority.

FROM THE FIELD

Letter to the Editor

Litovitz and DiCarlo Respond to FDA on EMFs and Cardiac Protection

September 13, 2000

To the Editor:

Dr. Russell Owen of the Food and Drug Administration (FDA) recently reported to *Microwave News* [J/A00] that his laboratory was unable to replicate the EMF hypoxia studies which we published [see *MWN,* N/D97 and M/J99]. Having read details of the replication experiment undertaken by the FDA laboratory, we feel that our protocol was not precisely followed.

It has been our experience that regardless of the responsiveness of a given flock to EMF exposure, a percentage of the embryo population does not respond to the EMF. We rarely see protection which exceeds 70% survival following hypoxia in field-exposed embryos. If we had allowed, as the FDA did, control survival to be 65%, we would never have seen a significant difference between control and exposed embryos. We state in several of our publications that a survival rate of approximately 35% is targeted.

We believe that FDA's inexperience with the assay led them to discontinue the hypoxia when the control embryo survival rate *appeared* to be 35%. They were likely misled by the phenomenon of myocardial stunning, in which hypoxic eggs without a discernible heartbeat appear dead, when, in fact, heartbeat resumes after re-oxygenation. Our familiarity with this detail allowed us to maintain hypoxic conditions for the appropriate length of time to achieve the targeted 35%.

Dr. Owen also comments that it is "unlikely" that EMF exposures would be protective during myocardial stress. In fact, EMF-induced increases in heat shock proteins (which are known mitigators of myocardial damage) have been shown in several models by five different laboratories.[1-5] Others have directly shown EMF-induced protection against cerebral ischemia[6] and myocardial damage.[7]

We have now studied EMF-induced protection against a number of stressors in over 30,000 embryos and in three different cell types (rat, mouse and human). Ten researchers in our laboratory have successfully replicated this EMF-induced protection.

Ted Litovitz, PhD and Andrea DiCarlo, PhD
Catholic University of America, Washington, DC 20064
(202) 319-5328; E-mail: <litovitz@cua.edu>

FDA's Dr. Russell Owen declined to respond to Litovitz and DiCarlo's letter, explaining that his group is planning to publish a paper on the attempted replication. A synopsis of FDA's findings can be found in the most recent Office of Science and Technology Annual Report, *available on the Internet at: <www.fda.gov/cdrh/ost/reports/fy99>.*

1. R. Goodman and M. Blank, "Magnetic Field Stress Induces Expression of HSP70," *Cell Stress & Chaperones, 3,* pp.79-88, 1998.

2. J.L. Pipkin et al., "Induction of Stress Proteins by Electromagnetic Fields in Cultured HL-60 Cells," *Bioelectromagnetics, 20,* pp.347-357, 1999.

3. B. Junkersdorf, H. Bauer and H.O. Gutzeit, "Electromagnetic Fields Enhance the Stress Response at Elevated Temperatures in the Nematode *Caenorhabditis Elegans," Bioelectromagnetics, 21,* pp.100-106, 2000.

4. K.-C. Chow and W.L. Tung, "Magnetic Field Exposure Enhances DNA Repair Through the Induction of DnaK/J Synthesis," *FEBS Letters, 478,* pp.133-136, 2000 [see p.14].

5. G. Tsurita et al., "Effects of Exposure to Repetitive Pulsed Magnetic Stimulation on Cell Proliferation and Expression of Heat Shock Protein 70 in Normal and Malignant Cells," *Biochemical and Biophysical Research Communications, 261,* pp.689-694, August 1999.

6. G. Grant, G. Steinberg and R. Cadossi, "Protection Against Focal Cerebral Ischemia Following Exposure to a Pulsing Electromagnetic Field," in *Electricity and Magnetism in Biology and Medicine,* edited by M. Blank, pp.723-724, San Francisco: San Francisco Press, 1993.

7. A. Albertini et al., "Protective Effect of Low-Frequency Low-Energy Pulsing Electromagnetic Fields on Acute Experimental Myocardial Infarcts in Rats," *Bioelectromagnetics, 20,* pp.372-377, 1999.

Hot New Papers

J. Laurence, P. French, R. Lindner and D. McKenzie, "Biological Effects of Electromagnetic Fields — Mechanisms for the Effects of Pulsed Microwave Radiation on Protein Conformation," ***Journal of Theoretical Biology, 206,*** **pp.291-298, September 2000.**

"[S]ignificant temperature transients which could cause protein conformational changes are induced by pulsed microwave exposures in realistic situations. We proposed an explanation for apparent nonlinear dose-response relationships. At some point, the power is sufficient to induce conformational change in some target proteins, but will be insufficient to induce the stress response, so a biological effect could occur unprotected by the stress response. At higher power levels, the conformational change will be great enough to activate the stress response, reducing or nullifying the effect by protecting against further protein unfolding. At still higher power levels irreversible damage will be done to a range of biological systems which the stress response is incapable of preventing."

King-Chuen Chow and Wai Lin Tung, "Magnetic Field Exposure Enhances DNA Repair Through the Induction of DnaK/J Synthesis," ***FEBS Letters, 478,*** **pp.133-136, July 28, 2000.**

"In contrast to the common impression that exposure to a magnetic field of low frequency causes mutations to organisms, we have demonstrated that a magnetic field can actually enhance the efficiency of DNA repair....The improvement was found to be mediated by the induced overproduction of heat shock proteins DnaK/J (Hsp70/40)."

Alan Preece, Jeff Hand, Robert Clarke and Alice Stewart, "Power-Frequency Electromagnetic Fields and Health. Where's the Evidence?" ***Physics in Medicine and Biology, 45,*** **pp.R139-R154, September 2000.**

"Further research seems to be required, but mainly in the area of mechanisms. To do this, care is need[ed] to characterize exposure and to define the characteristics of the fields producing the exposure, and until this has been worked out further epidemiological work seems unnecessary."

Jane Babbitt et al., "Hematopoietic Neoplasia in C57BL/6 Mice Exposed to Split-Dose Ionizing Radiation and Circularly Polarized 60 Hz Magnetic Fields," ***Carcinogenesis, 21,*** **pp.1379-1389, July 2000.**

"The present study design cannot adequately assess the influence of chronic MF exposure on the initiation of neoplastic lesions. However, another proposed effect of MF exposure has been the acceleration of neoplastic growth and progression. The present study data provide some supporting experimental evidence for this postulate, including the observation that histiocytic sarcomas and [three categories of] lymphomas were found earlier in unirradiated mice exposed to MF, although this comparison was not statistically significant....The observation that the final frequency of combined hematopoietic neoplasms is similar for all experimental groups of both irradiated and unirradiated mice, suggests that treatment within the range of split-dose ionizing radiation used for this experiment promotes the differentiation and growth of specific preneoplastic hematopoietic precursors, rather than initiating lymphomagenesis. The data from this study suggest that tumor development is promoted in those animals which received only ionizing radiation treatment or only MF exposure. The data also suggest an interaction of ionizing radiation treatment effects and MF exposure effects in the development of radiation-induced thymic LB lymphomas. The mechanisms by which these two different levels of radiant energy affect tumor development remain to be determined, as does the mechanism of their interaction. Future studies to elucidate these relationships are warranted."

Nonlinear Model Can Make Sense Of Inconsistent Data

Andrew Marino et al., "Nonlinear Response of the Immune System to Power-Frequency Magnetic Fields," ***American Journal of Physiology — Regulatory, Integrative and Comparative Physiology, 279,*** **pp.R761-R768, September 2000.**

"[I]f the biological effects of EMFs were governed by nonlinear laws, deterministic responses to fields could occur that were both real and inconsistent....The hypothesis of real inconsistent effects due to EMFs was tested by exposing mice to 1 G, 60 Hz for 1-105 days and observing the effect on 20 immune parameters....The data were evaluated by means of a novel statistical procedure that avoided averaging away oppositely directed changes in different animals, which we perceived to be the problem in some of the earlier EMF studies....In three independent experiments involving exposure for 21 or more days, the field altered lymphoid phenotype even though the changes in individual immune parameters were inconsistent. When the data were evaluated using traditional linear statistical methods, no significant difference in any immune parameter was found....We conclude that exposure to power-frequency fields produced changes in the immune system that were both real and inconsistent."

Paul Lichtenstein et al., "Environmental and Heritable Factors in the Causation of Cancer: Analyses of Cohorts of Twins from Sweden, Denmark and Finland," ***New England Journal of Medicine, 343,*** **pp.78-85, July 13, 2000.**

"Inherited genetic factors make a minor contribution to susceptibility to most types of neoplasms. This finding indicates that the environment has the principal role in causing sporadic cancer."

Geraldine Lee et al., "The Use of Electric Bed Heaters and the Risk of Clinically Recognized Spontaneous Abortion," ***Epidemiology, 11,*** **pp.406-415, July 2000.**

"These findings provide little support for the hypothesis that electric bed heaters increase the risk of spontaneous abortions. The decreased association of electric blankets used at low settings is most likely due to uncontrolled confounding. The initial assumption that electric bed heaters would deliver strong time-weighted average magnetic field levels to the uterus may be wrong (especially for low settings), so that although we can examine the association of electric blankets themselves, electric blankets may not be a strong enough magnetic field source, as generally used by our study population, to examine the relation between time-weighted average magnetic fields and spontaneous abortion."

Peter Wainwright, "Thermal Effects of Radiation from Cellular Telephones," ***Physics in Medicine and Biology, 45,*** **pp.2363-2372, August 2000.**

"[T]he maximum temperature rise in the brain is likely to be around 0.1°C. This figure is likely to be very sensitive to the individual anatomy....The predicted heating of the brain was greater at 1800 MHz than at 900 MHz....Using a simple finite element model with a continuum heat sink representing the vascular system, the profile of temperature rises within the head can rapidly be estimated for any given SAR distribution....It must be stressed that experimental validation of these results has not been carried out."

Across the Spectrum

"[Mobile phones constitute] the world's largest biological experiment ever."

— Dr. Leif Salford, professor of neurosurgery, University of Lund, Sweden, and long-time researcher on effects of microwaves on the blood-brain barrier, quoted by Norm Alster, "Cell Phones: We Need More Testing," *Business Week,* p.39, August 14, 2000

Einstein didn't win the Nobel Prize for the theory of relativity. He won it for showing that you don't need to worry about radiation from your cell phone.

— Dr. Robert Cahn, senior physicist, Lawrence Berkeley National Laboratory, Berkeley, CA, in "Einstein, Your Cell Phone and You," *San Francisco Chronicle,* p.A23, August 30, 2000

[T]hese little metallic instruments are this millennium's cigarette.

— Joel Conarroe, president, John Simon Guggenheim Memorial Foundation, referring to mobile phones in, "Addicted to Talking," *New York Times,* Op-Ed, p.A15, August 5, 2000

"We think the demand for tower space will increase three or four times over what it is now with the coming of the next generation of wireless data technology for cell phones, the G-3 networks."

— Phil Foreman, comanager, Evergreen Growth & Income Fund, quoted by Claire Mencke, "Array of Funds Hold Cellular Tower Stocks: Managers Expect Demand Will Grow for Several Years," *Investor's Business Daily,* p.B1, August 2, 2000

"[T]he EMF study at WHO is looking only at nonthermal effects. We are not interested in thermal."

— Dr. Michael Repacholi, director, WHO International EMF Project, Geneva, testifying before an Australian Senate inquiry on mobile phone health risks and RF/MW exposure standards, Canberra, August 31, 2000 (see p.7 and *MWN,* J/F00) (Repacholi's testimony is available as a PDF file at: <www.aph.gov.au/hansard/senate/commttee/s-ecita.htm>.)

"We have never said in a categorical way that power lines are safe, that simply would not be honest. What we say is that when you look at the totality of studies you come to the conclusion that the balance of evidence is that power lines do not have an effect on health."

— Dr. John Swanson, scientific advisor to the National Grid, U.K., quoted by Paul Brown, "New Cancer Link to Power Lines," *Guardian* (U.K.), p.2, September 21, 2000 (see p.9)

On the Internet

Petition for Ouster of Repacholi, ICNIRP

In Switzerland, the Association for Representation and Protection of Persons Afflicted by Electrosmog plans to submit a petition calling for a "worldwide moratorium" on new mobile phone towers to Kofi Annan, the secretary-general of the United Nations. WHO's Dr. Gro Harlem Brundtland will also receive a copy, Leopoldine Gaigg, the group's secretary, told *Microwave News*. "Already many people have become seriously ill" through exposure to radiation from cell towers, the association contends. It charges that the WHO, ICNIRP and Dr. Michael Repacholi "failed to fulfill their duty to protect world health" and demands that Repacholi and ICNIRP be replaced. The leader of the association is Hans-Ulrich Jakob, who lives in Schwarzenburg, the site of a former high-power shortwave radio transmitter (see *MWN,* N/D93, J/F96 and S/O96). The petition and letter are available in English and German — along with other material — on the Web at: **<www.gigaherz.ch>**.

"Microwave News" Flashback

Years 15 Ago

• Citing federal budget cuts, Dr. Gordon Heuter, director of EPA's health research lab in North Carolina, disbands the non-ionizing radiation division and reassigns its 25 members to other parts of the EPA.

• Analysts at the Lawrence Livermore Lab project that radio and TV broadcasters will have to spend $19.1-45.6 million in order to comply with a possible 100 μW/cm^2 RF/MW exposure standard.

• California radio station KERG–FM shuts down after state officials discover that its signal was exposing forest rangers stationed at a nearby lookout post to RF levels 2-3 times higher than the ANSI limits.

Years 10 Ago

• Boeing agrees to pay over $500,000 — the largest EMF injury settlement in U.S. history — to Robert Strom, a former employee who claims his leukemia was caused by on-the-job exposure to EMP radiation.

• The National Toxicology Program announces it will spend $6-10 million to sponsor a series of major animal studies on the reproductive, developmental and carcinogenic effects of 60 Hz EMFs.

• The Swedish National Board for Measurement and Testing (MPR) recommends that VDT manufacturers voluntarily adopt an ELF emission limit of 2.5 mG at 50 cm in front of the terminal.

Years 5 Ago

• Without explanation, Joe Jamail, a noted Texas trial attorney, unexpectedly withdraws a lawsuit on behalf of 11 families who charged that Houston Lighting & Power Co. power lines caused their children's cancer.

• The Senate Committee on Appropriations cuts $350,000 from the EPA's EMF budget. It states: "The committee believes EPA should not engage in EMF activities" (see p.2).

• Dr. Birgitta Floderus and coworkers at Sweden's National Institute for Working Life report that men and women have a small, but significant, increased risk of developing a number of different types of cancer if exposed to EMFs on the job.

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UPDATES

BROADCAST RADIATION & CANCER

Dispute Over TV Towers & Leukemia...A sharp debate on broadcast radiation and childhood leukemia has been waged over the last two years in the *Australian and New Zealand Journal of Public Health*. The controversy started after Dr. Bruce Hocking, former chief medical officer for Telecom Australia (now Telstra), found elevated rates of leukemia among children living near TV towers (see *MWN*, N/D95 and J/F97). In 1998 Drs. David McKenzie, a physicist, and Stephen Morrell, an epidemiologist, both of the University of Sydney, challenged this finding in a paper described as "a second look" at the Hocking study *(22,* pp.360-367, 1998). They argued that one of the three neighborhoods near the antennas, the Lane Cove area, "contributes all the excess," and that the link between the TV tower and childhood leukemia "disappeared when Lane Cove was omitted." McKenzie and Morrell also contended that Hocking's data do not suggest a causal link because there is no clear dose-response pattern. They noted that the incidence of acute lymphoblastic leukemia (ALL) "was highest in Lane Cove during 1972-78 when exposure was lowest, as 24-hour TV transmissions had not commenced until the end" of that period. Hocking, who is now an occupational medicine consultant in Melbourne, responded that the McKenzie and Morrell paper was "based on *post hoc* analyses which are not scientifically justified" *(23,* pp.104-105, 1999). Hocking wrote that when he began his study years ago, he had no reason to expect a higher leukemia risk in Lane Cove or any other neighborhood, and that statistical tests for heterogeneity provide no basis for singling out Lane Cove in hindsight. He also pointed out that while "24-hour [TV] broadcasting began in 1976...by 1972 the hours broadcast were 18 per day." Overall, Hocking contended, the data in McKenzie and Morrell's paper "confirm our own finding of a modest association, which warrants further study." McKenzie and Morrell shot back with a reply to Hocking's answer *(23,* pp.553-555, 1999). Emphasizing that another neighborhood near the tower, with similar exposures to Lane Cove, shows no excess leukemia risk, they wrote that this "makes it very difficult to support the TV tower hypothesis." They conclude with the charge that Hocking has published "spuriously alarming results." This prompted Hocking to respond again. In the latest issue of the journal *(24,* pp.106-107, 2000), he disputes McKenzie and Morrell's analysis on several points and describes one of their criticisms as "bizarre." Hocking suggests that a full-scale study based on careful and detailed radiation measurements "would be the best way of establishing whether there is any association."

EMFs & SUICIDE

Utility Worker Study Questioned..."Magnetic field exposure is unlikely to be either a necessary or sufficient cause of depression or suicide." That assertion is offered in a commentary by Dr. Corinne Peek-Asa of the University of California, Los Angeles, in the August issue of the *Western Journal of Medicine (173,* pp.100-101, 2000). Her remarks accompany a study of suicide among electric utility workers by Edwin van Wijngaarden and Drs. David Savitz and Dana Loomis, all of the University of North Carolina, Chapel Hill (pp.94-100). With some minor corrections, the paper is essentially the same as one they published earlier

this year in *Occupational and Environmental Medicine* (see *MWN*, M/A00). Their findings, based on data on 139,000 workers, include a statistically significant 70% increase in suicides among the workers with the highest recent EMF exposures. As a possible explanation for the association, they note that EMFs have been linked to lowered melatonin levels and that low levels of this hormone are thought to be connected to depression. Peek-Asa contends that even if this hypothesis is correct, it may not explain the observed increase in suicide rates: "Most cases of depression do not lead to suicide, and other mental illnesses are much more predictive of suicidal behavior." While allowing that EMFs could "exacerbate the effects of existing depression or other risk factors," she concludes that any role of EMFs "is likely to be small." Peek-Asa praises the study as "well-conducted" but points out that it lacks data on known suicide risk factors such as drug use, mental illness and family stresses. These gaps, she writes, "severely limit" the ability to determine whether the elevated risk among the exposed workers is due to such confounders. In an interview, van Wijngaarden agreed that the absence of controls for such factors "could have led to overestimation of associations." But, he stressed, "It is uncertain that these risk factors actually act as confounders, since they may not be highly correlated with EMF exposure."

MAGLEV

Government Assesses Maglev's Impact... In a few years, Maglev — magnetic levitation — trains could zoom through greater Los Angeles, Washington, Pittsburgh and Las Vegas at speeds up to 240 mph, if pilot projects being planned by the U.S. government and seven states are built. The projects' possible environmental effects are detailed in a draft statement issued by the Federal Railroad Administration. Roughly 20 of the document's 332 pages are devoted to EMFs and EMR, from static and ELF through low-frequency and up to radiofrequencies. Inside the cars of the German Transrapid system chosen for six of the seven projects, ELF magnetic fields would average 50 mG, according to the FRA. Levels along the right-of-way would be "minimal," it states. The document concludes that any adverse health impact due to EMFs would be "insignificant" and stresses that, "No public health risk associated with...Maglev systems has been clearly shown." The comment period for the draft closed September 5 and the FRA expects to release a final version by early November. For a copy of *Draft Programmatic Environmental Impact Statement — Maglev Deployment Program*, go to: <www.fra.dot.gov/s/env/maglev/MagPEIS.htm>.

MEASUREMENTS

Toll-Free Help Line... Holaday Industries Inc. has set up a help desk to answer questions about measuring non-ionizing radiation. Holaday — of course — sells meters and probes that cover the frequency band from DC to 40 GHz. The company has a variety of products: At the low end of the price scale, there is a microwave oven leakage meter that costs $339 and at the high end you can spend $10,000 to measure RF/MW electric fields. For more information, call (877) HOLADAY (465-2329), or send an e-mail to <info@holadayinc.com>.

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Request for Proposals

The Cellular Telecommunications Industry Association (CTIA) is soliciting proposals for research to be conducted under the Cooperative Research and Development Agreement (CRADA) with the U.S. Food and Drug Administration (FDA) for the first phase of research, specifically on the study of the effects of radiofrequency energy on micronucleus formation.

A copy of the full Request for Proposals (RFP) will be available by September 19, 2000, online through CTIA at <www.wow-com.com/rf> or by calling or e-mailing the CTIA CRADA administrator at (202) 785-0081 or <crada@ctia.org>.

Stay Ahead with Microwave News

Microwave News, May/June 2000

"Do Hands-Free Kits Triple Radiation Exposure? No Support for Claim by U.K. Consumer Group"

"'Safer' Phone Kit Critic Said To Be Out of Touch"

Financial Times, August 9, 2000

As We Go to Press

USAF Doctor Speaks Out on PAVE PAWS Radiation

Dr. Richard Albanese, a medical research officer employed by the U.S. Air Force (USAF), has called for more studies on the potential health effects of exposures to radiation from the PAVE PAWS radar on Cape Cod, MA. The high-power radar is operated by the USAF.

In a May 23 letter to Suzanne Condon, the director of the Massachusetts Department of Public Health's Bureau of Environmental Health Assessment in Boston, Albanese warns that the potential effects of the type of radiation emitted by the phased array radar are "completely unexplored."

"No data exist that are unambiguously relevant to the PAVE PAWS system," Albanese wrote. The "radiation field of PAVE PAWS is an overlapping set of single pulses," Albanese noted in his letter, which became public in late September. "In my opinion, controlled animal or human experimentation should be done on an urgent basis to support the claim that the PAVE PAWS radiation is safe for humans," he advised.

Albanese explained the motivation for his letter: "As a physician, this lack of testing makes me nervous indeed, and thus I report here out of a sense of conscience and concern," he wrote to Condon. Albanese works at Brooks Air Force Base in San Antonio, the home of the USAF's RF/MW radiation research labs.

The radar has drawn community opposition since it was first announced in the 1970s. Reports of higher-than-expected cancer rates have led to increasing levels of apprehension among residents. (See, most recently, *MWN,* M/A00.)

"Their concerns are not unwarranted," Albanese told *Microwave News* in a telephone interview.

In her June 16 reply to Albanese, Condon wrote that, "We do think that public health concerns [over the PAVE PAWS radar] warrant answers."

Each of the two 102-foot-wide faces of the PAVE PAWS radar is composed of 1,792 individual radiating elements. The system is powerful enough to detect missiles at a distance of 3,000 miles.

Keeping Current: Follow-Up on the News

◆ A new paper from Dr. James Trosko of Michigan State University in East Lansing and colleagues will add more fuel to the power line health debate. The new *in vitro* experimental results show that a 40 mG, 60 Hz magnetic field can cause effects similar to those of a chemical tumor promoter. The paper will appear in the October *Environmental Health Perspectives*.

◆ The papers presented at last June's *International Conference on Cell Tower Siting,* held in Salzburg, Austria, are now available (see *MWN,* J/A00). The 240-page proceedings, published in both German and English, cost 28.34 euros (approximately US$24.65) each. An order form is on the Web at <www.land-sbg.gv.at/celltower>. This site also has a summary of the individual presentations, as well as the text of the *Salzburg Resolution on Mobile Telecommunication Base Stations*.

◆ On September 20, the Norwegian National Institute of Occupational Health (STAMI) released its report on the cluster of congenital malformations among children born to sailors who served on the torpedo boat *Kvikk* (see *MWN*, J/F99). The report, which offers no firm conclusions, is at: <www.stami.no/publ/rapp/pdf/200003.pdf>. The report is in Norwegian, with an English summary on p.47.

◆ The FCC issued a public notice on August 24 reminding its licensees that they must *all* be in compliance with the commission's RF/MW rules by September 1 (see *MWN,* J/A96).

Today there is less debate over whether there is an association and more about what it means.

Even if the link is not due to bias, Dr. Martha Linet of the National Cancer Institute favors focusing research on other possible causes. "There is no risk for the 99.2% of kids with exposures under 4 mG," she argues. "There are a lot of other things we could study that would explain more than 0.8% of one type of childhood cancer." Linet is right to emphasize how little we know about children's cancer, but it is wrong to think that this makes the EMF–childhood leukemia connection unimportant.

First, while most children do not live in high-EMF environments, there are millions around the world who do. Second, the idea that there may be a health effect at four milligauss is a scientific bombshell, and this cannot be left unresolved. Third, public opposition to new power lines is an expensive problem for the electric utility industry — and it is not going to go away.

If the risk observed above 4 mG reflects a real health effect, that means that around a million children are at increased risk for leukemia in the U.S. alone (see *MWN,* M/J98). Over a million Americans — including hundreds of thousands of children — have average daily exposures above *10 mG*. The percentage of high-exposure homes is larger in North America than in Europe, due to different ways of distributing electricity, but on every continent there are millions of workers with reason to be concerned. If a 4 mG exposure can injure human health, what does that mean for garment workers? Sewing machine operators can easily average 20 or 30 mG for eight hours a day, with their legs exposed to 200 mG or more (see *MWN,* S/O95).

A biological effect from a 4 mG magnetic field is supposed to be impossible. The traditional view of non-ionizing radiation is that such exposure is safe as long as you don't get shocked or cooked. Once unquestioned, that paradigm is now in retreat. There is increasing agreement among biologists that nonthermal biological effects do exist, and there is evidence that some such effects may injure health. Impossible, according to the old theory — but it may be happening every day.

If our scientific understanding of extremely-low-frequency magnetic fields might have been so wrong, what does that mean for higher-frequency RF/MW radiation? From power lines to mobile phones to military radar, our safety standards are on shaky ground. From the IEEE to ICNIRP, it is clear they need an overhaul. It is less clear what should replace them.

Until these scientific and regulatory issues are resolved, we can be sure of one thing: Public concern about EMFs is here to stay. Parents in high-exposure homes have reason to be anxious about their children's health, and the data linking EMFs and childhood leukemia are robust enough that this is not likely to change. That has important implications for the utility industry.

Even with less of a media spotlight on EMFs in recent years, public concern has put a damper on new power line construction. Now rising demand for electricity has converged with deregulation and the decline of conservation measures to produce a loud industry campaign for more plants and more transmission lines.

But anyone who thinks parents are about to welcome high-voltage lines into their backyards is in for a rude surprise. Suburban neighborhoods have sprawled into formerly open land, which makes it more difficult than ever to build new transmission lines without plowing through population centers. The utility industry is on a collision course with the soccer moms, and the moms are not about to get out of the way.

For the sake of public health, the sake of science and the sake of economics, we need better answers about the effects of low-energy radiation. The ubiquity of technology in modern life means that we take a bath in it every day — and we're only going to be spending more time in the tub.

IEEE's Health Standards Panel: Major Changes Are Needed

The IEEE wants the health standards set by its committee on non-ionizing radiation to be recognized around the world. But there is little chance of this happening unless the committee, SCC-28, gets a good dose of reform. As it stands, SCC-28's composition is lopsided and its procedures unfair.

First, each organization should have only one vote, no matter how many of its representatives sit on a panel. At present, the subcommittee that writes RF/MW exposure limits has 64 members, more than 20% of which are from the military. The U.S. Air Force alone has seven votes. Motorola has four votes, the same as all federal health agencies combined.

Second, the committee must recruit more biologists and medical doctors. Should engineers really be in charge of writing health standards? In fact, the whole leadership of the committee should be reconstituted so that it no longer looks like a branch of the military-industrial complex.

Finally, SCC-28 should let in some daylight. Meetings should be open to all interested parties as well as the press. Working documents, including minutes of meetings and drafts of standards, should be posted on the Internet.

Another IEEE panel, the SCC-34 subcommittee that is writing the protocol for measuring cell phone radiation exposures, is already operating in just such a more open and equitable manner. The SCC-34 panel is not run by mobile phone manufacturers, but by the FCC and the FDA. Member organizations are limited to a single vote, and all draft documents and comments are automatically exchanged by e-mail or are posted on the subcommittee's Web site.

If SCC-28 wants to be taken seriously, it must make some serious changes.

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Why Not Precautionary Limits?

NCRP Should Reinstate Its RF/MW Committee

IEEE Drafts Major Relaxation of RF/MW Human Exposure Limits

Cell Phone SARs Could Be 12 Times Higher

A committee of the Institute of Electrical and Electronics Engineers (IEEE) has drafted a significantly more lenient standard for exposures of the general public to radiofrequency and microwave (RF/MW) radiation.

IEEE's International Committee on Electromagnetic Safety (ICES), commonly known as SCC-28, wants to set a single standard for all segments of the population (see p.10). The fivefold safety factor that presently is used to give children, the elderly and the infirm more protection than workers would be eliminated.

Under the new standard, a draft of which was obtained by *Microwave News,* the specific absorption rate (SAR) limit for mobile phones would jump from 1.6 W/Kg to 10 W/Kg. The committee also wants to modify the way SARs are measured. The combined effect of the two changes would be to increase by more than 12 times the allowable human exposure to cell phone radiation.

Dr. C.K. Chou of Motorola in Plantation, FL, who is leading the effort to write the new standard, said that it will be ready for public release next June.

The proposed one-tier standard would limit whole-body exposures to 0.4 W/Kg. This level now applies only to workers, but would be extended to cover exposures for the general public, replacing the current 0.08 W/Kg limit. (For the major elements of the proposed standard, see p.10.)

Under the IEEE proposal, the measurable exposure limits for the general

(continued on p.10)

WHO EMF Project Now Endorses Policy of Prudent Avoidance

In a major policy shift, the World Health Organization's (WHO) International EMF Project has endorsed prudent avoidance.

On October 3, the WHO advised that decisions on siting power lines should "consider ways to reduce people's exposures." The WHO also recommended that governments and industry should offer the public "suggestions for safe and low-cost ways to reduce exposures." The advice is contained in a fact sheet on extremely-low-frequency electromagnetic fields (ELF EMFs) and cancer.

The project's new outlook follows the decision by an expert panel convened by the International Agency for Research on Cancer (IARC) to classify ELF EMFs as "possible human carcinogens" (see *MWN,* J/A01). IARC, which is based in Lyon, France, is part of the WHO.

Three years ago, in its last fact sheet on ELF EMFs and cancer, the WHO

(continued on p.3)

Japanese Leave Little Doubt 12 mG EMFs Can Inhibit Melatonin Effect; Report Progress Towards a Mechanism

Over the last ten years, one research team after another has shown that power-frequency EMFs can block melatonin's ability to check the growth of breast cancer cells. Now Drs. Masami Ishido and Hiroshi Nitta, members of Dr. Michinori Kabuto's research group at Japan's National Institute for Environmental Studies in Tsukuba, have settled remaining doubts that the effect is real.

What the Japanese researchers have been able to do is to pin down how a magnetic field can disrupt the cell's signaling system, which mediates melatonin's anti-proliferation effects. Still missing, however, is the physical mechanism by which a magnetic field can intervene and alter these biological processes. Ishido told *Microwave News* that the team is investigating ideas from theoretical chemistry, including radical-pair theory.

Nevertheless, Kabuto's group may have finally settled a controversy that has bedeviled EMF research for a generation: There are reproducible low-level magnetic field effects.

The Japanese group is the fifth lab to repeat an experiment first reported by Dr. Robert Liburdy in 1992: A 12 mG 60 Hz magnetic field can inhibit the oncostatic action of melatonin on MCF-7 breast cancer cells (see *MWN,* J/A92).

"It's an excellent piece of work," Dr. David Blask of the Bassett Research Institute in Cooperstown, NY, told *Microwave News*. "I'm satisfied that the work has been replicated. There *is* something there." Blask himself repeated the Liburdy experiment in 1993 and, in the years that followed, three other labs reported similar findings (see *MWN,* M/A96 and J/A98).

But without a mechanism to explain the action of such a weak magnetic field, skepticism continued. For instance, in its 1999 report to Congress, the National Institute of Environmental Health Sciences pointed to concerns "about the experimental design of these studies."

"This paper should be enough for physicists who are skeptical of a 12 mG effect to reconsider," said Dr. Richard Stevens of the University of Connecticut Health Center in Farmington. In 1987, Stevens put forward the hypothesis that EMFs could suppress, either directly or indirectly, the action of melatonin and thereby contribute to the development of breast cancer.

"Rational scientists now have to embrace the data," Liburdy told *Microwave News*. "Otherwise, they are obstructing science. We need to move forward."

Another key finding of the Japanese team is that only some types of MCF-7 cells are sensitive to magnetic fields. "We have been saying all along that not all MCF-7 cells are the same," Blask said. The variation in sensitivity could explain why some labs have had a hard time repeating Liburdy's experiment.

The new Japanese results appear in the July issue of *Carcinogenesis (22,* pp.1043-1048, 2001).

« Power Line Talk »

The **NCRP** may finally release its long-delayed ELF EMF report — but without the recommendations. "I have been suggesting for two years that we publish the report as a 1998 snapshot in time, with the recommendations taken out," Dr. **Charles Meinhold**, NCRP's president, told *Microwave News* (see also p.11). But, at press time, the chair of the NCRP committee responsible for the report had not yet heard of Meinhold's plan. "It's news to me," said Dr. **Ross Adey**. His committee sent the NCRP a completed draft six years ago, which called for strong action to limit exposures above 2 mG (see *MWN,* J/A95). The report has yet to emerge from the NCRP review process. Two years ago, Meinhold announced that the council would release a draft for public discussion by the end of 1999 (see *MWN,* J/A99). It didn't. Adey, who has been working on the report since 1983, dismissed the idea of leaving out the recommendations as "ridiculous." "It's another headless monster," he said.

«« »»

In an innovative new study, **South Africa**'s Dr. **Linda de Jager** has found immunological effects among mice exposed to weak 50 Hz magnetic fields that varied over time. In a paper presented at the European Bioelectromagnetics Association meeting in Helsinki in early September, de Jager explained that she had used a variable exposure regimen to mimic the real-world environments of those who had participated in power line–cancer epidemiological studies. The mice were exposed 24 hours a day to a magnetic field that varied between 5 mG and 770 mG — with an average exposure of 27.5 mG. After 14 weeks, the mice's immune surveillance system had a decreased capacity, she reported. De Jager, who is with Technikon Free State, a university in Bloemfontein, is preparing her results for publication as she plans follow-up studies.

«« »»

Dr. **Robert Kavet** is the new head of **EPRI**'s EMF program in Palo Alto, CA. He takes over from Dr. **Leeka Kheifets**, who in July joined the WHO's International EMF Project in Geneva (see also p.3). Kavet, a longtime member of EPRI's EMF team, will also be responsible for EMC issues as well as a new program on RF safety to be launched next year. EPRI spokesperson **Jackie Turner** said that the EMF program could see some additional staffing changes, but that no decisions have been made.

«« »»

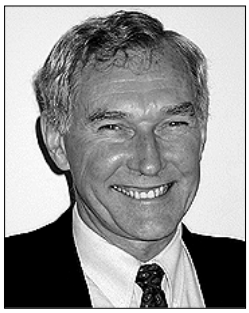
EPRI has issued a new report, *Communicating with the Public About Rights-of-Way: A Practitioner's Guide,* written by Dr. Teri Vierima of **Resource Strategies** Inc. in Madison, WI. It describes an eight-step plan to increase awareness and acceptance of new power lines. The report costs $5,000.

project took a very different view. "There is no need for any specific protective measures for members of the general public," it stated — beyond meeting the exposure limits recommended by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This standard protects against acute health hazards, such as shocks and burns, but does not address cancer risks.

At that time, Dr. Michael Repacholi, who oversees WHO's work on EMFs, told *Microwave News*: "It is not WHO's job to be recommending 'prudent avoidance' to national governments" (see *MWN,* N/D98).

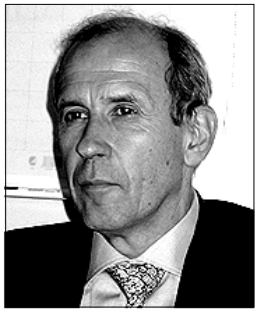
As late as last year, the EMF project advised that prudent avoidance "may be justified," but warned that "such actions should not be recommended by national authorities on health grounds." Rather, they may be appropriate to deal with individual perceptions of risks (see *MWN,* M/J00).

Repacholi was traveling and did not respond to a request for comment.



"The lower the limits, the greater the public concern."

— Dr. Michael Repacholi



"The precautionary principle cannot be applied to EMFs."

— Dr. Paolo Vecchia

The WHO now joins Germany and the U.S., among other nations, in advocating prudent avoidance based on leukemia risks to children (see p.6 and *MWN,* S/O97 and J/A99).

The new WHO fact sheet is silent on the use of precautionary exposure limits such as those that have been adopted in Switzerland and Italy (see *MWN,* J/F00 and M/A00).

Repacholi continues to oppose them. "Precautionary policies should not be applied to EMFs," he said in a talk at the opening session of the European Bioelectromagnetics Association's (EBEA) annual meeting in Helsinki on September 6.

"Introducing ad hoc additional safety factors into science-based standards as a precautionary measure undermines hundreds of millions of dollars of research for no apparent benefit to health," Repacholi said. Repacholi also argued that, "The lower the limits, the greater the public concern."

Dr. Paolo Vecchia, the president of the EBEA, holds a similar view. "I'm still not convinced that the precautionary principle can be applied," he said in an interview with *Microwave News*.

But, in a paper prepared for the EBEA meeting with two colleagues at the National Institute of Health in Rome, he wrote that invoking the precautionary principle is "justified" based on the EMF–childhood cancer risk. Vecchia, a member of ICNIRP, dismissed any apparent contradiction between the two statements.

Still Seeking Other Explanations For Childhood Leukemia Risk

WHO's Drs. Michael Repacholi and Leeka Kheifets favor more studies on EMFs and childhood leukemia. They recommend "a follow-up, focused research program to provide more definitive information."

"It remains possible that there are other explanations for the observed association," they write in the new WHO fact sheet. "Selection bias in the epidemiological studies and exposure to other field types deserve to be rigorously examined and will likely require new studies."

Both of these possible explanations were explored at the *13th Conference of the International Society for Environmental Epidemiology* in Garmisch-Partenkirchen, Germany, on September 4.

"We should seriously look at transients," Repacholi said in his presentation, pointing out that they induce currents — a well-accepted mechanism of interaction.

Kheifets commented that the recent hypothesis, championed by EPRI's Dr. Robert Kavet, that contact currents or electric shocks lead to a leukemia risk is at this point an "entirely theoretical" idea (see *MWN,* J/A00).

With respect to selection bias, Dr. Anders Ahlbom of the Karolinska Institute in Stockholm concluded that it alone is "unlikely to explain the EMF association." The data, he said in his paper in Garmisch, suggest that at most it accounts for only part of the observed excess risk.

This view was endorsed by Dr. Dan Wartenberg of the Environmental and Occupational Health Sciences Institute in Piscataway, NJ. "Given the variety of different studies in different countries using different methods, it seems unlikely that they would consistently show bias in the same direction," he said in an interview. (See also p.12.)

Dr. David Savitz of the University of North Carolina, Chapel Hill, told *Microwave News* that "selection bias remains a plausible source of the observed EMF–childhood leukemia link, though it's very hard to know exactly how plausible it is in any quantitative terms."

The WHO fact sheet notes that some epidemiological studies should help clarify these issues over the next two to three years. Kheifets, the manager of the radiation program, pointed to ongoing efforts in Italy and Japan as well as work by Dr. Patricia Buffler in California, though, she added, she doubted that they would offer final resolution.

When asked if ICNIRP will change its advice in light of the IARC decision, Dr. Alastair McKinlay of the U.K. National Radiological Protection Board (NRPB), the chair of the commission, said that any new policies would be decided at the national level.

Dr. Marco Martuzzi, who works for the WHO Regional Office for Europe in Rome, commented that some kind of precaution is warranted. "Different societies will make different choices based on the same data," he told *Microwave News*.

The new fact sheet (No.263) is available on the Web at: <www.who.int/inf-fs/en/fact263.html>.

EMFs Take a Backseat in Wisconsin Power Line Battle

As a 250-mile, 345 kV transmission line across northern Wisconsin and Minnesota nears final approval, concerns over the health effects of EMFs are playing a secondary role to the question of need in the debate about the project.

More than 20 years of research have failed to show any association between health problems and exposure to EMFs, concluded Ave Bie, chair of the Public Service Commission (PSC) of Wisconsin at an August 17 meeting. Soon afterwards, the three-member panel unanimously voted to authorize Wisconsin Public Service Corp. (WPS), an investor-owned utility, to move ahead with the project.

Bie's outlook was consistent with that of Dr. John Moulder of the Medical College of Wisconsin in Milwaukee, who appeared as an expert witness for the electric utility. On February 22, Moulder testified that, in his opinion, EMFs do not cause or promote cancer (see box at right).

Moulder's assertions went largely unchallenged. Neither of the two main groups opposing the line — Save Our Unique Lands (SOUL) and the Citizens Utility Board (CUB) — presented an expert witness on EMFs and health. "Most of our group agreed that the health issue is key," said SOUL's Roger Steffen. "But we were told by other power line activists that it's not what's going to win it for us."

Steffen, who lives in Hawkins, WI, explained that his group could afford to hire just one expert — Dr. Richard Rosen, an electrical engineer at the Tellus Institute in Boston. "We were told by PSC staff that this would be decided solely on the issue of need," Steffen said. But the PSC dismissed Rosen's contention that the strain on the grid could be eased in other ways. Bie stated that the PSC's 10,000-page record demonstrated the need for the line.

Dr. Duane Dahlberg, an emeritus professor of physics at Concordia College in Moorhead, MN, testified on EMF health effects on behalf of two smaller opposition groups, Citizens United for Responsible Electricity (CURE) and the World Organization for Landowner Freedom (WOLF). Dahlberg has long maintained that stray voltage from power lines is harmful to people and farm animals.

The proposed line will run from Duluth, MN, to Wausau in central Wisconsin, where it will connect with the existing system, bringing power from the western U.S. and Canada. The route is almost entirely in Wisconsin, except for an approximately ten-mile-long segment to be built by Minnesota Power, a unit of Allete Co.

The line will cross a thinly settled section of Wisconsin and only a few residences are within 100 feet of the centerline, according to the PSC's environmental impact statement. (The full text is available at <www.psc.state.wi.us>.) But the Minnesota segment runs through the outskirts of Duluth, a city of more than 80,000, and will pass close to many homes.

Dr. Dan Bracken, an engineering consultant based in Portland, OR, estimated the EMF exposures likely to be associated with the line on behalf of the utility (see box at right).

Moulder: IARC Classification System Is "Outdated"

On February 22, 2001, Dr. John Moulder of the Medical College of Wisconsin in Milwaukee testified on behalf of Wisconsin Public Service Corp., the utility seeking to build a 345 kV power line (see story at left). Excerpts appear below. Moulder later disclosed that he charges $180/hour as an expert witness and that he will receive up to $36,000 for his work on the project. In June, a group assembled by the International Agency for Research on Cancer (IARC) unanimously classified EMFs as 2B: possible human carcinogens (see MWN, J/A01*).*

Q: Have you reviewed the estimates of the magnetic field component of the [60 Hz] fields [as high as 88 mG at 100 feet from the centerline] associated with the Arrowhead-Weston 345 kV transmission line?

JM: Yes.

Q: Do you believe that those fields pose a risk to human health?

JM: In my opinion, there is no consistent scientific evidence that [60 Hz EMFs] of this magnitude produce any adverse effects on human health. While it is not possible in science to absolutely prove a negative, it is possible to say that this issue has been studied extensively by researchers and that no one has found consistent, reproducible evidence that [60 Hz] fields of this magnitude cause an adverse effect on human health. Consequently, based on what we know today, it cannot be demonstrated that the [60 Hz] fields calculated to be produced by this line create a risk to human health....

Q: [W]hy, in 1998, did a working group assembled by the NIEHS conclude that [60 Hz] fields should be placed in IARC Class 2B as a "possible human carcinogen"?

JM: There appear to be several reasons for this statement by the working group....[It] had very little time to write the report (less than two weeks), its report was not peer-reviewed and the report is full of mistakes....[I]n the IARC classification scheme Class 2B is effectively the lowest category.

Q: Do you think that the working group misapplied the IARC guidelines in placing [60 Hz] fields in Class 2B?

JM: Yes....

Q: If you were to use the IARC classification system, to what category would you now assign [60 Hz] fields with respect to human cancer?

JM: The IARC classification system is outdated and is no longer particularly useful for classifying substances because it does not take into account our increased understanding of carcinogenesis. That is, it gives little weight to animal, cellular or mechanistic studies. But, if I were forced to use the IARC criteria, in my opinion [60 Hz] fields should be placed in IARC Class 3: "Not classifiable as to carcinogenicity."

Q: Do you have an opinion...whether [60 Hz EMFs] have been demonstrated to have adverse human health effects?

JM: I do. In my opinion, no causal relationship between exposure to [60 Hz EMFs] and adverse human health effects has been established.

Q: What is the consensus of the scientific community...?

JM: The consensus of the scientific community is that [60 Hz EMFs] have not been shown to adversely affect human health....

The PSC will instruct the utilities to use EMF-reducing wiring configurations "wherever possible," according to spokesperson Jeff Butson. Such measures will be spelled out in the commission's formal authorization for the project, which is slated to be issued by the end of October.

Steffen said that SOUL may mount a legal challenge of the project. CUB has already filed suit in state court, alleging conflicts of interest in the PSC and improper changes in the utilities' proposal.

The project will now move forward unless a judge issues an injunction, Butson told *Microwave News*. Construction is expected to begin early next year.

An Assortment of New Epidemiological Findings

Peter Bethwaite, Angus Cook, Josephine Kennedy and Neil Pearce, "Acute Leukemia in Electrical Workers: A New Zealand Case-Control Study," *Cancer Causes and Control, 12,* pp.683-689, October 2001.

"The occupational and environmental exposure histories of 110 incident leukemia cases and 199 general population controls were compared....For subjects classified as having worked in one or more of the 'electrical occupations,' the degree of exposures to ELF EMFs was assessed in detail using a job-exposure matrix....An odds ratio of 1.9 (95% CI=1.0-3.8) was found for subjects who had ever worked in an electrical occupation. Significantly increased risks for leukemia are seen among welders/flame cutters (OR=2.8, 95% CI=1.2-6.8) and telephone line workers (OR=5.81, 95% CI=1.2-27.8)....A dose-response effect was also found, with acute leukemia risk rising with increasing occupational magnetic field exposure, based on both current and historical occupational field exposure estimates."

S. Davis, W. Kaune, D. Mirick, C. Chen and R. Stevens, "Residential Magnetic Fields, Light-at-Night and Nocturnal Urinary 6-Sulfatoxymelatonin [6-OHMS] Concentration in Women," *American Journal of Epidemiology, 154,* pp.591-600, October 1, 2001.

"[For] 203 women aged 20-74 years with no history of breast cancer ...lower nocturnal urinary 6-OHMS level was associated with more hours of daylight, older age, higher body mass index, current alcohol consumption and current use of medications classified as beta blockers, calcium-channel blockers or psychotropics. After adjustment for these factors, higher bedroom magnetic field level was associated with significantly lower urinary concentration of 6-OHMS during the same night, primarily in women who used these medications and during times of the year with the fewest hours of darkness....The results reported here provide intriguing suggestions that exposure to magnetic fields in the home...at night is sufficient to depress the normal nocturnal rise in circulating melatonin....[T]hese effects were associated with relatively low levels of exposure and focus attention on the possibility that they occur primarily in persons whose melatonin levels are already low or perhaps are more susceptible to change." (See *MWN*, N/D97.)

Patrick Levallois et al., "Effects of Electric and Magnetic Fields from High-Power Lines on Female Urinary Excretion of 6-Sulfatoxymelatonin," *American Journal of Epidemiology, 154,* pp.601-609, October 1, 2001.

"A sample of 221 women living near a 735 kV line was compared with 195 women of the same age living away from power lines....After adjustment for other factors associated with low melatonin secretion, such as medication use or light exposure, nighttime concentration of 6-OHMS was similar in the two groups....However, the trend of decreasing 6-OHMS concentration with age was more pronounced for women living near the lines, as was a lower 6-OHMS concentration in women with high body mass index. Chronic residential exposure to magnetic fields from high-power lines may accentuate the decrease in melatonin secretion observed in some vulnerable subgroups of the population.... Decreased nocturnal 6-OHMS concentration could be due either to a displacement of the secretion peak or a reduction in overall melatonin secretion. Our protocol could not distinguish these two...."

A. De Roos, K. Teschke, D. Savitz, C. Poole, S. Grufferman, B. Pollock and A. Olshan, "Parental Occupational Exposures to Electromagnetic Fields and Radiation and the Incidence of Neuroblastoma in Offspring," *Epidemiology, 12,* pp.508-517, September 2001.

"Cases were 538 children diagnosed...between 1992 and 1994 in the U.S. and Canada....Maternal exposure to a broad grouping of sources that produce [RF] radiation was associated with an increased incidence of neuroblastoma (OR=2.8; 95% CI=0.9-8.7)....Paternal average ELF magnetic field exposure >0.4 μT [4 mG] was weakly associated with neuroblastoma (OR=1.6; 95% CI=0.9-2.8)....Although our results are suggestive, a viable biologic mechanism has yet to be identified for a causal relation between parental exposures to [RF] radiation and neuroblastoma in offspring....The data indicate that any effect of paternal exposure to ELF EMFs is probably weak, and likely occurs only past an upper threshold of exposure. Our results indicate possible effects of maternal and paternal [RF] exposures on neuroblastoma, but the sparse data do not allow firm conclusions." (See also A. Olshan et al., "Neuroblastoma and Parental Occupation," *Cancer Causes and Control, 10,* pp.539-549, December 1999.)

E. van Wijngaarden, L. Nylander-French, R. Millikan, D. Savitz and D. Loomis, "Population-Based Case-Control Study of Occupational Exposure to Electromagnetic Fields and Breast Cancer," *Annals of Epidemiology, 11,* pp.297-303, July 2001.

"This...study examined occupational exposure to EMFs in relation to female breast cancer incidence among 843 breast cancer cases and 773 controls....Female breast cancer was not associated with employment as an office or industrial worker....Moderately elevated risks were found for intermediate but not high levels of cumulative exposure accumulated 20 or more years ago (OR=1.5; 95% CI=1.1-2.0). Associations were stronger for premenopausal women (OR=1.7; 95% CI=1.1-2.7) in the past 10-20 years, and those with estrogen-receptor positive (ER+) breast tumors (OR=2.06; 95% CI=1.1-4.0). No consistent dose-response patterns were observed....These findings give little support to the hypothesis that EMFs cause cancer of the female breast....The results of our study suggest an increased risk of breast cancer among premenopausal women with ER+ breast cancer cells in relation to employment as industrial worker, an occupational category with the highest measured exposure...." (See also *MWN*, S/O98 and J/F00.)

T. Sorahan, L. Nichols, M. van Tongeren and J. Harrington, "Occupational Exposure to Magnetic Fields Relative to Mortality from Brain Tumors: Updated and Revised Findings from a Study of United Kingdom Electricity Generation and Transmission Workers, 1973-1997," *Occupational & Environmental Medicine, 58,* pp.626-630, October 2001.

"The mortality experienced by a cohort of 83,997 employees of the former Central Electricity Generating Board...was investigated....[D]eaths from brain cancer were close to expectation (observed 158, expected 146.4). No significant positive trends were shown for risks of brain tumors either with lifetime cumulative exposure to magnetic fields or with such exposures received in the most recent five years....The U.S. five-utility study [Savitz & Loomis, 1995] provided positive findings; but given

the results from the other studies, these positive findings may well be due to chance." (See also *MWN,* J/F95 and M/J01.)

David Savitz, "Occupational Exposure to Magnetic Fields and Brain Cancer" (editorial), *Occupational & Environmental Medicine, 58,* pp.617-618, October 2001.

"To help assess the current state of knowledge about cancer among electric utility workers, we recently undertook a coordinated analysis of three of the largest studies to examine differences in methods and attempt to reconcile results....At least for electric utility workers...we seem to have a fairly complete answer for brain cancer. We may well be doing a disservice not to share the good news more energetically and widely — electric utility workers and other similar such workers do not seem to be at measurably increased risk of brain cancer....For now...on the restricted topic of typical time-weighted average occupational exposure to [EMFs] and brain cancer, further study of the type done thus far is not needed. This conclusion does not, however, apply to research on residential exposure; nor does it argue against the potential value of studies of occupational exposure to [EMFs] relative to less extensively investigated health end points, such as breast cancer or neurodegenerative disease."

HIGHLIGHTS

Finns Find Cell Phone Link to Brain Cancer—But Dismiss It

A team of Finnish researchers led by Dr. Anssi Auvinen of the University of Tampere has found a significant association between the use of a mobile phone and the development of brain cancer. But Auvinen is discounting his own results.

In a presentation at the European Bioelectromagnetics Association (EBEA) meeting in Helsinki on September 7, Auvinen said that he has more confidence in the three recent epidemiological studies that did not see a mobile phone–cancer link. He was referring to U.S. studies conducted by the American Health Foundation and the National Cancer Institute and the study by the Danish Cancer Society (see *MWN,* J/F01 and M/A01).

Dr. Birgitta Floderus of the Karolinska Institute in Stockholm, who chaired the session, expressed surprise at Auvinen's outlook. "It's quite convincing to me that there is an association," she said in the discussion period after his talk.

"It has to be taken in the context of other findings," Auvinen replied. "The fact that [the others] did not find a risk outweighs our results." He added: "If [ours] was the first and only study, I would put much more emphasis on the results."

"Our study was designed as a feasibility study," Auvinen later told *Microwave News*. "It's more of a pilot study."

The Finnish case-control study consisted of 398 brain tumors and 34 cancers of the salivary gland diagnosed in Finland in 1996. For those using the Nordic analog system, known as NMT, there was a statistically significant doubling of the risk of developing a glioma. For those who had used either an analog or a digital phone, the risk was 50% greater than expected.

Auvinen declined to review his results following his talk, arguing that doing so might jeopardize the chances of their publication. He said that he has submitted a paper to *Epidemiology*.

Auvinen is working on the Finnish component of the multinational epidemiological study being coordinated by the International Agency for Research on Cancer (IARC), known as the "interphone" study (see *MWN,* J/F98 and S/O98). Data collection is halfway completed in Finland, he said.

Also at the EBEA meeting, Dr. Elisabeth Cardis reviewed the current set of epidemiological studies and found them "inconclusive." Cardis, the chief of IARC's radiation and cancer unit in Lyon, France, and the head of the interphone study, said that at present one "cannot rule out the existence of a small individual risk of potential public health importance."

Auvinen agreed that, overall, the data are "inconclusive."

In his presentation, Auvinen pointed to a number of methodological problems that undermine his results. For instance, he was unable to identify the users of company phones. In addition, Finns under 18 are not allowed to have their own phone accounts and therefore their use cannot be tracked. He noted further that there was no information on which side of the head a user places a phone, nor on the model of the phone used or whether a hands-free set was used.

German Radiation Commission Endorses Prudent Avoidance

Germany's Radiation Protection Commission is recommending a policy of prudent avoidance.

In a report released on September 14, the panel — known by its German acronym SSK — states that it has confidence in the ICNIRP standards. But it calls for "minimizing" exposures to both ELF and RF/MW EMFs to the extent "technically and economically reasonable," especially in locations where people spend extended periods of time.

The SSK recommends that emissions from consumer appliances, including mobile phones, be kept as low as possible and that product labels indicate emission levels.

The SSK also argues for more health effects research.

The Federal Environment Ministry, which is revising Germany's EMF safety rules, requested the report (see *MWN,* S/O97). In July, the ministry announced that it was weighing precautionary exposure limits for mobile phone base stations, but would wait for SSK's advice (see *MWN,* J/A01).

The SSK's principal expert on non-ionizing radiation is Dr. Jürgen Bernhardt, who is the vice chair — and a past chair — of ICNIRP and a former head of Germany's Radiation Protection Office.

On July 31, the radiation office's current director, Wolfram König, advised against the use of mobile phones by children and called for restrictions on base station antennas near schools and hospitals (see *MWN,* J/A01).

The full text of the SSK's 56-page report, *Limits and Precautionary Measures to Protect the Public Against Electromagnetic Fields,* is available in German at <www.ssk.de>.

« Wireless Notes »

European health research on mobile phones continues to expand. The **European Commission** (EC) is adding two new projects to its already sizable RF/MW program (see *MWN,* M/A00). One is on potential impacts of mobile phone radiation on hearing and cognitive function; the other addresses possible neurological effects. **Callum Searle**, the EC program manager in Brussels, said that the contracts are still under negotiation and offered to give specifics when they have been finalized. In addition, another set of studies, which were coordinated by the Mobile Manufacturers Forum (**MMF**) and the **GSM Alliance** but were not funded by the EC program, will now go forward (see *MWN,* J/A99). These studies include a set of *in vitro* experiments as well as an animal experiment designed to repeat a behavioral study by Dr. **Henry Lai** of the University of Washington, Seattle. Dr. **Bernard Veyret** of the University of Bordeaux is coordinating this effort, known as PERFORM–B. It will be sponsored in part by the MMF and the GSM Alliance, as originally planned. In addition, each of the participating European labs raised matching funds from their respective national governments.

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At its first official meeting held in Brussels, September 26, **COST 281** elected Dr. **Norbert Leitgeb** of Austria's Graz University of Technology as its chair. He replaces Dr. **Ulf Bergqvist**, who died suddenly two weeks earlier (see p.16). Finland's Dr. **Maila Hietanen** and France's Dr. **René de Seze** are the vice chairs and FGF's **Gerd Friedrich** is the secretary of the new group on the ***Potential Health Implications from Mobile Communication Systems***. COST stands for European Cooperation in the Field of Scientific and Technical Research. COST281 is coordinating a workshop in Brussels in October and working with FGF on its microdosimetry meeting in December (see p.14). In addition, members of COST281 are planning to write a response to Dr. **Gerard Hyland**'s recent report for the European Parliament (see *MWN,* J/A01). For more information, go to the committee's Web site <www.cost281.org>.

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A leading Swiss insurance company will contest paying any costs stemming from class-action lawsuits that would force phone manufacturers to provide headsets for mobile phones. On July 23, Zurich North America in Schaumburg, IL, a unit of **Zurich Financial Services Group** in Switzerland, asked state courts in New York and Texas to exempt it from paying any such claims, ac-

Swedish Scientists in Public Row over Statements to the Press on the Health Risks of Mobile Phone Radiation

Five prominent Swedish professors have attacked Drs. Lennart Hardell and Olle Johansson in an unsolicited letter to one of the country's leading daily newspapers.

Under the headline RESEARCHERS WHO TALK NONSENSE published in the September 3 *Svenska Dagbladet,* the five denounce those who fabricate and misrepresent data, exaggerate their results and speculate beyond their area of expertise. They cite no names but leave no doubt that they are taking aim at Hardell and Johansson's public statements on the health risks associated with mobile phones.

The five professors* specifically criticize a June 6 press release issued by Hardell and Dr. Kjell Hansson Mild, which describes their new study pointing to a brain tumor risk from the use of cell phones (see *MWN,* J/A01). "We feel it is inappropriate to discuss pilot studies in the media," they write.

They also dismiss as "probably a random finding" Hardell's observation, in a previous paper, that cell phone users are more likely to develop a tumor on the side of the head they used the phone (see *MWN,* M/J99). The professors contend that Hardell's interpretation of the data is "biologically bizarre."

Johansson is rebuked for telling the Swedish tabloid *Aftonbladet* (March 12) that mobile phones may lead to mad cow disease by allowing toxic proteins to pass through the blood-brain barrier.

"Scientists who report unpublished findings in the media or exaggerate their own findings do damage. This has happened too often in EMF research and it destroys the reputation of the whole field," Dr. Anders Ahlbom told *Microwave News*. "Hardell has been doing a lot of this." Ahlbom is leading the Swedish component of the IARC "interphone" study on cancer risks from mobile phones (see p.6).

Both Hardell and Johansson see the letter as an attack on their freedom of speech. "The basic question is whether Sweden should allow scientists to debate new ideas in daily newspapers or if they should be controlled by a censorship board," Johansson said in an interview with *Microwave News*. Johansson, like four of those who wrote the letter, is at the Karolinska Institute.

In a reply published in the September 11 *Svenska Dagbladet* (ATTACKS ON INDIVIDUALS DO NOT HELP CANCER RESEARCH), Hardell charges that Ahlbom may not be fit to run the cell phone–brain tumor study: "If he has the preconceived notion that there is no link, then it is doubtful that he is sufficiently objective to direct the study." Hardell is a professor of oncology at Örebro University.

Hardell has also prepared a more detailed response, which reviews his work on dioxin and pesticides as well as on mobile phones. He calls the five professors a "little clique" that is waging a "sweeping smear campaign." The article will appear soon in the Swedish medical journal *Medikament* under the headline THE PRECAUTIONARY PRINCIPLE IS A WISER APPROACH.

Dr. Hans-Olov Adami, one of the signers of the letter, cowrote an editorial in the *New England Journal of Medicine* (January 11, 2001), which contended that the study by the National Cancer Institute "allays fears raised by alarmist reports that the use of cellular telephones causes brain tumors" (see *MWN,* J/F01).

The letter was signed by Drs. Hans-Olov Adami, Anders Ahlbom, Anders Ekbom and Magnus Ingelman-Sundberg, all of the Karolinska Institute in Stockholm, and Dr. Lars Hagmar of Lund University.

cording to an August 15 report from Mealey Publications, a leading source of information on insurance litigation. Zurich North America contends that the liability policies it issued to **Audiovox** and **Nokia** from 1987 until 2000 contain clauses that exclude damages such as those that could result from the lawsuits being mounted by **Peter Angelos** in Baltimore and others (see *MWN,* M/J01). The company also requested that it be released from any responsibility for the phone makers' legal bills. In 1999, Lloyd's of London stated that it would not cover mobile phone manufacturers for damages related to health risks (see *MWN,* M/A99). Zurich North America was previously known as Zurich-American Insurance Co.

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Is it the heat from the battery or the microwave radiation that is causing **headaches** among users of mobile phones? Dr. **Bruce Hocking**, one of the first to draw attention to such neurological symptoms (see *MWN,* N/D95), says that he now has clear evidence pointing to radiation. In a case report published in the September issue of *Occupational Medicine (51,* pp.410-413, 2001), Hocking and Dr. **Rod Westerman** write that a 31-year-old man who climbs towers and installs antennas suffered headaches after he was accidentally exposed to digital phone radiation from a low-powered base station. The tower worker also complained of fatigue and blurred vision, and had abnormal responses to nerve stimulation tests — a symptom that the two physicians, who are both based in Melbourne, Australia, have previously linked to phone use (see *MWN,* S/O00 and N/D00). They estimate that, during the 1-2 hours the antenna was left on, his exposure to the 900 MHz CDMA signal was no higher than 60 $\mu W/cm^2$ — which they note is "well below current safety levels." Hocking, who specializes in occupational health, and Westerman, a neurophysiologist, conclude that, because of the absence of confounders such as heat from the handset or the posture of the user, the case shows that "the previously reported unpleasant sensations...and permanent neurological changes" are due to RF/MW radiation.

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In **Singapore**, government officials are seeking to allay public concern about phone safety by citing reassurances from the **WHO International EMF Project**. "As long as the exposure is below international guidelines, it is safe," Dr. Clarence Tan, the head of Singapore's Health Sciences Authority (HSA), told the *Straits Times* (August 17). Tan explained that, according to the project, radiation emitted by phones is too weak to damage tissue. The WHO's conclusions are "global benchmarks" and "definitive," he said. Under rules issued by Singapore's Info-Communications Development Authority last year, SARs for GSM digital phones can be up to 10 W/Kg — the limit set by the U.K.'s NRPB (see <www.ida.gov.sg>). Tan discounted a survey by Dr. Sin-Eng Chia of the National University of Singapore that linked phone use to headaches (see *MWN,* J/A00). "It is always dangerous to take anecdotal evidence and generalize it," he said. But the Consumers Association of Singapore (CASE) contends that the government is misrepresenting the WHO's position. CASE, which has been pressing the government to mandate phone labels with information on SARs and possible health hazards, sought clarification from Geneva. In an August 22 press release, CASE quoted Dr. **Leeka Kheifets**, the EMF project's new manager, stating that, "Whilst current information does not point to the normal use of mobile phones as a health problem, the technology is new and there are gaps in knowledge which require further research." The government is still trying to decide whether to require labels, the *Straits Times* reported. (See also p.18.)

EMR Network: FCC Should Weigh Tighter RF/MW Rules

The EMR Network has asked the FCC to begin moving toward stricter RF/MW exposure guidelines. The network is an umbrella organization of grassroots groups fighting telecommunications towers.

"Leading scientists believe that the present standards may not adequately protect workers and the public," Janet Newton of Marshfield, VT, the director of the EMR Network, told *Microwave News*. Previously, the network failed to convince a federal court to set aside the FCC's exposure rules (see *MWN,* N/D97, M/A00 and J/F01).

In a petition filed on September 25 by Washington attorney James Hobson of Miller & Van Eaton, the EMR Network contends that the 1992 ANSI/IEEE guidelines and the 1986 NCRP standard, on which the FCC's current rules are based, are out of date. The network wants the FCC to set the process in motion by issuing a "notice of inquiry."

The petition cites extensively from a 1999 letter written by the government's RF Interagency Working Group outlining 14 issues that should be addressed "to provide a strong and credible rationale" for exposure guidelines (see *MWN,* J/A99 and also p.11).

The FCC has long maintained that it relies on the advice of government health agencies in setting RF/MW safety standards — for instance, the EPA, FDA, OSHA and NIOSH. In the October 2001 issue of the *Health Physics Society Newsletter,* FCC's Dr. Robert Cleveland writes that the FCC's RF/MW rules, adopted in 1996, are "largely based" on their recommendations.

An IEEE committee is in the process of revising its 1992 guidelines (see p.1), while a parallel effort by the NCRP has been scrapped (see p.11).

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The **Swiss government** and the **wireless industry** are at odds over how to interpret the country's precautionary limits for RF/MW radiation from cell towers. The Federal Agency for Environment, Forests and Landscape (known as **BUWAL**) is proposing to tighten its rules — already the world's strictest — by including the radiation from *all* antennas at a given site when determining whether exposures exceed the 4 V/m (4 $\mu W/cm^2$) limit (at 900 MHz). In an August 24 statement, the Swiss Information and Communications Technology Association (**SICTA**), an industry lobby group, maintains that such an interpretation would "hinder the development of mobile communications." Instead, SICTA calls for treating antennas as separate sites as long as they are operated by different carriers. SICTA argues that this would have the aesthetic advantage of consolidating antennas, thereby avoid-

ing "forests of towers." Switzerland's law on non-ionizing radiation does not define an "installation" except for stating that it includes several antennas on the same tower or in "close proximity" to each other (see *MWN*, J/F00 and N/D00). Local officials have interpreted this language in various ways, prompting BUWAL to step in to ensure that the rules are enforced consistently across the country. The agency's draft guidelines, released for public comment in March, define antennas as being part of the same site if they are within 100 meters of each other—in effect, leading to an ambient exposure limit of 4 V/m (see *MWN*, N/D00). In August, BUWAL expressed concern that the industry's approach would result in "massive violations of the limits." A final decision is expected next year.

Controversy Continues over Cancer near Vatican Antennas

An updated epidemiological analysis has again shown that rates of leukemia near the Vatican's radio transmitters in Cesano, outside Rome, are higher than expected.

But these results have been sharply disputed by a panel convened by the Italian Minister of Health. In its report, released in mid-September, the four-member panel concluded that such studies have "little possibility of producing useful insights into the association between EMFs and leukemia."

In a paper presented on September 4 at the *13th Conference of the International Society for Environmental Epidemiology,* held in Garmisch-Partenkirchen, Germany, Dr. Paola Michelozzi reported that the incidence of childhood leukemia was twice the expected rate within a 6 km radius of the Vatican transmitters. This estimate is just short of statistical significance.

In addition, Michelozzi, who is with the regional health authority in Rome, found that the risk among males of dying from leukemia declined with distance from the radio antennas, as did the incidence of leukemia. Both of these trends are statistically significant.

Michelozzi cautioned that, while her results are consistent with those covering an earlier time period, they may be due to chance because the number of cases is small. "These are not conclusive findings," she said. Nevertheless, she advised, some measures may be justified, "using the precautionary principle as a guide."

The report to the Minister of Health takes a very different view, dismissing efforts like Michelozzi's in no uncertain terms. It contends that there is no excess leukemia risk within 10 km of the transmitters, that there is no trend of decreasing risk with distance from the antennas and that distance is an inappropriate surrogate for RF exposure. (See box at right for the report's major findings.)

The four members of the panel, who have not previously worked on RF health effects, cite with apparent approval the assessment of the WHO EMF project that "the hypothesis that RF can cause or promote growth of tumors is highly unlikely."

Michelozzi told *Microwave News* that she was disappointed with the health ministry's report and that she is preparing a written response. She noted that the results of the panel's reanalysis of the cancer data pointed to a statistically significant increase in mortality among women living within 4 km of the antennas.

The panel was appointed by Dr. Umberto Veronesi, the former Italian Minister of Health, who has been an outspoken critic of those who are concerned about non-ionizing radiation. A few weeks before he convened the working group, he told the press that he was convinced that electromagnetic radiation is not a cancer agent (see *MWN*, M/J01).

The issue of electrosmog was front-page news in Italy for most of this spring. At one point, the Italian cabinet became so polarized that the minister of the environment, Willer Bordon, resigned — though only for a short time — when it appeared that the prime minister might not support his demand that the Vatican comply with Italy's strict standard for RF/MW radiation.

On August 31, Radio Vatican announced that it would be in compliance with Italy's 6 V/m exposure limit as of September 1.

Report to Italian Health Minister on Leukemia and Vatican Transmitters

Excerpted below are the conclusions of Current Status of Scientific Knowledge Concerning Radiofrequency Waves and Childhood Leukemia, with Specific Reference to the Situation in the Cesano Area, *dated September 3 and released in mid-September.*

The Italian Minister of Health requested the report on April 10, 2001. It was written by a four-member panel: Dr. Donato Greco, Laboratory of Epidemiology and Biostatistics, Istituto Superiore di Sanità, Rome; Prof. Peter Boyle, Imperial Cancer Research Fund, London, and the European Institute of Ecology in Milan; Dr. Giuseppe Masera, Pediatric Clinic of Monza Hospital, University of Milan; Prof. Roland Mertelsmann, Department of Hematology, University of Freiburg, Germany.

- Countless studies on animals, cell lines and other biologic models support an absence of a significant biologic effect of EMFs and RF such that it is highly unlikely that an effect exists in man.
- Ecologic studies, such as those conducted by the [regional health authority of Lazio] in the Cesano area, have little possibility of producing useful insights into the association between EMFs and leukemia, especially when precise data on individual exposure are lacking, and may result in public concern that is not subsequently validated by scientific data.
- The data examined did not show a relationship between the emissions of the Radio Vatican installation of S. Maria di Galeria and the incidence and death rate from childhood leukemia.
- The postulated association between distance from the installation and the declining incidence of childhood leukemia was not verified.
- The data...did not provide evidence that distance was an effective surrogate for the intensity of exposure of the population and therefore were not a valid measure of a possible association between exposure to the radio transmitter installation and childhood leukemia.
- The expected number of cases was too small to demonstrate, using ecologic study methods, an association between the exposure and the outcome.
- The difficulty in measuring exposure makes it difficult to draw meaningful conclusions.

population would increase from 200 μW/cm^2 between 100 and 300 MHz to 1 mW/cm^2, or 1,000 μW/cm^2. At other frequencies, the power densities would be higher.

"The IEEE charged our committee to produce a science-based standard," Dr. Eleanor Adair, the newly installed chair of SCC-28, told *Microwave News*. "It's hard for many of us to justify a second tier based on sociopolitical considerations." Adair is at Brooks Air Force Base (AFB) in San Antonio (see p.17).

Richard Tell, a consultant based in Las Vegas who is taking a leading role in drafting the new standard, said that the committee is not concerned about public reactions. "We are having a technical discussion," he said.

But Ron Petersen, the secretary of SCC-28 and a member of its executive committee, acknowledged that there might be resistance to the new proposal. "A one-tier standard makes sense scientifically," he said, "but politically it will be very hard to sell it." Petersen recently retired from Lucent Technologies and is now a consultant based in Bedminster, NJ.

Adair, Petersen and Tell each said that the standard is still under discussion and could change in the months ahead. "A straw man has been proposed, but it has not yet been discussed," Adair stressed. Tell said that, "It is a preliminary, internal draft."

Meetings of the SCC-28 revision working group that developed the proposed limits, which is chaired by Motorola's Chou, are closed to outside observers. Last year, Chou told *Microwave News* that, "The presence of the press is detrimental to free discussion" (see *MWN,* S/O00).

With the decision by the NCRP's board of directors to stop the revision of its 1986 RF/MW exposure guidelines under the chairmanship of Dr. James Lin, the ICES standard will undoubtedly gain in importance (see p.11). "This probably means that in the future we will look to the IEEE and ICNIRP for guidance on exposure limits," said Dr. Robert Cleveland of the Federal Communications Commission (FCC).

The FCC requires all new mobile phones to meet an SAR limit of 1.6 W/Kg, averaged over 1g of tissue. The proposal would not only raise the SAR to 10 W/Kg, but would also increase the averaging volume to 10 g. Lin, for one, has strenuously opposed such a change in averaging volume, arguing that it is not "scientifically defensible" (see *MWN,* J/A00). He has stated that an SAR of 2 W/Kg averaged over 10 g, the standard adopted by ICNIRP, is equivalent to an SAR of 4-6 W/Kg averaged over 1g (see *MWN,* N/D00). The new 10 W/Kg proposal would therefore be equivalent to an SAR of 20 W/Kg or greater, averaged over 1g.

Last summer, tensions beween ICNIRP and the IEEE came out into the open, with members of each standards-setting group claiming that their limits are the ones that are based on science (see *MWN,* J/A00). Representatives from the two groups have met to try to iron out their differences under the banner of international standards harmonization, but it is not clear how productive those efforts have been.

Although the proposal that has emerged from Chou's working group represents a major relaxation, Adair had sought an even greater loosening of the exposure limits. She had backed an alternative proposal for an SAR standard of 1 W/Kg — in effect, allowing public exposures to be increased more than tenfold. This proposal came to be known by the slogan "1-1-1": 1 W/Kg, one tier, in one year. "It even rhymes," commented a member of the committee.

Adair credited the 1-1-1 formulation to Dr. Martin Meltz of the University of Texas Health Science Center in San Antonio. She said that, while she still favors a 1 W/Kg limit, she "will go with 0.4 W/Kg, if that is the consensus."

The committee's preference for a single-tier standard emerged at an SCC-28 meeting last year at which no representatives of the federal health agencies were present (see *MWN,* M/J00).

The new draft standard has not been widely circulated and it is not yet clear how federal health officials will react to the proposed loosening of the limits.

In 1999, Dr. Gregory Lotz of the National Institute for Occupational Safety and Health (NIOSH) wrote to SCC-28 on behalf

Current & Proposed IEEE Limits 0.1 MHz to 3 GHz (W/Kg)

	Current§		Proposed
	Public	Workers	Public & Workers
Whole-Body Average	0.08	0.4	0.4
Spatial Peak	1.6*	8.0*	10.0†
Extremities‡	4.0†	20.0†	25.0†

*1 g averaging volume †10 g averaging volume

‡Hands, wrists, feet, ankles and the pinna of the ears.

§*IEEE C95.1-1991, Standard for Safety Levels with Respect to Human Exposure to Radiofrequency Electromagnetic Fields, 3 kHz to 300 GHz.* The standard makes a distinction between "controlled" and "uncontrolled" exposures, rather than between the workers and the general public.

One Tier or Two?

Whether the revised IEEE RF/MW standard should have one or two tiers was discussed at the IEEE SCC-28, Subcommittee 4 meeting held in St. Paul, June 8-9. Reprinted below is the discussion from the subcommittee's unapproved minutes. For more on this debate, see MWN, *M/J00.*

[Dr. Mays Swicord of Motorola] said that one option is a single-tier standard that could be relaxed for certain occupational exposures under certain conditions. [Dr. Tom] McManus [of Ireland's Dept. of Public Enterprise] pointed out that the report of the Stewart Independent Expert Group on Mobile Phones discredited the NRPB single-tier limits and recommended adoption of the ICNIRP recommendations in the U.K. — as a precaution. Swicord pointed out that the Stewart report was not a scientific response. In response to a question from [Dr. Martin] Meltz [of the University of Texas Health Science Center], Swicord said that the paper being prepared by [Dr. Linda] Erdreich [of E^{x}ponent Inc.] and [Deborah] Sena [of Lucent Technologies] is the framework for a white paper — it essentially describes the choices but needs further discussion and review. [Dr. Aviva] Brecher [of the Department of Transportation] said that IEEE would lose credibility if a single tier is adopted. [Dr. Eleanor] Adair [of Brooks Air Force Base] disagreed, pointing out that if two tiers were adopted the decision would not be science-based but would be political — the same as was done in 1989.

of the federal government's RF Interagency Working Group (RFIAWG). Lotz listed 14 issues that those developing the new standard should address "to provide a strong and credible rationale to support RF exposure guidelines" (see *MWN,* J/A99). "We are still hopeful that the SCC-28 will address those issues," Lotz told *Microwave News* at the end of September.

SCC-28's subcommittee 4, which is drafting the new standard, will hold its next meeting January 18-20 in San Antonio.

NCRP Disbands Committee Revising RF/MW Guidelines; Concerns Raised About Conflict with IEEE SCC-28

The board of directors of the National Council on Radiation Protection and Measurements (NCRP) has closed down its committee that was updating the council's report on RF/MW exposure limits.

In a September 6 letter to Dr. James Lin, the chair of NCRP Committee 89-5, NCRP President Dr. Charles Meinhold stated that the board believed that "timely completion of the report was unlikely."

Meinhold told *Microwave News* that Ron Petersen had recommended that the committee be disbanded because it was in the process of reorganizing for the third time, causing further delays. Meinhold also noted that the NCRP is having "a lot of financial problems."

"It looked like the committee would self-destruct," Petersen explained. He is the NCRP's vice-president for non-ionizing radiation and a member of the council's board of directors. Petersen is also the secretary of IEEE's SCC-28 committee, which is in the process of revising its own exposure limits (see p.1). Previously with Lucent Technologies' Bell Labs, Petersen recently became a consultant,

Dr. Marvin Ziskin of Temple University in Philadelphia, who is also on the NCRP board, said that, "The fundamental problem seems to be that the committee was dead in the water."

"I was quite surprised by the decision," Lin said in a telephone interview. "I was not consulted whatsoever." Lin is at the University of Illinois in Chicago.

Norbert Hankin of the Environmental Protection Agency in Washington was also startled by the news. "It came as a shock," he said.

A number of observers wondered aloud whether the long-standing rivalry between the NCRP and the IEEE's SCC-28 committee had colored Petersen's outlook and had led to the board's decision.

"I think that there was an obvious competition between the NCRP and SCC-28 and the NCRP lost," said NIOSH's Dr. Gregory Lotz, a member of the 89-5 committee. "I'm disappointed," he added. "It's a loss to the professional community."

Lin was charged with revising NCRP's report on *Biological Effects and Exposure Criteria for RF Electromagnetic Fields* six years ago (see *MWN,* S/O95). Drs. Eleanor Adair of Brooks AFB and C.K. Chou of Motorola were among those appointed to the committee to work with Lin.

Soon afterwards, in March 1996, as the Federal Communications Commission (FCC) was in the process of developing its RF/MW safety rules, the leadership of SCC-28 waged an intense lobbying campaign on behalf of its standard. Drs. Adair and Chou, accompanied by Dr. John Osepchuk and Ron Petersen and executives from the cellular phone industry, met with senior FCC officials in an effort to convince them to favor the IEEE standard over the NCRP's (see *MWN,* M/A96).

In separate interviews, Adair, Chou and Petersen all disputed the view that the two committees are in competition. "I don't see a conflict," said Petersen. He denied that any such concerns influenced his dealings with Lin's NCRP committee.

When asked about the FCC incident, Lin responded that he had later gotten assurances from Adair and Chou: "They said that they would not denigrate the work of the committee in public or in private. From then on, I treated the matter as closed."

At the time he learned that the NCRP no longer wanted him to work on the RF/MW report, Lin was trying to line up new members and raise funds to support the committee's work. He was especially looking for a replacement for Chou, who after being appointed in 1995 had gone to work for Motorola in 1998.

Lin sought Chou's resignation in early 2000 after Chou had officially notified the NCRP that he had a conflict of interest with respect to completing a chapter on the effects of microwaves on the nervous system. "The conflict could, potentially, compromise the committee's deliberation on recommendations for exposure criteria," Lin wrote to NCRP President Meinhold on February 11, 2000. Lin provided a copy of this letter at the request of *Microwave News*.

Meinhold and Petersen tried to convince Lin to keep Chou on the committee. "As long as everyone knows where you stand," Meinhold said, referring to Chou's ties to industry, "I don't have a problem."

Lin said that affiliation with industry has never been one of his concerns. But, he added, when Chou stated in writing that he had a conflict, "I felt that I had no choice but to replace him."

For a year and a half, the committee's work was held up as the membership issue went unresolved. Lin said that he could not get Petersen to agree to replace Chou. Then, at the Bioelectromagnetics Society meeting in St. Paul last June, Chou said that he would resign. Chou sent Lin a follow-up e-mail on June 21 confirming his decision — with copies to Meinhold and Petersen and the other members of the committee.

Lin heard nothing more from Petersen or Meinhold until August 31, when, he says, he received a phone call from Petersen announcing that the board had decided on July 18 to disband his committee on RF/MW health effects.

In addition to Adair, Chou, Lin and Lotz, the original members of NCRP Scientific Committee 89-5 were: Drs. Patricia Buffler, University of California, Berkeley; George Harrison, University of Maryland, Baltimore; Richard Luben, University of California, Riverside; and Jan Stolwijk, Yale University. In 1998, Dr. Robert Liburdy of the Lawrence Berkeley Lab replaced Luben, but he later resigned, as did Stolwijk. Dr. Faith Davis of the University of Illinois, Chicago, joined the commitee in 2000 when Buffler became a consultant rather than a full member.

Hot New Papers

Dale Jamieson and Daniel Wartenberg, "The Precautionary Principle and Electric and Magnetic Fields," ***American Journal of Public Health, 91,*** **pp. 1355-1358, September 2001 (one of three papers on "The Precautionary Principle and Public Health").**

"Despite the diversity of precautionary approaches, the public policy debate over the possible effects of exposure to EMFs has focused on regulatory extremes: Do nothing until the data are conclusive, or restructure major portions of the electric power delivery system. Regulations to limit the rate at which exposure is increasing by restricting construction of new power lines to the lower-exposure configurations met with fierce opposition in some locations from people who do not believe that the association between EMFs and cancer has been proven and thus contend that no action should be taken. Since the scientific uncertainty is unlikely to be resolved in the foreseeable future, policy decisions must be based on the possibility of risk and the cost and technology of reducing exposure. Whether such decisions should be dictated by personal choice in the marketplace (what to buy, which appliances to use) or governmental regulation (where to build or whether to modify the electric power delivery system) depends in part on how one views the precautionary principle and its implications."

María Isabel Cano and Marina Pollán, "Non-Hodgkin's Lymphomas and Occupation in Sweden," ***International Archives of Occupational and Environmental Health, 74,*** **pp.443-449, 2001 (published in August).**

"The base population was made up of Swedish men (1,779,646) and women (1,101,669) who were gainfully employed at the time of the 1970 census, had also been present in the 1960 census and were still alive and older than 24 years as of 1 January, 1971. They were followed up for 19 years until the end of 1989....There were 7,610 non-Hodgkin's lymphomas reported in the study cohort, 5,391 cases in men and 2,219 in women. A relative risk of over 1.20 and statistically significant was observed in men among accountants and auditors [1.71], secretaries and typists [2.11], auctioneers [3.95], nonspecified rail and road transport workers [3.08], telecommunications traffic officers [3.22], telegraph and radio operators [2.43], photographic-laboratory workers [3.19] and other production and related work [1.44]. The risk excess was confirmed in men with the same occupations in both censuses. In women, only three occupations achieved statistical significance: metal platers and coaters [6.36], truck and conveyer operators [4.15] and store and warehouse workers [1.54]. The risk excess observed in telecommunications and transport workers could be explained by electromagnetic radiation exposure."

Knut Skulberg et al., "Effects of Electric Field Reduction in Visual Display Units on Skin Symptoms," ***Scandinavian Journal of Work, Environment & Health, 27,*** **pp.140-145, April 2001.**

"On the basis of a screening survey of 4,556 office workers in 11 companies, 120 of 227 subjects reporting facial skin complaints were randomly selected to this double-blind intervention study. Antistatic measures were used to reduce the static electric fields of the visual display unit in the intervention group but not in the control group....The intervention group reported statistically significantly fewer facial skin complaints than the control group....Our findings provide some support for the hypothesis that exposure to static electric fields and dust may interact to cause skin symptoms among VDU users. However, the observation does not exclude additional causal factors, especially as there was still a non-negligible degree of symptoms after the intervention....The ELF electric field 30 cm in front of the VDU was statistically significantly reduced by the intervention, but it failed to be a factor of importance in explaining the reduction in skin symptoms."

RF Effects at mW/Kg Levels

John Tattersall et al., "Effects of Low-Intensity Radiofrequency Electromagnetic Fields on Electrical Activity in Rat Hippocampal Slices," ***Brain Research, 904,*** **pp.43-53, June 15, 2001.**

"Slices of rat hippocampus were exposed to 700 MHz continuous wave radiofrequency (RF) fields (25.2-71.0 V/m, 5-15 min exposure) in a stripline waveguide. At low field intensities, the predominant effect on the electrically evoked field potential in CA1 was a potentiation of the amplitude of the population spike by up to 20%, but higher intensity fields could produce either increases or decreases of up to 120 and 80%, respectively, in the amplitude of the population spike.... The maximum field intensity used in these experiments, 71.0 V/m, was calculated to produce a specific absorption rate (SAR) of between 0.0016 and 0.0044 W/Kg in the slices. Measurements with a Luxtron fiber-optic probe confirmed that there was no detectable temperature change (±0.1°C) during a 15 min exposure. These results suggest that low-intensity RF fields can modulate the excitability of hippocampal tissue *in vitro* in the absence of gross thermal effects. The changes in excitability may be consistent with the reported behavioral effects of RF fields....During *in vivo* exposures at RF frequencies, most of the applied electromagnetic field will be absorbed by superficial tissues, such as skin, cranial muscles and the skull, and the amount of power reaching the brain will be greatly attenuated by this absorption process. Although the fields induced in deeper structures, such as the hippocampus, will be very much smaller than the external field, it is possible that the SAR in the hippocampus could approach that induced in the present experiments in brain slices, at least in rats and mice. The results of the current study are therefore consistent with the behavioral effects reported by Lai et al.,[1] although these are not as yet widely accepted. Due to the much larger size of the head and brain in humans, the proportion of the applied RF field reaching the hippocampus would be considerably smaller than in rats and mice; however, there may be a significant field in more superficial structures, such as the cortex, which would be consistent with the results of Preece et al.[2] and Koivisto et al.[3]"

1. H. Lai, A. Horita and A.W. Guy, "Microwave Irradiation Affects Radial-Arm Maze Performance in the Rat," *Bioelectromagnetics, 15,* pp.95-104, 1994.

2. A. Preece et al., "Effect of 915 MHz Simulated Mobile Phone Signal on Cognitive Function in Man," *International Journal of Radiation Biology, 75,* pp.447-456, 1999.

3. M. Koivisto et al., "The Effects of Electromagnetic Field Emitted by GSM Phones on Working Memory," *NeuroReport, 11,* pp.1641-1643, 2000.

Trevor Dawson, Krys Caputa, Maria Stuchly and Robert Kavet, "Electric Fields in the Human Body Resulting from 60 Hz Contact Currents," ***IEEE Transactions on Biomedical Engineering, 48,*** **pp.1020-1026, September 2001.**

"Contact currents occur when a person touches conductive surfaces at different potentials and completes a path for current flow through the body....Three pathways of contact current are modeled: hand to oppo-

site hand and both feet, hand to hand only and hand to both feet....The induced electric fields in the child model are higher than in the adult model, typically by a factor of two or three [because of its smaller size]. An analysis of the results in light of present exposure guidelines [e.g., ICNIRP] indicates a lack of consistency between the contact current reference levels and the basic restriction in the guideline. Namely, the reference level for general public (0.5 mA) results in induced current-density values which are 2.5-7 times greater than the basic restriction of 2 mA/m^2 for the spinal cord, and up to 17 times for the heart. The results indicate that as little as 5 μA into the hand produces between approximately 20 mV/m (average) to 60 mV/m (95th percentile) within a child's lower arm bone marrow. Lower electric field values, but still greater than the benchmark 1 mV/m, are expected within the child's bone marrow at other sites. Because of body size differences, adults have lower fields/unit of current, about a third to one-half of the child's values. By comparison, a 60 Hz 1 μT [10 mG] magnetic field, a level exceeded in virtually every residence away from appliances, produces less than 0.1 mV/m in a child's bone marrow." (See *MWN*, J/A00.)

Santi Tofani et al., "Static and ELF Magnetic Fields Induce Tumor Growth Inhibition and Apoptosis," *Bioelectromagnetics, 22,* pp.419-428, September 2001.

"In this study, the *in vitro* experiments were carried out with the aim of selecting MF characteristics able to influence apoptosis-like death induction. The selected MF were then used to expose animals. The most significant readings show that MF treatment impaired the growth of human colon carcinoma transplanted subcutaneously in nude mice and this effect was associated with an increase in apoptopic tumor cells. Although the study shows that MF are able to induce apoptosis-like death in transformed cells, both *in vitro* and *in vivo,* we cannot exclude that the effects on tumor growth inhibition *in vivo* may be related to different mechanisms than apoptosis....The *in vitro* results, obtained using different MF characteristics, show that MF are able to induce apoptosis-like death when their intensity is higher than 1 mT and this effect does not depend upon MF frequency. This suggests that the biophysical mechanism connected to the apoptosis-like death induction may be more related to free-radical recombination processes than to ion-resonance-like mechanisms....Our data suggest that static and ELF EMF may have anti-cancer activity."

J. Babbitt et al., "Increased Body Weight in C57BL/6 Female Mice After Exposure to Ionizing Radiation or 60 Hz Magnetic Fields," *International Journal of Radiation Biology, 77,* pp.875-882, August 2001.

"Weanling C57BL/6 female mice were irradiated with four equal weekly cobalt-60 exposures (total cumulative doses: 3.0, 4.0, 5.1 Gy) and/or received chronic lifetime exposure to 1.4 mT 60 Hz circularly polarized MF or ambient MF. The body weights of 2,280 mice were recorded at 35 age intervals....A highly statistically significant effect of ionizing radiation on body weight was observed at 28 age intervals ($p \leq 0.001$), and for MF exposure at 10 age intervals ($p \leq 0.001$). During the young adult growth phase, mice exposed only to MF exhibited ≤0.5 g greater weight gain relative to sham-exposed controls ($p = 0.0001$)....The observed interactive effects of ionizing radiation and MF suggest that MF may have a stimulating effect on growth processes that have already been activated. In the absence of irradiation, the MF effect was observed during the normal growth phase of young animals (1.4 mT/0 Gy group). However, when MF exposure was concurrent with radiation-induced damage repair, the duration of the MF effect was related to radiation dose, and appeared to persist longer when higher doses and presumably greater damage were experienced."

On the Internet

SAR Sighting

The latest Web site on radiation exposures from mobile phones is **<www.sarvalues.com>**. It features SARs for 87 U.S. and 36 European models, with the highest and lowest units identified in separate lists. Although the site states that it is independent, it is in fact registered to Les Wilson of Enfield, U.K., a principal at Microshield Industries, which sells phone shields designed to reduce radiation exposures. (There is a link to Microshield's Web site.) A disclaimer states that "materials at this site are directed solely at those who access this site from the U.K. mainland." In 1997, Microshield agreed to curtail its U.S. marketing after Motorola threatened legal action over what it called "grossly misleading" statements in the shield maker's product literature (see *MWN,* M/J97).

Comet Assays

If you want to keep up with the community of genetic toxicologists and molecular epidemiologists who work on identifying DNA breaks, check out **<www.cometassay.com>**. Ever since Drs. Henry Lai and N.P. Singh of the University of Washington, Seattle, reported genetic damage in the brain cells of rats exposed to 2450 MHz radiation seven years ago, the comet assay has been a major interest among EMF researchers (see *MWN,* N/D94). The Web site features a brief overview of the technique, pioneered by the Swedish researchers Drs. O. Östling and K.-J. Johanson in the early 1980s. A later version developed by Singh — the alkaline comet assay — is the most widely used today. The site features the full texts of selected papers and information on upcoming meetings. For instance, there will be a workshop on recent advances and new applications at the *8th International Conference on Environmental Mutagens* in Shizuoka, Japan, October 21-26. You can even join the ongoing discussion forum. The site is maintained by Dr. Bharathy Kumaravel of the University of Toronto and her husband, Dr. T.S. Kumaravel of the Ontario Cancer Institute.

Phone Tower near School

The New Jersey Department of Environmental Protection (DEP) has posted the results of its survey of microwave exposures at a school near a wireless base station at **<www.state.nj.us/dep/rpp/ber/nrs/hinella.htm>**. VoiceStream and AT&T Wireless placed PCS antennas on a water tower immediately adjacent to the Samuel Yellin school in Stratford. In February, the DEP measured 1 μW/cm^2 (2 V/m) at the school, which is 0.02% of the state's regulatory limit. To emphasize the difference between the observed level and the health standard, the DEP includes bar graphs that look like a mud hut next to the Empire State Building. VoiceStream's worst-case calculation points to levels possibly as high as 30 μW/cm^2 (11 V/m). "It should be noted that these worst-case predictions grossly overestimate anticipated levels, even with all channels operating at full power," the DEP states.

Notes on Conferences, Meetings, Workshops

• Dr. **Robert Cleveland** of the FCC will head the U.S. delegation to the October 29-30 workshop on mobile phone health risks in Brussels. Representatives from the EU, Japan and Korea will also be there. The new **COST281** committee on potential health effects of wireless phones is coordinating the meeting, which is being hosted by the European Commission (see also p.6 and p.16). The first day of the by-invitation meeting will be devoted to talks by Sweden's Dr. **Kjell Hansson Mild**, Japan's Dr. **Masao Taki** and France's Dr. **Bernard Veyret,** followed by presentations by members of each of the four delegations on regulations, ongoing and future research, science policy and risk communication. On the second day, which will be closed to outside observers, the four delegations will discuss possible future coordination and collaboration. Proceedings will be prepared. WHO's Dr. **Leeka Kheifets** is chairing the workshop. The other members of the U.S. delegation will be: Dr. **Jerry Bushberg** of the University of California, Davis, Drs. **C.K. Chou** and **Joe Elder**, both of Motorola, Dr. **James Lin** of the University of Illinois, Chicago, and FDA's Dr. **Russell Owen**.

• The Italian EMF establishment is trying to dissuade scientists from attending an October 20-21 meeting on electrosmog. In a September 20 "Dear Colleagues" letter, Dr. **Paolo Vecchia**, a physicist at the National Institute of Health in Rome, warned that those who do go to **Ischia** might be placed in the embarrassing predicament of being asked to sign a radical position paper — as happened at last year's Salzburg conference on mobile phone towers (see *MWN,* J/A00). The Ischia meeting is being sponsored by the National Consumer Association (CODACONS), according to Dr. **Fiorenzo Marinelli** of the National Research Council in Bologna, one of the organizers. But Vecchia says the real force behind the meeting is a group of lawyers who are fighting electrosmog. The members of the conference's scientific committee "can hardly be found in the literature or in the list of participants in scientific events of BEMS, EBEA, COST, URSI etc. However, you can find them, for example, in the program of the Salzburg conference," Vecchia wrote. In an e-mail to *Microwave News,* Marinelli said that the problem of exposure to electromagnetic radiation should be solved with "an open mind and scientific honesty, not by fighting."

• A ***Workshop on Electrosensitivity*** was held in Stockholm, September 27-28. The meeting was organized by the Swedish Association for the Electrosensitive with the financial support of the Swedish government's Inheritance Fund. "The workshop was a success," said **Hélène Aastrup Samuels**, the project coordinator. "Everyone wants it to be repeated, annually or biannually." The abstracts of the papers presented at the meeting are available at <www.feb.se/NEWS/Abstracts010927.pdf>. Samuels is a radiojournalist and documentary filmmaker. Among her works is *Radiant Future,* a film on the life of a young man who is electrohypersensitive.

• The December 17-19 **FGF** workshop in Dresden is the third in a continuing series of industry meetings on mechanisms of interaction. (**COST281** is helping organize the meeting.) "It will especially deal with the possible influence of weak RF fields used in mobile communication," **Gerd Friedrich**, the director of FGF, the research arm of the German mobile phone industry, wrote in his letter of invitation. "An ultimate goal is to predict with confidence the effects of energy absorption from RF fields at the smallest dimensions and join these to macrodosimetry at anatomic and histological scales," he stated. The second workshop, ***Mechanisms for Interactions of RF Energy with Biological Systems,*** was held in Washington, May 22-23 (see *MWN,* M/J01). A report outlining the principal conclusions of the May meeting has been prepared by Drs. Asher Sheppard, Mays Swicord, Sakari Lang and Frank Gollnick and is available on the Internet at <www.mmfai.com/files/research/research.htm>. The first meeting,

Calendar

October 20-21: **Electromagnetic Radiation — One Science One Truth,** Lacco Ameno, Ischia, Italy. Contact: Dr. Fiorenzo Marinelli, Cytomorphology Institute, National Research Council, Via di Barbiano 1/10, 40136 Bologna, Italy, (339+051) 636-6755, Fax: (339+051) 583-593.

October 22-24: **WHO Meeting on EMF Biological Effects and Standards Harmonization in Asia and Oceania,** Shilla Hotel, Seoul, South Korea. Contact: Prof. Nam Kim, School of Electrical and Electronics, Chungbuk National University, Geasindong 48, Cheongju, Chungbuk 361-763, South Korea, (82+43) 261 2482, Fax: (82+43) 274 6206, E-mail: <namkim@cbucc.chungbuk.ac.kr>, Web: <www.rapa.or.kr/emf/index.htm>; or Dr. Leeka Kheifets, <kheifetsl@who.int>.

October 29-30: **International Scientific Workshop on Electromagnetic Fields, Mobile Telephony and Health,** Brussels, Belgium. Contact: Peter Wintlev-Jensen, DG Information Society F4, Av. Beaulieu 33, Office BU33 2/80, B-1160 Brussels, Belgium, (32+2) 299-9320, Fax: (32+2) 296-2981, E-mail: <peter.wintlev-jensen@cec.eu.int>.

November 7: **Future Research on Health Effects of Non-Ionizing Radiation in the Environment,** Bern, Switzerland. A BUWAL-sponsored conference. Contact: Felix Heckendorn, Sektion NIS, BUWAL, (41+31) 324-3415, Fax: (41+31) 324-0137, E-mail: <Felix.Heckendorn@buwal.admin.ch>.

November 30: **Electromagnetic Fields and Health: Which Regulatory Framework for the European Community?,** a conference of the Academy of European Law (ERA), Jean Monnet Bldg., Luxembourg. Contact: Uta Ellerhorst, ERA, Metzer Allee 4, D-54295 Trier, Germany, (49+651) 937-3741. Fax: (49+651) 937-3790, E-mail: <Uta.Ellerhorst@era.int>.

December 4-7: **WHO/ICNIRP Conference on EMF Biological Effects & WHO Standards Harmonization for the African Region** and **WHO RF Research Coordination Meeting,** University of Stellenbosch, Cape Town, South Africa. Contact: Prof. Barney de Villiers, University of Stellenbosch, PO Box 19063, Tygerberg 7505, Cape Town, South Africa, (27+21) 938-9201, Fax: (27+21) 938-9558, E-mail: <bhl@maties.sun.ac.za>.

December 17-19: **Physical Effects of Pulsed RF Fields at Microscopic and Molecular Dimensions (Microdosimetry),** Akademie für Arbeitssicherheit und Gesundheitschutz, Dresden, Germany. Contact: Gerd Friedrich, Forschungsgemeinschaft Funk (FGF), Rathausgasse 11a, 53111 Bonn, Germany, (49+228) 726-220, Fax: (49+228) 726-2211, E-mail: <info@fgf.de>, Web: <www.fgf.de>.

which was held in Germany last December, addressed the "portability" of biological data across frequencies and modulations. *Microwave News* published a précis of this workshop in the May/June 2001 issue. Among those invited to the December meeting are: Drs. Ross Adey, Dean Astumian, Frank Barnes, Ferdinando Bersani, S.M. Bezrukov, B. Bianco, Günter Boheim, Yuri Chizmadzhev, Chris Davis, Ken Foster, Günter Fuhr, Jan Gimsa, Roland Glaser, Frank Gollnick, Friedemann Kaiser, Klaus Kramer, Sakari Lang, Damijan Miklavcic, Andrei Pakhomov, Bill Pickard, Earl Prohofsky, Mays Swicord, Jim Weaver and Peter Wust.

• The **SCC-34** subcommittee that is developing the protocol for **measuring SARs** from mobile phones cancelled its September 17-19 meeting in Ottawa due to travel problems following the September 11 terrorist attacks. Most of the draft standard was approved, some with comments, by 80% of those qualified to vote. "There is one last hang-up," said FDA's **Howard Bassen**, the subcommittee chair. "We need to complete the section on uncertainty analysis of the measurements and the measurement procedures." Once that is completed, a meeting will be scheduled.

• The WHO ***Temperature Workshop*** that is being organized by Motorola's Dr. **Joe Elder** for October 16-17 in Geneva has been delayed until next March (see *MWN*, J/A01). These travel arrangements were also upset by the September 11 attacks. A second ***Thermoregulation Workshop***, organized by Dr. **Eleanor Adair** of Brooks Air Force Base on behalf of ICNIRP and the IEEE, is on hold until after the WHO–Motorola meeting.

• IEEE's International Committee on Electromagnetic Safety, better known as **SCC-28**, will meet in **Luxembourg**, December 1-2, immediately after the conference being organized by the European Academy of European Law. For more information, check SCC-28's Web site, <grouper.ieee.org/groups/scc28>. The committee will meet again in San Antonio, January 18-20.

Across the Spectrum

If any group had the White House wired, it was the electricity industry. The director [Thomas Kuhn] of its major lobbying arm, the Edison Electric Institute, roomed at Yale University with George W. Bush. Electricity generators and marketers contributed $19.7 million to Republicans since 1998, roughly double what they gave Democrats, according to the Center for Responsive Politics.

— Judy Pasternak, "Bush's Energy Plan Bares Industry Clout," *Los Angeles Times,* p.A22, August 27, 2001

In the age of Third World–sponsored terrorism, the E-bomb is the great equalizer.

— Jim Wilson, "E-Bomb: In the Blink of an Eye, Electromagnetic Bombs Could Throw Civilization Back 200 Years. And Terrorists Can Build Them for $400," *Popular Mechanics,* p.53, September 2001 (see also *MWN,* N/D99 and N/D00)

"Hundreds of studies all come to the same conclusion: that there is no link between cancer and mobile telephony."

— Mikael Westmark, spokesperson, Ericsson, Stockholm, quoted by Allyson Vaughan, "Germany Urges Caution in Wireless Use," *Wireless Week,* p.13, August 13, 2001 (on August 14, Ericsson posted a number of statements on mobile phones and health on its Web site; go to: <www.ericsson.com/health>)

It is "irresponsible" for operators to suggest in advertisements that youngsters needed a mobile phone to return to school.

— Sir William Stewart, former chair, U.K. Independent Expert Group on Mobile Phones, at the British Association for the Advancement of Science's festival of science in Glasgow, Scotland, September 4, quoted by Robert Uhlig, "Mobile Telephones in New Brain Tumor Alert," *Daily Telegraph* (U.K.), p.10, September 5, 2001

These days, cell phones are kids' stuff.

— Andrea Petersen, citing a projection by the Yankee Group, a consulting firm based in Boston, that phone use in the U.S. among children 13 to 18 years old will soon outstrip that of adults, "Should Kids Have Cell Phones?," *Wall Street Journal,* special report on "Telecommunications," p.R12, September 10, 2001

"Microwave News" Flashback

Years 20 Ago

• Dr. Norman Balabanian, the editor of the IEEE's *Technology and Society* magazine, criticizes a COMAR draft position paper on human exposures to RF/MW radiation as marred by inconsistencies, logical fallacies and inaccurate implications. COMAR President Dr. Om Gandhi responds that his committee is sticking with it.

• Dr. Gregory Lotz of the Naval Aerospace Research Lab in Pensacola, FL, reports that monkeys exposed to 225 MHz radiation at an SAR of 1.5 W/Kg experienced "much greater heating" than expected. "Something unexplained" is going on, he concludes.

Years 10 Ago

• Henry Kues of JHU's Applied Physics Lab and FDA's Jack Monahan find that pulsed 1.25 GHz radiation at an SAR of 3.5-4 W/Kg can damage the cone photoreceptors in the eyes.

• In a letter to IEEE SCC-28 Chair Dr. Tom Budinger, Sue Donaldson, a member of the Seattle city council, asks how the commitee can justify dismissing the existence of health effects below 4 W/Kg.

• The U.S. Congress picks the Department of Energy to lead and coordinate the federal government's EMF health research program.

Years 5 Ago

• A third epidemiological study links EMFs to female breast cancer. Dr. Patricia Coogan of Boston University sees a 43% increase in breast cancer among women "with a high potential for occupational exposures to magnetic fields."

• The FAA is urged to impose industry-wide restrictions on the use of electronic devices aboard aircraft. It is the second time in eight years that an advisory commitee has issued such a warning.

• The California Supreme Court rules that state courts cannot hear EMF property devaluation lawsuits. They fall within the jurisdiction of the state's Public Utilities Commission, the court finds.

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UPDATES

EMP

Trying Again To Protect Telecom Equipment...On September 25, a lawyer and a computer consultant petitioned the FCC to mandate the protection of civilian electronic equipment against potential disruption by an EMP, or electromagnetic pulse. Don Schellhardt, an attorney based in Waterbury, CT, and Nickolaus Leggett in Reston, VA, filed similar petitions 15 years ago, but the FCC turned them down twice (see *MWN*, S/O86, J/F87 and M/J87). Their new effort was prompted by the September 11 terrorist attacks. When asked by *Microwave News* why the FCC might now grant their request, Leggett pointed to the development of non-nuclear devices that can generate EMPs. Indeed, they appended a copy of the article on "E-Bombs" from the September issue of *Popular Mechanics* (see p.15).

MILITARY RADAR

Compensation for Radiation Exposures... The German government will compensate military personnel who became ill after working with or near radar equipment. On June 21, Defense Minister Rudolf Scharping announced that claims will be settled in a "prompt, nonbureaucratic" manner. Many current and former soldiers have blamed radar radiation for a variety of health problems, including cancer and cardiac and immunological irregularities. Up to now, their claims have languished because they were unable to prove that radar caused their injuries. The soldiers are also targeting the U.S. manufacturers of the radar systems: General Electric, ITT Industries and Raytheon. Ramo Klinger, a lawyer in Berlin who represents more than 500 former servicemen, said that he will take legal action if the companies are unresponsive, according to Reuters (August 30). The shift in government policy follows an inquiry on the military's use of toxic agents, including asbestos and electromagnetic radiation. A June 21 report by an independent commission, set up by the ministry of defense, concluded that in the 1960s and 1970s some soldiers could have been exposed to x-rays generated by high-power radar equipment. The panel stated that radar radiation was unlikely to have caused any of the illnesses — though it could not rule out such a link. These findings are based largely on the work of Dr. Eduard David of the University of Witten, but his study for the defense ministry remains classified. Others disagree. The report quotes Dr. Günter Käs, a radar engineer formerly on the faculty of the Federal Defense University in Munich, stating that ruling out the role of RF/MW radiation would be "preposterous." The full text of the 128-page report, *The Armed Forces and Their Handling of Hazards and Toxic Substances,* is available in German at: <www.bundeswehr.org/common/images/bild_78.pdf>.

PEOPLE

Dr. **Ulf Bergqvist** died suddenly on September 11, a few days after attending the EBEA conference in Helsinki. He was 52. Bergqvist was on the faculty of the Institute of Technology at Sweden's University of Linköping. A protégé of Dr. **Bengt Knave**, Bergqvist became a member of ICNIRP when Knave stepped down (see *MWN*, J/A92). At the EBEA meeting, Bergqvist told *Microwave News* that he was looking forward to the publication of the English edition of his report on *Electromagnetic Sensitiv-*

ity and Health Risks, which was in the process of being translated. Bergqvist had been playing a leading role in setting up COST281, the new effort on the potential health effects of mobile phone technology (see p.6)....Dr. **Boris Pasche** has decided not to join Dr. **Abe Liboff** as coeditor of the reformulated journal *Electromagnetic Biology and Medicine* (see *MWN,* J/A01). "I plan to bring in a medical doctor with appropriate clinical experience as a coeditor next year," Liboff said....Dr. **Eleanor Adair**, the newly installed chair of SCC-28, is going home to rejoin her husband, physicist Dr. Robert Adair, in New Haven, CT. In mid-October, Adair will leave Brooks Air Force Base in San Antonio where she has been a senior scientist working on electromagnetic radiation effects. She said that she will be a visiting fellow at the John Pierce Lab, where she worked before moving to Texas. ...**Tim Harrington** has joined the equipment authorization branch at the FCC lab in Columbia, MD, where he will review SAR data submitted by cell phone manufacturers. The objective is to free up time for **Kwok Chan** to do SAR testing with the lab's two new measurement systems. Previously, Harrington worked at Allgon Telecom in Fort Worth, TX, where he was an engineer in the handset antenna group.

PEST CONTROL

Zapping Zebra Mussels...EMFs could be used to control infestations of zebra mussels, according to Drs. Matthew Ryan of Purdue University Calumet in Hammond, IN, and Cliff Chancey of the University of Northern Iowa, Cedar Falls. In a paper presented on August 28 at a meeting of the American Chemical Society in Chicago, Ryan reported that, in their lab, mussels exposed continuously to 60 Hz magnetic fields at levels up to 100 G were all dead after 40 days, compared to only 10% of the control mussels. Other aquatic species suffered less harm or none at all. In an interview, Chancey suggested that the fields kill the bivalves by interfering with the way they filter calcium ions from water. The lima-bean-size mollusks cause extensive damage to ecosystems, ships and underwater pipes in the Great Lakes. While chemicals can also control them, they cause some serious side effects. Asked if the EMF system would be safe to use in the lakes, Chancey replied: "Why would I want to swim next to the intake pipe for a power plant?" Ryan and Chancey, who have a patent application pending, have received many inquiries from potential users since the Chicago meeting.

SOLAR POWER SATELLITES

NAS–NRC Progress Report... Space Solar Power (SSP) might make a comeback. The possibility of collecting solar energy with satellites and beaming it down to Earth with microwaves is addressed in an NAS–NRC report released on September 24. An eight-member panel chaired by Dr. Richard Schwartz of Purdue University in West Lafayette, IN, concludes that the human health effects of the system's microwave power beam *"must* be quantified before public acceptance is found." The panel warns that, "Little research has been performed at field levels specific to SSP," and predicts that the SSP program "may well be subject to the same sort of public relations requirements" as the wireless industry, where "public perception is driving cell phone manufacturers to change their designs even without clear scientific

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evidence." The energy will be beamed to Earth at 5.8 GHz. The power level is expected to be less than 1 mW/cm^2 outside the receiving antenna's protective fence. *Laying the Foundation for Space Solar Power: An Assessment of NASA's Space Solar Power Investment Strategy* is available free at <www.nap.edu>. A paperback copy is available for $22.60 at the same Web site.

WEAPONS DETECTION

Pulsed Technology... Scientific Applications & Research Associates in Huntington Beach, CA, will market a new generation of security systems that can distinguish weapons from other metallic objects as well as pinpoint where on a person they are hidden. The technology, which was developed in 1995 by the USAF's Directed Energy Directorate at Kirtland AFB, NM, can be incorporated in current walk-through archway systems. Dean Lawry, an engineer with the directorate's high-power microwave division, explained that pulsed radiation sets up eddy currents within metal objects, which then send signals to an antenna array. Radiation exposures are similar to those from security archways currently used in airports, according to Lawry. "We don't need very much power," he told *Microwave News*.

AS WE GO TO PRESS

WHO Clarification... On October 10, as *Microwave News* was on its way to the printer, the WHO issued a press advisory denouncing press reports that it "insists mobile phone emissions are safe" (see, for example, the controversy in Singapore, p.8). The WHO called such a statement a "distortion," and stated that it stands by its position spelled out in its fact sheet last year (No. 193) — that there are gaps in knowledge that ongoing research should clarify over the next 3-4 years (see *MWN,* J/A00).

Keeping Current: Follow-Up on the News

◆ AT&T Wireless is offering each of its customers a hands-free kit at no charge. In a September 27 press release, the company touted the fact that it is the first U.S. company to do so. A number of class-action lawsuits, which are still pending, are seeking free headsets for all users of mobile phones (see *MWN,* M/J01).

◆ Ken Gettman of the National Electrical Manufacturers Association (NEMA) in Washington spoke against a motion to post biographies and pictures of members on the SCC-28 subcommittee Web site at the panel's June 9 meeting in St. Paul. He cited concerns that having such information on a publicly accessible site would be a "security issue." The motion was later approved.

◆ Pekka Ala-Pietilä, the president of Nokia, has been fined more than $30,000 for running a red light in central Helsinki. The fine is based on his annual salary of approximately $4 million.

◆ Radiation from a communications antenna under construction at a British military base in Cyprus will pose no health risks, the governments of Cyprus and the U.K. stated on August 28. A measurement survey by local government officials, with the assistance of France Telecom, showed that public exposures are "at least 76 times lower than the [ICNIRP] limit," according to the statement and that the new antenna is "not expected to show a considerable increase in the levels of electromagnetic emissions." Rioting erupted in July after the arrest of a Cypriot elected official who was protesting the towers (see *MWN,* J/A01).

◆ Ancona on the Adriatic coast will be Italy's first city to bury all its power lines, according to *Italy Daily* (October 5), published by *Corriere della Sera*. An accord was reached between city officials and ENEL, the power company, to address public concerns over aesthetics and EMFs.

◆ In what some might describe as a major scientific breakthrough, Aulterra International, based in Coeur d'Alene, ID, has "confirmed" that its Neutralizer product "is 100% effective in eliminating the harmful effects" of ELF and RF EMFs from cell phones and most other electronic devices. The half-dollar-size disk, made of a "proprietary organic compound composed of natural earth elements," is easy to install — you simply stick it on any surface of your mobile phone. If you are wondering how it works, Dr. Glen Rein of Quantum Biology Research Labs in Northport, NY, and formerly a member of Dr. Art Pilla's lab, offers his ideas on Aulterra's Web site, <www.Aulterra.com>. The Neutralizer costs only $24.00, or you can get three for $60.00.

VIEWS ON THE NEWS

Why Not Precautionary Limits? (No, We Are Not Antiscience)

We welcome WHO's adoption of prudent avoidance (see p.1). It's about time.

The WHO EMF project had little choice after IARC classified EMFs as possible human carcinogens in June. The NIEHS working group designated EMFs possible cancer agents in 1998 and the U.S. EPA did so in 1990. The WHO project could have opted for prudent avoidance years ago.

At the same time as WHO's Dr. Michael Repacholi is finally advocating taking low-cost measures to limit exposures, he continues to adamantly oppose health standards based on the precautionary principle. His reason is that such a move would be antiscience.

At the EBEA meeting, Repacholi dismissed the idea of tighter exposure standards as "undermining hundreds of millions of dollars of research for no apparent health benefit." He was equally critical of the Swiss and Italian precautionary RF/MW standards. "Italy brought in their own limits and forgot the science," Repacholi told the press in Helsinki. "The lower the limits, the greater the public concern," he warned, based on some curious logic of his own (see p.3).

Italy's Dr. Paolo Vecchia shares these views. In his presentation, he said that the consequences of the Italian 6 V/m standard are to increase public fears and to "undermine science."

We are not antiscience — nor are we against motherhood and apple pie. But we also believe in public health. In the face of a possible 4 mG cancer risk, blind allegiance to ICNIRP's 1,000 mG standard puts public health in the backseat behind economic interests.

Vecchia concedes that the ICNIRP standard does not offer any protection against cancer risks. "No one ever thought that ICNIRP's limit is justified for long-term effects," he said in Helsinki. That prompted Dr. Norbert Leitgeb of Austria's Graz University to respond that the 1,000 mG standard presents "a very large problem in risk communication."

Leitgeb is on to something. One sure way of being antiscience is to misrepresent the facts. People are not stupid — they are quick to realize when they are being sold out. After that, they will not believe anything and science *has* been devalued.

If the citizens of Zurich, Rome or Salzburg want strict standards for mobile phone towers, let them have them. There are enough uncertainties in the scientific data to allow for a precautionary approach. Yes, such limits will make their phone service more expensive. But if they decide that the price is too high, they can always opt for looser limits. That is *their* choice.

Setting standards is as much a social as a scientific exercise. It is about dealing with uncertainty and deciding on acceptable levels of risk. Scientists can offer advice, but they should not get indignant if their views don't prevail.

We expect the power and phone companies to argue for looser standards; they are trying to make money for their shareholders. But if the scientific community also worries about corporate profits, who then will argue for public health?

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NCRP Should Reinstate Its RF/MW Standards Committee

The directors of the NCRP made a grave mistake when they closed down Dr. Jim Lin's committee on RF/MW health effects and exposure guidelines (see p.11).

Lin was only months away from finishing his draft report, yet no one consulted him or the members of his committee or the 85 members of the council before deciding to junk six years of work. Indeed, Lin was seen as so insignificant that no one bothered to tell him of the board's decision for six weeks.

Lin's committee, No.89-5, was the victim of a military-industrial coup orchestrated by IEEE's SCC-28 committee.

Ron Petersen, the NCRP vice-president in charge of non-ionizing radiation and a former staff member of Lucent Technologies, and Dr. C.K. Chou, an original member of Lin's committee, also have leading positions within SCC-28. They played a major part in the demise of NCRP 89-5.

Five years ago, both showed their true loyalties when, accompanied by executives from the cellular phone industry, they lobbied the FCC against adopting the NCRP exposure standard. They urged the commission to favor the IEEE limits. SCC-28 has long had designs on becoming the preeminent standards group and is now one step closer to fulfilling this ambition. Only ICNIRP stands in its way.

In January 2000, two years after he joined Motorola, Chou finally conceded the obvious: He had a conflict of interest. When Chou put this in writing, Lin felt he had no choice but to ask him to resign. Work on the report stopped while Chou resisted leaving the committee and Petersen refused to force the issue.

Having put roadblocks in Lin's path for 18 months, Petersen closed down his committee on the pretext that it was working too slowly. With the NCRP committee out of the picture, Chou will soon unveil his own major relaxation of the RF/MW exposure standard (see p.1).

If Chou succeeds in getting the standard approved, Motorola should make him employee of the month. He will have helped win acceptance of a standard that allows the radiation delivered to the user of a cell phone to increase by more than tenfold — a level so high that it would make compliance testing of phones a mere formality.

Are Dr. Charles Meinhold, the NCRP president, and the rest of the NCRP board aware of these blatant conflicts of interest? If they aren't, they ought to be.

We urge the NCRP to put its house in order.

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In Search of a Few Revolutionaries

Australian Cell Phone Cancer Study Prompts Widespread Skepticism

A new animal study from Australia is being touted by its authors and the mobile phone industry as refuting an earlier experiment that linked cell phones to cancer. But a wide array of researchers from around the world say that the paper — and perhaps the whole study — is deeply flawed.

The paper by Drs. Tammy Utteridge, Tim Kuchel, and coworkers, which appears in the September issue of *Radiation Research*, has a number of anomalies and omissions, according to its critics. Since the paper's release in mid-August, letters have been sent to the journal pointing out these inconsisten-

Does the new Australian experiment suggest that RF radiation can protect against cancer? See p.12.

cies and calling for clarification — some have already been accepted for publication. The study team is working up a unified response but, as of the end of September, had yet to release any official statement.

In 1997, Dr. Michael Repacholi, then at Australia's Royal Adelaide Hospital, announced that he had observed a significant increase in lymphoma in transgenic mice chronically exposed to GSM radiation. His *Pim*-1 mice had 2.4 times more cancer compared to unexposed controls (see *MWN,* M/J97). The Repacholi study has been widely considered to be the most significant evidence pointing to a cancer risk from cell phone radiation.

(continued on p.10)

Evidence Linking Mobile Phones to Brain Cancer Is Flawed, Judge Rules

In a major victory for the wireless industry, a federal judge has rejected the entire slate of expert witnesses who were ready to testify that mobile phone radiation can lead to brain cancer. On September 30, Judge Catherine Blake of the U.S. District Court in Baltimore ruled that the evidence for such a link has not "gained general acceptance in the scientific community."

Four days later, Blake announced that she would dismiss the $800 million lawsuit on October 30, unless either side files an objection by October 25.

Dr. Christopher Newman, a 43-year-old Baltimore neurologist, sued Motorola and other leading cell phone companies in August 2000, alleging that his brain tumor was caused by the use of a handheld analog phone.

"We will appeal," John Angelos, one of Newman's attorneys at the Peter Angelos law firm in Baltimore, told *Microwave News* — even though he initially conceded to the *Wall Street Journal* (October 1) that Blake's September decision was "pretty much a complete victory" for the defense.

(continued on p.5)

European Labs Show EMFs Induce DNA Breaks; Intermittent, Not Continuous, Fields Are Effective

Labs in Austria and Germany have shown that power-frequency magnetic fields can induce DNA damage. Researchers at the University of Vienna and the University of Hannover bring to six the number of groups that have demonstrated this type of genotoxic effect, which was first reported seven years ago.

Drs. Oswald Jahn and Hugo Rüdiger of the University of Vienna observed increases in DNA breaks only after intermittent exposure and only in some types of cells. "This study strongly indicates a genotoxic potential of intermittent EMFs," they write in the August issue of *Mutation Research, Genetic Toxicology (519,* pp.1-13, 2002).

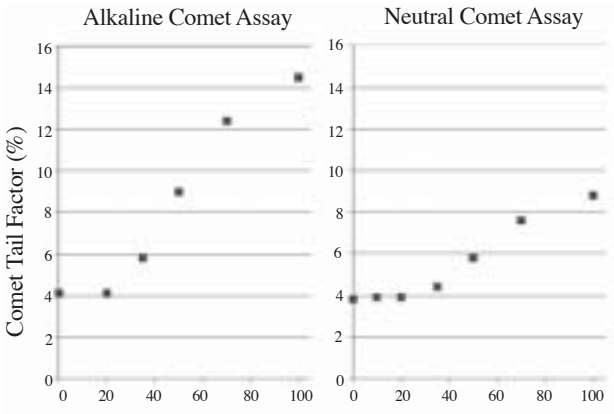
In Hannover, Dr. Hans-Albert Kolb was so skeptical that he bet that he could not repeat the Vienna experiment in his own lab. "I lost a bottle of champagne," Kolb told *Microwave News*.

Dr. Niels Kuster of IT'IS in Zurich, who designed and built the exposure system used by both labs, wants to rule out one last possible artifact before endorsing these findings. "I am still somewhat concerned about vibrations," he said in an interview.

The possible impacts, if any, of vibrations on strand breakage will be investigated later this year, Dr. Franz Adlkofer of the Verum Foundation in Munich told *Microwave News*. Adlkofer is coordinating the EC's REFLEX research project, which includes the Austrian and German efforts.

EMF-induced DNA breaks were first reported in 1995 by Drs. Henry Lai and N.P. Singh of the University of Washington, Seattle. They analyzed the brain cells of rats that had been exposed *in vivo* to continuous 60 Hz fields (see *MWN,* N/D95). "The new results provide solid support for our earlier work and have important implications for future animal and epidemiological research," Singh told *Microwave News*.

DNA Breaks from Intermittent EMFs



Exposure (∝T): 15 hours, 5 minutes on/10 minutes off

Source: Dr. Hugo Rüdiger; reprinted with permission.
Notes: "Comet Tail Factor" is a measure of DNA damage. To convert microtesla (∝T) to milligauss (mG), multiply by 10.

Jahn and Rüdiger found that when the field was cycled on for five minutes and then off for ten minutes over a 24-hour period, fibroblasts (connective tissue cells) had statistically significant higher levels of DNA breaks at exposures as low as 700 mG. They also found a dose-response trend with increasing field intensity. (The chart below is for a 15-hour exposure.)

They obtained similar results with both the neutral comet assay, which detects damage only when both DNA strands are broken, and the alkaline assay, which can also spot damage limited to a single strand.

"We did not see anything with continuous exposures," Rüdiger said at the Bioelectromagnetics Society's (BEMS) annual meeting in Quebec, Canada, in June. In their paper, Jahn and Rüdiger suggest that continuous exposures "may induce adaptive mechanisms," such as DNA repair, which intermittent exposures might fail to trigger.

The importance of intermittent exposures was a chance finding, Rüdiger said in Quebec. They repeated the experiment many times with different exposure schedules. While 5 minutes on/10 minutes off yielded the largest increases in DNA breaks, other combinations produced less pronounced, but still significant, changes. But some (for example: 5 minutes on/20 minutes off) had no effect.

At the BEMS meeting, Rüdiger pointed out that he saw no effects in blood lymphocyte cells. The differing responses point to cell type as a variable that "could explain the highly divergent results" from different labs studying genotoxic effects of ELF EMFs, he suggested.

Lai agrees. "I think that cell type is a key factor," he told *Microwave News,* explaining that some types of cells might be more susceptible to damage from continuous exposures, while others might be affected more by intermittent fields.

Lai said that he has unpublished data that show DNA damage at levels as low as 100 mG for exposures of 24 hours. When he extended the exposures to 48 hours, he saw even more damage.

Indeed, Jahn and Rüdiger note in their paper that not all fibroblast cells responded uniformly to the exposures. The fibroblasts from the two volunteer donors in the experiment had different levels of DNA damage (although the increases were significant for both).

At BEMS, Rüdiger also reported observing more micronuclei in cells exposed to intermittent EMFs, as well as an "immediate additive effect" of intermittent EMFs on DNA breaks in cells exposed to ultraviolet radiation.

Three other labs have observed increased DNA damage following exposure to power-frequency EMFs. In the U.S., Dr. Jerry Phillips investigated human lymphoblastoid cells (see *MWN,* N/D98). Dr. Yog Raj Ahuja in India used human blood cells, and Sweden's Dr. Britt-Marie Svedenstål examined brain cells from mice (see *MWN,* N/D98).

Researchers at Battelle were the first to look for DNA damage following exposure to ELF EMFs. In 1988, they reported

finding no effect in ovarian cells of Chinese hamsters. (A member of the team, Dr. Rick Jostes, is now a project officer on the National Research Council's study on the PAVE PAWS radar; see *MWN,* N/D01.)

In the February issue of *Bioelectromagnetics (23,* pp.106-112, 2002), Dr. Kim O'Neill reported that human HL-60 cells — but not Raji cells — take longer to repair DNA damage after exposure to a 1.5 G, 60 Hz field (see "Hot Papers," *MWN,* M/A02).

« Power Line Talk »

"I was gobsmacked by the lack of press coverage" of **IARC**'s designation of power-frequency EMFs as possible human carcinogens, Dr. **Michael Repacholi** told *Microwave News* during a coffee break at the August radio science (**URSI**) meeting in Maastricht, the Netherlands (see *MWN,* J/A01). (For newcomers to British slang: He was amazed.) "There is something about cancer in children that is very emotive," and these fields are "everywhere," which makes the news media's reaction all the more surprising, he added. Despite this media indifference, Repacholi vowed to continue pushing for more research: "I am not going to let it go. I honestly think that it's important." His EMF project, based in Geneva, is "reviewing every possible mechanism," because "we need to explain the epidemiological evidence." In his invited talk at the weeklong conference, Repacholi promoted a somewhat different view. He pointed out that under the scheme devised by the International Agency for Research on Cancer, "possible" is the weakest of three classes of carcinogens. This designation is at a "much lower level" than IARC's known or "probable" categories. (There are two other classes: "unclassifiable" and "probable noncarcinogen.") Repacholi speculated that the IARC decision is being misinterpreted and causing excess anxiety because in a number of languages there is no distinction between "possible" and "probable," leading people to exaggerate EMF health risks. We caught up with Repacholi after his talk and asked him which languages he had in mind. "Japanese, French, Spanish and Chinese," he replied. Dr. **Joe Wiart** of France Telecom was sitting nearby, so we sought his linguistic opinion. There is a distinction between the two, he said, but the difference is smaller in French than in English. But then again, Repacholi himself believes that the difference between the two is "subtle" even in English.

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The **IEEE** has a new set of exposure limits for EMFs in the 0-3 kHz frequency range. On September 12, the IEEE's Standards Board approved the **ELF standard**, which was written by a subcommittee of **ICES** (formerly SCC-28), chaired by **Kent Jaffa** of PacifiCorp. The new standard, designated C95.6, addresses acute hazards only — because none of the "major reviews" of health effects research "concluded that any hazard from long-term exposure has been confirmed." At 50 and 60 Hz, the limits are 5 kV/m and 9.04 G for the public and 20 kV/m and 27.1 G for those who are in a "controlled environment." Exposures of arms and legs can exceed 63 G and still be in compliance. Work on the EMF standard began in 1991 but stalled out, and then started again in 1999 (see *MWN,* N/D91 and N/D99). *Standard for Safety Levels with Respect to Human Exposure to Electromagnetic Fields* will be available soon from <shop.ieee.org/store>.

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The Australian Radiation Protection and Nuclear Safety Agency (**ARPANSA**) has decided to develop its own ELF exposure standard. Dr. **Andrew Wood** of Swinburne University has been asked to chair a working group to draft limits for frequencies up to 3 kHz, according to Dr. **John Loy**, the CEO of ARPANSA. The other members have not yet been chosen. Wood said he did not know whether his panel would follow the **ICNIRP** guidelines. "They are now several years old and we will need to address some more recent developments," he told *Microwave News*. He pointed to ICNIRP's own assessment of EMF epidemiology, which indicates a link between magnetic fields and childhood cancer that is "unlikely to be due to chance," and to the fact sheet issued by WHO's EMF project that endorses prudent avoidance (see *MWN,* J/F02 and S/O01, respectively). Wood is planning to hold his first meeting later this year. ARPANSA recently completed an RF/MW radiation standard that was based on the ICNIRP guidelines (see *MWN,* M/J02).

Leak: EMF–Childhood Leukemia Link Also Found in Japan

Preliminary results of a large epidemiological study show that Japanese children exposed to magnetic fields of more than 4 mG from power lines and appliances had twice the expected rate of leukemia, *Asahi Shimbun,* one of Japan's leading national newspapers, reported on August 26.

These results were leaked to the press — very unusual in Japan. If confirmed, they would give added support to two well-regarded meta-analyses that indicate a childhood leukemia risk above 3-4 mG (see *MWN,* S/O00).

Dr. Michinori Kabuto of the National Institute for Environmental Studies in Ibaraki, who is leading the study team, declined to comment on the accuracy of the *Asahi* story. "The results will be submitted shortly," he told *Microwave News*.

Kabuto planned to include 1,000 leukemia and 500 brain tumor cases among children under the age of 15 (see *MWN,* M/J99). A final report was due last spring.

Asahi Shimbun noted that the EMF issue has been largely ignored in Japan. The Gauss Network, a citizens' group based in Tokyo, is concerned that corporate and government officials will downplay the results by insisting that the WHO EMF limits are being met, even though they are close to a thousand times higher than the observed threshold for an increased cancer risk, according to Tetsuo Kakehi, the president of the network.

The Japanese study is the last major epidemiological effort to investigate the EMF–childhood cancer link. Many observers believe that Japan is an ideal place to study it because exposures tend to be higher there.

Sweden's Lennart Hardell: Under Attack from All Sides

Dr. Lennart Hardell's two papers on brain tumor risks from mobile phones have now been published (see excerpts from the abstracts at right). Both he and the papers are under attack from all directions. Here is a brief rundown of who is saying what:

• The two papers, which had been circulating for over six months, are the centerpiece in a U.S. brain tumor case. (Hardell also testified in court.) In a strongly worded opinion, Judge Catherine Blake finds that Hardell's work has "serious flaws" (see p.1 and excerpts from her decision on p.5).

• In a report for the Swedish Radiation Protection Authority (SSI) in Stockholm, two American epidemiologists present a detailed critique of Hardell's work, pointing to "questionable and inconsistent statements throughout [the *European Journal of Cancer Prevention*] paper" (see also p.9). Drs. John Boice Jr. and Joseph McLaughlin, both with the International Epidemiology Institute in Rockville, MD, also conclude that: "Overall, the epidemiologic and laboratory studies to date have ruled out with a reasonable degree of certainty that cellular telephones cause cancer, at least for durations of use up to 5 years." Boice and McLaughlin were coauthors, with Drs. Christoffer Johansen and Jørgen Olsen of the Danish Cancer Society in Copenhagen, on two epidemiological studies that found "no support" for an association between mobile phones and brain and eye cancer (see *MWN,* M/A01 and M/A02). Dr. Kjell Hansson Mild, a coauthor on the Hardell papers, told *Microwave News* that they are preparing a response to the SSI report. "In our view," he said, "a consistent picture is emerging from these studies that a causal association between use of cellular phones and brain tumors *cannot* be ruled out."

• Members of the Swedish cancer establishment continue to wage a campaign against Hardell. In an interview with *Svenska Dagbladet (SvD),* a leading national newspaper (August 21), Dr. Magnus Ingelman-Sundberg, the vice chair of the Karolinska Institute's Institute of Environmental Medicine in Stockholm, called Hardell's paper in the *European Journal of Cancer Prevention* "alarmist" and "irresponsible." He also characterized the *European Journal* as a "fifth-rate" publication. Then on September 2, Ingelman-Sundberg took another shot in a letter to *SvD*, under the headline "Fantasies About Mobiles." Over the last year, he has repeatedly attacked Hardell's concerns over phone safety (see *MWN,* S/O01 and J/A02). Meanwhile, one of Hardell's critics has come under scrutiny. Dr. Hans-Olov Adami, also of the Karolinska Institute, is being pressured to explain his work as a consultant to the chemical industry on the risks posed by dioxin.

Hardell and Mild have another paper in press. "Vestibular Schwannoma, Tinnitis and Mobile Phones" has been accepted by *Neuroepidemiology,* Hardell told *Microwave News* ("neuroma" is often used interchangeably with "schwannoma"). "This is an expansion of the acoustic neuroma issue with some case reports of tinnitis among mobile phone users," he said, pointing out that tinnitis may be a precursor of acoustic neuroma. In an interview, Mild noted that in his study of headaches among Scandinavian users of mobile phones some people complained of one-sided tinnitis (see *MWN,* M/J98 and J/A00).

Despite the best efforts of Hardell's critics, a majority of the Swedish public believes that mobile phones present a health risk, according to informal polls run by Sweden's two major newspapers. Following the release of the *European Journal* paper, 64% of some 8,000 who voted on the *Dagens Nyheter* Web site said that they think using a mobile phone is harmful. In a similar poll on *SvD*'s site, close to half of 1,285 voters said that they are either worried about their use of mobile phones or are using them less.

And Ingvar Oldsberg, a TV personality whom some describe as the most familiar face in Sweden, reacted to Hardell's new study with, "It's not surprising," adding that he has long had doubts about the safety of mobile phones and limits his use of them.

The Hardell Abstracts

L. Hardell, A. Hallquist, K. Hansson Mild, M. Carlberg, A. Påhlson and A. Lilja, "Cellular and Cordless Telephones and the Risk for Brain Tumors," ***European Journal of Cancer Prevention, 11,*** **pp.377-386, August 2002.**

"...We included in a case-control study 1,617 patients aged 20-80 years of both sexes with brain tumor diagnosed between 1 January 1997 and 30 June 2000. They were alive at the study time and had histopathologically verified brain tumor....Exposure was assessed by a questionnaire that was answered by 1,429 (88%) cases and 1,470 (91%) controls. In total, use of analog [phones] gave an increased risk with an OR=1.3 (95% CI=1.02-1.6). With a tumor induction period of >10 years the risk increased further: OR: 1.8 (95% CI=1.1-2.9). No clear association was found for digital or cordless telephones....[T]he risk was increased for tumors located in the temporal area on the same side of the brain that was used during phone calls; for analog cellular telephones the OR was 2.5 (95% CI=1.3-4.9). Use of a telephone on the opposite side of the brain was not associated with an increased risk for brain tumors. With regard to different tumor types, the highest risk was for acoustic neurinoma (OR: 3.5, 95% CI=1.8-6.8) among analog cellular telephone users."

L. Hardell, K. Hansson Mild and M. Carlberg, "Case-Control Study on the Use of Cellular and Cordless Phones and the Risk for Malignant Brain Tumors," ***International Journal of Radiation Biology, 78,*** **pp.931-936, October 2002.**

"A case-control study was performed on 649 patients... Exposure was assessed by a questionnaire answered by 588 (91%) cases and 581 (90%) controls. Phone usage was defined as 'ever use' and usage starting within 1 year before diagnosis was disregarded. Overall, no significantly increased risks were found: analog cellular phones yielded an OR: 1.13 (95% CI=0.82-1.57), digital cellular phones OR: 1.13 (CI= 0.86-1.48) and cordless phones OR: 1.13 (CI=0.85-1.50). For ipsilateral (same side) RF exposure, analog mobile phones gave OR: 1.85 (CI=1.16-2.96) for all malignant brain tumors. For astrocytoma, this risk was OR: 1.95 (CI=1.12-3.39). For all malignant brain tumors, digital mobile phones yielded OR: 1.59 (CI=1.05-2.41) and cordless phones yielded OR: 1.46 (CI=0.96-2.23) in the analysis of ipsilateral exposure. *Conclusion*: The ipsilateral use of an analog cellular phone yielded a significantly increased risk for malignant brain tumors."

Judge: Mobile Phone Cancer Evidence Flawed *(continued from p.1)*

Baltimore attorney Joanne Suder, who originally filed the Newman suit two years ago and who has six other claims pending and even more clients waiting in the wings (see *MWN,* S/O 00, N/D01 and M/J02), is also not ready to quit. "We have enough solid scientific evidence to establish a link between cell phone use and brain cancer," she said following Blake's decision.

Nevertheless, the ruling casts doubt on the viability of other similar suits that have been filed across the country. In late July, a panel of federal judges in Washington issued a preliminary order transferring nine of the pending cases to Blake's court (see *MWN,* J/A02). The panel is expected to issue a final decision later this year.

In another victory for the industry, an Illinois court of appeals has affirmed the dismissal of Robert Kane's brain tumor case against Motorola. Here again, the courts cite the lack of scientific evidence. Kane told *Microwave News* that his lawyers will continue to pursue this case (see *MWN,* J/F94 and J/A00).

The wireless industry immediately hailed the Newman decision. It should send "a strong message" to others who may be thinking of filing their own claims, read a statement on Motorola's Web site: "Dr. Newman's lawyers had the resources to search far and wide for reliable evidence to buttress their claims, but came up short." The Angelos firm has won many millions of dollars in litigation against the asbestos and tobacco industries.

In her strongly worded 22-page opinion, Blake details why the testimony of Newman's experts fails to meet the *Daubert* standard, which, under a 1993 Supreme Court decision, requires that scientific evidence be "reliable and relevant" in order to be admitted in federal court (see *MWN,* M/A02).

The epidemiological studies of Dr. Lennart Hardell of Sweden's Örebro University, who has shown higher rates of cancer among some phone users, are crucial to the plaintiff's case. Blake asserts that they are needed to "support a theory of cancer causation in humans" but that the work suffers from "serious flaws."

While acknowledging that Hardell is qualified to offer an expert opinion in the fields of oncology and epidemiology, Blake writes that, " The validity and relevance of [his results are] subject to serious criticism" due to recall bias, the lack of dose-

Excerpts from Judge Blake's "Serious Criticism" of Hardell's Work

Dr. Hardell supports his theory of causation, however, with his purported findings of an increased association between development of malignant brain tumors, including astrocytoma, and "ipsilateral" phone use...The validity and relevance of this finding is subject to serious criticism...

Applying the *Daubert* factors, it is first important to note that neither of these papers had been accepted for publication in a peer-reviewed journal as of the time of the hearing in February 2002. Indeed, the manuscript was rejected for publication by *The Lancet*, a well-respected British medical journal, based on substantial criticism by the peer reviewers, including concerns about the "large confidence intervals" and that "the overall message of the paper was written much too forcefully."...

The fact of publication, of course, does not eliminate the need to examine the results and methodology of the study...On the issue of relevance, as noted, neither paper shows any statistically significant increased risk for the development of malignant brain tumors based on analog cell phone use. The plaintiffs rely instead on the increased risk for all brain tumors, obtained by including the category of benign acoustic neuroma, which is not applicable to Dr. Newman's case and was not observed in Dr. Hardell's 1999 paper. They also rely on the association of astrocytoma with ipsilateral use. The validity of these results is suspect for several reasons.

First is the problem of recall bias. Dr. Hardell's questionnaire necessarily relied on persons who had developed a brain tumor on one side of their head being asked to recall on which side of the head they had used their cell phones. Dr. Meir Stampfer, professor of medicine at Harvard Medical School and chair of the department of epidemiology at the Harvard School of Public Health...persuasively stated the reasons for finding that recall bias likely had affected Dr. Hardell's results. One of the most significant of those reasons was that the study found an increased risk of tumor with ipsilateral use for all phones — analog, digital and cordless — even though there is otherwise no scientific claim that cordless phones cause brain cancer....Another is the pattern of decreased risk on the contralateral side, averaging out to an overall "null" finding (no association).

Second is the lack of any demonstrated dose-response relationship, which Dr. Hardell agrees is one of the most important factors to prove causality. Fairly read, his papers, deposition and hearing testimony do not support finding a scientifically valid dose-response relationship for mobile phone use and brain cancer, particularly not for astrocytoma.

Third are the significant problems with relying on an ipsilateral association as evidence of causation when there is no underlying evidence of an association between cell phone use and development of malignant brain tumors. As explained by a review [by Kenneth Rothman] in *The Lancet* commenting on Dr. Hardell's 1999 paper, his ipsilaterality theory is inherently flawed: "[S]ince there had been no increase in the overall risk of tumor, an association between side of tumor and side of telephone use requires the implausible inference that telephone use does not affect the risk of whether a brain tumor will occur but only its location." That criticism is particularly applicable as to the papers resulting from Dr. Hardell's later studies, where the numbers involved were sufficiently large to show an increased risk for malignant brain tumors if such risk existed.

Fourth, Dr. Hardell puts overdue emphasis on the positive findings for isolated subgroups of tumors. As Dr. Stampfer explained, it is not good scientific methodology to highlight certain elevated subgroups as significant findings without having earlier enunciated a hypothesis to look for or explain particular patterns, such as dose-response effect. In addition, when there is a high number of subgroup comparisons, at least some will show a statistical significance by chance alone. In Dr. Hardell's study, there is no overall showing of increase in a significant number of the subgroups. While Dr. Richter disagrees with this analysis, I find Dr. Stampfer more persuasive.

Dr. Hardell's methodology for testing laterality has not been used by any other scientist proffered to the court. Nor has it been replicated. The Inskip and Muscat studies, which tested laterality by other means and admittedly with a smaller number of people, do not show increased risk.

Arrayed against Dr. Hardell's findings are the numerous studies published in peer-reviewed journals and by international scientific and governmental bodies...

Footnotes are omitted. The full text of Blake's decision in the Newman case is available at: <www.mdd.uscourts.gov/Opinions152/Opinions/newman0902.pdf>.

response and the absence of independent replication (see excerpts p.5; also p.4).

Blake also discounts the experiments of Dr. Henry Lai of the University of Washington, Seattle, linking RF/MW radiation to DNA breaks because he used 2450 MHz radiation rather than the 824-848 MHz frequency band of analog mobile phones. Lai's work does not "fit" in this case, according to Blake.

Blake leaves little doubt that she is unimpressed by the testimony of Dr. Jerry Phillips of the Biological Sciences Curriculum Study in Colorado Springs, CO, and Dr. Elihu Richter of Hebrew University in Jerusalem.

In contrast, Blake, who was trained at Harvard, describes the scientists offered by the defense as an "array of established, experienced and highly-credentialed experts." She cites with approval the testimony of Drs. Eugenia Calle of the American Cancer Society, Mark Israel of Dartmouth Medical School, John Laterra of Johns Hopkins Medical School and Meir Stampfer of Harvard University.

The experts on both sides testified at a week-long "*Daubert* hearing" last February (see *MWN,* M/A02).

On November 1, Blake will hear oral arguments on motions to dismiss a group of cases — some of which were filed by the Angelos firm — that seek to require that headsets be provided with all cell phones (see *MWN,* N/D00, M/J01 and J/A02).

Radiation Sickness or the Flu? U.K. RF Workers Lose in Court

A U.K. judge has rejected the claims of two tower workers that their persistent health problems were caused by FM radio radiation. After an appeals court upheld the ruling, the plaintiffs must now decide whether to file a final appeal with the House of Lords.

Alan Davis and John Docherty became ill in July 1996, soon after beginning to install TV antennas on a BBC tower in Cornwall (the southwestern tip of England). Both reported severe headaches, dizziness, nausea, diarrhea, fatigue and pain, numbness and tingling sensations. Neither has fully recovered or been able to return to tower work.

In 1999, they went to court seeking compensation from the BBC, the telecom company NTL and the engineering firm Balfour Kilpatrick, their former employer.

Dr. Chris Schilling, an occupational physician consulting for NTL, examined Davis and Docherty in August 1996 and concluded that they were suffering from radiation sickness. He published a case report in *Occupational Medicine (50,* pp.49-56, 2000). Schilling suggested that a metal cable running down the center of the tower could have acted as a secondary antenna, causing unusually high exposures. In the same case report, he described how two other men who worked on the same tower had complained of similar—though less severe—symptoms (see *MWN,* J/A00).

Dr. Colin Blakemore, a neurologist at Oxford University, testified for the defense that Davis and Docherty's exposures to the 100 MHz radio radiation had not exceeded 70 V/m (1.3 mW/cm^2) — below the 100 V/m (2.7 mW/cm^2) guideline specified by the U.K.'s National Radiological Protection Board (NRPB) to protect against thermal injury.

In a joint statement submitted to the court, Blakemore and Dr. Bruce Hocking, a Melbourne-based occupational physician who served as an expert for the plaintiffs, agreed that the workers' symptoms did not fit the characteristic profile for thermal tissue damage from RF/MW radiation.

Blakemore suggested that the two men were suffering from a viral infection and insisted that there is "simply no evidence" that lasting damage from RF/MW radiation "can happen without tissue heating." Blakemore has long been a member of NRPB's Advisory Group on Non-Ionizing Radiation and also sits on the Independent Expert Group on Mobile Phones, chaired by Sir William Stewart (see p.14 and *MWN,* M/J00).

Hocking countered that a different mechanism could have been responsible. "There is reason to be cautious in assuming we understand all the ways that RF radiation may interact with the nervous system," he wrote. Hocking is a former chief medical officer of the Australian national telecom company, Telstra.

Following the week-long trial in March 2001, Judge Sean Overend of the civil court in Exeter concluded that it is no more than "a remote possibility" that lasting damage could result from RF/MW radiation at the levels to which Davis and Docherty were likely to have been exposed — not enough to sustain their claims.

Explaining why he saw no reason to reverse Overend's ruling, Lord Justice Tuckey of the civil court of appeal in London called Blakemore "a distinguished physiologist," and commented that Overend was "not surprisingly...impressed by his expertise." Tuckey's opinion was issued on May 23 of this year.

According to Schilling, who still consults for NTL, broadcasters have become more cautious following a rash of health

Germans Make It Official: Cell Phones Do Not Raise Blood Pressure

Dr. Stefan Braune and coworkers have officially conceded that GSM signals do not raise blood pressure.

In 1998, Braune of Germany's University of Freiburg made international headlines by publishing a research letter in *The Lancet* announcing that mobile phone radiation could affect the cardiovascular nervous system. But last year he told *Microwave News* that he believed that his initial observations had nothing to do with electromagnetic radiation (see *MWN,* J/A98 and J/A01).

Details on Braune's follow-up experiment, which failed to reproduce the original findings, appear in the September issue of *Radiation Research (158,* pp.352-356, 2002). He now concludes that his findings are consistent with previous efforts that also failed to see nonthermal effects.

complaints among tower workers—including Davis and Docherty's. "They have been advised to operate under a principle of, 'If in doubt, stop and check,'" Schilling told *Microwave News*.

Chinese Delegation Tours Europe Seeking Advice on SAR Limits

A delegation of Chinese officials traveled to Europe in August to meet with research scientists as well as representatives of industry and government. Their mission is to help the Chinese government decide whether to adopt a 1 W/Kg SAR standard for mobile phones or to follow the more lenient limits set by ICNIRP or the IEEE.

The ten-member delegation was led by Sun Xiaokang of the Standardization Administration of China (SAC). The other nine are members of the Joint Working Group (JWG), according to Michael Milligan of the Mobile Manufacturers Forum (MMF), who helped plan their trip. The JWG is charged with making the SAR decision (see *MWN,* M/J02).

The Chinese began their tour in Finland, where they visited the Nokia research center and the Finnish Institute of Occupational Health (FIOH). The following week they attended a workshop at the University of Bordeaux's electromagnetic research lab and then went north to Paris for meetings with French health and industry representatives. The last stop was Brussels, for a discussion on safety standards at the offices of the European Commission (EC).

"We hope the meeting will lead to true global harmonization of safety standards for EMFs," Mark Bogers of the EC's Directorate-General (DG) Enterprise told *Microwave News*. The objective of the DG Enterprise is to promote economic growth and free trade.

In an interview, MMF's Michael Milligan commented that, "We remain hopeful that the Chinese will see the benefits of international harmonization of standards and in particular that they see the value of the WHO-recommended ICNIRP guidelines." The MMF, an association of companies that make radio equipment, including mobile phones, is based in Brussels.

Dr. Maila Hietanen of FIOH and Bernard Veyret of the University of Bordeaux, both of whom are members of ICNIRP, were among those who met with the Chinese officials.

A second, smaller delegation from China is planning to come to the U.S. in November. Dr. C.K. Chou of Motorola in Plantation, FL, is helping organize that trip. On the agenda, Chou said, are meetings with the executive committee of the IEEE's ICES standards group in Piscataway, NJ, FCC officials in Washington and the staff at the Motorola labs in Plantation. At the end of September, Chou told *Microwave News* that the November trip had yet to be confirmed.

Wang Xilin of the SAC, the chair of the JWG, was a member of the delegation that went to Europe. Among the other Chinese government groups represented in the party were the Airspace Medical Institute, Center for Disease Control and Prevention, Environmental Protection Agency, Ministry of Information Industry and National Institute of Metrology, according to Milligan.

International EMF Panel with Precautionary View in Formation

A group of European and U.S. researchers has taken the first step toward establishing an international commission to protect public health and to promote EMF research. The panel will base its outlook on the precautionary principle, according to a resolution adopted at a meeting in Catania, Sicily, in mid-September (see below).

Many of those who were in Catania had also signed the Vienna Resolution, which states that low-level RF/MW effects have been established (see *MWN,* N/D98).

The Catania Resolution

The scientists at the international conference *State of the Research on Electromagnetic Fields – Scientific and Legal Issues,* organized by Italy's National Institute for Prevention and Work Safety (ISPESL), the University of Vienna and the City of Catania, and held in Catania, Italy, September 13-14, 2002, agree to the following:

1. Epidemiologic and *in vivo* and *in vitro* experimental evidence demonstrates the existence of EMF-induced effects, some of which can be adverse to health.
2. We take exception to arguments suggesting that weak (low intensity) EMFs cannot interact with tissue.
3. There are plausible mechanistic explanations for EMF-induced effects which occur below present ICNIRP and IEEE guidelines and exposure recommendations by the EU.
4. The weight of evidence calls for preventive strategies based on the precautionary principle. At times the precautionary principle may involve prudent avoidance and prudent use.
5. We are aware that there are gaps in knowledge on biological and physical effects, and health risks related to EMFs, which require additional independent research.
6. The undersigned scientists agree to establish an international scientific commission to promote research for the protection of public health from EMFs and to develop the scientific basis and strategies for assessment, prevention, management and communication of risk, based on the precautionary principle.

*Signers**: Drs. ***Fiorella Belpoggi***, Ramazzini Foundation, Bologna, Italy; ***Carl Blackman***, Environmental Protection Agency, Research Triangle Park, NC, U.S.; ***Martin Blank***, Columbia University, New York City, U.S.; ***Emilio Del Giudice***, National Institute of Nuclear Physics, Milan, Italy; ***Livio Giuliani***, University of Camerino, Italy; ***Settimio Grimaldi***, National Research Council, Rome, Italy; ***Lennart Hardell***, Örebro University, Sweden; ***Michael Kundi***, University of Vienna, Austria; ***Henry Lai***, University of Washington, Seattle, U.S.; ***Abraham Liboff***, Oakland University, Rochester, MI, U.S.; ***Wolfgang Löscher***, Hannover Veterinary Institute, Germany; ***Kjell Hansson Mild***, National Institute of Working Life, Umeå, Sweden; ***Wilhelm Mosgoeller***, University of Vienna, Austria; ***Elihu Richter***, Hebrew University, Jerusalem, Israel; ***Umberto Scapagnini***, University of Catania, Italy; ***Stanislaw Szmigielski***, Military Institute of Hygiene and Epidemiology, Warsaw, Poland.

* Institutional affiliations are for identification only and do not necessarily indicate endorsement of the resolution.

EPA: Current RF Limits Are Adequate for Thermal Risks

Responding to pressure from the wireless industry, the U.S. Environmental Protection Agency (EPA) has reaffirmed its support for the Federal Communications Commission's (FCC) exposure standards for RF/MW radiation.

"It remains EPA's view that the FCC exposure guidelines adequately protect the public from all scientifically established harms," states Frank Marcinowski, the director of the agency's radiation protection division, in a September 15 letter to the Cellular Telecommunications and Internet Association (CTIA). "However," he points out, there is "continued scientific uncertainty" about "possible nonthermal effects, such as those due to chronic exposure."

This language is consistent with previous comments from EPA officials on RF/MW exposure standards (see box at right).

Marcinowski's letter was prompted by a request for "clarification" from Jo-Anne Basile, a CTIA vice president in Washington. Basile's September 6 letter was, in turn, a reaction to a letter from EPA's Norbert Hankin to the EMR Network, a grass roots activitist group. Basile was concerned that Hankin had failed to fully endorse the FCC limits and asked Marcinowski for "written confirmation" that the EPA had not changed its position, in order to "dispel any misconceptions."

In his three-page letter to the network, dated July 16, Hankin noted the uncertainties related to current exposure limits and detailed the possible implications if nonthermal effects were to be confirmed (see excerpt at right).

Janet Newton, the president of the EMR Network in Marshfield, VT, set the stage for all these letters in January by asking the EPA and five other federal agencies whether they agree with FCC's reliance on the IEEE and NCRP standards.

Dr. Ken Olden, director of the NIEHS, replied on February 21 that "additional research is needed" into possible effects of long-term exposures. Both OSHA and NIOSH responded that they are monitoring research on nonthermal effects. The FDA and the NTIA did not reply.

The network, an organization concerned with possible health effects of electromagnetic radiation, has posted the correspondence on its Web site, <www.emrnetwork.org>. Previously, it had mounted an unsuccessful challenge to the FCC guidelines in court (see *MWN,* M/A00) and failed to convince the FCC to reconsider its exposure limits (see *MWN,* J/F02).

According to the trade publication *RCR Wireless News* (September 2), Basile's letter followed a request by CTIA's attorneys at Arnold & Porter in Washington for a meeting with EPA officials to discuss the agency's position on the FCC limits.

On September 30, Dr. Robert Adair entered the fray with a strongly worded letter to EPA Administrator Christine Whitman. He expressed his "strong dissatisfaction" with Marcinowski and Hankin's letters. Adair lambasted EPA's work on EMFs as being marked by "incompetence and worse in a field marred by documented scientific dishonesty." He closed by citing his credentials, including having held a chair in physics at Yale University and his membership in the National Academy of Sciences.

EPA on Nonthermal Effects

The Letter at the Center of a Storm

The July 16 letter from EPA's Norbert Hankin to the EMR Network is excerpted below. The full text is at <www.emrnetwork.org>.

"I believe it is correct to say that there is uncertainty about whether or not current guidelines adequately treat nonthermal, prolonged exposures...[T]here are reports that suggest that potentially adverse health effects, such as cancer, may occur. Since EPA's comments were submitted to the FCC in 1993, the number of studies reporting effects associated with both acute and chronic low-level exposure to RF radiation has increased.... Federal health and safety agencies have not yet developed policies concerning possible risk from long-term, nonthermal exposures. When developing exposure standards for other physical agents such as toxic substances, health risk uncertainties, with emphasis given to sensitive populations, are often considered. Incorporating information on exposure scenarios involving repeated short duration/nonthermal exposures that may continue over very long periods of time (years), with an exposed population that includes children, the elderly and people with various debilitating physical and medical conditions, could be beneficial in delineating appropriate protective exposure guidelines."

A Consistent View over a Decade

Since the early 1990s, EPA officials have repeatedly stated that the FCC's exposure limits, which are based on those set by the National Council on Radiation Protection and Measurements (NCRP) and the IEEE, do not address nonthermal effects.

***November 9, 1993**, Margo Oge, Director, Office of Radiation and Indoor Air (ORIA), Washington, to the FCC*: "The thesis that the 1992 ANSI/IEEE recommendations are protective of all mechanisms of interaction is unwarranted because the adverse effects level in the [IEEE] standard is based on a thermal effect." (See *MWN,* J/F94.)

***October 8, 1996**, Norbert Hankin, ORIA, to David Fichtenberg*: "Both the NCRP and ANSI/IEEE standards are thermally based and do not apply to chronic, nonthermal exposure situations. The statement referring to 'adequate protection' pertains to thermally related effects." (See *MWN,* M/J97.)

***April 30, 1999**, Robert Brenner, Acting Deputy Assistant Administrator for Air and Radiation, to the FCC*: "The FCC guidelines expressly take into account thermal effects of RF energy but do not directly address postulated nonthermal effects, such as those due to chronic exposure."

***June 17, 1999**, RF Interagency Working Group, to IEEE SCC-28, signed by seven federal officials, including Hankin and EPA's Dr. Joseph Elder, Health Effects Research Lab, Research Triangle Park, NC*: "The past approach of basing the exposure limits on acute effects data with an extrapolation to unlimited chronic exposure durations is problematic....For lower-level ("nonthermal"), chronic exposures, the effects of concern may be very different from those for acute exposure..." (See *MWN,* J/A99.)

« Wireless Notes »

Frustrated by the lack of answers to questions about mobile phone safety, editors at two large-circulation magazines want the wireless industry and the government to **step up the research**. "Simply not enough is known to say whether cell phones are safe," writes **David Kirkpatrick** in his "Fast Forward" column (August 28) posted on the ***Fortune*** Web site, <www.fortune.com/technology>, and distributed free by e-mail. Kirkpatrick points out that, despite industry assurances, most of the Wall Street analysts at a recent Nokia presentation were using hands-free kits. It's "shameful," he contends, that no top wireless executive "will step up and admit that there is a credibility gap between users and the companies that must be addressed" through a more aggressive research effort. Kirkpatrick allows that the "marvelous efficiencies" made possible by mobile phones "could even be worth some minor health risks," but, he adds, "We ought to know what we're getting into." A somewhat different and shorter version of Kirkpatrick's column appears in the September 30 issue of *Fortune*. **Suzanne Kantra Kirschner**, a technology editor at ***Popular Science***, offers a similar view on the safety question in the magazine's September issue. "Despite countless studies...we still don't know if cell phones are dangerous," she writes. With more than 130 million mobile phone users in the U.S. and new broadband technologies on the way, Kirschner advises, "It's time to put this issue to rest, and only the government's deep pockets can do so." She calls on the FDA to "develop a plan to definitively study the long-term effects of cell phone use."

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Shook, Hardy & Bacon has joined the many law firms defending the wireless industry against brain cancer claims. Shook, Hardy is well known for its efforts on behalf of **tobacco** companies—it represented Philip Morris in the first trial of a personal injury case alleging the health hazards of smoking half a century ago. The firm is representing **Sprint** Corp., a service provider named as a defendant in a lawsuit filed by David Keller in a Washington, DC, court earlier this year (see *MWN,* M/A02 and J/A02). Keller, who claims that radiation from his mobile phone caused him to develop a brain tumor, is represented by **Morganroth & Morganroth** in Detroit. Shook, Hardy, which has offices in the U.S. and Europe, is also defending Sprint against several suits that seek to force the wireless industry to provide hands-free kits with every mobile phone (see *MWN,* N/D00 and M/A01).

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Levi Strauss & Co. is using high-tech features to market its Dockers line of **trousers** to European men. Its new S-Fit pants boast a special "**anti-radiation**" **pocket** for a mobile phone. "Our intention is not to cash in on consumer fears but provide the consumers with what they want," a Levi's spokesperson told Reuters (September 12). The shielded pocket will also keep the phone from sending or receiving a signal, a letter to Scotland's *Herald* noted four days later. "The same effect can be achieved with any trousers," the canny reader wrote: "Turn off the phone before placing it in your pocket."

« Eye on Europe »

School, day care and hospital officials in **Berlin**, as well as those who serve other "sensitive" members of the population, now have some control over the placement of **wireless antennas**. Under the *Principles for the Siting of Base Stations* enacted by the city's senate on September 10, they can veto proposed sites on nearby city property. The guidelines also stipulate that antennas on municipal buildings and land must be three times farther away from populated areas than is currently allowed by federal regulations — effectively making the limits ten times stricter than **Germany**'s ICNIRP-based standards. "We view this as a pilot regulation," Harald Wolf, the sponsor of the new ordinance, told the *Berliner Morgenpost* (September 11). Although not required to do so, managers of Berlin's "huge" public housing system will also be encouraged to follow the new guidelines, a spokesperson for Wolf, who is a deputy mayor and member of the Democratic Socialist Party, told *Microwave News*. Last December, in exchange for a promise from federal regulators not to tighten exposure limits, Germany's wireless carriers pledged to give local officials a greater say in siting antennas near schools and kindergartens — without saying how they would do so (see *MWN,* J/F02). Berlin, the German capital, is joining a number of other cities across Europe — including Brussels, Salzburg and Zurich — that want rules that are tougher than their national standards (see *MWN,* S/O00, J/A00 and N/D00, respectively).

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The **Swedish Radiation Protection Authority** (SSI) is increasing its work on non-ionizing radiation — UV and solar radiation and low- and high-frequency EMFs. The new report on cellular phones and cancer (see p.4) is one example of its new priorities. In June, the SSI set up an independent scientific advisory group, chaired by Dr. **Anders Ahlbom** of the Karolinska Institute in Stockholm. The other members are: Drs. **Eduard David** (Germany), **Malcolm Harrington** (U.K.), **Jukka Juttilainen** (Finland), **Leeka Kheifets** (WHO), **Bernard Veyret** (France) and **Harri Vainio** (IARC). Dr. **Lars-Erik Paulsson**, a principal scientist in SSI's non-ionizing radiation department, said that Ahlbom's panel will file a report each year describing the main scientific developments on EMFs. While Paulsson spends the bulk of his time on UV and solar radiation, SSI's **Gert Anger** works on EMF issues full time.

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The Austrian wireless industry's feud with health officials in **Salzburg** continues. In announcing the launch of the country's first nationwide **3G** system, service provider **Mobilkom** said that it cannot offer the service in Salzburg because of the city's 1 ∝W/cm^2 precautionary limit, the September 26 *Salzburger Nachrichten* reported (see *MWN,* J/A00 and N/D01). Earlier this year, **FMK**, which lobbies on behalf of Austria's wireless industry, described Salzburg's nonbinding limit as "political PR, not reality" (see *MWN*, M/J02). Salzburg has not yet been left behind, however. Even though the new base stations are up and ready, 3G mobile phones will not be available for several months.

Now, five years later, Kuchel and Utteridge of the Institute of Medical and Veterinary Science (IMVS) in Adelaide say that they have failed to reproduce Repacholi's experiment — that they saw no significant increase in lymphoma among *Pim*-1 mice following long-term exposure to GSM radiation.

"[Our] study throws water on the concerns about the potential deleterious effects of mobile phones," Kuchel told the Australian Broadcasting Corp. in an August 30 interview. Kuchel declined to respond to questions for this report.

"This was a failure to replicate," said Dr. Mays Swicord, who heads Motorola's program on electromagnetic energy and health in Plantation, FL. The CTIA, the lobbying arm of the U.S. cell phone industry, has taken a similar position.

"The paper is chock full of contradictions."
—Dr. Q. Balzano

In a review for the Swedish Radiation Protection Authority, two U.S. epidemiologists state that the Repacholi study "has been refuted" (see p.4).

Others disagree. Dr. Q. Balzano, the former director of Motorola's Florida research lab and now a part-time consultant to Motorola, was sharply critical of the new paper. "It's not carefully reviewed or well-written," he told *Microwave News*. "It's obvious. It's chock full of contradictions."

Dr. Ron Melnick, a toxicologist at the National Institute of Environmental Health Sciences (NIEHS) in Research Triangle Park, NC, said that he would not have accepted the paper as written, but added, "I would probably not have accepted Repacholi's paper either. I am not convinced that either one has shown a lot."

"It is impossible to compare the two studies," commented Dr. Alexander Lerchl of International University Bremen in Germany. Lerchl said that he was astonished that the Utteridge-Kuchel paper had been published in its current form: "Who in heaven reviewed the manuscript?"

Both Melnick and Lerchl are working on their own animal experiments to explore the possible RF–cancer link. Melnick is helping design the animal studies that are being planned by the U.S. National Toxicology Program (see *MWN,* M/J01). Lerchl was recently awarded a grant by Germany's Federal Radiation Protection Office to run his own GSM–cancer experiment using leukemia-prone mice (see *MWN,* J/A02).

When *Microwave News* asked Repacholi for his opinion, he demurred. "I'll wait until the second replication," he said. Repacholi later added that the Australian paper, in its current published form, does not "refute, quash or demonstrate an inability to replicate" his results. Repacholi now leads the WHO's EMF program in Geneva (see p.3).

The second attempted replication, which is being carried out by Dr. Germano Oberto at RBM Bioscience in Colleretto Giacosa, near Ivrea, Italy, got under way last October.

A 74% Lymphoma Rate Among the Control Mice

The new Australian paper does not lend itself to simple interpretations. The key complication is that the *Pim*-1 mice that served as controls developed lymphoma at a very high rate — more than three times the rate among Repacholi's controls.

Utteridge and Kuchel's published data show that 74% of their control mice had lymphoma by the end of the experiment, compared to 22% of Repacholi's control mice. (The control mice were treated differently in the two experiments.)

Replication or New Experiment?

The new GSM–*Pim*-1 transgenic mouse study by Drs. Tammy Utteridge and Tim Kuchel is widely regarded as an attempt to replicate the 1997 Repacholi *Pim*-1 study. But there are important differences between the two experiments:

- Utteridge's weekly exposures were 29% shorter than Repacholi's. Her mice were exposed for one hour a day, five days a week. Repacholi exposed his mice for one hour a day, seven days a week.
- Utteridge exposed her mice for one hour in a single session. Repacholi exposed his mice for half an hour at 12-hour intervals.
- Utteridge exposed the mice individually in a fixed orientation in a Ferris wheel apparatus. This setup was designed to give the mice a more precise dose of radiation than Repacholi gave his animals. In Repacholi's experiment, the mice lived and were exposed in their cages — with five unrestrained mice in each cage.
- Utteridge had four different exposure groups (0.25, 1, 2, and 4 W/Kg) with 120 mice in each group; there were also 120 sham-exposed mice and 120 cage controls. Repacholi had 100 mice, each exposed to a wide range of levels: 0.008-4.2 W/Kg, averaging 0.13-1.4 W/Kg. It was not clear how much radiation each mouse received. He also had 100 free-running control mice.
- Utteridge was planning to expose her mice for two years, while Repacholi stopped his experiment after 18 months. The vast majority of Utteridge's *Pim*-1 mice died after 17 months of exposure, however, so the two experiments turned out to have very similar exposure periods.
- Repacholi discarded any mice that were "clinically healthy" after the 18-month exposures. Utteridge autopsied all the mice used in her experiment.
- Utteridge exposed both *Pim*-1 and wild type mice. Repacholi used only *Pim*-1 mice.

Alexander Lerchl in Bremen summed it up this way: "This is an independent experiment, not a replication of the Repacholi study." Motorola's Mays Swicord offered a different opinion: "I think [the new study] responds to its objective of addressing the original study."

Tammy Utteridge et al., "Long-Term Exposure of E∝-*Pim*-1 Transgenic Mice to 898.4 MHz Microwaves Does Not Increase Lymphoma Incidence," *Radiation Research, 158,* pp.357-364, September 2002.

Michael Repacholi et al., "Lymphomas in E∝-*Pim*-1 Transgenic Mice Exposed to Pulsed 900 MHz Electromagnetic Fields," *Radiation Research, 147,* pp.631-640, 1997.

Utteridge and Kuchel do not discuss this anomalously high rate of cancer in their paper. They do not even cite the 74% number, although it can be easily derived from the data presented.

"If you have a 74% background rate, it's going to be very difficult to see an increase," Melnick said. "There is something different between the two sets of sham-exposed [control] mice and the question is why are they so different," he added. "It's a little disturbing."

Kuchel, the head of veterinary services at IMVS and the lead biologist on the study team, refused to explain how, with such a high cancer rate among the controls, he could conclude that his experiment showed no increased cancer risk. Indeed, Kuchel did not answer any questions from *Microwave News* over a four-week period, despite a number of assurances that he would do so.

Utteridge sent detailed replies to a large number of questions from *Microwave News,* but she referred the question about the elevated cancer rate among the controls to Kuchel. Utteridge, who served as the project manager, was trained in applied physics.

"I'll wait until the second replication."
— Dr. Michael Repacholi

Although the Utteridge-Kuchel study is widely seen as a replication of the Repacholi experiment, there are many differences between the two (see box on p.10). One of the most important changes is in the way the mice — both the exposed and the controls (the shams) — were handled and irradiated.

In the Repacholi study, the mice were allowed to roam free in their cages, even when they were being irradiated. Utteridge and Kuchel, on the other hand, kept each mouse in a fixed position inside a plastic tube for a one-hour microwave or sham exposure in order to give it a more precise dose of radiation. Forty of these plastic tubes were arranged around an antenna in a Ferris wheel configuration. The exposure equipment was supplied by Motorola.*

Utteridge and Kuchel's control mice were also placed in plastic tubes while Repacholi's controls ran free. It is this difference between the two sets of controls that might explain the difference in their lymphoma rates.

"If animals are restrained, they are stressed. This is common knowledge among biologists," said Lerchl, adding that stress can cause a lot of parameters to change, including hormones that can influence malignant tissue.

As part of the RF animal experiments he carried out for Motorola at the VA Hospital in Loma Linda, CA, Dr. Ross Adey found that rats immobilized in a similar, though different, exposure system showed significant signs of stress after two hours of confinement in loose plastic tubes.† Adey concluded that stress "could significantly mask" potential RF effects. "The possible impacts of stress appear to have been ignored in the Utteridge paper," Adey said in an interview.

Prof. Michael Kundi of the University of Vienna, one of the first to spot the high rate of lymphoma in the controls, suggested that the title of the paper should have been: "Immobilization Stress Obscures the Effect of Microwave Exposure in E∝-*Pim*-1 Transgenic Mice."

Both Lerchl and Melnick said that they are planning to use free-running animals in their own exposure studies.

Utteridge and Kuchel were certainly aware of the stress problem. To test for this possibility, they had 120 free-moving *Pim*-1 mice which were never placed in the Ferris wheel apparatus. But the lymphoma rates for these "negative," or "cage," controls are not presented in their *Radiation Research* paper.‡

Here again, Kuchel refused to discuss the lymphoma rate among the cage control mice. (Utteridge said that she did not have ready access to those data.) In an e-mail exchange with another researcher, which was obtained by *Microwave News,* Kuchel wrote that, "There was no difference between the cage control and the sham-exposed groups." But in the same message, he also stated that, "At 18 months old our mice showed the same pattern of disease, including lymphomas, as the Repacholi study" —a statement that appears to be contradicted by what Kuchel published in *Radiation Research*.

Motorola's Swicord doubts that the high rate of cancer among the sham-exposed mice is due to stress. Instead, he believes that over the last five years the *Pim*-1 mice became genetically different from those used by Repacholi. "We are in uncharted territory," he said.

Donna Gulezian of Taconic Transgenics in Germantown, NY, which supplied Kuchel's *Pim*-1 mice, told *Microwave News* that, "Taconic's procedures attempt to minimize the potential genetic variability," but she allowed that, "This does not guarantee that there is no genetic variability over time."

Dead Mice Weigh In?

The most startling inconsistency in Utteridge and Kuchel's paper is that in one graph (Figure 1B) they show that all the *Pim*-1 mice had died at an age of approximately 19 months, after 17 months of radiation or sham exposure. Yet on the same page, they present weight data for the same *Pim*-1 mice up to the age of 28 months (Figure 2B).

Utteridge explained that some of the weight data were based on only one surviving mouse of the 120 originally assigned to a given exposure group at the beginning of the experiment. "The survival curves were thus very close to zero and the lines may have been indistinguishable from [zero]," she told *Microwave News*. NIEHS' Melnick commented that it made no sense to keep the experiment going with one animal when the other 119 had died.

The new study was designed to last six months longer than

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* The Ferris wheel exposure system was designed by Q. Balzano and was built, maintained and paid for by Motorola. "It cost us between half a million and a million dollars," Balzano said. See: *IEEE Transactions on Microwave Theory and Techniques, 48,* pp.2040-2049, 2000.

† *Radiation Research, 155,* pp.584-592, 2001.

‡ In his paper, Repacholi states that the breeder of the *Pim*-1 mice, GenPharm International, told him that 15% would develop lymphoma spontaneously within 18 months. Donna Gulezian of Taconic Transgenics, which subsequently bought GenPharm, could not substantiate this 15% rate.

Repacholi's, which ran for 18 months. This decision is perplexing, because no one else has ever used the *Pim*-1 strain for such a long experiment. Repacholi was the first, and to date the only one, to even go as long as 18 months.

At a meeting convened by Repacholi in Erice, Italy, in 1999, Motorola's Swicord warned that experts on transgenic animals were "horrified" that anyone would use *Pim*-1 mice for any exposure study longer than 6 months, the length of time the strain was designed to be used to test cancer agents.

In an interview, Dr. Ray Tennant, a leading expert on transgenic experimental animals at the NIEHS, commented, "The basic principle is that studies with transgenic mice should be completed in a short time period." Tennant, the director of NIEHS' National Center for Toxicogenomics, was among those consulted by Kuchel in designing his experiment.

Another area of concern is how much radiation the mice actually received. Utteridge and Kuchel present specific absorption rates (SARs) for the mice as single precise numbers for each exposure group. But there were substantial variations.

There are two complicating factors in estimating the actual SARs. First, the mice grew as the experiment progressed (some doubled in weight), but no adjustments were made to increase the power. As the mice became heavier, the SARs decreased, Balzano explained. He said that the power levels were set so that 28 g mice would have the specified SARs. Since many of the mice weighed over 30 g after reaching 7 months of age and then continued to grow, the published SARs are higher than the mice actually received for most of the experiment. Some of the *Pim*-1 mice weighed close to 40 g — at that weight, the actual SARs would be approximately 70% of those given in the paper.

A second complication arises as the result of interactions among the mice in adjoining compartments in the Ferris wheel. According to Balzano, this could cause an added variation in SAR by a factor of about two. Others, like Adey, believe that the variations could be even larger. For the Italian *Pim*-1 experiment, the Ferris wheel was modified to reduce such interactions.

Once Again, the Data Point to RF Inhibiting Cancer

The new Australian data, whose validity remains open to doubt, show that weak mobile phone radiation can inhibit cancer. The study lends support to a number of previous animal studies that also indicate a protective effect of RF/MW radiation.

Drs. Tammy Utteridge and Tim Kuchel found that *Pim*-1 mice exposed at SARs of 0.25 W/Kg had a 70% lower incidence of lymphoma — a statistically significant reduction. They also see what appears to be a dose-response relationship — more cancer with higher exposures — though the trend lacks significance.

Some observers are comparing the new Australian results with those of Dr. Ross Adey, showing a reduction of central nervous system tumors in rats exposed to digital cell phone signals (see *MWN,* M/J96, J/A96 and S/O99). The Australians do not make this connection and do not even include the Adey paper among their references.

Adey clearly sees a link. "This new study does not close the book on cell phones and cancer," he said in an interview. "Rather, it opens it wider than ever." He is at the Loma Linda University School of Medicine in California.

Drs. Bernard Veyret of France's University of Bordeaux and Christian Bartsch of Germany's University of Tübingen have each found some, albeit inconsistent, support for the proposition that low-level GSM radiation can protect against breast cancer.

DR. BERNARD VEYRET IS TRYING TO IDENTIFY THE MOST BENEFICIAL SIGNAL

In an initiation-promotion study using the known carcinogen DMBA, Veyret saw fewer tumors in restrained rats exposed at SARs of less than 1.4 W/Kg — and a slight increase in tumors at SARs above 1.4 W/Kg. This work, which was first presented in 1999, has been submitted to *Radiation Research* (see *MWN,* J/A 99).

"Our goal in our lab is to try and identify the type of signal that would be most beneficial," Veyret said in an interview following the release of the Australian paper. "We are currently working on this at low SARs."

Bartsch, who ran a similar study, but with free-moving rats, found a highly significant delay in the development of breast tumors at whole-body SARs of 0.0175-0.07 W/Kg. But he failed to see the same reduction in two subsequent efforts to repeat the experiment (see *MWN,* N/D00 and M/A02).

"The work of Utteridge is very interesting and underlines that it may be important to work at relatively low SAR values," Bartsch told *Microwave News*.

Utteridge herself would like to pursue her finding of a lower cancer rate. "We were interested in the reduction in those mice," she told *Microwave News,* "But the NHMRC is not giving out any more funding for animal studies."

In the *Radiation Research* paper, Utteridge and Kuchel report that the National Health and Medical Research Council (NHMRC), which paid for their experiment, "has decided that the issues involved in *in vivo* laboratory animal investigations have been fully addressed by this study of E∝-*Pim*-1." They say the council's decision is based on a "report from the WHO meeting in Erice."

"I don't know where they got that from," said WHO's Dr. Michael Repacholi, who organized the Erice meeting, held in 1999. The statement in the Utteridge-Kuchel paper is not referenced and the report on the Erice meeting on the Web site of the WHO's EMF Project makes no mention of such a decision.

Utteridge referred questions about the NHMRC's decision on pursuing the observed reduction in lymphoma to David Clarkson. He did not respond to requests for comment.

Repacholi does not, however, believe it is a true effect. "I think that it's an artifact," he said, "but it is something worth following up because of the other studies showing positive results. We really have to take a look."

Dr. David McCormick of IITRI in Chicago, who has carried out a large number of animal studies, including some with the *Pim*-1 mouse, attributes the observed lower rate of lymphoma to variability among the animals. "With one data point, you cannot say that it is real," he said, although he conceded that the 70% reduction was greater than he had found in tests of two chemical lymphoma inhibitors on *Pim*-1 mice.

DR. FRANK PRATO: IS THERE HORMESIS WITH NON-IONIZING RADIATION?

This is the second time in a year that the NHMRC has shown no interest in pursuing an unexpected finding associated with RF/MW exposure. In last November's *Radiation Research,* Dr. Pamela Sykes reported fewer than expected changes in DNA after exposure to GSM radiation, but when she tried to secure funding to follow it up with a larger number of animals she came away empty-handed (see *MWN,* N/D00 and N/D01; also p.15).

Sykes of Flinders University in Adelaide told *Microwave News* that the reduction in lymphoma observed by Utteridge is "fascinating," but that it would have to be repeated with a larger number of animals and at lower doses to be convincing.

Sykes drew a parallel between the possible beneficial effects of RF/MW radiation and those found with low doses of ionizing radiation — a protective phenomenon known as hormesis.

Dr. Frank Prato, a medical biophysicist at the University of Western Ontario in London, Canada, also raised the possibility that a hormesis-like effect might occur with non-ionizing radiation. "We should look for and expect to see both beneficial and detrimental effects if there are biological effects at low doses of non-ionizing radiation," he said. Prato is the president of the Bioelectromagnetics Society (see also p.16).

FROM THE FIELD

Letters to the Editor

Motorola Is "Open and Objective"

September 12, 2002

To the Editor:

On behalf of Motorola, I want to object in the strongest terms to the tone and substance of your July/August editorial "Motorola's Junkyard Dog." Mean-spirited and personal attacks of this kind should be out of bounds and out of character for a publication that purports to encourage sound science and constructive dialogue. Your comments about Dr. Joseph Morrissey, a dedicated and talented research scientist, were unfair and unwarranted. Your comments about Motorola were unjustified and inaccurate. Motorola has a longtime position of prominence in bioelectromagnetics. We take pride in that fact and consider it an extension of our commitment to global corporate responsibility. We believe Motorola's efforts over many years have made significant contributions to the scientific knowledge base and to promoting the principle that new research findings receive critical review in the full light of day. We resent any suggestion that Motorola has been anything but open and objective in this regard.

Industry, government, science and the media have a shared responsibility to help see that research findings are viewed and communicated in proper context. *Microwave News* can do its part by taking a higher road than the one reflected in your July/August issue. It is one thing to use your editorial pages to provoke debate. It is quite another to malign the motives of Motorola or its employees. Such behavior serves only to generate contrived controversy that distracts us from what should be a common goal of assuring that considerations of serious issues benefit from diverse and open scientific discourse.

Norman D. Sandler
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Morrissey Responds

September 30, 2002

To the Editor:

The comments made by *Microwave News* in the July/August 2002 editorial titled "Motorola's Junkyard Dog" were offensive and unprofessional. I welcome a chance to respond.

During an open scientific session at the recent BEMS meeting in Quebec, I voiced my opinion to Dr. Dariusz Leszczynski that extrapolation of his *in vitro* findings to possible human health effects without clearly incorporating available results from more relevant human and animal studies into his theory was inappropriate. I further had concerns that his *in vitro* system seemed to indicate peak SARs during exposure that may have reached 5 W/Kg or more (depending upon the method of exposure characterization), and that a non-RF heat control had not been performed for comparison. I apologize for any offense that Dr. Leszczynski or any of the other attending research scientists may have taken to the delivery of my questions, although the questions themselves *stand* and remain unanswered.

My concerns may prove to have been unfounded if additional research validates Dr. Leszczynski's findings. Conversely, further research may address my concerns and show that the initial findings were spurious. In any event, these questions were appropriate at that time and place, and should be sifted out by a scientific process involving qualified scientists. That process should not be impeded or prejudiced by attempts to incite buzz or conflict to tantalize the readers of *Microwave News*.

Joseph J. Morrissey, PhD
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Meeting Notes

• During the second week of November, **U.K.** and **COST** committees on **mobile phone** research will hold back-to-back meetings at the Royal Society in London. The U.K. seminar, the first since the **Mobile Telecommunications and Health Research Program (MTHR)** announced its grants last January (see *MWN,* J/F02), will feature a talk by Sir **William Stewart**, who chairs the MTHR advisory panel and who led the expert group that recommended this research effort (see *MWN,* M/J00). Among the other speakers are Gerd Friedrich, Dr. Maila Hietanen, Dr. Kjell Hansson Mild, Dr. Mays Swicord, and Dr. Bernard Veyret, according to a draft agenda posted at <www.mthr.org.uk>. Only a limited number of places are available and these will be allocated on a first-come, first-served basis. The following day, while the MTHR hosts "small informal meetings for invited participants," COST281 will open its own seminar in the same location to try to hash out the differences between thermal and nonthermal effects. The two-day meeting, which is open to the public, will "discuss the results of experiments that have included a subtle temperature increase, and also those that have been reported to be 'nonthermal,' analyzing and discussing the real process of energy absorption," according to a statement posted on the COST Web site. Dr. David de Pomerai's experiments showing a stress response in worms following low-intensity microwave exposure are sure to be a major topic of conversation. The agenda was not available as we went to press. COST281 has also announced its next workshop, ***Mobile Communication Base Stations and Health***, which will be held in **Dublin**, May 15-16. The September edition of the COST281 newsletter features summaries of the last two workshops — on *Emerging Technologies* and *Mobile Phones and Children* — held in Rome in May (see *MWN,* M/J02*)*. The newsletter and other workshop documents are available at <www.cost281.org>.

New Listings

November 11: **Research Seminar on Mobile Telecommunications and Health**, Royal Society, London, U.K. Contact: Mobile Telecommunications and Health Research Program (MHTR), c/o National Radiological Protection Board (44+1235) 831600, Fax: (44+1235) 822650, E-mail: <mthr@nrpb.org> Web: <www.mthr.org.uk>.

November 12-13: **Subtle Temperature Effects of RF-EMFs: A COST 281 Seminar**, Royal Society, London, U.K. Contact: Gerd Friedrich, FGF, Rathausgasse 11a, D-53111 Bonn, Germany, (49+228) 726-220, Fax: (49+228) 726-2211 E-mail: <info@fgf.de>, Web: <www.cost281.org>.

November 25-27: **Genetic and Cytogenetic Aspects of RF-Field Interaction**, Löwenstein, Germany. Contact: Gerd Friedrich, FGF. See above.

• The September issue of ***Health Physics*** features a collection of 11 papers that were first presented at an **EPRI** workshop on EMF exposure guidelines held in Brussels in June 2000 (see *MWN,* J/F00). Dr. **William Bailey** of Exponent in New York City served as the editor for this special issue of the journal.

• In November 2000, **Germany**'s Federal Institute for Occupational Safety and Health (FIOSH) organized a workshop in Berlin, ***Is Central Nervous Information Processing Influenced by Electromagnetic Fields of Mobile Phones?*** (see *MWN,* J/A01). The proceedings of that meeting are now available from FIOSH for €19.50 (US$19.15). Some of the papers are in English and some are in German — but even those include abstracts in English. Order from <www.baua.de>; this Web site has text in either German or English. Or contact the publisher, Wirtschaftsverlag, at Fax: (49+471) 945-4488. Order volume No. Tb122.

"MICROWAVE NEWS" FLASHBACK

Years 20 Ago

• ANSI adopts a new safety standard for RF/MW radiation with limits as much as ten times lower than the previous 10 mW/cm^2 standard. Its approval comes on the heels of a new, stricter exposure limit of 200 ∝W/cm^2 for the general public in Massachusetts.

• Women exposed to fluorescent light at work were twice as likely to develop skin cancer in a study from Australia's Sydney Hospital and the London School of Hygiene and Tropical Medicine. A smaller study of men found a similar increase.

Years 10 Ago

• In Sweden, Dr. Anders Ahlbom and Maria Feychting report that the risk of leukemia was four times higher among children exposed to 3 mG or more at home, and Dr. Birgitta Floderus finds that men with similar exposures at work had triple the expected rate of leukemia. The Swedish government responds that it will now "act on the assumption" that EMFs are linked to cancer.

• The U.S. Congress directs NIOSH to do a study of cancer among police officers who work with traffic radar.

• A childhood leukemia cluster near the U.S. Navy's Lualualei antenna farm is not due to chance, EPA and Hawaiian health officials find — but they stop short of naming RF/MW as the cause.

Years 5 Ago

• "Low radiation is better!" proclaims Germany's Hagenuk, maker of a low-SAR mobile phone. Its marketing campaign is the first to use health concerns to sell phones.

• Radiation from antitheft devices can interfere with many cardiac pacemakers, U.S. and German researchers announce.

• A cluster of birth defects among children of servicemen aboard the *Kvikk* prompts the Norwegian navy to investigate a possible link to the ship's radar and communications systems.

Hot New Papers

Patrick Levallois, "Hypersensitivity of Human Subjects to Environmental Electric and Magnetic Field Exposure: A Review of the Literature," ***Environmental Health Perspectives, 110,*** **supp.4, pp.613-618, August 2002.**

"Hypersensitivity to exposure to electric and magnetic fields (EMFs) has been reported for nearly 20 years; however,...[t]he result of the literature review is rather meager. Few studies have been published on the subject of HSEMF in peer-reviewed journals. Most of the studies published on HSEMF come from Nordic countries and are concerned with nonspecific skin disorders related to VDUs. Few studies have been conducted in other countries and almost nothing comes from North America. The evidence of the existence of a more general syndrome associated with HSEMF (including such different nonspecific symptoms of the nervous system as fatigue, dizziness, headache and depression) is still very weak....Globally, the largest amount of the evidence pleads against a role of EMFs in the reported symptoms and, moreover, its existence in North America has yet to be demonstrated....In conclusion, I found no substantial grounds on which to build a framework for helping a risk assessor to take into account the alleged 'HSEMF syndrome.' Our knowledge of the nature of the problem seems too vague to integrate it into an EMF risk assessment protocol. But there are certainly grounds for further research to assess more carefully its nature and its possible burden in North America."

See also: "Hot Papers," *MWN,* N/D99; and Patrick Levallois, Raymond Neutra, Geraldine Lee and Lilia Hristova, "Study of Self-Reported Hypersensitivity to Electromagnetic Fields in California," *Environmental Health Perspectives, 110,* supp.4, pp.619-623, August 2002.

Reprints: Dr. Patrick Levallois, University of Quebec, Beauport, Canada, E-mail: <patrick.levallois@msp.ulaval.ca>.

Xiaomei Ma, Patricia Buffler et al., "Critical Windows of Exposure to Household Pesticides and Risk of Childhood Leukemia," ***Environmental Health Perspectives, 110,*** **pp.955-960, September 2002.**

"A total of 162 patients (0-14 years old) with newly diagnosed leukemia were rapidly ascertained during 1995-1999, and 162 matched control subjects were randomly selected from the birth registry. The use of professional pest control services at any time from 1 year before birth to 3 years after was associated with a significantly increased risk of childhood leukemia (odds ratio (OR): 2.8, 95% confidence interval (CI)=1.4-5.7), and the exposure during year 2 was associated with the highest risk (OR: 3.6, 95%CI=1.6-8.3)....Insecticide exposures early in life appear to be more significant than later exposures, and the highest risk was observed for exposure during pregnancy. Additionally, more frequent exposure to insecticides was associated with a higher risk. In contrast to insecticides, the association between herbicides and leukemia was weak and nonsignificant.

Reprints: Dr. Xiaomei Ma, School of Public Health, University of California, Berkeley, E-mail: <xmma@uclink4.berkeley.edu>.

Neil Cherry, "Schumann Resonances, a Plausible Biophysical Mechanism for the Human Health Effects of Solar/Geomagnetic Activity," ***Natural Hazards, 26,*** **pp.279-331, July 2002.**

"A large number of studies have identified significant physical, biological and health effects associated with changes in solar and geomagnetic activity (S-GMA)....A key scientific question is, what factor is it in the natural environment that causes the observed biological and physical effects? The effects include altered blood pressure and melatonin, increased cancer, reproductive, cardiac and neurological disease and death. Many occupational studies have found that exposure to ELF fields between 16.7 Hz and 50/60 Hz significantly reduces melatonin levels. They are also associated with the same and very similar health effects as the S-GMA effects....It is found that the Schumann Resonance signal is extremely highly correlated with S-GMA indices of sunspot number and the Kp index. The physical mechanism is the ionospheric D-region ion/electron density that varies with S-GMA and forms the upper boundary of the resonant cavity in which the Schumann Resonance signal is formed. This provides strong support for identifying the Schumann Resonance signals as the S-GMA biophysical mechanism, primarily through a melatonin mechanism. It strongly supports the classification of S-GMA as a natural hazard."

Reprints: Dr. Neil Cherry, Lincoln University, Canterbury, New Zealand, E-mail: <neil.cherry@crc.govt.nz>.

New Research Projects

• The **U.S. Air Force** Office of Scientific Research has awarded Dr. **Charles Tseng** of Purdue University Calumet, IN, $2.5 million to investigate the possible **genetic effects of RF/MW radiation**. "We are going to survey the entire scope of human genes, as well as total genes of two bacterial species," Tseng said. He will use the powerful new tools of proteomics to see whether RF/MW radiation can alter gene expression in human myeloid cells and in *E. coli* and *Bacillus subtilis*. Tseng's approach will be different than that of Finland's Dr. Dariusz Leszczynski (see *MWN,* J/A01, M/J02 and J/A02). "We are trying a new approach in terms of the RF sources, cell types [and] subcellular information," Tseng told *Microwave News*. In addition to several Purdue Calumet colleagues, Tseng's team includes Dr. **San Ming Wang** at the University of Chicago and Dr. **Chung Lee** at Northwestern University Medical School, also in Chicago. The study will run for three years, with a possible two-year extension.

• Australia's National Health & Medical Research Council (**NHMRC**) is planning to set up a **Center of Research Excellence** to investigate possible health effects of **mobile phone and base station radiation**, with an annual budget of about US$280,000. In addition to doing research, the NHMRC wants the center to foster collaboration across disciplines—including biology, medicine, physics and engineering. Another objective is training scientists for work in the field so that Australia "is well prepared for future and related research in this important area." The NHMRC is encouraging proposals "from investigators who would not normally apply," noting that its expert committee on electromagnetic energy is "disappointed" by "the apparent limited pool of researchers" addressing the issue in Australia. A total of Aus$2.5 million (approximately US$1.4 million) has been allocated for a five-year period. The deadline for expressions of interest is October 28.

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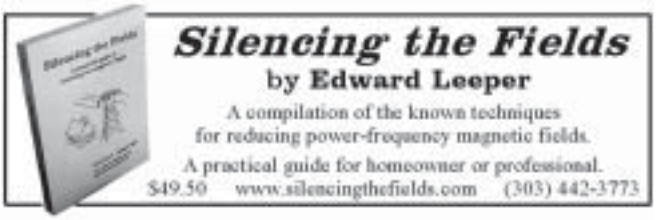

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UPDATES

BROADCAST RADIATION

AM Radiation Under Scrutiny in Korea... Cancer rates among children exposed to AM radio radiation warrant further investigation, according to a small case-control study by a team of Korean researchers. At the *14th Conference of the International Society for Environmental Epidemiology* (ISEE), held August 11-15 in Vancouver, Canada, Dr. Mina Ha of Dankook University in Cheonan reported that brain tumor and leukemia risks were greater than expected among those 15 years old or younger living within 2 km of AM transmitters with an output power of 100 kW or more. But these associations are based on very few cases and must therefore be interpreted with caution, Ha said. Children living near 50-100 kW transmitters did not have higher rates of cancer. Ha's abstract is in the July issue of *Epidemiology (13,* p.S197, 2002); a paper has been submitted for publication. In an interview with *Microwave News,* Ha said that the study period is being extended to include more cases and RF measurements are planned. Elevated cancer rates have previously been found in the vicinity of TV and radio transmitters in Australia, Italy and the U.K. as well as in the U.S. (Portland, OR, and Honolulu, HI) (see *MWN,* N/D95, S/O01, J/F97, J/F82 and M/J87, respectively). Ha can be reached at: <minaha@dku.edu>.

MECHANISMS

Radical Pair Recombination... Dr. Brian Brocklehurst of the U.K.'s University of Sheffield presents a detailed review of the effects of magnetic fields on the recombination of radical pairs (RP) in the September issue of *Chemical Society Reviews (31,* pp.301-311, 2002). He notes that, "It is not yet clear whether [the RP mechanism] is relevant to human biology." Most of his analysis is on high-field interactions — in the millitesla-to-tesla range (10-10,000 G), but he also addresses low-field effects. "One might well conclude that small fields cannot possibly be dangerous, but one must not forget that birds navigate using the geomagnetic field (0.05 mT [500 mG]) and many other organisms use it to aid orientation," he writes. Brocklehurst adds that, "[B]iological systems are full of surprises. Reaction mechanisms are far from simple and it is possible that very small effects can be amplified." His e-mail address is: <b.brocklehurst@sheffield.ac.uk>.

PEOPLE

Dr. **Gro Harlem Brundtland** announced on August 23 that she will step down as director-general of the WHO next July at the end of her first five-year term. She cited age (she will be 64 next summer) as a major factor in her decision not to seek reappointment. Brundtland, a physician and a former prime minister of Norway, favors a precautionary approach to mobile phone radiation and advises children not to use them (see *MWN,* M/A02 and J/A02)....At the general assembly of the Union of Radio Science (URSI) held in Maastricht, the Netherlands, in August, Dr. **Frank Prato** of the University of Western Ontario in London, Canada, was elected vice chair of Commission K on Electromagnetics in Biology and Medicine. At the meeting, Dr. **Bernard Veyret** of the University of Bordeaux moved up from vice chair, replacing Dr. **Shoogo Ueno** of the University of Tokyo as the

head of Commission K. Prato will in turn replace Veyret at the next general assembly, which will be held in New Delhi in October 2005. Ueno is the president-elect of the Bioelectromagnetics Society (BEMS) and he will take over from Prato, the current president, next June. In other URSI news, Dr. **Q. Balzano**, formerly of Motorola and now a consultant based in Annapolis, MD (see p.10), is the new chair of Commission A on Electromagnetic Metrology....Dr. **Raymond Neutra,** the head of the California EMF Program, has been presented the **John Goldsmith Award** by the International Society for Environmental Epidemiology (ISEE) for his "sustained and outstanding contributions to the knowledge and practice of environmental epidemiology." In a lecture delivered at the ISEE's awards ceremony in Vancouver on August 14, Neutra described how the California EMF program used novel techniques to clarify the reasoning behind its conclusions. At press time at the end of September, the final report of the EMF program had not yet been released (see *MWN,* J/A02)....Dr. **Jutta Brix** has left Germany's Federal Office for Radiation Protection, where she headed the unit on the effects of non-ionizing radiation at the Institute of Radiation Hygiene. Brix, a biologist, has joined the Bavarian health ministry in Munich, where her responsibilities include monitoring the health impacts of mobile phones. No replacement has yet been named....**Richard Strickland** has launched RF Safety Solutions, a consulting firm based in South Setauket, NY, which advises clients on how to minimize RF exposure risks and comply with exposure guidelines. Strickland was long the director of product development at Narda Safety Test Solutions in Hauppauge, NY, a leading manufacturer of radiation meters. His new Web site is <www.rfsafetysolutions.com>.

PROTECTIVE DEVICES

QLink Affects EEG... Clarus Products International in San Rafael, CA, claims that the low-power microwaves emitted by its QLink pendant can "strengthen your immunities to cell phone, computer and workplace EMFs." Now, researchers in Australia and the U.K. report that the QLink produced changes in brain function in their tests. A team led by Dr. Rodney Croft of Australia's Swinburne University monitored the electroencephalogram (EEG) of 16 male and eight female volunteers, ages 19-48, over a one-hour period during which they performed cognitive response tests. When exposed to GSM digital phone signals, subjects had elevated neural activity in response to auditory stimuli, but when the QLink was switched on at the same time (without the subjects' knowledge) this effect was attenuated, Croft writes in the August *Journal of Alternative and Complementary Medicine (8,* pp.427-435, 2002). The QLink also appears to have reduced the effect of phone signals on EEG during rest periods between tests. But Croft cautions that the study could not determine "whether the response was beneficial," and added that, "It is possible that the influence was due to the DC or 50 Hz power source" of the device, rather than its 7.4 GHz signal. Clarus sponsored the study. This paper can be downloaded free from the journal's Web site, <www.liebertpub.com/pagedisplay/Toc.asp?id=26>. (See also *MWN,* J/A02). The basic QLink model costs $129. A version in gold is also available for $799.

Keeping Current: Follow-Up on the News

◆ The California EMF Program's final report, which contains the strongest warning to date on EMF health risks (see *MWN*, J/A02), has not yet been released. The program's director, Dr. Raymond Neutra of the state's Department of Health Services, had predicted that it would be released by the end of the summer, but in a September 27 letter he told the state's Public Utilities Commission that the report is "still undergoing final review."

◆ Research proposals in response to the CTIA's solicitation under the second phase of its CRADA with the FDA are due by October 31 (see *MWN*, N/D99 and M/J01). The CTIA is interested in ideas to improve exposure assessment in relation to past and future epidemiological studies.

◆ Both ICNIRP and the WHO International EMF Project have revamped their Web sites: <www.icnirp.de> and <www.who.int/peh-emf/en/>. The WHO site now includes a searchable database of exposure standards from around the world. ICNIRP guidelines, published in *Health Physics*, can be downloaded for free.

◆ Blue Angel, the product-labeling offshoot of Germany's Federal Environment Ministry, has translated the commentary explaining its requirements for certifying low-SAR mobile phones into English (see *MWN*, J/A02). It is available at: <www.blauer-engel.de/englisch/navigation/body_blauer_engel.htm>.

◆ The requirement that U.S. wireless companies offer analog phone service will lapse following a five-year transition period, the FCC announced on August 8. Commissioner Michael Copps faulted his fellow commissioners for failing to insist that phone makers develop hearing-aid compatible digital models before the analog service is dropped.

◆ In its September issue, the German consumer magazine *ÖKO-TEST* reports on radiation levels from the base stations of 1.9 GHz DECT digital cordless phones. At a distance of 1 meter, the levels ranged from 0.9 to 2.1 ∝W/cm^2 for the 13 models tested. Noting that DECT base stations transmit at all times, even when the phones are not in use, *ÖKO-TEST* judged all but two phones "unsatisfactory." A summary of the report, in German, is at <www.oekotest.de/cgi/ot/otgs.cgi?doc=28467>.

◆ On August 27, the U.S. Army extended the U.S. Air Force's permit to occupy the land on Cape Cod, MA, where the PAVE PAWS radar is located for an additional 20 years. The permit is now good through September 30, 2026.

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China Weighs Breaking Ranks, Adopting 1W/Kg SAR Limit for Mobile Phones

Microwave News, May/June 2002

China May Draw a Sharply Lower Line On Mobile Phone Radiation

IEEE Spectrum, September 2002

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A Massive Failure of Peer Review

The new Australian animal study may or may not show that mobile phone radiation is safe, as Tim Kuchel claims (see p.1). His and Tammy Utteridge's paper in *Radiation Research* is so full of mistakes and omissions that we cannot offer an opinion until they provide more data.

But one thing is already clear: There has been a massive failure in the peer-review process.

Many of those we interviewed want to know who reviewed the paper. This is, of course, cloaked in secrecy. John Moulder, the senior editor at *Radiation Research* who handles RF manuscripts, would not say whether he had shepherded it through peer review, but he is handling the letters that are flowing in.

It seems just possible that the reviewers were lenient on the Australians because they agreed with the paper's conclusions. How else could they have failed to notice that some of the mice were dead according to one figure but were still being weighed according to another figure on the same page? How could they have failed to notice that the rate of lymphoma among the controls was abnormally high and that the cancer data for the cage control mice were missing?

The paper appears to have been rushed into print with only minimal editing. There are undefined columns of numbers floating in three different figures. There are even two typographical errors in the title.

How do we account for those who are blithely touting the Utteridge-Kuchel paper as evidence that cell phones do not promote cancer? Or those who are using it to attack Lennart Hardell's epidemiological studies? (See p.4 and p.10.) We suspect that few of them have actually read beyond the abstract. Their biases are all too apparent.

"I thought that nothing in this area of research/politics could surprise me any more," Germany's Alexander Lerchl told us after reading the paper. "I was wrong."

One final note: Kuchel's refusal to answer questions, both ours and those of others, is disgraceful. If he is willing to sound an all clear on television, he should be willing to talk to people who have actually read his paper.

Things Do Change

On Sunday morning, September 22, we opened the *New York Times Magazine* and noticed something that made our day. Accompanying an article on Deputy Secretary of Defense Paul Wolfowitz is a picture of him working at his Pentagon desk. In the background is a flat-panel computer screen with the telltale round, green-and-red TCO'95 sticker indicating that it is a *low-radiation* display meeting the standards set by the TCO, Sweden's white-collar union. When *Microwave News* began publishing more than 20 years ago, we were repeatedly chided for asking questions about VDT radiation. Today, shielded terminals are everywhere.

In Search of a Few Revolutionaries

Hans-Albert Kolb in Hannover lost a bottle of champagne betting that relatively weak EMFs cannot induce DNA breaks (see p.2).

To his credit, Kolb ran the experiment despite his initial skepticism and proved himself wrong. By repeating the work of Vienna's Oswald Jahn and Hugo Rüdiger, Kolb's lab becomes the sixth to show that magnetic fields can disrupt genetic blueprints. Taken together, these studies make the epidemiology linking EMFs to childhood cancer more credible. (Now there are reports that this same link has been found in a Japanese study; see p.3).

The standard response from physicists is that this work cannot be right because power-frequency EMFs do not have the energy to break chemical bonds. Some even suggest that the experimenters must be incompetent or dishonest (see p.8).

Anyone who has taken high school chemistry will agree that bonds are not being broken, but that does not mean these experiments are flawed. The researchers may not yet understand the subtle changes that lead to genetic damage — the important thing is that magnetic fields have repeatedly been shown to cause such damage.

These labs have not been wasting time and resources pursuing phantom science, as the critics claim. On the contrary, we should step up the search for an explanation for these genetic changes. Identifying the mechanism of interaction would help us interpret the epidemiological evidence. On a deeper level, it would advance an ongoing scientific revolution. Electrobiology promises a host of new medical therapies and other benefits, in addition to controlling unnecessary risks to public health.

Observations that run against the grain of establishment science promise the greatest rewards. A few individuals with some good ideas and money in their pockets, together with the confidence to brave the inevitable jeers from the old guard, could integrate these new laboratory findings into a coherent biological model.

We'll bet a magnum of champagne on that.

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Vol.V No.7 A Report on Non-Ionizing Radiation September/October 1985

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EPA RF/MW Guidelines: Compliance Costs Estimated

The cost to the U.S. broadcast industry of complying with a 100 uW/cm² radiofrequency and microwave (RF/MW) radiation exposure standard for the general public would be between $19.1 and $45.6 million, according to an economic analysis by the Lawrence Livermore National Laboratory. FM stations would bear the greatest burden of compliance with a 100 uW/cm² standard — 57-64 percent of the total industry costs.

Compliance with the American National Standards Institute (ANSI) standard would cost radio and television broadcasters $8.4-16.2 million, of which FM stations would pay $4.0-8.2 million.

In a report to the Environmental Protection Agency (EPA), Livermore's Charles Hall estimated the economic impact of 18 alternative exposure limits for radio and television stations: from 1 uW/cm² to 10 mW/cm² for FM and TV and from 10 V/m to 1,000 V/m for AM. Hall found that the average reduction in profit as a result of a 100 uW/cm² standard would be 1.8-5.4 percent for FM stations and 0.8-1.3 percent for TV stations, and 0.4-0.8 percent for AM stations meeting an 86.6 V/m standard.

The Livermore study also estimated the social cost of the EPA radiation guidelines — defined as the opportunity cost of allocating resources to RF/MW radiation control instead of to other projects. For 100 uW/cm² and 86.6 V/m, the social costs would be $38.7-93.4 million; for 200 uW/cm² and 264.6 V/m, $26.5-60.3; and for 1 mW/cm² and 446.7 V/m, $15.9-31.2 million. (Calculations were run for "low" and "high" cost assumptions yielding the ranges cited above; the estimates are for the present value of the net after-tax costs.)

(continued on p.8)

EPA To Disband Radiation Research Group

The Director of the Environmental Protection Agency's (EPA) Health Effects Research Laboratory is moving to disband the non-ionizing radiation research group and abolish the Experimental Biology Division (EBD) in which it works. Laboratory Director Dr. Gordon Heuter has asked the division to develop a phase-out and reorganization plan to submit to the EPA headquarters in Washington. Final approval could come before the end of the year.

According to EBD Director Dr. Richard Phillips, ongoing research which can be completed in the next few months will be allowed to continue, as will extramural projects that already have been fully funded.

(continued on p.11)

HIGHLIGHTS

Connecticut Dispute Prompts 10 uW/cm² Recommendation

A dispute over a proposed UHF-TV transmitting tower on Avon Mountain, CT, has led the town of Avon's leading health official to recommend that the community adopt a public, residential exposure safety standard of 10 uW/cm² for radiation from a single source or from multiple sources on a single tower. The standard would apply to levels measured at homes nearest the tower.

The 10 uW/cm² recommendation is equivalent to the 1984 exposure standard set by the Soviet Union (see *MWN*, June 1985) and is a hundred times stricter than the Connecticut state standard.

Avon's Director of Health, Hudson Birden, Jr., explained in a memorandum to the town's Planning and Zoning Commission that his recommendation "anticipates eventual standards at the state or federal level by being more conservative by a whole order of magnitude than any standard currently established or proposed in this country" and that the 10 uW/cm² standard can be "easily achieved" by the station planning to build the tower. The memorandum notes that knowledge of adverse health effects of non-ionizing radiation is "not definitive" but adds that the proposed tower presents "no cause for concern."

Astroline Communications, which owns WHCT-TV, Channel 18, wants to construct a 750-foot tower for a 3.26 megawatt broadcast antenna operating at 495.25 MHz. The tower would be sited near a small antenna farm on Avon Mountain in a sparsely populated area. The station is now broadcasting from a 279-foot tower in the antenna farm; it would be torn down if the new tower is approved.

Local residents opposing the tower argued at two planning commission hearings in October that the transmissions pose a potential health hazard and could reduce property values. In addition, the residents contend that the tower would be an eyesore and would detract from the beauty of a hiking trail that runs through the area.

Both Sides Might Sue

The planning commission is expected to issue a decision on Astroline's application in mid-November. Marshall Berger, Jr., the residents' attorney, said in a telephone interview that his clients will sue to block construction of the tower if the planning commission approves the application. Berger is a partner in the Simsbury, CT, firm of Pease, Main & Berger. Mark Oland, Astroline's attorney, said that the company would consider going to court if the planning board rules against it.

At the board's October 1 meeting, Professor Abe Liboff of Oakland University in Rochester, MI, warned the commission to move "very cautiously" in light of uncertainty about low-level effects of non-ionizing radiation. Liboff previously had presented data to the board on behalf of the local residents which projected a 26.8 uW/cm² field from the new tower in the house nearest the proposed tower site, approximately 1,200 feet away. The field level at the house from all sources, including those at the antenna farm, was estimated to be 41.3 uW/cm².

By contrast, Micro Communications, Inc. of Manchester, NH, a consultant to the broadcaster, projected a field at the house of just 0.3 uW/cm² from the proposed tower, excluding an FM transmitter that would broadcast from the tower. The consultant also estimated ambient fields near the house to be 11.72 uW/cm².

Another consultant to Astroline estimated a combined field level at the road, 750 feet from the tower site, of 81.9 uW/cm², with 44 uW/cm² from the proposed transmitter alone.

Astroline was also represented by Dr. Herbert Pollack, a private consultant, who has done extensive work for the State Department, especially on the irradiation of the U.S. embassy in Moscow.

Connecticut Standard

In 1984, Connecticut passed a law directing the state's Department of Environmental Protection to implement public safety rules based on the 1982 American National Standards Institute (ANSI) standard (see *MWN*, June 1984). The ANSI limit at the Channel 18 broadcast frequency is approximately 1.65 mW/cm².

The law could make the Avon 10 uW/cm² recommendation moot if the state intends for the law to preempt local regulations, but Astroline attorney Oland, who works for the Hartford-based firm of Schatz & Schatz, Ribicoff & Kotkin, noted in a telephone interview that the Connecticut law is unclear on preemption. It is "no comfort for either side," he said.

Kevin McCarthy, director of the state's Radiation Control Unit, told *Microwave News* that his staff is in the process of drafting the legislatively mandated radiation rules. He said that the preemption issue is unresolved and, if necessary, will be addressed by state attorneys.

Other broadcasters transmitting from the antenna farm, which is across the street from the proposed Astroline site, have said they will increase power output if the WHCT

Vernon & Cougar Mountain

In November, EPA officials will drive a van loaded with detection equipment to Vernon, NJ, from Las Vegas, NV, to measure RF/MW radiation levels in the town. The EPA is responding to citizen concerns over an increased incidence of Down's Syndrome among children in Vernon (see *MWN*, May 1985).

A report on the cluster of Down's cases is expected soon from the Centers for Disease Control in Atlanta, GA.

Meanwhile, an EPA report on measurements taken on Cougar Mountain, WA, by EPA's Richard Tell and FCC's Dr. Robert Cleveland has not yet been released (see *MWN*, May 1985).

tower is approved and radiofrequency interference results. Residents expressed concern that this would further increase field levels in the area. Plans to expand existing facilities could run into zoning obstacles, however, since all of the towers currently violate the town's zoning laws and operate under special exemptions. These exemptions would be nullified by expansion, according to Oland.

FCC Delays RF Rules; Rejects State and Local Preemption

The Federal Communications Commission (FCC) has delayed implementation of its radiofrequency (RF) safety rules until January 1, 1986. The rules, which will require broadcasters seeking FCC permits to comply with public exposure standards set by the American National Standards Institute (ANSI), were scheduled to take effect October 1.

The delay came in response to petitions filed by the National Association of Broadcasters (NAB) and the TV Broadcasters All Industry Committee (TVBAIC), who asked the FCC to push back implementation of the rules as far as June 1, 1986 and to preempt state and local RF standards, most of which are stricter than ANSI's (see *MWN*, May 1985).

The Corporation for Public Broadcasting, GTE, KONG-TV and the Electromagnetic Energy Policy Alliance generally supported the NAB and TVBAIC positions.

In a notice published in the September 24 *Federal Register* (50 *FR* 38653), the commission granted a delay in the effective date of the rules but rejected a request to override state and local RF safety standards. As it stated when the RF rules were issued earlier this year, the FCC said that preemption is "beyond the scope" of the proceeding (see *MWN*, April 1985). The commission added that it was unsure of the legal basis for FCC preemption.

The FCC did say however that it intended "to consider on an ad hoc basis non-federal RF radiation standards adversely affecting a licensee's ability to engage in FCC-authorized activities."

Under the rules, the FCC will require applicants for construction permits, licenses and renewals to assess radiation levels. If the levels could cause public exposures in excess of the ANSI standard, applicants would be required to prepare an environmental impact statement (EIS) under the National Environmental Policy Act of 1969 (NEPA).

In its September 24 notice, the FCC also:

- rejected the NAB's recommendation that an individual transmitter at a multiple-transmitter site be treated as a single source without regard to signal levels from the other transmitters. The FCC explained that the overall RF radiation environment is the critical factor, not whether a single source is operating within the exposure limits.
- denied requests made by the NAB and others that more extensive public involvement be permitted in the development of the technical bulletin the FCC is preparing to help broadcasters evaluate compliance (see box). The commission said that all interested parties had already been invited to participate and it saw no reason to make the proceeding more formal.

Technical Bulletin

The FCC's advisory bulletin on how applicants for broadcast facilities and satellite station permits can determine whether they comply with the ANSI standard is scheduled to be published in early November.

Evaluating Compliance with FCC-Specified Guidelines for Human Exposure to RF Radiation, Office of Science and Technology (OST) Bulletin No.65, will be available from: International Transcription Services, 2100 M St., NW, Washington, DC 20037. The cost has not yet been set.

The NAB is planning to reprint the bulletin independently and distribute it to its more than 5,000 radio and television station members.

California FM Station Ordered To Cut Power

The Federal Communications Commission (FCC) recently ordered a California FM radio station to severely reduce its power after state officials discovered that forest rangers using a nearby fire-lookout tower were exposed to radiofrequency (RF) levels two to three times higher than the American National Standards Institute (ANSI) limit.

The tower, which is used only from May to October when the risk of forest fires is greatest, sits just 66 feet from the station's transmitter and is at virtually the same height. Neil Smith, consulting engineer to station KERG-FM, said that the office atop the metal tower is in the station's main broadcast signal.

FCC and California officials are handling this highly unusual situation cautiously. The effective date of the FCC's RF public exposure rules is January 1, 1986, and the officials are concerned that the KERG problem could set a precedent with far-reaching consequences. Pat Healey, who owns the station along with her husband, Daniel, said that several other broadcasters have contacted KERG, and FCC officials told *Microwave News* that the National Association of Broadcasters (NAB) has expressed interest in the situation, although a NAB spokeswoman denied any involvement.

State officials refused to comment, but Smith explained that the state first expressed concern about the possibility of a hazard when the station began upgrading its transmitter from a Class A to a Class C license, increasing its power output from 40 watts to more than 50 kW. The FCC had approved the Class C license at 56 kW in May, but the station could produce just 51 kW and so received "special temporary authorization" from the FCC to operate at that level.

When a California Department of Telecommunications staffer measured power levels of approximately 2.5 mW/cm^2 in the rangers' office, or "cab," the FCC ordered KERG, which operates at 104.7 MHz, to reduce its output from 51 kW to 2 kW. ANSI's limit for the FM broadcast range is 1 mW/cm^2. After KERG constructed a copper shield around part of the cab, the commission allowed the station to increase to 19 kW. But when new state measurements again found hot spots in excess of the ANSI limit, the FCC ordered KERG back down to 2 kW. At the conclusion of the fire season in early October, when the fire tower was no longer occupied, the station resumed broadcasting at 51 kW.

The FCC has instructed the station and the state to find a solution to the problem before May 1986, when the fire season begins again. Smith, representing KERG, said that he is confident that the conflict will be easily resolved.

Leukemia Risk Among Coal Miners Linked to EM Fields

Researchers studying male, underground coal miners have found an apparent association between leukemia and prolonged exposure to electromagnetic fields (EMFs) from overhead transmission lines and transformers.

Dr. Priscilla Gilman of the School of Medicine at West Virginia University in Morgantown and Dr. Richard Ames and Michael McCawley of the National Institute for Occupational Safety and Health (NIOSH) office in Morgantown found that men who worked 25 or more years in coal mines had a statistically significant, two-and-a-half-fold increased risk of developing all types of leukemia, compared to men who worked underground for less than 25 years. (The investigators estimated EMF exposure on the basis of years worked in coal mines.)

In a case-control study comparing 40 coal workers who died from leukemia with 160 controls who died from causes other than cancer or accidents, the team calculated the odds ratio for all chronic leukemia to be 8.22 and the odds ratio for chronic lymphocytic leukemia (CLL) to be 6.33. For myelogenous leukemia the odds ratio was 4.74. All of these increased risk indices were statistically significant.

The researchers point out that the overall increased risk of leukemia was not related to cigarette smoking or to coal miners' pneumoconiosis and that while acute myelogenous leukemia (AML) previously has been linked to toxic chemical exposures, their study did not find a statistically significant relationship between AML and EMFs.

Strikingly, Gilman and coworkers note that CLL "has been reported not to be related to chemical, radiation or other environmental agents by most authors." They conclude that EMFs are a "prime suspect in the elevated risk for CLL."

Gilman and Ames recently left West Virgina: Gilman is now chief of pediatrics at Fort Gordon, GA, and Ames has returned to the California Department of Health Services in Berkeley, CA. NIOSH's McCawley told *Microwave News* that he is not planning to do a follow-up study.

The study, "Leukemia Risk Among U.S. White Male Coal Miners," appeared in the September issue of the *Journal of Occupational Medicine*.

FCC Releases ISM Rules; RF Lighting Provisions Contested

The Federal Communications Commission (FCC) has issued final rules simplifying its procedures for handling industrial, scientific and medical (ISM) equipment under Part 18 of the commission's regulations. The new rules, which took effect on September 27, streamline equipment authorization procedures, specify new measurement methods, reclassify ISM frequencies and set technical standards for radiofrequency (RF) lighting devices, pending the outcome of the commission's separate proceeding on RF lighting.

The RF lighting provisions already have been challenged. The National Association of Broadcasters (NAB) has filed a petition for partial reconsideration of the rules, repeating its earlier recommendation that the FCC include a limit for radiated emissions below 30 MHz. The NAB contends that emissions from RF lighting devices pose a serious RF interference (RFI) problem for AM radio broadcasters.

Rules Consistent with Proposal

The final rules are essentially the same as the FCC's November 1984 proposal (see *MWN*, December 1984). One major change is that, under the final rules, manufacturers of non-consumer equipment must "verify" compliance with the RFI standards by submitting test results — in last year's proposal, the commission only asked manufacturers to notify it of compliance. The change was made in response to widespread industry support for verification, according to the commission.

Verification procedures require manufacturers to show compliance with ISM standards where the equipment is installed or at a "suitable" measurement site if the tested equipment is "representative" of equipment produced later.

Consumer equipment, including microwave ovens, and RF lighting devices used for general purpose and consumer applications must be "certified" — other RF lighting devices will be subject only to verification. (For certification, measurement data must be submitted to the FCC; test data need not be submitted for verification.) The commission will permit operation of consumer equipment prior to approval to avoid marketing delays.

The FCC eliminated its three-year recertification requirement that had applied to some ISM equipment. Medical diagnostic ultrasound equipment is exempt from the rules.

In response to a comment from IBM concerning the applicability of Part 18 rules to its computer plasma dis-

plays, which use RF energy to excite gases in the display tube, the FCC explained that this type of display is governed by Part 15 rules for computing devices since its primary use of RF energy is not for ISM purposes. In another area, the FCC rejected a request submitted by the Aerospace and Flight Test Radio Coordinating Council that ISM equipment at aerospace manufacturing plants be exempted from testing procedures and emission limits.

Measurement Methods

The final ISM rules consolidate emission measurement methods into Bulletin MP-5, *Methods of Measurements for Industrial, Scientific and Medical Equipment,* which supersedes FCC Bulletins OCE 39 (on medical diathermy equipment), OCE 20 (on microwave ovens) and Test Procedure No.2 (on ultrasonic equipment). The FCC emphasizes in its final rules that MP-5 "is not a mandatory test procedure, but is basically a guideline and a summary of the methods used at the FCC laboratory."

The FCC defines ISM equipment as machines that generate RF energy from 9 kHz to 3,000 GHz for non-telecommunication purposes. ISM uses of frequencies were approved for 6.78 MHz, 61.25 GHz, 122.5 GHz and 245 GHz.

The final rules, which appear in the September 5 *Federal Register* (50 *FR* 36061), emerged after a seven-year effort to overhaul the decades-old Part 18 regulations. The FCC simplified the ISM rules by condensing them from nine to three subparts.

RF Lighting Dispute

The FCC rejected a NAB recommendation that RF lighting devices meet an emission limit of 25 uV/m at 10 meters below 30 MHz. Instead, RF lighting will continue to be subject to Part 15, subpart J standards for electromagnetic interference (EMI) from digital and computing devices at least until action is completed on a separate rulemaking on RF lighting. (In August 1983, the FCC issued a Notice of Inquiry on these devices, Docket 83-806, see *MWN,* September 1983).

According to the commission, no reports have been submitted on interference caused by RF lighting devices to radiocommunication services when the Part 15, subpart J rules were met, and there is "insufficient information" to determine whether a limit below 30 MHz is needed.

The NAB responded to the final ISM rules by repeating its request for a 25 uV/m limit in its petition for partial reconsideration filed on October 7. The petition contends that "the interim standards essentially provide no limitations on radiated emissions in the AM broadcast band whatsoever, and new evidence submitted herein indicates that such limitations are indeed warranted and necessary."

In a report submitted with the petition, the NAB argues that: "the risk does not appear to be the potential interference from a particular, individual lighting device; rather, the risk is the inevitable effect on the AM listening environment that would clearly arise from unchecked increases in the *cumulative* interference effect of *multiple* RF lighting devices" (emphasis in original). The report notes that RF lighting devices are expected to replace incandescent and fluorescent lighting in millions of homes and offices.

The report, *Electrical Interference to AM Radio Reception,* prepared by the NAB's AM Improvement Subcommittee, compares conducted and radiated interference from light dimmer switches to interference from RF lighting devices. It concludes that the RF lighting units tested "exhibited conducted levels of RFI that were approximately equal to the various dimmers. However, while the radiated RFI was slightly lower than that from the noisiest dimmers, it was considerably higher than the best 'RFI suppressed' dimmers."

The report concludes that, "Suppressing RFI is clearly possible in any RF lamp, and shouldn't be an overly burdensome task for RF lamp manufacturers."

Workers File Suits Over Clear Radiation Accident

Workers involved in the 1983 radiation accident at the Clear Air Force Station in Alaska have gone to court alleging a range of injuries due to overexposure to radiofrequency (RF) radiation. In what is likely to be a long, drawn-out battle, suits were filed in Alaska and New York in September.

Richard Eldridge, one of six workers involved in the accident, and his family filed suit on September 12, charging that Felec Services, Inc., a subsidiary of ITT which operates Clear for the U.S. Air Force, "engaged in conduct which made injury to its workers from RF radiation substantially certain to occur." The complaint was filed in the Alaska State Superior Court in Fairbanks by Richard Friedman of Royce, Wollenberg & Friedman, based in Sitka, AK (Case No. 4FA-85-2077). Eldridge and his family are asking for both compensatory and punitive damages from Felec, but do not specify an amount. The case has been moved to federal court at Felec's request.

Friedman told *Microwave News* that he did not expect Eldridge's case to go to trial for another year.

Also on September 12, three other workers and their families filed complaints against Felec, Federal Electric Corp. and ITT Arctic Services, Inc., all ITT subsidiaries, in U.S. District Court in Anchorage (Nos. A85-517 and 518). Edgar Forsling, Ronald Foster and John Jessop also sued RCA Corp. in U.S. District Court in New York City. RCA manufactured some of the key components used at Clear. In total, the suits ask for more than $100 million for negligence, fraud and malicious breach of contract. The three workers are represented by Jon Running and Noble Sokolosky of Running & Culver in Tulsa, OK.

Mary Hughes, an attorney with Hughes, Thorseness, Gantz, Powell & Brundin, who is representing Felec, refused to comment. Hughes works in the firm's Anchorage office. RCA is represented by the New York City firm of Quirk & Bakalor.

Accident History

In September 1983, the six civilian welders and technicians were working on a high-power radar at Clear, near Fairbanks, when it was accidently turned on (see *MWN*, November 1983 and January/February 1984). The intensity of the workers' exposure is disputed; according to an Occupational Safety and Health Administration (OSHA) reenactment of the accident, the levels could have been as high as 390 mW/cm^2 for approximately eight minutes (see *MWN*, December 1984).

In his complaint, Eldridge alleges that although there was supposed to be a foolproof system to prevent the radar from operating when a worker was in the radome, "Felec instituted a policy which called for this system to be routinely bypassed" and that, in order to save money, Felec "routinely had the radar understaffed and manned by undertrained personnel." Eldridge claims that Felec misled its employees as to the dangers of RF radiation, issuing the men useless radiation badges, and that Felec and the Air Force conspired to keep everyone ignorant of the severity of the workers' injuries.

In their 55-page Felec complaint, Foster, Forsling and Jessop catalog a series of safety violations and contract violations at Clear and allege that the company misled them as to the risks associated with radiation exposures. They present new details on working conditions at the Air Force installation. For instance, they state that the radiation measurement meters used at Clear routinely underestimated the actual levels of exposure and that as early as 1979 Felec was telling its workers that radiation badges could detect RF energy.

The three workers contend that RCA installed defective equipment at Clear, which led to the radiation accident.

GAO Report

A report on the Clear accident by the U.S. General Accounting Office (GAO) is due to be released in November, according to a spokesman for Congressman Don Young, who requested the GAO study.

The *Anchorage Daily News*, which obtained a draft copy of the document, reported that the GAO concluded that Felec was responsible for the accident and that Air Force oversight of the contractor's performance was inadequate.

Florida Panel Recommends 190-Foot ROW for 500 kV Line

The Florida Department of Environmental Regulation (DER) has recommended a uniform 190-foot right-of-way (ROW) as a condition for certifying a proposed 500 kV AC transmission line. The DER based its decision on uncertainties over the biological effects of magnetic fields.

The Florida Power Corporation, which wants to build the 42-44 mile Lake Tarpon-Kathleen transmission line, had planned to use 190-foot ROWs in undeveloped areas but only 100-foot ROWs in certain residential areas.

In an August 22 report, the DER recommended a buffer greater than 50 feet between the line and residential areas until some of the outstanding questions about biological effects have been settled. The department noted that "some state action is appropriate," but was unwilling to establish a field restriction based on leukemia and cancer risks.

The DER decision follows a utility-funded study which concluded that it is "unlikely" that power lines pose a public health problem and that "there is not currently sufficient evidence to allow the scientifically based choice of a measure of exposure to electric and magnetic fields that could be used as the basis for a program of exposure control" (see *MWN*, July/August 1985).

Karen Anthony, a DER spokeswoman, explained in a telephone interview that there is "still enough uncertainty about magnetic fields that we feel we have to include a margin of caution." She added that the DER generally agrees with the study panel's findings.

According to utility calculations cited in the DER report, the 500 kV line would create magnetic field levels of 242-246 milligauss (mG) at the edge of a 100-foot ROW under maximum load conditions. According to Anthony, the maximum magnetic field at the edge of the ROW would be 154 mG with a 190-foot ROW. With a normal load, the magnetic field would be 35-37 mG and 24 mG for 100 and 190-foot ROWs, respectively. The maximum electric field at the edge of a 100-foot ROW would be 3.73 kV/m, and 1.8 kV/m at the edge of a 190-foot ROW.

The DER also recommended an induced current limit of 4.5 mA to protect against shocks (and cardiac pacemaker interference) as a condition for certifying the line. To facilitate compliance, the department suggested a maximum electric field strength of 9 kV/m for non-roadway areas. In addition, the DER advised that television reception should not be significantly degraded by interference from the transmission line.

The hearing officer for the Lake Tarpon-Kathleen line is expected to make her recommendations by mid-January and the project application will then be sent to Governor Bob Graham.

The DER has no more copies of its August 22 report. For more information, contact Karen Anthony, DER, Twin Towers Office Building, 2600 Blair Stone Rd., Tallahassee, FL 32301, (904) 488-0130.

Editor's Note

We apologize for the lateness of this issue. Our November/December issue will be published before the end of the year. We will resume our regular schedule starting with the January/February 1986 issue.

BEMS Roundup

Outlined below are some of the highlights from the annual meeting of the Bioelectromagnetics Society (BEMS), held in San Francisco, CA, in June. (See also the reports in our July/August issue.)

• Dr. Ross Adey of the VA Hospital in Loma Linda, CA, is studying the connection between electromagnetic fields (EMFs) and cancer promotion. He presented a three-stage model to explain how EMFs couple with cells: energy is amplified on the surface of the cell membrane, then passed through the membrane into the cell interior. Adey described how weak, low frequency EMFs can influence three different enzyme systems: adenylate cyclase, protein kinases and ornithine decarboxylase. (Protein kinases and ornithine decarboxylase play important roles in cancer promotion.) He stressed that non-linear, non-equilibrium processes are at work, allowing relatively small amounts of energy to activate biochemical reactions. "It's an exciting time," he said, because EMFs are not only the object of our studies, but they provide us with a unique tool for unraveling what is going on.

• Female mice chronically exposed to continuous wave 2.45 GHz radiation at a power density of 10 mW/cm^2, a specific absorption rate (SAR) of 6.8 W/Kg, showed an "appreciably shorter lifespan" compared to controls, according to Dr. Charles Liddle and coworkers at the Environmental Protection Agency's (EPA) Experimental Biology Division in Research Triangle Park in North Carolina. EPA's Dr. John Allis, who presented the paper in San Francisco, said that half the exposed mice died within 82 weeks, while it took 102 weeks for the controls to reach 50 percent mortality. The mice were exposed for one hour a day, five days a weeks for 26 months, beginning at five weeks of age. The experiment had not yet been completed, but Allis pointed out two interesting preliminary findings: First, most animals failed to show any gross lesions and there was no pattern among those that did. And second, the mice's rectal temperature went down a few hours after exposure.

• Dr. Reba Goodman of Columbia University and Dr. Ann Henderson of Hunter College, both in New York City, have found that sine waves can stimulate RNA transcription more than the pulsed electromagnetic fields (PEMFs) associated with bone-healing devices. In a continuation of their studies on RNA transcription in the salivary gland chromosome of a gnat (see *MWN*, July/August 1983), Goodman and Henderson compared the effects of seven types of single pulses, repeated at 15 and 72 Hz, and five types of pulse bursts, repeated at 1.5 to 15 Hz, with 72, 222 and 4400 Hz sine waves. Each of the three types of signals diplayed a different pattern of stimulation: the sine waves had the greatest effect, and the pulse burst the least. The 72 Hz sine waves were the most effective of all. Not only can the signals increase preexisting RNA activity, they can induce new transcription. The researchers emphasized that the fields did not raise the temperature of either the cells or their surrounding media. A paper describing their results will be published in *Bioelectromagnetics* next year.

• In our July/August 1984 issue, we reported on a paper by German scientists showing that magnetic fields like those associated with nuclear magnetic resonance (NMR) imaging can induce relatively large temperature changes in live mice. At BEMS, Dr. Tom Tenforde of the Lawrence Berkeley Lab at the University of California announced that an attempted replication had failed. Tenforde exposed female rats and mice to either a static magnetic field of 7.55 T (tesla) or a magnetic field gradient of up to 60 T/m. He concluded that the results of his studies "clearly indicate that strong magnetic fields and magnetic field gradients do not influence thermoregulation in rodents."

• Dr. Gregory Lotz and Jack Saxton of the Naval Aerospace Medical Research Lab in Pensacola, FL, have found, on the basis of studies on male rhesus monkeys, that the "heat produced in deeper tissues by the resonant RF frequency is not fully redistributed by the circulatory system, even during steady-state conditions." Lotz and Saxton based their conclusions on exposures of five monkeys at 225 MHz (their resonant frequency) and 1290 MHz at power densities of 7 to 42 mW/cm^2 — SARs of 0.102 $(W/Kg)/(mW/cm^2)$.

• In China, microwave heating is being used for reversible male contraception, as well as for the treatment of prostatitis and epididymitis caused by vasectomy. A group headed by Dr. Bill Guy at the University of Washington in Seattle and Dr. Han-Bao Jiang, who was visiting Guy's lab from Sichuan University, used fiberglass models filled with material dielectrically similar to muscle to estimate localized specific absorption rates (SARs) resulting from such clinical treatments. Using 915 and 2450 MHz radiation, they found that when the applied power for male contraception was about 60 watts, the maximum SAR in the testes was about 480 W/Kg — or more generally, 8 W/Kg per watt of input power. The highest SARs for both near and far field exposures were at the base of the penis, when the model was exposed with the penis parallel to the electric field.

NBS To Set Up EMC LAP

The National Bureau of Standards (NBS) has decided to set up a laboratory accreditation program (LAP) for electromagnetic compatibility (EMC) and telecommunications equipment testing.

In a notice published in the September 25 *Federal Register* (50 *FR* 38874), the NBS announced that the scope of the LAP will include four test methods for conducted emissions, radiated emissions and terminal equipment compatibility, all using procedures devised by the Federal Communications Commission (FCC). Military and foreign test methods will be added to the LAP later, according to the NBS. (The fees for participating in the LAP are listed in the *Federal Register* notice.)

The NBS anticipates that the first group of labs will be accredited by April 1986.

The electromagnetics LAP is being set up under the National Voluntary Laboratory Accreditation Program (NVLAP) at the request of Walter Poggi, president of Retlif, Inc. in Ronkonkoma, NY (see *MWN*, March and June 1985).

On June 17, the NBS hosted a workshop to discuss the LAP; 15 industry and government experts attended. For a report on the meeting or for additional information, contact Harvey Berger, Laboratory Accreditation, NBS, Admin A531, Gaithersburg, MD 20899, (301) 921-3431. The NBS's Jeffrey Horlick is the project leader for the electromagnetics LAP.

Economic Impact of RF/MW Guidance *(continued from p.1)*

The EPA guidance would apply to all sources of RF/MW radiation, but previous research by the agency has indicated that most public exposures to RF/MW radiation stem from broadcast transmissions. The Livermore study, released in late October, only estimated the economic impact on broadcast sources of the planned EPA guidelines.

There are approximately 4,400 FM and 4,600 AM radio stations and 1,100 broadcast TV stations in the U.S., according to the report. *Broadcasting* magazine's statistics are higher: 5,050 FM, 4,799 AM and 1,219 TV stations.

EPA Guidance Stalled

The EPA was set to propose a 100 uW/cm^2 standard in the summer of 1984 but, at the last minute, the agency did not publish its proposal (see *MWN*, October 1984). EPA's guidance would directly affect only federal agencies, though once approved it would de facto become a national standard.

Earlier this year, EPA officials announced that they would issue a proposal on the guidance in 1985 and reach a decision by 1986 — though the agency would only list a number of options for the guidance rather than propose a specific number (see *MWN*, January/February 1985).

The EPA options have yet to be published. Sources told *Microwave News* that the proposal is still awaiting the approval of the Office of Management and Budget (OMB).

Compliance Strategies

The Livermore report provides details on possible compliance strategies. Hall concluded that the available techniques to reduce RF radiation levels were limited to variations on three types of actions:

(1) Exclude or warn the public of areas exposed to RF over the standard;

(2) Use existing antenna models or design new ones that produce less unwanted downward grating, or side-lobe radiation; or

(3) Raise the antenna to reduce the RF energy at ground level.

Although all three strategies are applicable to FM stations, Hall noted that only limiting public access is appropriate for AM stations. TV radiation can be controlled through a combination of changing the designs of antennas and increasing their height.

The first volume of the Livermore study, *An Estimate of the Potential Costs of Guidelines Limiting Public Exposure to Radiofrequency Radiation from Broadcast Sources* (No. EPA 520/1-85-025, July 1985) describes the study results; the second volume in two parts, is a compilation of sample calculations. The study is available from the National Technical Information Service (NTIS), Springfield, VA 22161, (703) 487-4650 for $40.95 (paper) or $5.95 (microfiche); order No. PB86-108826.

Related EPA Reports

The EPA has also released *An Engineering Assessment of the Potential Impact of Federal Radiation Protection Guidance on the AM, FM and TV Broadcast Services* (No. 520/6-85-011, April 1985) by Paul Gailey and Richard Tell of the EPA's Office of Radiation Programs' (ORP) Non-Ionizing Radiation Branch in Las Vegas, NV. Gailey and Tell have developed computer models to estimate the RF/MW radiation levels on the ground near broadcast stations and have investigated the impact of possible mitigation strategies.

The Gailey-Tell report is also available from NTIS for $16.95 (paper) or $5.95 (microfiche); order No. PB85-245868.

A third EPA report, *The Radiofrequency Radiation Environment; Environmental Exposure Levels and RF-Emitting Sources*, by ORP's Norbert Hankin, is a comprehensive summary of potential exposures from different types of equipment. Hankin told *Microwave News* that the report is a compilation of material that has already been published in other agency reports.

Hankin said that although his report is still in draft form, it is already publicly available at the EPA library in Washington, DC, and at each of the EPA regional offices. The final report should be printed by the beginning of the year.

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• We invite contributions to *From the Field*, our column featuring news and opinions from the non-ionizing radiation community. Letters from readers are also welcome.

Options for Addressing Potentially Adverse Health Effects from Public Exposure to RF/MW Radiation

In June 1984, the Office of Radiation Programs (ORP) at the Environmental Protection Agency (EPA) was set to propose a standard (or "guidance") for public exposures to radiofrequency and microwave (RF/MW) radiation. The proposal was never issued due to conflicts within the agency; opposition came primarily from EPA's Office of Policy Planning and Evaluation (OPPE).

In our July/August 1984 issue, we published the full text of an options paper written by Jack Campbell of OPPE. Reprinted below is a response to Campbell's memorandum, written in August 1984 by staffers at ORP and the Office of Air and Radiation (OAR), of which ORP is a part. Microwave News *obtained the ORP-OAR memorandum under the Freedom of Information Act.*

This memo is the first official confirmation that EPA was planning to propose an exposure standard ten times stricter than the 1982 American National Standards Institute guidelines – or 100 uW/cm² in the 30-300 MHz band.

Since early this year, EPA officials have maintained that they plan to publish a list of options for the guidance in the Federal Register *(see* MWN, *January/February 1985). The list is still under review at the Office of Management and Budget (OMB), however; when (and if) it emerges, it is likely to be similar to the one published here.*

Background

Radiofrequency (RF) radiation exposure levels in the environment have been studied by the Office of Radiation Programs (ORP) since 1972 and range from very low general population levels of less than one microwatt per square centimeter (uW/cm²) for most people to levels of several thousands of uW/cm². EPA has also conducted research on the biological effects of RF radiation showing that exposures within this range of environmental levels can evoke numerous kinds and degrees of biological effects in laboratory animals.

In April 1979, EPA initiated a program to develop Federal Radiation Protection Guidance to protect the public from potentially adverse health effects from exposure to RF radiation. An Advance Notice of Proposed Recommendations (ANPR) was published in the *Federal Register* in December 1982. This action was prompted by:

- a growing knowledge of the biological effects of RF radiation with a concomitant rise in environmental exposure levels, and by
- requests for EPA to develop regulations from: (1) the National Telecommunications and Information Administration within the Department of Commerce, (2) the Federal Communications Commission and (3) industry.

Based on these findings the Office of Air and Radiation (OAR) has concluded that the establishment of federal guides which define maximum permissible exposure intensities is appropriate. Accordingly, an Interagency Workgroup was developed consisting of representatives from all involved federal agencies (sixteen agencies) to assist in the preparation of recommended exposure limits. ORP also conferred with an EPA workgroup in the actual drafting of a Notice of Proposed Recommendations (NPR). A decision package consisting of a background information document, a Science Advisory Board (SAB) reviewed and approved critical assessment of the biological effects literature developed by the Office of Research and Development titled *Biological Effects of Radiofrequency Radiation,* and an analysis of the potential economic impact of various alternative regulatory levels was assembled.

At a meeting of the Steering Committee on April 6, 1984, it was determined that all representatives of the Agency, except for the Office of Policy, Planning and Evaluation (OPPE), concurred with the issuance of the draft NPR for public comment. The NPR recommended maximum permissible exposure limits equal to one-tenth of the current American National Standards Institute (ANSI) voluntary standard (see Option 4). OPPE staff subsequently revealed that their opinion was that:

- because there is no statutory requirement that EPA regulate RF radiation exposures, and
- because ORP was unable to enumerate actual adverse health effects in the population,
- EPA should not recommend exposure limits (see Option 1).

OPPE later developed an options paper and circulated it for review, suggesting that it be used to resolve their concerns over policy issues raised by proposing federal guidance for RF radiation.

Current Status

There exist significant differences of opinion between OPPE and ORP over this issue. Matters have not been resolved as of this date. With consideration of OPPE's options paper, OAR has developed this brief summary of various alternative options for dealing with RF radiation. The options range from no regulatory action to proposing environmental exposure limits comparable to those used in the Soviet Union, the most stringent standards in existence today.

Related Matters

To help form a perspective on the difficult issue of selecting an appropriate option to follow, it may prove useful to be aware of several activities related to radiation protection in the RF area. ANSI, in 1982, revised its voluntary standard for RF radiation by making the permissible exposure limits dependent upon frequency, and in the frequency range of most stringent control of exposure intensities, set its radiation protection guide at 1,000 uW/cm². The International Radiation Protection Association (IRPA) has recently published guidelines on limits of exposure to RF radiation which recommend intensities, at the most stringent frequencies, not to exceed 200 uW/cm². The National Council on Radiation Protection and Measurements (NCRP) currently has under review a draft report recommending public exposure limits also equal to 200 uW/cm². The NCRP scientific committee preparing its report had several members who also served on the SAB panel which reviewed the EPA biological effects document which was used as a basis for deriving acceptable exposure limits by OAR. The conclusions of these two prestigious radiation protection organizations are compatible with the adoption of similar limits in the state of Massachusetts, Multnomah County, Oregon and the City of Portland for public exposure. Recently the Johns Hopkins Applied Physics Laboratory adopted a similar yet somewhat more stringent standard (100 uW/cm²) for use within its facilities. The National Institute for Occupational Safety and Health (NIOSH) has prepared a new recommended occupational exposure limit for RF radiation of 500 uW/cm². In addition, the Food and Drug Administration's Center for Devices and Radiological Health is considering the promulgation of a performance standard for RF heat sealing machines.

A recent scientific report, in which laboratory animals were

exposed over their entire life span to low-level RF radiation at an intensity equivalent to the present ANSI standard, has described a statistically significant increase in the incidence of malignant tumors in the exposed animals. This study is the first lifetime study and the first to link RF radiation exposure with cancer. This finding may play a significant role in public perception of possible public health implications for RF radiation exposures in the environment and consequently in public expectations of EPA's regulatory action in this area.

Alternative Regulatory Options

Option 1— No Regulatory Action

Pro:

- Would reduce agency resource requirements in ORP.
- Would avoid inconsistency between ANSI standard and possible agency position.
- Avoids the need to make risk management decision.
- Could allow for continued research to better define threshold exposures resulting in adverse effects.
- Could allow for more time to identify and quantify adverse health effects in the population resulting in more refined risk estimates.

Con:

- Is unresponsive to state, federal agency and industry requests for guidance.
- Offers no public health protection.
- Will tend to promote even greater fear over possible health effects by public.
- Will do nothing to reduce proliferation of standards at the local level and associated resulting economic impact.
- Transfers responsibility for protection of public health to others unequipped technically and/or administratively to develop RF exposure limits.
- In view of the current context, i.e., high public concern and the issuance of an ANPR, no regulatory action could make the agency appear foolish.

Option 2— Adopt the ANSI Standard

Pro:

- Industry has stated that it would like the ANSI standard and is willing to comply with it.
- Would be consistent with ANSI and avoid controversy in some circles over reason for differences in EPA recommendations and ANSI.
- Total estimated cost of compliance to broadcast industry is approximately $15 million spread over a ten-year period resulting in an average annual cash flow of $1.6 million.

Con:

- Would result in rates of energy absorption in the body which are above the observed threshold for some biological effects, including recent observations of cancer.
- Could lead to heat stress for some individuals in high temperature and humidity environments.
- Would carry the negative connotation of applying a standard which industry itself largely developed.
- ANSI itself stated that the limits are to be used as upper limits of exposure, particularly for the public, suggesting that a greater margin of safety may be required for the general population.
- Would be unusual and precedent setting in that the general population exposure limit would exceed the probable recommended occupational exposure limits (NIOSH's draft standards are one-half of the ANSI values). This would create controversy and be inconsistent with traditional radiation protection practices.
- ANSI has been criticized on the basis of not including sufficient public participation in its radiation protection guide development process.

Option 3 — Base Guidance on Recommendations of IRPA and NCRP

Pro:

- Would result in rates of energy absorption in the body which are generally below the observed threshold for most biological effects.
- Would be responsive to the statements within the current ANSI standard that its limits should be used as upper limits of exposure, particularly for the public.
- Would help to reduce level of controversy brought about by adoption of less stringent limits such as the ANSI standard which were developed largely by industry.
- Would remove inconsistency with recent recommended occupational exposure limits from NIOSH which are one-half the ANSI values.
- Would appear conciliatory and responsive to concerns of some federal agencies expressed during interagency workgroup process in which more stringent limits were discussed.
- Would be consistent with general recommendations of two prestigious radiation protection organizations.
- Would be consistent with usual practice of generally providing more protective standards for the general public than those established for occupational exposures.

Con:

- Relatively higher cost of compliance to industry ($28 million, spread over 6 years).
- Could be viewed by some as not conservative enough in view of certain biological effects research findings involving relatively low-level, non-thermal exposures.
- Although the population exposure standard would be lower than that expected to be proposed for occupational exposure by NIOSH, the difference would not be near the factor of 10 normally used.
- Could be viewed by some as too conservative in view of the controversial nature of some of the low-level effects findings and their implications for public health; the Agency has been criticized for placing too much emphasis on thermal effects only.
- Number of potentially impacted VHF broadcast stations would rise to 835 as compared to 202 stations for compliance with ANSI standard.
- Leaves no practical negotiating room for OMB review short of adopting ANSI standard with attendant negative connotations listed above.
- If recent cancer findings prove accurate and are used to define a no observed adverse effects level (NOAEL), guidance would only be a factor of 5 below this; this would be inconsistent with the normal use of a factor of 10 for interspecies comparisons.

Option 4 — Base Limits on 1/10 of ANSI Standard (OAR Proposal)

Pro:

- Strongly protective of public health in relation to Options 1-3 above.
- Would be viewed as a conservatively set public health standard by most all individuals, including consideration of nonthermal effects.
- Would increase cost of compliance by less than a factor of 3 over ANSI standard or only 39 percent over Option 3 to a value of $41.5 million spread over a ten year period resulting in an average annual cash flow of $4.7 million.

- Is in range (a factor of 2) of those limits recommended by IRPA and NCRP, thereby enhancing technical credibility.
- Other federal health protection agencies have indicated their agreement with approach in deriving such limits and the resulting numerical limits.
- Low likelihood of need to further tighten standard if later research shows low-level effects.

Con:

- Number of potentially impacted VHF broadcast stations would rise to 1,229.
- Could be viewed by some as too conservative in view of the controversial nature of some of the low-level effects findings and their implications for public health.
- Some federal agencies have suggested that such limits might impose some constraints on their operation of certain transmitting systems (these agencies have not provided supporting data for such claims despite EPA requests for same).

Option 5 — Propose Limits Similar to Soviet RF Standard

Pro:

- Would be equivalent to most conservatively set exposure standard in the world, removing virtually any doubt as to lack of health protection afforded.
- Would provide enough margin of safety to accommodate most conceivable future adverse findings in biological/ epidemiological research.

Con:

- Would require large expenditure for compliance costs by industry, increasing costs to at least $333 million and affecting 86 percent of all broadcast VHF stations in the country.
- Could realistically add to overall impact by affecting military operations and possibly impacting on national security.
- Would be difficult to justify in terms of additional economic and operational impact relative to added degree of protection.
- Would be inconsistent with recommendations of other radiation protection organizations such as IRPA and NCRP.

EPA Lab To Close *(continued from p.1)*

Senator Albert Gore, Jr. (D-TN), has been trying to save the radiation research program — Senator Jake Garn (R-UT) has opposed restoring the funds. In response to Gore's efforts, on November 8, the House-Senate Conference Committee on HUD and Independent Agencies directed EPA to "make no final decision or take no action on terminating the non-ionizing radiation health effects research program before January 1, 1986."

The EBD was slated to stop work on non-ionizing radiation under the President's fiscal 1986 budget (see *MWN*, March 1985). Supporters of the program, including industry groups, waged a letter-writing campaign to try to reverse the administration's decision.

In 1983, when a similar effort to stop research on non-ionizing radiation at EPA failed, Congress instructed the agency to step up work on the extremely low frequency (ELF) fields associated with power lines. That work was just beginning when the research group was again cut out of the budget.

The 25 researchers in the division, who contribute a total of 16 person-years on non-ionizing radiation research, will be reassigned to other parts of the laboratory. None of them will lose their jobs as a result of the reorganization.

A number of well-publicized studies will be discontinued when the division is closed. Among those are a long-term, low-level exposure study that has been in preparation for years; Dr. Ezra Berman's experiments to try to replicate the teratological effects of very weak, low-frequency magnetic fields discovered by Dr. Jose Delgado and Dr. Jocelyne Leal in Spain; and Dr. Carl Blackman's studies on calcium efflux and the role played by the Earth's magnetic field in weak field interactions. ●

CONFERENCES

December 4-5: **International Conference on Electric and Magnetic Fields in Medicine and Biology,** London, UK. Contact: Conference Services, Institution of Electrical Engineers, Savoy Place, London WC2R 0BL, UK, (01) 240-1871, ext. 222.

December 5-8: **2nd Annual Meeting of the American Society of Clinical Hyperthermic Oncology,** Gene Autry Hotel, Palm Springs, CA. Contact: Dr. Haim Bicher, Hyperthermic Oncology, Daniel Freeman Memorial Hospital, 301 N. Prairie Ave., Suite 311, Inglewood, CA 90301, (213) 673-8620.

December 9-13: **10th International Conference on Infrared and Millimeter Waves,** Americana Dutch Resort Hotel, Lake Buena Vista, FL. Contact: Dr. Kenneth Button, MIT, Box 72, MIT Branch, Cambridge, MA 02139, (617) 253-5561.

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January 8-10: **Detection of Optical Radiation,** Americana Dutch Resort Hotel, Lake Buena Vista, FL. Contact: V. Amico, Professional Engineering Development, University of Central Florida, Orlando, FL 32816, (305) 275-2123.

January 13-14: **Satellite Communications: Applications, Technology & Competition,** Halloran House, New York, NY. Contact: Carol Every, Frost & Sullivan, 106 Fulton St., New York, NY 10038, (212) 233-1080.

January 13-16: **National Radio Science Meeting,** University of Colorado, Boulder, CO. Contact: Professor S.W. Maley, Dept. of Electrical Engineering, University of Colorado, Boulder, CO 80309.

January 21-23: **Electrical Overstress Exposition,** Anaheim Hilton and Towers, Anaheim, CA. Contact: Jim Russell, 2504 North Tamiami Trail, Nokomis, FL 33555, (813) 966-3631.

January 30-February 1: **RF Technology Expo,** Anaheim Hilton and Towers, Anaheim, CA. Contact: Kathy Kriner, *RF Design*, 6530 S. Yosemite St., Englewood, CO 80111, (303) 694-1522.

February 2-7: **Winter Meeting of the IEEE Power Engineering Society,** Penta Hotel, New York, NY. Contact: PES-IEEE, 345 East 47th St., New York, NY 10017.

March 5-7: **Workshop on Measurement of Electrical Quantities in Pulse Power Systems II,** National Bureau of Standards (NBS), Gaithersburg, MD. Contact: Ron McKnight, B344 Metrology Bldg., NBS, Gaithersburg, MD 20899, (301) 921-3121.

March 12-13: **IEEE 1986 National Radar Conference,** Los Angeles, CA. Contact: Radar Systems Group, Hughes Aircraft Co., R-1, D-428, PO Box 92426, Los Angeles, CA 90009.

March 25-27: **IEEE IMTC/86: Instrumentation/Measurement Technology Conference,** University of Colorado, Boulder, CO. Contact: Robert Myers, IMTC/86 Coordinator, 1700 Westwood Blvd., Suite 101, Los Angeles, CA 90024, (213) 475-4571.

April 2-3: **22nd 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.

UPDATES

BIOLOGICAL EFFECTS

Light Literature... In the fall of 1984, the New York Academy of Sciences (NYAS) hosted a conference on the *Medical and Biological Effects of Light* (see *MWN*, December 1984). The academy has now published the 44 papers presented at the meeting (*Annals of the NYAS*, Volume 453, September 20, 1985). Among the topics covered are the direct effects of light, the indirect effects of light, especially on biorhythms, and the health effects of interior lighting. Contact: NYAS, 2 East 63rd St., New York, NY 10021, (212) 838-0230....Dr. Norman Rosenthal and coworkers at the NIMH's Clinical Psychobiology Branch in Bethesda, MD, authored one of the papers presented at the NYAS meeting. In addition, they have published results on the "Antidepressant Effects of Light in Seasonal Affective Disorder" in the February 1985 issue of the *American Journal of Psychiatry*....In the popular press, Jack Fincher reviews the field of photobiology in "Notice: Sunlight May Be Necessary to Your Health" in the June 1985 issue of the *Smithsonian*. See also Bruce Fellman's article on the pineal gland, "A Clockwork Gland," in the May issue of *Science 85*....A team headed by Dr. Penny Glass of the Children's Hospital National Medical Center in Washington, DC, has found evidence that bright lights in hospital nurseries may be a contributing factor in the development of eye ailments among premature infants. They recommend that lighting standards be reassessed. See the August 15 issue of the *New England Journal of Medicine*....In our March issue, we described a case of phytophotodermatitis among supermarket employees who were exposed to psoralens from vegetables and then to UV or bright sunlight. Now the Centers for Disease Control reports a similar outbreak among children using limes in an art class at a day camp in Maryland. The skins of limes and other citrus fruits contain furocoumarins, which are chemically similar to psoralens. Details of the outbreak appear in the August 2 issue of *Morbidity and Mortality Weekly Report*.

EPRI Reports... The Electric Power Research Institute (EPRI) has released four new reports: (1) T.J. Reed of Westinghouse Electric Corp. in Pittsburgh, PA, and G.W. McKee of the Pennsylvania State University in State College, PA, have found that five types of plants suffered no significant adverse effects on germination, growth and survival when exposed to 60 Hz electric fields ranging from 10 kV/m to more than 40 kV/m. Sharply-pointed leaves on some plants showed "very limited" damage at levels above 30 kV/m. *Effects of 60 Hz Electric Fields on Living Plants Exposed for Extended Periods* (EA-4159), July 1985, $25.00....(2) R.J. Weigel and W.T. Kaune of Battelle Pacific Northwest Labs in Richland, WA, have designed and built a facility for exposing small animals to air ions and static electric fields like those associated with high voltage DC power lines. *Design, Construction and Testing of a DC Bioeffects Enclosure for Small Animals* (EA-4189), July 1985, $25.00....(3) Researchers at Westinghouse Electric Corp. and Pennsylvania State University in State College found "no direct effect on the growth, development and overall health and well-being" of chick embryos exposed to 60 Hz electric fields. The results are based on the exposure of 20,000 eggs to field strengths ranging from 0.1 to 100 kV/m over three years. *Effects of 60 Hz Electric Fields on Embryo and Chick Development, Growth and Behavior* (EA-4161), July 1985, $25.00....(4) B. Greenberg and V. Bindokas of Bioconcern and J. Gauger of IITRI, both in Chicago, IL, have issued the final report on their study of bees living in hives located under high voltage power lines (see *MWN*, July/August 1985). *Extra-High Voltage Transmission Lines: Mechanisms of Biological Effects on Honeybees* (EA-4218), August 1985, $20.00. All four reports can be ordered from Research Reports Center, PO Box 50490, Palo Alto, CA 94303, (415) 965-4081.

Guy Study... The Air Force has published the ninth and final volume on the long-term, low-level exposure study done at the University of Washington in Seattle under the direction of Dr. Bill Guy (see *MWN*, July/August 1984, March and June 1985). In this summary report, Guy and coworkers conclude: "In summary, no defendable trends in altered longevity, cause of death or spontaneous aging lesions and neoplasia can be identified in the rats exposed to this long-term, low-level radiofrequency radiation exposure." *Effects of Long-Term Low-Level Radiofrequency Radiation Exposure on Rats, Volume 9: Summary*, August 1985, USAFSAM-TR-85-64, and the previous eight volumes are available from Dr. Jerome Krupp, USAF School of Aerospace Medicine, Brooks AFB, TX 78235.

COMPATIBILITY & INTERFERENCE

RFI to Cochlear Implants... Inner-ear cochlear implants that electrically stimulate auditory nerves are highly sensitive to RFI from a wide variety of sources, such as light dimmers, computer terminals, police radar and UHF mobile radios. Sharon Hepfner and Dr. Michael Skelly of the University of Cincinnati Medical Center (UCMC) report in the August 8 *New England Journal of Medicine* that, "Patients with implanted nerve stimulators should be warned of the possibility of such interference and should be alert to the presence of radio transmitters, library and airport metal detectors and electrical sources capable of emitting appreciable radiofrequency energy..." All seven deaf patients who have received the House/3M Cochlear Implant System at the UCMC have reported interference problems, according to the authors, who offer tips for implant users to reduce the risk of RFI.

Assorted Notes... In October 1982, the FCC fined Sonic Cable TV in California $6,000 for violating the commission's signal leakage limits (see *MWN*, November 1982). Sonic appealed the ruling, but lost (see *MWN*, January/February 1984). Sonic appealed again and, in a decision handed down in September, lost again....In its August 19 issue, *Aviation Week & Space Technology* reports a case of unidentified UHF interference at about 401.9 MHz to the

U.S. geostationary weather satellite, GOES-4. Ground controllers have been unable to locate the source of the RFI....Three British researchers have published "Measurements of the Field Strengths on Offshore Oil Platforms for Assessing Radiofrequency Hazards with Electroexplosive Devices" in the August *IEEE Transactions on Electromagnetic Compatibility*....Concern over EMI to electronic devices in automobiles is growing. See articles in the October *IEEE Spectrum* and the June 13 *New Scientist*.

INTERNATIONAL

IRPA on UV and Lasers... The International Non-Ionizing Radiation Committee of the International Radiation Protection Association (IRPA) has released guidelines for exposure to non-coherent ultraviolet (UV) radiation between 180 nm and 400 nm and for exposure to laser radiation of wavelengths between 180 nm and 1 mm. Both sets of guidelines appear in the August 1985 issue of *Health Physics*.

Spy Dust... Recent U.S. allegations that the Soviet KGB used a toxic chemical to track the movements of American diplomats in Moscow resurrected memories of the Moscow microwaves affair. U.S. officials admitted to knowing about the chemical, nitrophenyl pentadienal (NPPD), which is a mutagen and is visible under ultraviolet light, since 1976. A 1979 Senate report on microwaves in Moscow chastised the State Department for withholding information for 23 years about the irradiation of the embassy.

MEASUREMENT

VOR Calibration... The NBS is now offering calibration services for very high frequency omnidirectional range (VOR) air navigation systems — though direct generation or measurement of VOR RF signals is not part of the service. A new NBS publication provides details on the service: *VOR Calibration Services*, NBS Technical Note 1069, by Neil Larsen, Dominic Vecchia and George Sugar. The report includes overviews of VOR systems and the new NBS VOR audio generator and phasemeter. The report is available from the Government Printing Office, Washington, DC 20402 for $6.50. Order No. 003-003-02652-2. For more information, contact: Neil Larsen, Mail Code 723.01, NBS, Boulder, CO 80303, (303) 497-3711.

Resources... Early next year, the *Proceedings of the IEEE* will feature a special issue on "Radio Measurement Methods and Standards," edited by Bruno Weinschel and Stephen Adam....Amplifier Research is marketing a new 14"x5.5" transmission-line cell to test the effectiveness of RF shielding materials which the company claims produces more reliable and repeatable results than those obtained by shielded-room testing. The portable unit, SET-19, is manufactured by Elgal in Israel and costs $6,600. For more information, contact Amplifier Research, 160 School House Rd., Souderton, PA 18964, (215) 723-8181....Three recent papers: M. Martinelli, P.A. Rolla and E. Tombari of the Dept. of Physics at the University of Pisa in Italy, "A Method for Dynamic Dielectric Measurements at Microwave Frequencies: Applications to Polymerization Process Studies," *IEEE Transactions on Instrumentation and Measurement*, September 1985; M. Mostafavi, J.C. Bolomey and D. Picard of the Ecole Superieure d'Electricite in Gif Sur Yvette, France, "Far-Field Accuracy Investigation Using Modulated Scattering Technique for Fast Near-Field Measurements," *IEEE Transactions on Antennas and Propagation*, March 1985; and S. Burkhart of Lawrence Livermore National Lab in Livermore, CA, "Coaxial E-Field Probe for High-Power Microwave Measurement," *IEEE Transactions on Microwave Theory and Techniques*, March 1985.

MEETINGS

60 Hz Measurements... Last February 12-13, DOE and EPRI sponsored a *Workshop on Measurement of Non-Uniform and Fluctuating 60 Hz Electric and Magnetic Fields* at the EPA's Las Vegas, NV, facilities. Aerospace Corp., DOE's contractor for support on its electric field effects program, has now published a report on the workshop, including brief synopses of the 15 presentations made by the 12 invited speakers, together with reproductions of their slides. A copy of the report is available from Dr. William Wisecup or Lee Rosen, c/o W/L Associates, Suite 401, 600 S. Frederick Ave., Gaithersburg, MD 20877, (301) 948-0642.

MILITARY APPLICATIONS

ELF Monitoring Program... The IIT Research Institute (IITRI) has published the third annual report of the Navy's ongoing ecological monitoring program on the possible effects of the electric and magnetic fields from the Navy's Project ELF communications system. The report covers 1984. In addition, IITRI has released a two-volume compilation of status reports from the 11 contractors who are participating in the ecological studies. The monitoring program is funded by the Navy's Space and Naval Warfare Systems Command and is administered by IITRI; R.D. Carlson is IITRI's program manager. The 53-page summary report, *Extremely Low Frequency (ELF) Communications System Ecological Monitoring Program: Summary of 1984 Progress*, by J.E. Zapotosky, July 1985 (Technical Report E06549-18), and the two-volume, 1148-page *Compilation of 1984 Annual Reports of the Navy ELF Communications System Ecological Monitoring Program* (Technical Report E06549-17, June 1985) are available from the National Technical Information Service (NTIS), Springfield, VA 22161.

PEOPLE

William Mumford, a pioneer in the field of microwave radiation bioeffects as well as in many areas of microwave technology, died on June 19 at the age of 80. Among his many accomplishments, he was a member of the Elec-

tromagnetic Radiation Management Advisory Council (ERMAC) from the time it was formed in 1968 until it was disbanded in 1982....**Dr. Robert Powers** resigned as chief scientist of the FCC on September 12 to join the MCI Telecommunications Corp. **Dr. Thomas Stanley** has taken over as acting chief scientist....Over at NTIA, **David Markey** has resigned as administrator and has been replaced by **Rodney Joyce,** the former minority counsel of the House telecommunications subcommittee....**William Lambdin** has retired as the general manager of Electro-Metrics, based in Amsterdam, NY....**Dr. Mays Swicord,** chief of the molecular biology branch of the Office of Science and Technology at FDA's Center for Devices and Radiological Health, is on a year's assignment at the World Health Organization's Division of Diagnostic, Therapeutic and Rehabilitative Technology in Geneva. **Dr. Larry Bockstahler** is taking over as acting branch chief....**Dr. Tom Rozzell** is back as manager of ONR's bioelectromagnetics program after a two-year stint at ONR's London office. **Dr. Michael Marron,** who took over during Rozzell's absence, has moved to ONR's molecular biology branch.

POWER LINES

EPRI Takes Over Test Facility... In September, the Electric Power Research Institute (EPRI) took over the ownership of the High Voltage Transmission Research Facility (HVTRF) from General Electric. The facility, located in western Massachusetts, is used for both AC and DC research and testing; among the many projects carried out there are studies on electric and magnetic fields and corona phenomena. For more information, contact HVTRF Manager Luciano Zaffanella at (413) 494-4356 or EPRI Project Manager John Dunlap at (415) 855-2305.

STANDARDS

EIA on TV and VCR Immunity... The Electronic Industries Association (EIA) has published *Immunity of Television Receivers and Video Cassette Recorders (VCRs) to Direct Radiation from Radio Transmissions, 0.5 to 30 MHz,* Interim Standard No.16. The standard was developed by an EIA committee under the chairmanship of Howard Lester of GE. (See also *MWN,* January/February 1985). Copies are available for $7.00 from EIA's Standards Sales Office, 2001 Eye Street, NW, Washington, DC 20006, (202) 457-4966.

IEC and CISPR... The following publications are now, or will soon be, available from ANSI's International Sales Dept., 1430 Broadway, New York, NY 10018; note prices do not include postage and handling. (1) *Effects of Current Passing Through the Human Body* (Publication 479-1), prepared by IEC Technical Committee 64, on electrical installations in buildings, details human shock threshold limits for direct currents and for 15-100 Hz currents (Cost: $31.00). (2) *Limits and Methods of Measurement of Radio Interference Characteristics of Fluorescent Lamps and Luminaires* (CISPR Publication 15) recommends methods to control RFI to radio reception at frequencies from 150-1605 kHz. It was prepared by Subcommittee F, on RFI from motors, household appliances, lighting apparatus and the like, of the International Special Committee on Radio Interference (CISPR) (Cost: $41.00). (3) *Measurement of the Immunity of Sound and Television Broadcast Receivers and Associated Equipment in the Frequency Range 1.5 MHz to 30 MHz by the Current-Injection Method/ Guidance on Immunity Requirements for the Reduction of Interference Caused by Radio Transmitters in the Frequency Range 26 MHz to 30 MHz* (CISPR Publication 20) is an interim document for use while CISPR Subcommittee E, on EMI characteristics of radio receivers, prepares a more extensive document (Cost: $33.00). (4) *Interference to Mobile Radiocommunications in the Presence of Impulsive Noise; Methods of Judging Degradation and Measures to Improve Performance* (CISPR Publication 21) was prepared by Subcommittee D, on EMI relating to motor vehicles and internal combustion engines (Cost: $13.00). (5) Subcommittee D also prepared a report on *Limits and Methods of Measurement of Radio Interference Characteristics of Vehicles, Motor Boats and Spark-ignited Engine-driven Devices* (CISPR Publication 12) (Cost: $31.00)....The IEC also has released three amendments for review under the *Six Months' Rule*; copies can be ordered from ANSI: (1) *CISPR/A (Central Office) 32 Amendment No. 1* to CISPR Publication 7B adds data processing equipment, information technology equipment, home computers and video games and other sources of potential EMI to a chart included in CISPR 7B (Cost: $9.00). (2) *CISPR/A (Central Office) 33 Amendment No. 3* to CISPR Publication 16 pertains to the use of an absorbing clamp to measure interference (Cost: $9.00). (3) *CISPR/A (Central Office) 34 Amendment No. 3* to CISPR Publication 16 adds information regarding quasi-peak and average detector response (Cost: $9.00).

TECHNOLOGY

A Change in Direction... Old ideas have a way of popping up again, often in a slightly different form. A recent example is a new project on the drawing boards at NASA and DOE: the perpetual plane — or at least one that can stay aloft for a year. NASA is looking into the feasibility of using such an unmanned aircraft to monitor atmospheric concentrations of carbon dioxide. How do you keep a plane up for so long? By beaming up microwave power from a ground station. A leading proponent of the plan within DOE's carbon dioxide research program is Fred Koomanoff, who used to be the director of DOE's Solar Power Satellite (SPS) project before the idea lost its appeal in the early 1980s. Under the SPS program, satellites in Earth orbit would have collected solar energy and beamed it down to elliptical receiving antennas (called "rectennas") on the ground. According to an analysis by Rice University researchers in 1978, finding the land for the rectennas, each with 13-by-9 kilometer axes, in the

continental U.S. would not be easy. Beaming up microwaves should be a lot simpler, but it is still far from certain whether NASA and DOE will go ahead with the perpetual plane.

Microwave Sintering...EPRI has awarded a $94,600 contract to Northwestern University in Chicago, IL, to study methods of "Microwave Sintering of Ceramics" (No. RP2730-1). Researchers at Northwestern will develop a new cylindrical cavity to test rapid heating and rapid sintering using microwaves and compare the results with those from conventional techniques. Microwave sintering offers the promise of improved efficiency over electrically heated ovens. The project is scheduled to take 11 months. For more information, contact EPRI's A. Karp at 3412 Hillview Ave., PO Box 10412, Palo Alto, CA 94303, (415) 855-2000.

VDTs

UV Hypothesis... Near-ultraviolet radiation (UV-A) could be responsible for headaches, irritability, skin rashes, visual problems, reproductive abnormalities and a host of other ailments reported by VDT users, according to Dr. Anthony R. Mawson of the Louisiana State University Medical Center (LSUMC) in New Orleans. Mawson suggests that "chronic exposure to subliminal amounts of UV-A radiation produces the VDT-associated ill-effects by catabolizing vitamin A in skin and plasma into highly active metabolites, the gradual accumulation of which results in an endogenous form of vitamin A intoxication." He adds that these metabolites can cross the placenta and cause pregnancy abnormalities. Mawson does not dispute that UV-A emissions from VDTs are much lower than current standards, but contends that such safety standards are of "dubious validity" and that ill-effects could result from chronic exposure. Mawson emphasizes the speculative nature of his theory, but argues that it lends itself to further research. "Speculations on the Origin of the Ill-Effects Associated With the Use of VDTs" appeared in the *Journal of Theoretical Biology, 114,* 223-241, 1985. A reprint is available from Mawson at the Section of Rheumatology and Rehabilitation, Department of Medicine, LSUMC, 1542 Tulane Ave., New Orleans, LA 70112.

Terminal Shock...A Canadian labor official has published *Terminal Shock,* a full-length book on VDTs. Bob DeMatteo of the Ontario Public Service Employees Union (OPSEU) in Toronto focuses mainly on VDT radiation emissions, providing the most detailed discussion yet published in the popular press. The book is a greatly expanded version of a 1981 OPSEU pamphlet (see *MWN,* November 1981). To order, send $9.95 to Independent Publishers' Group, One Pleasant Ave., Port Washington, NY 11050, (516) 944-9325.

Resources...A year-long study by a congressional subcommittee has ended in a staff recommendation that further radiation research is needed. The subcommittee on health and safety of the House of Representative's Committee on Education and Labor argues in a recently released staff report that this research "could eliminate, and definitely reduce, any lingering doubts" about radiation hazards. The staff recommends against legislation setting VDT standards for equipment design, lighting and other environmental factors. For a copy of the "Staff Report on the Oversight of OSHA with Respect to VDTs in the Workplace" (Serial 99-A), contact the subcommittee at Room B345A, Rayburn Bldg., U.S. House of Representatives, Washington, D.C. 20515....Dr. Karel Marha and David Charron, among the first researchers to suggest that very low frequency (VLF) pulsed radiation might cause biological effects among operators, have published "The Distribution of a Pulsed Very Low Frequency Electric Field Around Video Display Terminals" in *Health Physics, 49,* 517-521, 1985. The paper details measurements taken around four identical, unshielded VDTs with an EFS-1 electric field sensor made by Instruments for Industry of Farmingdale, NY. They found that VLF electric fields exceeded 300 V/m measured as far as 20 cm from the right side of the set. Beyond 20 cm, the fields decreased rapidly and "were mostly negligible at 50 cm from the surface of the VDT." Marha and Charron, who work for the Canadian Center for Occupational Health and Safety (CCOHS), previously published reports on VDT emissions (see *MWN,* December 1983)....Dr. Arthur Frank of the University of Kentucky has uncovered no evidence that VDT work can cause injury to the human eye. The study, sponsored by The Newspaper Guild (TNG), is the second part of a two-phase effort involving members of six TNG locals in the U.S. and Canada (see *MWN,* November 1983). For a copy of the Part II report, contact TNG at 1125 15th St., NW, Washington, DC 20005.

NIOSH Radiation Testing... Dr. Bill Guy of the University of Washington in Seattle will measure electric and magnetic fields, induced body currents and static charges from as many as 25 VDTs under a contract with NIOSH (Order No. 85-35744). The measurements will be made at AT&T's offices in Washington, DC, as part of a Health Hazard Evaluation. Guy will complete his work by December 1 and his results will be incorporated in a report due by December 31. Previously, Guy studied VDT emissions for IBM (see *MWN,* April 1985).

Legislation... The Governor of **Rhode Island** has signed the first VDT bill to become law in 1985. On May 29, Governor Edward DiPrete approved Bill No. 85 H6097, sponsored by Representative Edward Dambruch, requiring the state's Department of Labor to produce a brochure on the proper use of VDTs in the workplace and to develop a training program for VDT workers. In **Oregon** on July 12, Governor Victor Atiyeh vetoed Senate Bill 57, sponsored by the Senate Interim Committee on Labor, chaired by Senator Margie Hendriksen. The bill, which had passed both houses of the state legislature, would have directed the state Workers' Compensation Board to develop guidelines for the purchase and use of VDTs in public and private offices.

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Toronto Power Line Meeting: Shifting Outlook on ELF Risks

Perceptions about the health risks associated with power lines are changing. Whether they believe the risks are real or imagined, utility managers now realize they can no longer dismiss the possibility that electromagnetic fields can cause biological effects.

"Utilities will be facing up to this issue more and more," Ontario Hydro's John O'Grady told *Microwave News* at the close of the *International Utility Symposium on the Health Effects of Electric and Magnetic Fields*. Even O'Grady, who spent two years organizing the meeting, was surprised by the large turnout: some 300 people came to Toronto, Canada, the week of September 16, almost double the number he had originally expected.

To be sure, some of the attendees remain convinced that power line fields are safe, but many had their confidence shaken when Dr. Richard Phillips told a jammed evening session that there is a real probability of a health hazard and that he would not buy a house along a power line right-of-way (see box on p.9). Phillips, who is now with the Environmental Protection Agency's Office of Research and Development, is best known for his studies on power line, or extremely low frequency (ELF), fields, carried out at the Battelle Pacific Northwest Labs in Richland, WA.

(continued on p.9)

Cancer Death Tied to AM Radiation in Spokane Lawsuit

A Spokane, WA, widower is suing a nearby AM radio station, alleging that his wife died as a result of overexposure to its broadcast radiation. In a complaint filed on July 30 in the Superior Court for Spokane County, Thomas DiLuzio charges that long-term exposure to KGA-AM's 50 kilowatt signal was responsible for his wife developing cancer. The suit also names the local school district and Spokane County as defendants.

Janice DiLuzio died at age 39 in 1982 of multiple myeloma, a cancerous proliferation of blood plasma cells that is similar to leukemia. Multiple myeloma usually strikes much older people; in the suit, DiLuzio contends that his wife's illness "is one of the, if not the, earliest reported cases of multiple myeloma in the United States."

John Glassman, DiLuzio's attorney, told *Microwave News* that the DiLuzios moved to their home, which is approximately 600 feet northwest of KGA's transmission tower, in 1972. Their children, now 15 and 12 years old, later attended the Mullan Road Elementary School, which is located less than 200 feet from the tower, on land purchased from KGA.

The DiLuzio suit also charges that the children were exposed to hazardous levels of radiofrequency (RF) radiation while attending the school, accusing both school and county officials of putting the school where they knew, or should have known, a hazard exists.

(continued on p.15)

HIGHLIGHTS

Microwave-Induced Changes in Blood Barriers Related to Alzheimer's Disease and Corneal Effects

Microwave radiation may influence the development of Alzheimer's disease, according to Dr. Sam Koslov of the Johns Hopkins University Applied Physics Lab (JHU-APL) in Laurel, MD. Speaking at the Environmental Protection Agency's public meeting in Washington, DC, on September 22, Koslov said that a JHU-APL team had observed the telltale Alzheimer's pattern of neurofibrillary tangles in a monkey chronically exposed to microwaves.

Although unwilling to draw any conclusions based on only one experiment, he emphasized the finding's significance for understanding microwave bioeffects and as a possible primate model for studying Alzheimer's disease. (Researchers have long sought such a model.) Koslov said that he was reporting unconfirmed observations out of frustration over the lack of funding in microwave research.

In a wide-ranging presentation, Koslov hypothesized that the Alzheimer's tangles may be related to unintended leakage through the blood-brain barrier (BBB). He also suggested that a similar mechanism may explain the key findings of JHU-APL's Henry Kues that 2450 MHz radiation can disrupt the endothelial layer of the cornea in primates: this effect may be caused by a breakdown in the blood barrier in the eye, causing an increased production of free radicals. "You can see the blood vessels in the eye leaking following exposure to microwaves," he told *Microwave News* after the hearing (see story on opposite page).

According to Koslov's testimony, the brain cells of the monkey with the pattern of neurofibrillary tangles did not show the formation of plaques, another sign of Alzheimer's disease. Two other monkeys chronically exposed to 20-40 mW/cm^2 did not show any indications of Alzheimer's. Lack of funds has stymied the possibility of more experiments.

Samples of the microwave-exposed monkeys' cerebrospinal fluid (CSF) were sent to Dr. Hans-Arne Hansson at the University of Goteborg in Sweden, who has previously identified specific abnormal protein patterns in the CSF of radar workers (see *MWN*, May 1985). Koslov said that the monkeys' CSF showed protein bands that were closely related, though not identical, to those of the radar workers.

Earlier BBB Findings

At the 1981 meeting of the Bioelectromagnetics Society, Dr. Allan Frey of Randomline, Inc., reported that pulsed 1.2 GHz microwaves could affect the blood-vitreous humor barrier in the eyes of rats. At the time, Frey, who is based in Huntingdon Valley, PA, said that more research was needed to elucidate "what is happening and why."

In 1975, Frey was the first to report that microwaves can alter the permeability of the BBB (*Annals of the New York Academy of Sciences, 247,* pp.433-439, 1975). Following a 1977 paper by two army researchers, Drs. Kenneth Oscar and Daryl Hawkins, showing that pulsed 1.3 GHz radiation at power levels as low as 30 uW/cm^2 affected the BBB (*Brain Research, 126,* pp.281-293, 1977), the problem became a hot research topic. A number of conflicting reports appeared, but soon afterwards, funding dried up and work stopped, leaving many questions unanswered.

The decision to stop research on the effects of microwave radiation on the permeability of the BBB was strongly influenced by the Department of Defense, according to Dr. Nicholas Steneck, a historian at the University of Michigan, in his book, *The Microwave Debate* (Cambridge, MA: MIT Press, 1984).

BBB Work Should Have Continued

In an interview following the EPA hearing, Koslov said that BBB work "should not have been abandoned." He added that the JHU-APL researchers were now exposing monkeys to microwaves to monitor leakage through the BBB. Before joining JHU-APL, Koslov was a senior Navy advisor. He is a member of the Frequency Management Advisory Council (FMAC) at the National Telecommunications and Information Administration.

Although Koslov's presentation is the first to publicly associate microwave exposure to Alzheimer's disease, the possibility was raised years ago in the case of Samuel Yannon, a former New York Telephone technician, who died in 1974 after having worked on microwave relay equipment on the 87th floor of the Empire State Building for 15 years. His doctor diagnosed Yannon's condition as "chronic brain syndrome with psychotic overtones due to biological brain changes resulting from prolonged exposure to short wave radiation." In its defense, New York Telephone argued that Yannon suffered from pre-senile dementia, probably Alzheimer's disease (see *MWN*, April 1981).

EPA Closes Bioeffects Lab

The Environmental Protection Agency's (EPA) non-ionizing radiation research program has been closed down. After waging a four-year battle against their own senior management, EPA staffers in Research Triangle Park, NC, have conceded — all bioeffects research has now stopped.

"We're dead in the water," Dr. Richard Phillips told *Microwave News* in an interview. Phillips left the Battelle Pacific Northwest Labs two years ago to take over EPA's non-ionizing radiation effort, only to spend most of his time trying to keep the program alive. Phillips said that he is still trying to secure some funds so that Dr. Carl Blackman can continue his studies on the role of the Earth's magnetic field on electromagnetic interactions. Phillips called Blackman's calcium work "critically important."

Most of the researchers who used to work on radiation are now studying problems associated with toxic chemicals (see also *MWN*, January/February 1983, September/October 1985 and January/February 1986).

Florida Power Line Award Appealed to State Supreme Court

Florida Power & Light Co. (FP&L) has asked the state Supreme Court to overturn a $1.6 million award to owners of land adjacent to lots condemned for a 500 kV power line right-of-way. The 1985 award, which was upheld by an appeals court in April, was based on the jury's opinion that power line radiation poses a potential health risk, resulting in lower property values nearby.

In the appeals court decision issued on April 4, 1986, in a suit originally brought by S. Bryan Jennings, Jr., and co-plaintiffs, the presiding judges supported the lower court's decision to include expert testimony on health risks at the trial. They found that there is a "reasonable basis" for residents to fear the health hazards posed by power line radiation and to seek compensation for losses in land value. FP&L had contended that the testimony should have been excluded.

In a second, virtually identical, case, an appeals court ruling handed down on June 5 agreed with the April 4 Jennings decision and affirmed a $1.8 million award to Virginia S. Roberts and co-plaintiffs.

The two cases stem from FP&L's 1983 condemnation of land for a power line. Because the lots fell in two different counties, the cases were tried separately.

Theresa Rooney, a lawyer associated with Jacksonville attorney David Foerster, who is representing the landowners in both suits, told *Microwave News* that the utility could have combined the cases on appeal to the Supreme Court; she said that the outcome of the Jennings appeal will apply to the Roberts case.

Barry Davidson of the Miami firm of Steel, Hector & Davis is representing FP&L in conjunction with Carlos Alvarez, who specializes in electromagnetic radiation cases for the Tallahassee firm of Hopping, Boyd, Green & Sams. Speaking at the International Utility Symposium in Toronto in mid-September, Alvarez said that he expects the Supreme Court to hand down a decision in the spring of 1987.

In its brief to the Supreme Court, FP&L argued that the trial and appeals courts erred in permitting expert testimony regarding the health effects of power lines. The utility contended that "such evidence has no relevance and serves only to inflame and improperly prejudice a jury, given the nature of such evidence, which suggests, among other things, that living near transmission lines, or even distribution lines, may 'promote' cancer."

In a telephone interview, Alvarez said that in both the Jennings and Roberts cases, the health risks testimony was used to persuade the juries to increase the amount of the condemnation awards. He maintained that courts should rely solely on real estate assessments to determine settlements. In both the Jennings and Roberts trials, FP&L attorneys argued that evidence suggesting a link between power line siting and land market values was only speculative.

Trial Witnesses

Drs. Nancy Wertheimer and John Norgard, both of the University of Colorado, testified for both sets of landowners. Wertheimer told the jury that "there [is] a relationship between adverse health effects and the electromagnetic field," according to the owners' brief filed in response to FP&L's Supreme Court appeal. Norgard, a professor of electrical engineering, described the field distribution of power line radiation and concluded that humans could not live safely within 440 feet of a 500 kV line.

Dr. Morton Miller of the University of Rochester Medical School testified for FP&L that adverse health effects from the power line are extremely unlikely.

Attorney Rooney also submitted several reports from neighboring towns, which showed that property values near power lines were lower than those elsewhere.

The citations for the decisions in the Florida District Courts of Appeal are: Florida Power & Light Co. v. S.B. Jennings a/k/a S. Bryan Jennings, Jr., et al. [485 So.2d 1374 (Fla. App. 1 Dist. 1986)], opinion filed April 4, 1986, and Florida Power & Light Co. v. Virginia S. Roberts, et al. [490 So.2d 969 (Fla. App. 5 Dist. 1986)], opinion filed June 5, 1986.

Industry Urges EPA To Set RF/MW Safety Standard

Business users of radiofrequency and microwave (RF/MW) radiation urged the Environmental Protection Agency (EPA) to set an exposure standard for the general public, at a public meeting in Washington, DC, on September 22. The message was clear: the specific limit is less important than the need for a national standard.

Richard Ekfelt, the executive director of the Electromagnetic Energy Policy Alliance (EEPA), expressed "strong opposition" to federal inaction. "A federal standard is sorely needed by the public and by industry," he told EPA.

Similarly, Ralph Justus of the National Association of Broadcasters (NAB) stated that he "vigorously" opposed the EPA's non-regulatory option. It would be the "most harmful option," he said, adding that the costs associated with the other three options "pale" in comparison with that of not setting a standard. Justus conceded that it is "a peculiar situation" in which industry is asking for regulation but, he said, it is "absolutely necessary," given the proliferation of local RF/MW rules.

EPA held the meeting to hear responses to its four proposed options for limiting public exposures to RF/MW radiation (see *MWN*, July/August 1986). Although the options are cited in terms of specific absorption rates (SARs), they are equivalent to power density levels of 100, 200 and 1,000 uW/cm^2; the fourth option is to not set a standard. EPA does not have the authority to set a national exposure standard; instead, the agency is proposing to issue a guidance which, when approved by the President, would apply to all other federal agencies.

Despite the growing public interest in the health effects of RF/MW radiation, only a dozen people spoke at the hearing — three of whom represented NAB. Approximately 40 people attended the hearing.

Both Ekfelt and Justus, as well as Arthur Varanelli of Raytheon, favored a federal standard that would preempt

Zapping at Greenham Common?

Women protesting the deployment of cruise missiles at the U.S. Air Force base at Greenham Common in southwest England claim they are being exposed to non-ionizing radiation in order to force them to abandon their peace camp.

Kim Besly, the coordinator of the "zapping" investigation at Greenham, blames the radiation for a large array of symptoms reported by the women: disturbances in menstrual cycles and sleeping patterns; irregular heartbeats; head, chest and ear pains; anxiety and nausea. One woman said that she got a sunburn during the night.

Besly told *Microwave News* that women identified radiation as the most probable cause of the ailments by a process of elimination: checks of food and water failed to indicate any contamination. She said that military and civilian officials "have tried every way to move us away since the camp was set up more than five years ago."

Many people in the U.K. discount the possibility of a radiation problem, saying that the symptoms are those of "hysterical" women who are living out in the open without proper food and shelter.

Besly has begun a medical project to document the health problems: All visitors are being asked to keep diaries of any ailments they develop while at the camp, and doctors and nurses are being recruited to examine those women with serious medical complaints.

Besly has asked the U.K.'s National Radiological Protection Board (NRPB) for help in measuring the radiation levels, but without success. In an interview, Frank Cook, a Member of Parliament, said that he had also asked John Dunster, the director of NRPB, to lend the women power density meters but was turned down.

NRPB's Alastair McKinlay told *Microwave News* that the board has volunteered its services to local government officials but that they have not replied. Many of the residents in the nearby village of Newbury are unsympathetic to the Greenham women's politics and want them to abandon the peace camp — making a request to the NRPB unlikely.

Allegations of "zapping" at Greenham began to circulate two years ago and have been extensively covered by small circulation, peace-oriented publications, but have been largely ignored by the mainstream media. In the last few months, the Greenham women have mounted a more concerted effort to bring attention to the radiation problem. The women say that they do not know whether they are being exposed to the radiation deliberately or unintentionally, perhaps by a communication or radar system at the base.

Over the years, there has been speculation about the use of non-ionizing radiation to affect behavior. The most famous example involved the possible motives for the beaming of microwaves at the U.S. embassy in Moscow from the 1950s through the 1970s.

Extensive interviews by *Microwave News* with knowledgeable U.S. government experts indicate that radiation-based technology for manipulating crowds is feasible, and could be available soon, if it is not now. All of those interviewed said that they did not believe that the U.S. government is using such electromagnetic weapons at Greenham Common.

state and local limits.

Ann Hagemann of the Association of Maximum Service Telecasters (AMST) said that it is "unacceptable" for EPA not to set a guidance. And AT&T's Kelly Kollios, representing Bell Labs' Dr. Max Weiss and Ron Peterson, "urged EPA to disregard Option 4," to reduce the costs incurred by having to comply with conflicting state and local ordinances.

Non-business speakers were not unanimous in their conviction that EPA has the necessary information to set a standard, but they all endorsed the need for more research on the biological effects of non-ionizing radiation. Elise Kreindler of Citizens Against the Tower in Vernon, NJ, said that "the setting of any standard can only serve to benefit the industry," arguing instead that EPA should reactivate its bioeffects research program. Regina Siberski of Newtown Square, PA, asked EPA to set an "interim standard" while reinstating the EPA research effort in North Carolina (see box on p.2).

Aside from asking for a federal standard, most of the speakers were not specific as to desired limits. AT&T's Kollios was the most direct, endorsing 200 uW/cm^2 (option 2), while Raytheon's Varanelli said that 1,000 uW/cm^2 (option 3) is "sufficient" and that EPA's limits should not be more stringent than 200 uW/cm^2.

Dr. Sam Koslov of the Johns Hopkins University Applied Physics Lab (JHU-APL), speaking for himself, said that he favors a 100 uW/cm^2 limit — the standard already adopted by JHU-APL (see *MWN,* December 1984) — and that he is willing to tolerate 200 uW/cm^2, but nothing higher.

The NAB representatives and EEPA's Richard Ekfelt said that they were still analyzing the options and would submit additional comments to EPA by the October 28 deadline. AMST's Hagemann said that she too was still reviewing the data, though at present she favors the ANSI standard.

In an extended presentation, Dr. Marjorie Lundquist of the Industrial Hygiene Institute in Milwaukee, WI, said that EPA should be treating the results of the Guy long-term exposure study more seriously and that the results suggesting a link to cancer cannot be discounted because of the low incidence of cancer among the control rats (see *MWN,* March 1985). Researchers cannot set aside the results and use historical controls because they don't like the outcome, she said.

Pulsed Radiation More Harmful Than CW to Rats' Lenses

Pulsed microwave radiation can cause approximately five times more damage to the lens of the eye than can continuous wave (CW) radiation at the same average power level, according to the results of recent experiments on isolated rats' lenses at the Walter Reed Army Institute of Research (WRAIR) in Washington, DC, in a collaboration with the University of Western Ontario in London, Canada.

Dr. John Trevithick of the university's Department of Biochemistry measured radiation damage by studying changes in the lenses' cell membranes. Pulsed 918 MHz microwaves disrupted the membranes – thereby initiating the disintegration of cells – more effectively than did CW radiation.

In a poster paper presented at the Bioelectromagnetics Society meeting in Madison, WI, in June, Trevithick reported that an empirical model based on the experimental data showed that pulsed microwaves "caused 4.7 times the depth of damage as CW at the same average power."

Trevithick told *Microwave News* that, at this time, he "cannot make any inferences about *in vivo* damage" based on the present *in vitro* results.

This is the first demonstration of an increased biological efficacy of pulsed radiation compared to CW for the lens of the eye, although Henry Kues and coworkers at the Johns Hopkins University Applied Physics Lab (JHU-APL) in Laurel, MD, have reported that pulsed 2.45 GHz radiation at a specific absorption rate (SAR) of 2.6 W/Kg could cause abnormalities in the corneal endothelium of monkeys *in vivo* similar to those caused by CW radiation at an SAR of 5.3-7.8 W/Kg (see *Bioelectromagnetics, 6,* pp.177-188, 1985, and *MWN,* July/August 1983). Recent work by the JHU-APL team indicates that people taking glaucoma medication may be at increased risk of microwave injury (see box below).

Numerous earlier studies have shown a similar effect for other end points: in 1977, Dr. Elliot Postow of the Naval Medical R&D Command in Bethesda, MD, identified more than 20 examples of the greater efficacy of pulsed microwaves at frequencies between 1 and 12 GHz (see *The Biological Effects of Radiofrequency and Microwave Radiation,* by H.M. Assenheim et al., National Research Council of Canada, No. 16448, 1979). Postow told *Microwave News* that an updated version of the table will appear in the forthcoming *CRC Handbook of Biological Effects of Electromagnetic Fields.*

Temperature Changes

Although the lenses absorbed relatively large amounts of energy during the radiation exposure – 6-60 minutes at power densities with SARs of 23 to 750 W/Kg – they were maintained at 37°C by a circulating water bath. Trevithick said that recent, preliminary experiments with a Luxtron temperature probe showed that the resulting temperature increases were less than half a degree C.

The question of how fast heat is transferred during experiments of this type has been disputed. See, for instance, the exchange between Dr. Kenneth Foster and coworkers at the University of Pennsylvania and T.C. Guo and W.W. Guo of the JHU-APL and coworkers at WRAIR in *IEEE Transactions on Microwave Theory and Techniques,* August 1982 and September 1983.

Work with Millimeter Waves Next

Trevithick recently started a series of *in vivo* experiments, under a $194,000, three-year grant from the U.S. Army Medical R&D Command. In a continuing collaboration with WRAIR, he will expose the corneas of anesthetized rabbits' eyes to 35 GHz millimeter waves.

See also the research team's earlier paper, "In Vitro Studies of Microwave-Induced Cataract: Reciprocity Between Exposure Duration and Dose Rate for Pulsed Microwaves," *Experimental Eye Research, 40,* pp.1-13, 1985.

Glaucoma Treatment Potentiates MW Effect

People who use topical drugs for glaucoma are at increased risk of eye damage from exposure to microwave radiation, according to Dr. Sam Koslov of the Johns Hopkins University Applied Physics Lab in Laurel, MD.

In remarks made at an Environmental Protection Agency hearing on September 22, Koslov said that JHU-APL's Henry Kues and coworkers had found that pulsed microwaves at an average power level of 5 mW/cm² caused cell death in the endothelial layer of the corneas of experimental monkeys, whose eyes had been treated with pilocarpine or similar glaucoma drugs. The corneas of untreated monkeys were affected at 10 mW/cm².

Koslov warned that, due to lack of funds, the experiments have not been completed, and any threshold for the effect – with and without drug-microwave synergy – has still to be determined. The work, which was paid for by the Office of Naval Research, will be published soon, Koslov said.

Microwaves have previously been found to potentiate the action of a number of drugs, including the tranquilizer Librium (see *MWN,* February 1981).

FCC Asked To Guard Against EMP

Two individuals have asked the Federal Communications Commission (FCC) to study how the U.S. civilian economy could be protected from an electromagnetic pulse (EMP) generated by a high-altitude nuclear explosion. On July 30, Nickolaus Leggett and Donald Schellhardt petitioned the FCC to open a "Notice of Inquiry" (NOI) for possibly requiring the shielding of civilian communications against EMP.

Leggett, a technology analyst, and Schellhardt, an attorney, argue that "EMP has become the last word in economic warfare" and that not enough attention has been paid to the threat to the civilian sector.

Electromagnetics LAP: Accredited Labs

The National Bureau of Standards (NBS) has accredited 14 laboratories for electromagnetic compatibility (EMC) and telecommunications testing under the bureau's National Voluntary Laboratory Accreditation Program (NVLAP). The new EMC NVLAP is intended to ensure that foreign nations accept test data from accredited labs and to help standardize domestic EMC testing procedures.

NBS set up the EMC LAP last year in response to a petition from Walter Poggi, president of Retlif, Inc., in Ronkonkoma, NY, and from four other testing labs (see *MWN*, March, June and September/October 1985 and March/April 1986). The program covers test methods for conducted emissions, radiated emissions and terminal equipment compatibility, all using procedures devised under Parts 15J and 68 of the Federal Communications Commission's (FCC) rules. Military and foreign test methods may be added later, according to NBS.

FCC staffers, who oversee U.S. EMC policies, have not yet said that they will recognize the new LAP, and some observers are asking whether the program can be effective without FCC support. *Microwave News* will report on the FCC's involvement in the EMC LAP in a future issue.

The 14 accredited labs, together with contacts, are listed below. For more information, contact Jeffrey Horlick, NVLAP, NBS, Admin A531, Gaithersburg, MD 20899, (301) 921-3431.

Amador Corp.
Wild Mountain Rd.
Almelund, MN 55002
(612) 583-3322
Daniel D. Hoolihan

AT&T Information Systems:
EMC Laboratory
M/S: Building 41-112
Crawfords Corner Rd.
Holmdel, NJ 07733
(201) 834-1801
Don N. Heirman

Communication Certification Laboratory
1940 West Alexander St.
Salt Lake City, UT 84119
(801) 972-6146
William S. Hurst

Continental Testing Laboratories
8385 South U.S. Highway 17-92
Fern Park, FL 32730
(305) 831-2700
Joe Sini

D.L.S. Electronic Systems, Inc.
10350 Dearlove Rd.
Glenview, IL 60025
(312) 699-9060
Donald L. Sweeney

Dash, Straus & Goodhue, Inc.
593 Massachusetts Ave.
Boxborough, MA 01719
(617) 263-2662
Glen Dash

Elite Electronic Engineering Co.
1516 Center Circle
Downers Grove, IL 60515
(312) 495-9770
James C. Klouda

EMACO, Inc.
7562 Trade St.
San Diego, CA 92121
(619) 578-1480
Herbert K. Mertel

GTE Evaluation & Support Dept.
3050 Harrodsburg Rd.
Lexington, KY 40503
(606) 223-3061
Clifford Eugene Jones

MET Electrical Testing Co., Inc.
916 West Patapsco Ave.
Baltimore, MD 21230
(301) 354-2200
Robert D. Johnson

Norand EMC Test Laboratory
104 Cemetery Rd.
Fairfax, IA 52228
(319) 369-3539
Michael W. Howard

Retlif, Inc. Testing Laboratories
795 Marconi Ave.
Ronkonkoma, NY 11779
(516) 737-1500
Walter A. Poggi

R&B Enterprises
20 Clipper Rd.
West Conshohocken, PA 19428
(215) 825-1960
Finbarr M. O'Connor

Underwriters Laboratories, Inc.
1285 Walt Whitman Rd.
Melville, NY 11747
(516) 271-6200
Louis Okin

"We are trying to correct the oversight of dealing only with the EMP risk to the military," Schellhardt told *Microwave News* in a telephone interview. "The EMP threat exists outside a full-blown nuclear war," he added, "because any country that can get hold of one nuclear weapon and one delivery vehicle could stage an EMP attack."

Schellhardt stressed that neither he nor Leggett acted on behalf of an organization: they filed the petition as private citizens because "we got tired of watching the evidence pile up while no one in authority took any meaningful action." He said that they felt that filing the petition was "mildly patriotic."

GTE Responds

On September 11, GTE Service Corp. filed comments on the petition, arguing that no FCC action is needed. Daniel Bart, a GTE attorney based in Washington, DC, acknowledged that, while Schellhardt and Leggett had made "some valid points," they nevertheless "appear to be uninformed" about ongoing efforts to address the EMP threat. Bart noted that the American National Standards Institute's (ANSI) T-1 Telecommunications Standards Committee is developing EMP standards.

The ANSI EMP effort grew out of a recommendation by the EMP Task Force of the President's National Security

Telecommunications Advisory Committee (NSTAC) to take steps to protect the public telephone network from a high altitude EMP (see *MWN*, June 1985).

On September 24, Schellhardt and Leggett replied that the NSTAC and ANSI efforts are insufficient because they both "fail to guarantee a *voice* for the general public" and "fail to guarantee consideration of the public *interest.*" Schellhardt and Leggett also argued that ANSI's focus on telephones alone is insufficient. They again urged the FCC to address the EMP problem.

The FCC does not have a time limit for responding to the petition, but must act within a "reasonable" period of time.

For more information, contact: Nickolaus Leggett, Apt. 610, 1500 Massachusetts Ave., NW, Washington, DC 20005, (202) 223-8689, or Donald Schellhardt, Apt. 202, 6062 Edsall Rd., Alexandria, VA 22304, (703) 370-9067. And GTE's Daniel Bart, Suite 1200, 1850 M Street, NW, Washington, DC 20036, (202) 463-5212.

U.K.'s NRPB ELF, RF & MW Radiation Standards Criticized

The United Kingdom's National Radiological Protection Board's (NRPB) proposed standard for frequencies below 300 GHz is receiving generally unfavorable reviews from the non-ionizing radiation community. The proposal, which recommends limits for workers and the general public, has been criticized as too complex and poorly reasoned.

The 17-page document specifies one set of standards for workers and two different (short-term and long-term) sets of standards for the public. Some of the limits also can be adjusted for different exposure times. The three sets of limits are hard to compare because each is divided into different frequency ranges. For example, for extremely low frequencies up to 10 MHz, the short-term population standard is divided into eight frequency ranges, while the other two standards are each divided into six ranges — to complicate matters further, the latter two sets of frequency ranges are not the same.

According to the NRPB's "explanatory notes" that accompany the proposed standards, the board adopted a 0.4 W/Kg limit for radiofrequency and microwave frequencies. Nevertheless, the NRPB specifies an 80 uW/cm² standard for the general public from 10 to 300 MHz, a level much stricter than other standard-setting bodies have adopted based on the same 0.4 W/Kg limit. The 80 uW/cm² level would apply for continuous exposures in residential areas. The NRPB states that below 80 uW/cm² it would be "unnecessary to consider occupancy and shielding factors."

The NRPB notes that, although the evidence for the carcinogenic and mutagenic effects due to electromagnetic fields is "extremely weak," exposures "should be kept as low as reasonably practicable" until the possibility of such effects can be eliminated "beyond reasonable doubt."

"Too Complicated"

In interviews at the International Utility Symposium in Toronto in mid-September (see p.1), power line radiation specialists from both the U.K. and the U.S. gave the proposal poor reviews. Brian Maddock of the U.K.'s Central Electricity Research Laboratories said it is "too complicated." In terms of the NRPB's derivation of limits and demonstration of compliance, he added, the "scientific basis is rather weak." A leading U.S. researcher, who asked not to be identified, questioned the document's complexity: "It's weird. It's hard to follow the rationale."

Dr. P. Czerski of the U.S. Center for Devices and Radiological Health at the Food and Drug Administration in Rockville, MD, also criticized the scientific groundwork for the limits. "They have sacrificed basic physical and biological accuracy for some rather doubtful mathematical elegance," he said in a telephone interview.

For workers, the proposal is keyed to two-hour exposures per day: at 50 Hz, 30 kV/m and 1.88 mT for electric and magnetic fields, respectively [at 60 Hz, the limits are 25 kV/m and 1.57 mT, respectively]; for 30-100 MHz, a power density of 1 mW/cm², rising to 5 mW/cm² at 500 MHz up to 300 GHz.

For the general public, the proposals for up to 5 hours a day and continuous exposures are: at 50 Hz, 12 kV/m (electric), 0.76 mT (magnetic) and 2.6 kV/m, 0.174 mT, respectively [at 60 Hz, the limits are 10 kV/m and 0.63 mT (5-hour) and 2.13 kV/m and 0.145 mT (continuous)]; for 30-300 MHz, a power density of 400 uW/cm² (5-hour) and for 10-300 MHz, 80 uW/cm² (continuous); at 1.5 GHz, the limits rise to 2 mW/cm² (5-hour) and 400 uW/cm² (continuous).

After reviewing comments submitted in response to the proposal, NRPB plans to issue a final standard in early 1987. The document, *Advice on the Protection of Workers and Members of the Public from the Possible Hazards of Electric and Magnetic Fields with Frequencies Below 300 GHz: A Consultative Document* (May 1986), is available from NRPB, Chilton, Didcot, Oxon OX11 0RQ, U.K.

EPRI Reorganizes Its Radiation Program

Following a major reorganization, the Electric Power Research Institute (EPRI) has started a new radiation program, which will contain the old electric and magnetic fields sub-program — now renamed the "non-ionizing radiation" sub-program.

Dr. Leonard Sagan, an EPRI senior scientific advisor, will head the radiation program. Sagan effectively replaces Dr. Gordon Newell, who, as senior program manager of the health studies program, was in charge of research on electric and magnetic fields before it was moved to the new radiation program. Dr. Bob Patterson continues to oversee EPRI's contracts on the effects of power line radiation as the manager of the non-ionizing sub-program. Newell continues to monitor work on air pollution, occupational health and other environmental issues.

The other part of the radiation program will be a new EPRI initiative on the effects of ionizing radiation. No one has yet been selected to oversee this work.

The implications of the reorganization are still unclear. In a telephone interview from his office in Palo Alto, CA, Patterson said that the change should sharpen the focus of EPRI's efforts on radiation but added that it is unclear

whether there will be any new research funds. EPRI's 1986 budget for power line health effects is $1.7 million.

In order to help evaluate its electromagnetic radiation program, the institute has asked a number of researchers to give seminars in Palo Alto. Those invited include: Drs. Ross Adey, Jonathan Charry, H.B. Graves, William Kaune and David Savitz.

Some observers have speculated that the change was precipitated by EPRI's member utilities, who wanted the institute to do more research on the effects of power line radiation. When asked about this, Patterson said, "I don't believe it." He explained that the true litmus test would be an increase in his budget, and this, he said, has not happened.

Nevertheless, at September's symposium on power line effects (see p.1), some utility representatives complained that EPRI was not servicing their needs. "EPRI is not helping me answer the questions on health and safety raised by our customers," Ronald Ponist of Duquesne Light Co. in Pittsburgh, PA, told *Microwave News.*

Patterson is hopeful that EPRI will begin sponsoring less-directed research on electromagnetic fields next year. This effort was to have gotten underway in 1986 (see *MWN,* November/December 1985), but was sidetracked by budget cuts.

VDT-Miscarriage Risk Downplayed by Epi Study

The first epidemiological study of reproductive risks among video display terminal (VDT) operators completed in the U.S. shows a slight, though insignificant, rise in spontaneous abortions and stillbirths for female workers who use VDTs more than 20 hours per week. The study did not address the risk of malformations among the offspring of VDT operators.

Drs. Bill Butler and Kelley Brix, of the University of Michigan in Ann Arbor, reported in late September that they found 26 spontaneous abortions and stillbirths in 120 pregnancies among women who worked at VDTs 21-40 hours per week. Controlling for smoking, alcohol and other variables that might have affected the pregnancies, they had predicted 21.2 abnormal outcomes in the study group.

In a telephone interview, Butler noted that the approximately 25 percent increase was not statistically significant and was likely due to chance. Both Butler and Brix recommend further study of VDT operators who use terminals more than half-time, however.

Workers who said they used VDTs 20 hours or less per week showed no signs of increased risk. The study, which considered spontaneous abortions and stillbirths jointly, also found no link between VDT-related stress and these abnormal outcomes, according to Butler, who cautioned that he still plans further analyses of the stress data.

The retrospective study was based on interviews with 728 women who worked in four Michigan state offices from 1980 to 1985. The women were selected from 26 different job classifications.

Butler and Brix presented their results on September 30 at the annual meeting of the American Public Health Association in Las Vegas, NV. Earlier in the month, state and union officials reviewed the preliminary results.

NIOSH Study Protocol Appealed

In an effort to overturn the controversial conditions — the elimination of questions on stress and fertility — placed on the epidemiological study at the National Institute for Occupational Safety and Health (NIOSH), Congressman Ted Weiss (D-NY) has asked the Secretary of Health and Human Services (HHS) to help override these constraints imposed by the federal Office of Management and Budget (OMB).

In a September 2 letter to HHS Secretary Otis Bowen, Weiss argued that, "There is general agreement that the revisions required by OMB will seriously weaken the study, making any results difficult to interpret." Weiss supported his claim by submitting a "Staff Paper," prepared by the congressional Office of Technology Assessment, which is critical of the OMB ruling and with a series of letters from epidemiologists familiar with the VDT-reproductive risks issue.

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In an interview, Phillips explained that he would have answered questions about the health risks associated with power lines differently a year ago. "You cannot refuse to accept the biological data any longer," he said. "I am sick of the arrogance that allows people to ignore the data." Phillips cited the European utility industry which, he said, is unwilling to accept recent experimental and epidemiological results. "There is also a certain amount of engineering arrogance in the U.S.," he added.

However, Phillips said that, overall, North American utilities "are finally taking the ELF problem seriously – admittedly reluctantly."

Pleas for More Research

Most presentations at the meeting ended with pleas for more research. Dr. Larry Anderson, who took over from Phillips at Battelle, said that there are three major study areas that need resolving: (1) reproduction and development; (2) nervous system, including biorhythms; and (3) carcinogenesis.

Among the utility representatives, there was a clear preference for research that can help answer questions about health risks, as opposed to laboratory studies. "We should be spending our money on studies that are most meaningful to our employees and the public," Dr. Sol Sax said in an interview. Sax, who is the chief physician at Ontario Hydro, specified the need for good epidemiological studies, provided that they are accompanied by good dosimetry. "There is room for animal studies," he added, "but *in vitro* work has to wait."

Dr. Robert Patterson of the Electric Power Research Institute agreed. "The principal research needs are epidemiological studies of workers and the public," he told *Microwave News*. And Drs. Andrew Marino and H.B. Graves, who are usually on opposite sides of the ELF issue (Marino, both a lawyer and a researcher, represents plaintiffs; Graves is a consultant to the utility industry) also said that epidemiological research is the most important.

Funding remains scarce, however, and it is far from clear who will pay for such expensive studies at a time when research budgets for all types of non-ionizing radiation have been slashed (see *MWN*, November/December 1985).

Marino placed the responsibility for funding the studies on the utilities. At one of the evening sessions, he pointed out that all the epidemiological studies done to date "have not cost the industry a dime." Researchers have had very little money and have done the best possible work with the available data, he said: "If you want new results you are going to have to pay for them."

More than 15 reports have identified some association between ELF fields and cancer over the last few years (see *MWN*, March/April and May/June 1986).

The need for better dosimetry will be simplified by a new pocket-size "electromagnetic dosimeter" developed by Paul Heroux of IREQ, the research branch of Hydro-Quebec. This dosimeter can measure 60 Hz electric and magnetic fields every minute for 18 days over a dynamic range of 84 dB, starting at 0.5 V/m and 3 nT, as well as high frequency (5-20 MHz) electromagnetic fields. (The 60 Hz magnetic field is measured in the x,y and z directions.) The data can then be unloaded into an HP-200 microcomputer. Each dosimeter costs approximately $500 (U.S.). ●

Would You Buy a House Next to a Power Line?

Some of the symposium's most lively moments occurred at an evening panel session, when a member of the audience asked five well-known ELF bioeffects experts whether they would live along the right-of-way of a power line.

The hypothetical question presupposed that each panelist had a family with two young children and that the house next to the transmission line, though identical in every respect to another one, was *$25,000 cheaper*. Here's what the experts said:

Dr. H.B. Graves, a consultant based in Reston, VA : "Yes. No question about it, I'd buy the home along the right-of-way."

Dr. Andrew Marino, Louisiana State University Medical School, Shreveport, LA: "No. If I was bald and 65 years old, I might." He added that $25,000 was not enough money to take the chance.

Dr. Richard Phillips, Environmental Protection Agency, Research Triangle Park, NC: "No." He explained that he is asked this question all the time and that his usual response is, "If it bothers you, don't buy the house." His unstated implication was that the power line would bother him.

Dr. Asher Sheppard, VA Hospital, Loma Linda, CA: "No." He said that his decision was based not on the risk of adverse health effects but on the corona noise and the loss of aesthetics due to the power line.

Dr. Sol Sax, Ontario Hydro (moderator): "Yes. I would buy the house next to the transmission line and pocket the difference." He explained that he would not live right under a 500 kV line, but would do so along the right-of-way.

Growing Attention to ELF Risks

The Toronto utilities' symposium was but one of many that are addressing ELF risks.

For instance, a small group of researchers met in Seattle, WA, August 14-15 to review *Electric Power Use and Possible Biological Mechanisms of Interaction*. The discussion focused on pineal and cellular effects as they relate to the causes of cancer. The meeting was organized and hosted by Battelle.

And at the 1986 Department of Energy and Electric Power Research Institute Contractors' Review, to be held in Denver in November (see Conference Calendar), there will be a workshop on epidemiological issues related to ELF fields. Attendance at the workshop will be by invitation only, although the contractors' review is open to all.

BOOKS

Selected Reviews

W. Stephen Cheung and Frederic H. Levien, editors, **Microwaves Made Simple: Principles and Applications,** Norwood, MA: Artech House, Inc., 1985, 356 pp., $59.00.

The staff of the Microwave Training Institute in Mountain View, CA, based this primer on its training program. Editors Cheung and Levien take the reader from the basic mathematics of microwaves to a range of applications, including electronic warfare, radar systems and health sciences. The book assumes some knowledge of electronics and mathematics. Cheung works for the NASA-Gravity Probe Program at Stanford University in Palo Alto, CA, and Levien is president of CTT, Inc., in Santa Clara, CA.

A. Chiabrera, C. Nicolini and H.P. Schwan, editors, **Interactions Between Electromagnetic Fields and Cells,** New York, NY: Plenum Press, 1985, 640 pp., $95.00.

This is a most useful collection of papers first presented at a workshop in Erice, Italy, in September 1984. Although already two years old, the three dozen papers cover theories and findings that are still at the forefront of bioeffects research — including Dr. Abe Liboff on cyclotron resonance (his most recent contribution to this model was the highlight of this summer's Bioelectromagnetics Society meeting), Dr. Carl Blackman on calcium efflux and Dr. W. Grundler on non-thermal effects on yeast at 42 and 84 GHz. Also, the late Herbert Pohl presents a succinct review of his work leading to the hypothesis that AC fields play a crucial role in cellular reproduction, and Dr. Martino Grandolfo outlines the debate over safety standards at ELF and RF/MW frequencies. For those interested in the politics of this field, there is a paper by Dr. Sol Michaelson, who tries to show that calcium efflux is a thermal effect. Interestingly, in his introduction, Dr. Herman Schwan indicates that he is still not totally convinced that there are direct interactions between non-ionizing fields and biomolecules.

M. Grandolfo, S.M. Michaelson and A. Rindi, editors, **Biological Effects and Dosimetry of Static and ELF Electromagnetic Fields,** New York, NY: Plenum Press, 1985, 697 pp., $97.50.

In these proceedings of a course held in Erice, Italy, in November 1983, many of the leading researchers in the field — L.E. Anderson, A. Chiabrera, R. Conti, W.T. Kaune, B.G. Knave, W.G. Lotz, R.D. Phillips, M.H. Repacholi, H.P. Schwan, T. Tenforde and H. Wachtel — are represented, among others. This typescript volume contains a large number of well-referenced review papers on dosimetry, effects and measurement of static and power frequency fields.

Sonny Kleinfield, **A Machine Called Indomitable,** New York, NY: Times Books, 1986, 250 pp., $16.95.

Kleinfield chronicles the story behind the development of the first nuclear magnetic resonance (NMR) scanner for humans. Rummaging through scrap bins and bargain basement hardware stores for parts, Dr. Raymond Damadian overcame peer ridicule and numerous grant application rejections to build his "indomitable" imager. He finally obtained a patent and FONAR, his company, has since grown into a multi-million dollar enterprise. Whether other companies infringed on his patent is now in litigation and, if FONAR ultimately wins, more books will undoubtedly follow.

Andrew Marino and Joel Ray, **The Electric Wilderness,** San Francisco, CA: San Francisco Press, 1986, 120 pp., $18.75.

By all accounts, Dr. Marino charmed the utility executives at September's power line meeting (see story on p.1). Those who liked his speech will like this book — a personal account of a 765 kV line siting battle in New York state. Though the narrative begins 12 years ago, it has strong similarities to the battles taking place all over the U.S. today. Pitted against Marino and his mentor, Dr. Robert Becker, who argued that power lines present a potential health hazard, were Drs. Herman Schwan, Sol Michaelson and Morton Miller, all of whom disputed such claims on behalf of power companies. Intertwined with the power line controversy are those associated with the Navy's Project ELF (aka Project Sanguine and Project Seafarer) and bone healing devices. Marino and Ray, a freelance writer, ask: If EM radiation can have beneficial non-thermal medical applications, could it not also entail risks to human health? The book ends with the establishment of the New York Power Line Project, the closing down of Becker's lab and Marino calling for "a serious, sustained Congressional investigation."

Meg Patterson, **Hooked? NET: The New Approach to Drug Cure,** London, U.K.: Faber and Faber, 1986, 280 pp., 4.95 pounds (paperback).

Since 1973, Dr. Meg Patterson has been developing a NeuroElectric Therapy (NET) stimulator for all types of addictions, including drugs, alcohol and cigarettes. In this personal account, she describes her success in treating addicts and her failure to get her device on the market. The technical details are rather sketchy, but Patterson offers a number of intriguing facts. For instance, she posits that specific frequencies (5-2,000 Hz) are best for treating particular addictions and notes that the Queen of England has had PEMF therapy for a strained shoulder. Patterson has helped a number of rock and roll stars fight off drug dependencies — most recently, she weaned Boy George off heroin; in return, her research has been supported by such unlikely sources as Atlantic Records and rock concerts. At a time when the U.S. is working itself into an anti-drug frenzy, one wonders why no one is taking Patterson more seriously.

Peter Rainger, David N. Gregory, Robert V. Harvey and Antony Jennings, **Satellite Broadcasting,** New York, NY: John Wiley & Sons, 1985, 326 pp., $29.95.

This is a step-by-step guide to the operations of direct broadcast satellite (DBS) systems, including satellite orbits, economics, laws and regulations. The authors, who are British, have attempted to present information for use around the world but acknowledge that they only partially achieve this goal. Though technical by nature, the book is written in simple language and is accessible to the uninitiated.

Recently Published

Hugh G.J. Aitken, **The Continuous Wave: Technology and American Radio, 1900-1932,** Princeton, NJ: Princeton University Press, 1985, 589 pp., $67.50 (hardcover), $19.95 (paperback).

J.E. Bridges, G.L. Ford, I.A. Sherman and M. Vainberg, editors, **Electrical Shock Safety Criteria: Proceedings of the First International Symposium,** Elmsford, NY: Pergamon Press, 1985, 368 pp., $82.50.

Alexander Scott Gilmour, **Microwave Tubes,** Norwood, MA: Artech House, 1986, 490 pp., $60.00.

Louis J. Ippolito, Jr., **Radiowave Propagation in Satellite Communications,** New York, NY: Van Nostrand Reinhold, 1986, 241 pp., $39.95.

Darko Kajfez and Pierre Guillon, **Dielectric Resonators,** Norwood, MA: Artech House, 1986, 500 pp., $60.00.

Eugene Knott, John Shaeffer and Michael Tuley, **Radar Cross Section,** Norwood, MA: Artech House, 1985, 462 pp., $60.00.

Preston E. Law, Jr., **Shipboard Antennas,** Norwood, MA: Artech House, 1986, 575 pp., $61.00.

Thomas A. Milligan, **Modern Antenna Design,** New York, NY: McGraw-Hill, 1985, 408 pp., $44.50.

J. Musil and F. Zacek, **Microwave Measurements of Complex Permittivity by Free Space Methods and Their Applications,** Amsterdam, The Netherlands: Elsevier Science Publishers, 1986, 275 pp., $64.75.

Robert A. Pucel, editor, **Monolithic Microwave Integrated Circuits,** New York, NY: IEEE Press, 1985, 501 pp., $69.95 ($41.95 for IEEE members).

D. Curtis Schleher, **Introduction to Electronic Warfare,** Norwood, MA: Artech House, 1986, 559 pp., $61.00.

S.S. Swords, **Technical History of the Beginnings of Radar,** London, U.K.: Peter Peregrinus, 1986, 325 pp., $60.00.

Leung Tsang, Jin Au Kong and Robert T. Shin, **Theory of Microwave Remote Sensing,** New York, NY: John Wiley & Sons, 1985, 613 pp., $44.90.

J. Van Bladel, **Electromagnetic Fields,** New York, NY: Hemisphere Publishing Corp., 1985, 556 pp., $39.95.

J.R. Wait, **Introduction to Antennas and Propagation,** Piscataway, NJ: IEEE Service Center Publishing Dept., 1986, 272 pp., $25.00.

Forthcoming

Andrew Marino, editor, **Foundations of Modern Bioelectricity,** New York, NY: Marcel Dekker, February 1987, 27 chapters, Price: NA.

Charles Polk and Elliot Postow, editors, **CRC Handbook of Biological Effects of Electromagnetic Fields,** Boca Raton, FL: CRC Press, Fall 1986, 576 pp., $165.00.

Morris Waxler and Victoria Hitchens, editors, **Optical Radiation and Visual Health,** Boca Raton, FL: CRC Press, Late 1986, 272 pp., $87.00.

CONFERENCES

November 2-6: **1986 IEEE Conference on Electrical Insulation and Dielectric Phenomena,** Hilton Hotel, Claymont, DE. Contact: Roy Wootton, 501-3W57, Westinghouse R&D Center, 1310 Beulah Rd., Pittsburgh, PA 15235, (412) 256-2108.

November 4-6: **4th International Symposium on Antennas: JINA'86,** Acropolis Convention Center, Nice, France. Contact: J.L. Guiraud, CNET-PAB Centre de La Turbie, 06320 Cap D'Ail, France, (93) 411717.

November 6-7: **Millimeter Wave/Microwave Measurements and Standards for Miniaturized Systems,** U.S. Army Missile Command, Redstone Arsenal, AL. Contact: Malcolm Shelton, U.S. Army TMDE Support Group, Attn: AMXTM-SM, Redstone Arsenal, AL 35898, (205) 876-1550.

November 7-10: **8th Annual Conference of the IEEE Engineering in Medicine and Biology Society,** Worthington Hotel, Fort Worth, TX. Contact: Dr. Charles Robinson, Rehabilitation R&D Center, Hines VA Hospital, Box 20, Hines, IL 60141, (312) 7200, ext. 2240.

November 10-12: **RF Expo East,** Marriott Copley Place, Boston, MA. Contact: James MacDonald, *RF Design,* 6530 S. Yosemite St., Englewood, CO 80111.

November 17-20: **31st Annual Conference on Magnetism & Magnetic Materials,** Hyatt Regency Hotel, Baltimore, MD. Contact: Diane Suiters, 655 15th St., NW, Suite 300, Washington, DC 20005, (202) 639-5088.

November 18-20: **1986 DOE-EPRI Contractors Review: Biological Effects of Electric and Magnetic Fields,** Sheraton Tech Center, Denver, CO. Contact: W/L Associates, 600 S. Frederick Ave., Suite 401, Gaithersburg, MD 20877, (301) 948-0642.

November 19-23: **Fall Conference of the Society of Telecommunications Consultants (STC),** Intercontinental Hotel, San Diego, CA. Contact: Effie Cooper, STC, 1 Rockefeller Plaza, Suite 1410, New York, NY 10020, (212) 582-3909.

November 30-December 5: **Symposium on Heat and Mass Transfer in Thermally Significant Vessels and the Microcirculation,** Anaheim, CA. Contact: Prof. Ken Diller, Biomedical Engineering Center, University of Texas, ENS 612, Austin, TX 78712, (512) 471-7167.

December 3-4: **Workshop on Microwave Applications in the Food and Beverage Industry,** Toronto, Ontario, Canada. Contact: Gillian MacLeod, Ontario Hydro, 620 University Ave., U4-E4, Toronto, Ontario M5G 1X6, Canada, (416) 592-5526.

December 4-5: **28th Conference of the Automatic RF Techniques Group (ARFTG),** Don Cesar Beach Resort, St. Petersburg Beach, FL. Contact: Richard Irwin, Systems for Automatic Test, 1292 Reamwood Ave., Sunnyvale, CA 94089, (408) 734-9447.

December 11-14: **3rd Annual Meeting of the American Society of Clinical Hyperthermic Oncology (ASCHO),** Gene Autrey Hotel, Palm Springs, CA. Contact: Dr. H. Bicher, ASCHO, 14427 Chase St., Suite 203, Panorama City, CA 91402, (818) 895-1379.

UPDATES

COMMUNICATIONS

EPA-FCC Surveys...EPA's Richard Tell and FCC's Dr. Robert Cleveland measured RF radiation levels in Portland, OR, the last week of July and on Lookout Mountain near Denver, CO, the week of September 22. Portland has been the scene of a continued radiation controversy, especially in the community near the antenna farm in Healy Heights. Its moratorium on new radiation sources of more than 500 watts is still in effect and the city is now considering the adoption of a 200 uW/cm² exposure standard (see *MWN,* July/August and November/December 1985). No action on either the standard or the moratorium is expected until EPA issues its report. "We're in limbo," Steve Gerber of the Portland Bureau of Planning told *Microwave News.* Similarly, people living near Lookout Mountain have raised concerns over the radiation levels associated with the TV and FM antennas sited there. A report on the Portland survey is scheduled to be released before the end of the year. The Denver study will be published in 1987. These are the third and fourth EPA-FCC radiation surveys: the first was in Honolulu, HI (see *MWN,* January/February 1985); the second was on Cougar Mountain outside Seattle, WA (see *MWN,* January/February 1986).

RF Compliance Testing...With broadcasters now facing FCC rules concerning human exposures to RF/MW radiation and with EPA weighing a national standard as low as 100 uW/cm², new markets are opening up for engineering firms that can compute and measure RF/MW power levels and show that their clients are complying with the applicable federal, state or local regulations. Comsearch, Inc., may be the first company to openly position itself to win a share of the business. The firm has begun offering testing and support services for broadcast and satellite stations and recently opened an RF testing lab at its new headquarters in Reston, VA. For more information, contact Comsearch's Nancy Whitacre, 11720 Sunrise Valley Dr., Reston, VA 22091, (703) 476-2683.

COMPATIBILITY & INTERFERENCE

Computer LAN and Satellites...The National Oceanic and Atmospheric Administration (NOAA) has filed comments opposing a proposal to link computers in a local area network (LAN) by using 1.70-1.71 GHz radiation — a frequency now allocated to NOAA for transmitting weather satellite data. The FCC proposed the LAN rules last May in response to a petition from Motorola, which contended that wireless networks are needed because typical LANs are difficult and expensive to change. NOAA responded that, under the FCC proposal, radiation-based LANs would interfere with receivers of NOAA satellite signals. NOAA wants the FCC to move the microwave LANs to another frequency band or to prohibit them altogether. At the same time, NOAA — which argued that Motorola has vastly underestimated the number of receivers that would be affected — is asking users of its satellite signals to register so that the extent of the EMI problem can be gauged. For more information, contact Richard Barth, NOAA, Department of Commerce, Room 6106, Herbert Hoover Bldg., Washington, DC 20230, (202) 377-0635.

Beyond Captain Midnight...When John MacDougall, alias Captain Midnight, jammed a Home Box Office (HBO) satellite signal last April (see *MWN,* July/August 1986), he did more than just irritate HBO executives and FCC staffers. The incident also sent a chill down the spine of those in charge of the military's satcom systems. According to the cover story in the October issue of *Mother Jones,* a study prepared for AT&T by SRI International's Strategic Studies Center in Arlington, VA, revealed that, during the aborted rescue attempt of U.S. hostages in Iran in 1980, each side monitored and sabotaged the other's communications in a full-scale electronic battle. Furthermore, the magazine reports, DoD has not improved the anti-jamming capabilities of its satellites in the last six years and interference is still a very real threat to vital military systems. Indeed, speaking at the *Electronics and Aerospace Systems Conference* in September, Donald Latham, assistant DoD secretary for C^3I, admitted that UHF-band satellites such as FleetSatCom are "vulnerable to some extent." As reported in the September 15 *Aviation Week,* he said that SHF-band satellites, such as those in the Defense SatCom System, have some, albeit limited, protection. Future satellites, such as Milstar, will be able to ward off interfering signals, he noted. Milstar isn't scheduled to be operational until the 1990s, however.

RFI Fence...A CBS affiliate in Columbus, OH, has built a 31-foot-high and 740-foot-long concrete fence to protect its C-band earth stations from RFI, according to a report in the September 8 *Broadcasting.* (The actual fence is 27 feet high and sits on a 4-foot berm.) Fanwall Corp. of Arlington, VA, designed the irregular-shaped wall for WBNS-TV so that the station could put the dishes next to its studios in town rather than 20 or 30 miles away.

Power Line-RF Interference...The Canadian Electrical Association (CEA) has awarded Ontario Hydro a $200,000 contract to study *Power Line Carrier Radiofrequency Interference to and from Radio Communication Services: Phase I* (Contract No. 200-T-387). Among the project's objectives are how power line configurations determine nearby field strengths as well as how, and under what conditions, the configurations affect their susceptibility to RF signals in the 30 kHz to 1 MHz band. In addition, Ontario Hydro will build models to predict whether power line and RF sources can coexist. For more information, contact CEA's R.A. Del Bianco, Suite 500, 1 Westmount Square, Montreal, Quebec H3Z 2P9, Canada, (514) 937-6181.

GOVERNMENT

FCC RFI Crackdown...The FCC continues to get tough on computer makers whose products fail to meet Part 15 RFI rules for computing devices (see *MWN,* March/April 1986). The commission's seven-week delay in approving Tandy Corp.'s new personal computers — models 1000 EX, 1000 SX — hurt sales, especially after Tandy had announced them with great fanfare. Widely covered by the press and often criticized by the computer industry, the FCC's stepped-up RFI certification program has resulted in the collection of approximately 100 $2,000 fines in the last year, according to *The Wall Street Journal* (September 5). Commis-

sion officials are unfazed by the harsh words from the industry, however; they cite the growing number of interference complaints.... In a related action, the FCC rejected petitions from Electronics Associates, Inc., Cray Research, Inc. and Denelcor, Inc. for exemption from Part 15 rules for computers used for research, engineering and other specialized applications. The three computer makers had asked to be excused from testing their limited-production computers because of the high cost per unit. After reviewing the 32 sets of comments and 7 sets of reply comments filed in response to its August 1984 Notice of Proposed Rulemaking (see *MWN,* October 1984), the commission rejected the petitions because it foresaw difficulties in "uniformly interpreting" the resulting rule. In its notice released on August 12, the FCC noted, however, that most of the specialized computers fall into existing categories for exemptions.... The FCC confiscated approximately $10,000 worth of RF amplifiers and transmitters from H&Y Electric Supply, a Louisville, KY, distributor, in late August for noncompliance with interference regulations despite a prior, written warning. A conviction could result in a maximum penalty of a $100,000 fine and a year imprisonment.

MEASUREMENT

Magnetic Fields...Dr. Maria Stuchly of Canada's Radiation Protection Bureau in Ottawa has surveyed previously reported measurements on human exposures to static and time-varying magnetic fields from zero to a few hundred kilohertz. The largest DC fields are associated with both NMR imagers and high technology devices like Tokamak fusion reactors. Proposed transportation systems using magnetic levitation (Maglev) would entail the strongest DC fields (up to 100 mT) for relatively long exposure times. Among household appliances, can openers and hair driers generate the largest 60 Hz fields — up to 2 mT at 3 cm. Although Stuchly covers the 0.1-0.3 uT ELF fields 30 cm from VDTs, she omits the stronger VLF emissions that are up to an order of magnitude higher. She told *Microwave News* that when she wrote the paper in early 1985 there were no published data on the VLF fields emitted by the VDTs' flyback transformers. Stuchly's paper appears in the August issue of *Health Physics*.... Ontario Hydro's Dr. S.M. Harvey has detailed the "Requirements for 60 Hz Magnetic Field Dosimetry" in a working paper issued on May 5. For more information, contact Harvey at Ontario Hydro's Research Division, 800 Kipling Ave., Toronto, Ontario M8Z 5S4, Canada.... Dr. Henry Baltes of the University of Alberta in Edmonton, Canada, and Dr. Radivoje Popovic of Landis & Gyr Corp. in Zug, Switzerland, have prepared a major review paper on "Integrated Semiconductor Magnetic Field Sensors," which appears in the August issue of the *Proceedings of the IEEE*.... Researchers at the Sandia National Labs have combined a magnetic semiconductor with optical fiber technology to devise a magnetic field sensor with a response time of less than a nanosecond. Designed by Michael Butler and Stephen Martin, the sensor can monitor rapidly changing magnetic fields at frequencies of up to 5 GHz in noisy environments. "It may also find application in the direct detection of intense RF fields," they believe. For more information, contact Butler and Martin at the Microsensor Division, Sandia National Labs, Albuquerque, NM 87185.

MEDICAL APPLICATIONS

Stun Gun Cure...High voltage, low amperage electric shock therapy is being used as a new treatment for poisonous snake bites in the Amazon jungle areas of Ecuador, where antivenom medicine is often not readily available. In the July 26 *Lancet,* Dr. Ronald Guderian, an American missionary physician, and his colleagues reported curing 34 snake bite victims by using shocks applied with stun guns within 30 minutes of the bites. (Outboard motors have also been used as sources of current.) The treatment consists of 4-5 shocks of 20-25 kV with less than 1 mA direct current to the bite area, each lasting 1-2 seconds with 5-10 seconds between each jolt. In all cases the pain disappeared within 10-15 minutes and the swelling, bleeding, blistering, shock and renal failure which usually accompany snake bites did not develop. Shocks applied hours after bites also produced positive results. Guderian and coworkers noted that others have also successfully used this technique to treat bites from scorpions and ants. They speculate that electrospasms shut down the local blood vessels, confining the short-living venom long enough for it to become inactive. The letter prompted a reminder by Andrew Pearson (August 23 *Lancet*) that, in 1979, an Australian research team reported that a crepe bandage applied firmly over the bite area to prevent venom absorption was perhaps "the cheapest and best form of first-aid."

MEETINGS

T&D EMI in Anaheim...At the same time that many utility staffers interested in the effects of power line radiation were at the Toronto international symposium (see story on p.1), the *10th IEEE/PES Transmission and Distribution Conference and Exposition* was being held in Anaheim, CA. One of the Anaheim sessions was on "AC Fields and Radio Interference" and featured papers on the "Effects of Power Line Structures on AM Broadcast Stations" (No.86T&D516-9), by M.S. Hammam and R.S. Baishiki of Pacific Gas & Electric Co. (PG&E); "Interference from 60 Hz Electric and Magnetic Fields on Personal Computers" (No.86T&D609-2), also by PG&E's Baishiki, in collaboration with GE's Dr. Don Deno; and "Analysis of Radio Interference and Substation Modifications for Uprating a 115 kV Substation to 230 kV" (No.86T&D517-7), by a team from Louisiana Power & Light Co. and Westinghouse Electric Corp. Copies of each paper are available for $3.00 (IEEE members) or $6.00 (others) from the Single Publications Sales Dept., IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854.

OCCUPATIONAL HEALTH

Electrical Risks...Two recent studies shed new light on the potential hazards associated with electrical occupations. The first indicates that working with electricity may increase the risk of contracting amyotrophic lateral sclerosis (ALS), a degenerative and usually fatal disease of the motor neurons commonly known as "Lou Gehrig's disease." Drs. Dennis Deapen and Brian Henderson of the University of Southern

California School of Medicine in Los Angeles report that patients with ALS were almost four times as likely as controls to have worked in electrical occupations. A history of severe electric shock resulting in unconsciousness was also significantly associated with ALS (odds ratio of 2.8). Other physical traumas that caused unconsciousness also were slightly significant. Suspected risk factors, such as prior diseases and toxic chemicals, were not significant, however. The paper appears in the *American Journal of Epidemiology, 123,* pp.790-799, 1986. In the second study, researchers sought a link between background *ionizing* radiation and acute myeloid leukemia but, instead, found that electrical technicians, electrical welders and computer and telephone mechanics had a greater than average risk of developing the disease (odds ratio of 3.8). Dr. Ulf Flodin, of the Department of Occupational Medicine at the University Hospital in Linkoping, Sweden, is the principal author of the paper, which appears in the *Archives of Environmental Health, 41,* pp.77-84, 1986.

NIOSH RF Heater Study Review...NIOSH held a public meeting on September 11 to review its plans for an epidemiological study of reproductive risks among *male* RF heater operators. A separate study of exposed women is likely to be ready for review by early 1987, agency staffer Clinton Cox reports. The two-part project, which has been underway since 1978 (see *MWN,* February 1981), may get started by mid-1987, though Cox admits that further delays are possible. For more information, contact Cox at the Division of Biomedical and Behavioral Science, NIOSH, 4676 Columbia Parkway, Cincinnati, OH 45226, (513) 533-8482.

PEOPLE

Changes at DoD...The Air Force's John Mitchell has been named chief of the Radiation Sciences Division at the School of Aerospace Medicine at Brooks Air Force Base in San Antonio, TX. Mitchell will now be responsible for laser and ionizing – as well as RF/MW – radiation. Dr. Jerome Krupp has taken over from Mitchell as chief of the radiation physics branch. Within the branch, James Merritt has become chief of the bioeffects section; Dr. David Erwin and William Hurt continue as the heads of the mechanisms and the RF/MW facility sections, respectively...At the Office of Naval Research (ONR), Dr. Charles Rafferty took over from Dr. Tom Rozzell on October 1 as manager of the bioelectromagnetics program. Rafferty is currently on a six-month assignment and may continue there permanently. He came to ONR from the Department of Microwave Research at the Walter Reed Army Institute of Research. Rozzell has moved to the National Research Council (see *MWN,* July/August 1986).

POWER LINES

Florida Advisory Panel...The Florida Department of Environmental Regulation (DER) has set up an advisory panel to help develop rules for siting transmission lines (see *MWN,* March/April 1986). Professor Lloyd Beidler of Florida State University in Tallahassee, who has worked on the mechanisms of taste stimulation and olfaction and who is a member of the National Academy of Sciences, is chairing the six-member panel. The Electromagnetic Field Advisory Panel will help DER establish "reasonable" standards to protect the public from power line fields. Buck Oven of DER's Division of Environmental Permitting told *Microwave News* that he expects a proposal to be completed by May or June 1987 for consideration by the state's Environmental Regulation Commission. For more information, contact Oven at DER, 2600 Blair Stone Rd., Tallahassee, FL 32301, (904) 488-0130.

Go-Ahead for Australian Power Line...In our last issue, we described the controversy over a 220 kV power line in Victoria, Australia. On August 11, the line was approved, because state Minister for Health David White concluded that it "did not pose any public health problems." Among the official reasons for the state government's approval were: (1) "The fact that all sides of the debate agree that no existing epidemiological studies conclusively demonstrate any health risk associated with high voltage transmission lines"; (2) "The fact that *electric* fields associated with the proposed [State Electricity Commission of Victoria] transmission lines are half the minimum acceptable standard recommended by the World Health Organization (WHO) of 2 [kV/m] at the edge of the easement"; and (3) "The fact that *magnetic* fields under the transmission lines are extremely low, typically in the range of 5 to 50 milligauss compared with a WHO minimum standard of 3,000 milligauss." Referring to the studies of Dr. Jerry Phillips of the Cancer Therapy and Research Foundation in San Antonio, TX, White said that experiments on cell tissue are of "limited value" in resolving questions about the health effects of electromagnetic radiation (see *MWN,* July/August 1986). Overall, White said that his staff advised him that "animal studies do not support links between...ELF radiation and cancer."

STANDARDS

Walkie-Talkie EMI...The IEEE Committee C37 on Power Switchgear has approved a two-year "trial use" standard to protect against EMI caused by operating walkie-talkies near electrical relays: it recommends that relays be tested in a shielded enclosure in fields between 10 and 20 V/m over the 25-1,000 MHz frequency range. In an interview with *Microwave News,* Douglas Dawson of Southern California Edison Co., chairman of the IEEE's Power Engineering Society working group that developed the measure, explained that the impetus for the standard came from numerous reported EMI incidents over the past decade, notably several at nuclear power plants (see *MWN,* March/April 1986). Differences among panel members over the acceptable interference level prevented the group from issuing a final standard, he said, adding that he expects the interim measure, *Withstand Capability of Relay Systems to Radiated Electromagnetic Interference* (C37.90.2), to provide data on testing methods and on the effectiveness of the limits. He hopes that a final standard can be issued using these data. For more information, contact Dawson at SoCal Edison, PO Box 800, Rosemead, CA 91770, (818) 302-1676. Due to printing delays, the interim standard will not be available until 1987.

Satcom Antennas... The Electronic Industries Association (EIA) has published Recommended Standard, EA-411-A, *Electrical and Mechanical Characteristics of Earth Station Antennas for Satellite Communications* (see *MWN*, May/June 1986). The new standard replaces EIA-411 (released in 1973) and was developed by a subcommittee chaired by Roland Schwerdtfeger of Scientific Atlanta Co. A copy is available for $40.00 from the EIA Standards Sales Office, 2001 Eye St., NW, Washington, DC 20006, (202) 457-4966.

ETC...

Odds and Ends... The lead article in the September issue of *Scientific American* is "The Microwave Problem" by Drs. Ken Foster of the University of Pennsylvania and Bill Guy of the University of Washington. The article has received mixed reviews from members of the community. Watch for replies on the magazine's letters page. Interestingly, the same issue has an article on "The Blood-Brain Barrier" by Gary Goldstein and Lorris Betz of the University of Michigan Medical Center. In contrast to Koslov's statements at the EPA hearing (see p.2), Foster and Guy dismiss a low-intensity microwave effect on the BBB.... Variations in the earth's magnetic field may help "lost" salamanders find their home ponds. In the August 15 *Science*, John Phillips of Yale University reports that salamanders not only navigate by a compass mechanism but have map sense, as well.... A short circuit in an umbilical cord connector caused the inadvertent ground launch of a Raytheon Sidewinder air-to-air missile from an F-15J fighter in a hangar at an air base near Tokyo, Japan, according to the September 29 *Aviation Week*.... Drs. Stewart Jaslove and Peter Brink, of the State University of New York in Stony Brook, examine "The Mechanism of Rectification at the Electronic Motor Giant Synapse of the Crayfish" in the September 4 *Nature*.... In this column in our March/April issue, we reported that a jury awarded $1 million to a psychic after she alleged losing her special power following a CAT scan. According to an August 9 UPI item, a Philadelphia judge rejected the jury's decision and ordered a new trial, saying that the award was "so grossly excessive as to shock the court's sense of justice."... A front-page story in the September 14 *New York Times* described the emerging uses of thin films of synthetic diamonds. One of the applications cited is the U.S. Navy's desire for diamond radomes. (The diamond coatings are made using a microwave discharge.) These were no doubt discussed September 17-19 at the *18th Electromagnetic Window Symposium* sponsored by Georgia Tech in Atlanta.... Researchers from the New Mexico Institute of Mining and Technology and from the State University of New York in Albany have published "Abnormal Polarity of Thunderclouds Grown from Negatively Charged Air" in the September 26 *Science*. See also a discussion of the paper in the September 27 *Science News*.... The 26th annual meeting of the American Society of Dowsers took place in Danville, VT, in September and, according to an item in the September 28 *New York Times*, there was more talk about possible electromagnetic pulls on the dowser's pineal and adrenal glands. A letter from Tom Williamson of Surrey, U.K., published in the April 17 *Nature*, suggests that magnetic gradients must exceed one nanotesla per meter for dowsers to find water.... And finally, there is the strange story of the Rumanian family that turned up at the U.S. Capitol on September 4 with two dozen suitcases and asked a guard for asylum — partly because they claimed they were being bombarded by radiation in their California home. It turned out that the family of nine already had visas which were good until 1988. Their story quickly disappeared from the newspapers without further explanation.

AM Radiation Lawsuit *(continued from p.1)*

KGA broadcasts an omnidirectional signal during the day and a northwesterly, directional signal at night, both at 1,510 kHz. According to the complaint, the DiLuzio's house is in the path of the directional signal used at night.

Constant RFI Problems

The DiLuzios and their neighbors have complained for years about RF interference (RFI) to their radio and TV reception and to their telephones. In addition, the signal is reportedly so strong in the community that chain-link fences and metal objects inside homes can act as receivers.

During the building of the Mullan Road School in 1977, workers suffered electrical shocks and burns. Inside the school, students and teachers reported getting shocks until, in 1981, a grounded, copper roof was installed. The shielding cost more than $50,000, according to a feature story in the May 26, 1985 Spokane *Spokesman-Review*.

AM radio signals are generally thought to be far less harmful than FM signals. Recent studies by Dr. Om Gandhi of the University of Utah in Salt Lake City are forcing a re-evaluation of this view (see *MWN*, July/August 1985 and July/August 1986). According to Glassman, the DiLuzios were unaware that the RF fields might be hazardous until a cancer specialist treating Mrs. DiLuzio asked if she had been exposed to RF radiation.

The Environmental Protection Agency (EPA) listed the Spokane area, where there are numerous broadcast towers, on its list of RF radiation "hot spots" (see *MWN*, January/February and May 1985). ●

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MICRO WAVE NEWS

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New RF/MW Exposure Standards: Sweden and Canada

The Swedish government has adopted – and the Canadian government has proposed – revisions in their radiofrequency and microwave (RF/MW) radiation exposure standards that will make them significantly stricter than before. They are the first regulations to take into account new data indicating that low frequency RF radiation is riskier than once believed (see *MWN*, July/August 1985).

On May 7, the Swedish National Board of Occupational Safety and Health (NBOSH) adopted new on-the-job limits – to take effect on January 1, 1988 – which are frequency-independent between 30 MHz and 300 GHz: 60 V/m and 0.16 A/m (1 mW/cm²) for the electric and magnetic fields, respectively.

In the 3-30 MHz band, the limits are 140 V/m and 0.40 A/m (approximately 5 mW/cm²) for on-the-job exposures. When the workers are in contact with electrical ground, the limits fall to 47 V/m and 0.13 A/m for 3-30 MHz and to 20 V/m and 0.05 A/m for 30-60 MHz (see table on p.5). There is no standard for exposures below 3 MHz.

Work is underway to revise standards governing the exposure of the

(continued on p.5)

Vision, Stealth & Mechanisms

Chemists at Carnegie-Mellon University have identified a family of compounds similar to rhodopsin – the molecule that is the basis of vision – which can absorb specific frequencies of radiofrequency and microwave (RF/MW) radiation. The potential implications and applications are enormous.

These compounds – retinyl Schiff base salts – promise to revolutionize the ability to make aircraft and other military hardware invisible to radar detection more efficiently than current "Stealth" technology, which is based on destructive interference by reflected signals. The findings may also help in deducing a mechanism for frequency-specific biological effects, especially those in the eye, where many different types of Schiff bases are naturally present.

After Dr. Robert Birge, the chairman of the chemistry department at Carnegie-Mellon University in Pittsburgh, PA, told *Aviation Week* that, "It should be possible to modify these salts so that an ensemble of them could absorb over the entire RF range," the military moved in and put a cloak of secrecy over his work – it is now classified along with other Stealth research.

Thirty years ago, Drs. George Wald and Ruth Hubbard of Harvard University showed that a single photon could initiate a biochemical rearrangement in retinal, a Schiff base that is one of the components of

(continued on p.15)

HIGHLIGHTS

Ontario Hydro & IBM Study on PMFs and Reproductive Effects

Ontario Hydro and IBM are jointly sponsoring a study of the possible link between the pulsed magnetic fields (PMFs) associated with video display terminals (VDTs) and adverse pregnancy outcomes. "It will be a major experiment," according to Ontario Hydro's Murray Walsh, who is serving as the project manager.

The announcement of the new study follows reports from Sweden and Spain indicating reproductive effects among PMF-exposed mice and chick embryos (see *MWN*, March 1983, March/April and May/June 1986 and July/August 1987). An IBM spokesperson said that, while "extensive studies to date show no proof of hazard," questions about VDTs and pregnancy outcomes have been raised by the Swedish and Spanish research.

Dr. Michael Wiley, a professor of anatomy at the University of Toronto's Faculty of Medicine, will expose pregnant mice to simulated VDT fields for the first 18 days of pregnancy; the mice will then be killed and the embryos checked. Professor Paul Corey, a biostatistician at the university, will collaborate with Wiley.

The mice will be exposed to 20 kHz PMFs at three different intensities in an effort to see if there is a dose-response relationship, according to Ontario Hydro's Dr. Stuart Harvey, who is designing the exposure system. A fourth group of mice will serve as controls.

In a telephone interview, Walsh said that the experimental protocol is still in draft form but that current plans call for 200 mice in each of the four groups. The three exposure levels will be approximately 4, 16 and 200 μT. Harvey told *Microwave News* that the levels are much greater than the average exposure of VDT operators, which he said is approximately 0.1 μT.

A panel of experts from both sides of the Atlantic Ocean is being assembled to consult on the study. At press time, the names of the members of the panel had not been released.

A pilot study is scheduled to begin in October; the full-scale experiment will start in February, with results due in January 1989. The experiment will be run "blind"; Wiley will not know which are the exposed mice and which are the controls.

The project will cost $400,000-500,000 (Canadian). Neither Ontario Hydro nor IBM would specify how much each company is contributing. IBM's role is limited to funding the study; the company will not be involved in its management.

The study is part of Ontario Hydro's project on the "Hazard Assessment of Video Display Units" (HAVDU): an animal exposure study was first announced nearly four years ago but was delayed until now (see *MWN*, January/February 1984). Walsh said that the delay was caused by "major budgetary restraints."

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Suit Seeks More Protection Against HERO and ESD Risks

A lawsuit seeking greater protection against the accidental detonation of conventional and nuclear weapons by electromagnetic radiation (EMR), electrostatic discharge (ESD) and lightning was filed in federal court on September 1. The plaintiffs, a coalition of private citizens and activist groups, are asking the Department of Defense, each of the armed services and the Departments of Energy and Transportation to stop the use of electro-explosive devices (EEDs) until detailed environmental impact statements (EISs) on the siting of weapons with these devices near population centers have been completed.

In their complaint, the plaintiffs cite a number of incidents caused by EMR, ESD and lightning – they lump these together, calling them "hazards of EMR to ordnance," or "HERO." They warn of many possible accidents, including "the detonation of a nuclear or conventional weapon, the ejection of rockets or missiles, the firing of a rocket...the explosion of a weapon's fuel supply."

Patricia Axelrod, a ceramic tile designer from Key West, FL, is the moving force behind the petition, having spent the last two years researching HERO risks and accidents. Her concerns began when the Navy decided to reactivate an air station and to build a Homeport project, both in Key West, but failed to address potential HERO problems – for example, from nearby Coast Guard communications transmitters – in its EISs.

Asked about the allegations raised in the suit, Ramie Thompson of the Applied Physics Department at the Franklin Research Center in Philadelphia, PA, told *Microwave News* that there certainly are risks from HERO and ESD, but that, overall, the military "is not doing a bad job." Thompson is the editor of *Explosives and Pyrotechnics*, a newsletter published at the Franklin center.

Axelrod says that she is being investigated by the Naval Investigative Service because of her efforts to research HERO and related risks. In a background document, *The Deadly HERO*, Axelrod claims that more than 25 HERO accidents have occurred.

Axelrod has the backing of Dr. Theodore Taylor, a former nuclear weapons designer and staffer at the Defense Nuclear Agency, who has voiced his "deep concern" about accidental

explosions.

The National Peace Academy of Abbeyhills in Columbus, OH, is also a plaintiff, as is its president, Thomas Siemer, a former Rockwell International Missile Systems Division manager, now retired.

The plaintiffs are represented by Edward Lee Rogers, an attorney based in Washington, DC, who was the principal deputy assistant secretary of the Army during the Carter Administration. Rogers also represents a group seeking detailed EISs on the military's electromagnetic pulse (EMP) simulators (see *MWN*, March/April 1987).

One of the best known accidents attributed to ESD was the 1985 fire at a Pershing II site in West Germany, which killed three servicemen and injured 16 others (see *MWN*, June 1985). This past June, three National Aeronautics and Space Administration (NASA) rockets were inadvertently launched from NASA's Wallops Island facility in Virginia after being struck by lightning (see also item on ESD contract on p.12).

A Hazard for Surgeons?

Surgeons are often exposed to high levels of radio-frequency (RF) radiation while using electrosurgical units (ESUs), according to new measurements published in the July issue of the *Journal of Occupational Medicine*.

In a simulation of an operation, a team led by Dr. Jacob Paz of the New York Medical College in Valhalla found surgeons' eyes and foreheads were exposed to the highest levels of radiation – far in excess of the ANSI standard. The electric and magnetic fields were as high as 9,000,000 V^2/m^2 and 3.5 A^2/m^2, respectively. The ANSI standard is 4,000 V^2/m^2 and 0.025 A^2/m^2 between 30-300 MHz. Although not specified in the paper, ESUs operate at about 27 MHz in the ISM band.

An ESU is a standard fixture in most operating rooms; it is used to cut and seal tissue and to stop bleeding. In abdominal surgery, for instance, a surgeon may use an ESU in the coagulation or sealing mode 100 times or more in the course of one operation, according to Paz and coworkers. The team warns that "our result strongly suggests that a potential for eye injury exists" and calls for more research on exposure levels during surgery, as well as on the actual risks from extended exposure.

Paz also just completed taking measurements during an actual operation. The readings from a probe placed on the operating table were as high as 50,000,000 V^2/m^2, with background levels between 1,000 and 3,000 V^2/m^2. He did not take magnetic field measurements. Paz told *Microwave News* that these results, which have not been published, confirm his original work.

More than ten years ago, Dr. J.W.C. Fox and colleagues warned of the possible health risks due to RF radiation from ESUs in the operating room. Writing in *The Lancet* (*i*, p.962, May 1, 1976), they noted that they had measured power densities above 150 mW/cm^2 at the point of application and along the active lead of the unit.

NBS and FCC Step Up Action Against EMI

The National Bureau of Standards (NBS) and the Federal Communications Commission (FCC) are developing new ways of dealing with electromagnetic interference (EMI) problems.

EMC LAP Expands

The NBS has expanded its electromagnetic compatibility (EMC) National Voluntary Laboratory Accreditation Program (NVLAP) to meet the needs of the FCC and the U.S. Naval Air Systems Command. New test methods covering a host of FCC and military standards have been added to the ones established last year (see *MWN*, September/October 1986).

In a series of telephone interviews, members of the EMC community expressed their unanimous approval for the LAP and for the FCC's participation. "It's excellent," said Finbarr O'Connor of R&B Enterprises in West Conshohocken, PA. "It's a good sign for everybody; it adds credibility," concurred Ed Bronaugh of Electro-Metrics in Amsterdam, NY.

Uncertainty hangs over the program, however. A draft proposal is being circulated which would transfer laboratory accreditation to non-governmental organizations. The impetus for this comes from the American Association for Laboratory Accreditation.

If the informal proposal is well received, NBS will publish a proposed rule in the Federal Register for public comment. It would be at least a year before the LAP for any one industry is taken private, according to Harvey Berger, the manager of the NVLAP. Berger said that if the privatization proposal is approved, he doubts that the EMC LAP will be one of the first to be transferred out of NBS.

There are now 16 accredited labs: Spectrum Control, Inc., of Erie, PA, and Unisys Corp. of Salt Lake City, UT, have joined the 14 others that were on the original NBS roster. (GTE Evaluation & Support Dept. in Lexington, KY, has changed its name to Testmark Laboratories.) For more information on the EMC LAP, contact: Jeffrey Horlick, NVLAP, NBS, Admin A531, Gaithersburg, MD 20899, (301) 975-4016.

FCC Amends Measurement Methods

The FCC has amended its Procedure for Measuring RF Emissions from Computing Devices, better known as *MP-4*.

Although the changes are billed as "editorial," there are a number of substantive amendments. Among the changes are new ways to configure the cables during testing and a requirement that monitors display a repeating pattern of the letter "H" (scrolling H's) during testing.

The changes have met with differing reactions. Some of those involved in testing products agree that the changes are minor; others, like Glen Dash of Dash, Straus & Goodhue in Boxborough, MA, argue that the commission should have issued a formal proposal of its changes. Dash, who is both an engineer and an attorney, said that the changes go "way beyond" the threshold point for rulemaking.

The Computer and Business Equipment Manufacturers Association (CBEMA), which recently proposed some major changes to *MP-4* (see *MWN*, May/June 1987), warns that its members "could suffer severe economic impacts" from the changes and that some devices might have to be redesigned.

Dash said that the revisions in the *MP-4* document have "solved the debate on how the commission tests" but have not "solved the problem of repeatability." He called the scrolling H's a "mistake."

Art Wall of the FCC's testing lab in Columbia, MD, discounted the complaints, noting that it has been five years since *MP-4* was adopted and that it is time to incorporate the lessons learned.

On September 17, CBEMA asked the FCC to seek public comment on its "editorial" changes. Meanwhile, the FCC has extended the deadline for commenting on the revisions to *MP-4* proposed by CBEMA in April until November 15, with reply comments due on December 15.

Recent FCC test results indicate that certain electronics products are meeting the FCC's EMI rules. Tests of 16 VCRs showed that, with one minor exception, all passed the conducted and radiated emissions tests. Class B (for home use) computer devices did less well, with six of 15 failing the compliance requirements. The FCC's Wall said that the commission would recommend a simplification of the authorization requirement for VCRs – but not for Class B devices.

Copies of the revised *MP-4* are available from the FCC Consumer Assistance Office, 1919 M St., NW, Washington, DC 20554, (202) 632-7000. For more information on the FCC testing program, contact: Art Wall, FCC Lab., 7435 Oakland Mills Rd., Columbia, MD 21046, (301) 725-1585.

Conducted EMI Tests

The NBS and a consortium of collaborators are working to develop ways of protecting sensitive electronic equipment against power surges. Under the leadership of NBS's François Martzloff, a team is undertaking extensive measurements to better understand the propagation of pulses – from lightning, transformers and switches – through a building's electrical wiring.

Basic Measurement Instruments (BMI) is allowing the NBS to inject surges into the power lines in its building in Foster City, CA. Martzloff said that BMI has already lost two laser printers as a result of the test surges. He explained that protecting against such losses can be complicated – in particular, he cited the problem of multiple grounds when many pieces of equipment are interconnected.

One of the project's main objectives is to recommend surge protection devices that are cost-effective. Martzloff notes – as others have in the past – that many commercially available surge protectors do not work and that, "It would be desirable for an objective organization to rate such devices." A staffer at Consumers Union in Mt. Vernon, NY, told *Microwave News* that it has no plans to tests surge protectors at this time.

Members of the consortium include: BMI, Current Technology, Inc., EDCO, EPRI, GE, General Semiconductor Industries, Pass & Seymour and TII Industries, Inc. The Building Industry Consulting Service International, a trade group based in Tampa, FL, is the coordinator for the consortium.

Those interested in joining the effort or seeking more information, should contact: François Martzloff, B162 Metrology Bldg., NBS, Gaithersburg, MD 20899, (301) 975-2409.

EPA RF/MW Guidance Now Due in 1989

The Environmental Protection Agency (EPA) now expects to publish its guidance for public exposures to radiofrequency and microwave (RF/MW) radiation in July 1989.

EPA began working on the guidance in the 1970s, but its progress has been marked by repeated delays. In July 1986, EPA issued three options for limiting RF/MW exposures – the equivalent of 100, 200 and 1,000 $\mu W/cm^2$ – as well as a non-regulatory-action option (see *MWN*, July/August 1986). When the agency published its proposal last year, the schedule called for a final rule by the end of 1987.

In August, letters were sent to more than 20 federal agencies, asking them to designate representatives to the Interagency Working Group on Radiofrequency Radiation, which will be reactivated to monitor EPA's guidance development. The first meeting of the working group is scheduled for November. Once a federal radiation guidance is adopted by EPA and approved by the President, it must be implemented by federal agencies, not by EPA.

For more information, contact: Norbert Hankin, Office of Radiation Programs, ANR-461, EPA, 401 M St., SW, Washington, DC 20460, (202) 475-9630.

Swedish Occupational Exposure Limits

Frequency	E (V/m)	$E_{grounded}$ (V/m)	$E_{ceiling\ [grounded]}$ (V/m, rms)	H (A/m)	$H_{grounded}$ (A/m)	$H_{ceiling\ [grounded]}$ (A/m, rms)
3-30 MHz	140	47	300 [100]	0.40	0.13	0.8 [0.27]
30-60 MHz	60	20	300 [100]	0.16	0.05	0.8 [0.27]
60-300 MHz	60		300	0.16		0.8
0.3-300 GHz	60		300			

Time averaged over any six-minute period.
The ceiling values are averaged over one second.

Standards *(continued from p.1)*

general population, according to NBOSH's Dr. Kjell Hansson Mild.

Mild told *Microwave News* that a frequency-independent standard was adopted to simplify enforcement – so that health inspectors do not have to check the frequency of the emitter to know the applicable standard.

NBOSH has also specified a maximum exposure of 300 V/m and 0.8 A/m during any one-second period; normally, exposures are averaged over a six-minute interval. In the 3-60 MHz band, grounded workers cannot be exposed to more that 100 V/m or 0.27 A/m in any one second.

The new limits are the first revision since 1977, when the standard was set at 5 mW/cm² between 10 and 300 MHz and 1 mW/cm² between 300 MHz and 300 GHz.

For more information, contact: Dr. Kjell Hansson Mild, NBOSH, Box 6104, S-900 06 Umea, Sweden.

Following the lead of the U.S. National Council on Radiation Protection and Measurements (NCRP), the Canadian Bureau of Radiation and Medical Devices is planning to tighten allowable *public* exposures to RF/MW radiation by a factor of five. Like their Swedish counterparts, the Canadian rules are significantly more stringent when applied to grounded individuals or to those in contact with ungrounded objects.

For members of the general population, the Canadian proposal calls for an exposure limit of as low as 10 V/m, when people are grounded – for ungrounded individuals, the limit is 28 V/m (approximately 200 μW/cm²). In a telephone interview, Dr. Maria Stuchly of the radiation bureau said that the

Canadian General Population and Occupational Exposure Limits

Frequency	E_{occup} (V/m, rms)	E_{pop} (V/m, rms)	H_{occup} (A/m, rms)	H_{pop} (A/m, rms)
0.01-1.2 MHz	600	280	4	1.8
1.2-3 MHz	600	280	4.8 (f)	2.1 (f)
3-30 MHz	1800 (f) or 3120 ($f^{1.5}$)*	840 (f) or 1600 ($f^{1.5}$)*	4.8 (f)	2.1 (f)
30-100 MHz	60 or 20*	28 or 10*	0.16	0.07
100-300 MHz†	60 or 0.2 (f)*	28 or 0.1 (f)*	0.16	0.07
0.3-1.5 GHz	3.45 ($f^{0.5}$)	1.61 ($f^{0.5}$)	0.0093 ($f^{0.5}$)	0.004 ($f^{0.5}$)
1.5-300 GHz†	140	60	0.36	0.16

Pop = general population; Occup = occupational; f = frequency in MHz.
* The lower limits apply only when the exposed person is less than 0.1 m from electrical ground; in all other cases the higher limits apply.
† For 100-300 MHz, the power density is 1 mW/cm² for occupational exposure and 0.2 mW/cm² for general population exposure. For 1.5-300 GHz, the power density is 5 mW/cm² for occupational exposure and 1 mW/cm² for general population exposure.