MICRO WAVE NEWS

Vol. I No. 1 A Monthly Report on Non-Ionizing Radiation January 1981

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MICROWAVES IN MOSCOW

At its August 26, 1980 meeting, the Electromagnetic Radiation Management Advisory Council (ERMAC) concluded that an investigation, such as the formal study of the health of Americans exposed to microwave radiation in the U.S. embassy in Moscow, would be pointless. Without dissent, members of ERMAC agreed that, based on current knowledge, there are no scientific or theoretical grounds to predict potential health impacts of the Moscow signal.

A consequence of the ERMAC finding may well be that the State Department will do no further epidemiological research on the 1,827 employees who worked at the embassy during the 22 year period when the Russians irradiated the upper floors with low levels of mostly continuous and some pulsed microwaves. As Stephen Cleary of Virginia Commonwealth University, an ERMAC member, explained, the sample population is too small and the dose too low for anything but a grave risk to show up, and therefore any money allocated to such research could be better spent elsewhere. One ERMAC member went so far as to say that he would not hesitate to expose himself or his family to those levels of microwaves found in the embassy.

ERMAC is an advisory committee to the Administrator of the National Telecommunications and Information Administration, Mr. Henry Geller.

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ANSI News

Meeting Scheduled

There will be a meeting of the C95 Committee on Radio Frequency Radiation Hazards of the American National Standards Institute (ANSI) on Thursday, February 26, 1981 at the ANSI headquarters in New York City (1430 Broadway). The main purpose of the meeting is to seek final approval of the new subcommittee IV standard on radiofrequency and microwave safety levels. Other business will include the new standards on measurements (subcommittee I) and hazard signs (subcommittee II/III).

Standard Nears Completion

The ANSI safety standard went out for C95 Committee vote last July. Although the standard was accepted by a majority vote of the Committee three important organizations withheld their approval: the Bureau of Radiological Health, the Environmental Protection Agency, and the Electronic Industries Association.

At a meeting in Bethesda in late October, the subcommittee was able to satisfy BRH objections and it is now very likely that the Bureau will cast a positive vote on the new standard. While an attempt was also made to win EIA's approval, it is not yet clear how EIA will vote. Apparently EPA does not intend to vote at all.

Microwave News will present an in-depth look at the new ANSI standard in a forthcoming issue.

GOVERNMENT

CONGRESS

The Congressional Research Service of the Library of Congress has updated its issue brief on "Radiation Health and Safety Issues of Congressional Interests." The brief written by Christopher Dodge of the Science Policy Research Division covers both ionizing and non-ionizing radiation and includes a listing of legislative authorities, federal regulatory authorities, pending legislation, hearings, and a chronology of events. (Brief Number IB77062, October 23, 1980.)

AGENCIES

Air Force

The Air Force wants to develop new and improve existing hardening techniques for its systems exposed to a nuclear electromagnetic pulse (EMP). See *Commerce Business Daily*, November 7, 1980.

Bureau of Radiological Health (FDA)

BRH promulgated a final rule amending the performance standard for microwave ovens in the *Federal Register* on November 28, 1980 (45 *FR* 79028). The rule, which becomes effective on November 30, 1981, deletes the error limit and effective aperture requirements for instruments used to detect leaks from microwave ovens.

The rule was on the agenda of the Technical Electronic Product Radiation Safety Standard Committee (TEPRSSC) meeting held on December 3-4 in Washington.

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BRH proposed a performance standard for microwave diathermy products in the July 29, 1980, *Federal Register* (45 *FR* 50359). A summary of the comments on the standard submitted to BRH will appear in our February issue.

Department of Commerce

The Commerce Department ruled in early December that the Toshiba Corporation of Japan sold countertop microwave ovens at prices so low that they were unfair and violated the Tariff Act. The case has been forwarded to the US International Trade Commission, which will determine whether Toshiba ovens injured domestic production. If the ITC makes such a finding, penalty duties will be assessed.

According to the December 3 *Federal Register* (45 *FR* 80157) notice, ovens made by the Matsushita Electric Industrial Company, the Sanyo Electric Company, and the Sharp Corporation were not dumped in the American market. The four companies accounted for 98% of the 740,000 ovens imported into the United States from Japan in 1979 at a value of $149 million.

Environmental Protection Agency

EPA sponsored a workshop on RF measurements in Las Vegas last November 3-5. Thirty government officials and a limited number of outsiders held intensive discussions on the current status of measuring electromagnetic fields. According to Richard Tell of EPA, the workshop organizer, "This was the first time all the instrumentation experts from the government were in the same room at the same time."

The participants agreed to two sets of recommendations:

1. That a group, such as the American National Standards Institute (ANSI), should set the following standards for broad band RF survey instruments: a) minimum, uniform reporting requirements of performance characteristics for existing instruments; b) minimum testing procedures for evaluating instrument performance; and c) performance characteristics for future instruments.

2. That standardized measurement techniques be developed based on: a) existing instrumentation, b) applicable safety standards, and c) specific exposure situations.

The second set of recommendations arose from the lack of uniformity in the way measurements are taken.

The recommendations will be published at a later time, though the form of publication has yet to be decided, perhaps an EPA technical report or a journal article.

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The Nonionizing Radiation Surveillance Branch of EPA is providing all the Agency's regional offices with a new Holaday electric field probe to permit local surveys of radiofrequency levels. According to Branch Chief, Dave Janes, "We are providing only the training and equipment, the time and resources devoted to this are up to each individual regional office."

EPA is also buying higher frequency probes: one of five or six Narda probes will be lent to a regional office when requested as soon as they are delivered by the manufacturer. A single field intensity meter and associated antennas which can identify the frequency of a particular source will also be available for loan. A four day training course for regional personnel was held by EPA in mid-December in Las Vegas.

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Department of Energy

The DOE's Office of Electric Energy Systems held its annual contractors review meeting on the biological effects of electric fields from overhead transmission lines in Washington DC last November 18-19. Researchers from about a dozen on-going projects in the multi-million dollar program reviewed their progress.

The DOE program is now focused on AC work, but in the years ahead the emphasis will change to DC lines.

For a copy of the abstracts presented at the November meeting contact: Mr. Alec O. Bulawka, US DOE/EES, Mail Stop 3344, 12th and Pennsylvania Avenue, NW, Washington DC 20461, (202) 633-8638.

Federal Communications Commission

At the end of January, the FCC will issue a statement in response to the comments received on its 1979 Notice of Inquiry (NOI) [44 *FR* 37008, June 25, 1979] concerning the biological effects of radiofrequency radiation.

The FCC has decided not to issue any interim radiation standards, according to Robert Cleveland of the Commission's Technical Planning Staff. But the FCC will participate in the rulemaking proceedings of other agencies on RF issues. The statement will include a summary of the some 25 comments submitted to the FCC in response to the NOI.

Cleveland said that the FCC issued the NOI to meet its duties to promote safety under the Communications Act, and to satisfy its responsibilities under the National Environmental Policy Act.

National Cancer Institute

NCI has issued a request for proposals for the synthesis and evaluation of radiosensitizers, chemicals which selectively sensitize hypoxic (oxygen deficient) tumor cells to radio-therapy. A three year project is planned. RFP NCI-CM-17485 is available from Maria Decker, NCI, Treatment Contracts Section, Blair Building, Room 228, NIH, Bethesda, MD 20205.

National Institute for Occupational Safety and Health

The schedule for the NIOSH criteria document on radiofrequency and microwave (RF/MW) radiation is still slipping. Drafts of the document were released in 1979, but were withdrawn due to unfavorable reviews. NIOSH is now aiming for a substantially shorter document, one that is less encyclopedic with more critical analysis. NIOSH's consultants are in the process of evaluating the RF/MW biological data. This phase of the operation is going slowly, and the agency cannot proceed until it is completed. A review draft may be finished by the spring.

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The NIOSH procurement office in Cincinnati has issued a request for quotation [RFQ 81-12; November 14, 1980] for the writing of two television scripts on the health risks associated with Video Display Terminals (VDT's).

NIOSH, BRH, OSHA

A team from NIOSH, BRH and OSHA is developing a bulletin on control technologies for dielectric heaters, including RF sealers.

Preliminary tests indicate that shielding can have a significant effect on both the magnitude and direction of the impinging field. The team is not yet ready to make firm recommendations on control technologies.

The joint bulletin is due to be out in late Spring.

National Telecommunications and Information Agency

The Electromagnetic Radiation Management Advisory Council (ERMAC), the advisory committee to NTIA, is anticipating holding a meeting at the end of January or early February in Washington.

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The BENER Task Force report, "Nonionizing Electromagnetic Radiation Safety: A Program of Coordinated Federal Activities Related to Biological Effects of Nonionizing Electromagnetic Radiation (0-300 GHz)," was published last summer, but has yet to receive any official attention.

Dr. Howard Clark of the National Bureau of Standards who served as the Task Force chairman hoped that the report would provide "a frame of reference for examination of the various agency programs and budgets that relate to the coordinated federal BENER program," and would be "useful to federal agencies in planning or describing their individual activities as related to a common goal."

The Task Force was set up by Henry Geller, the Administrator of NTIA at the request of Dr. Frank Press, the President's science advisor. Nevertheless, the report has not been officially forwarded to Press, nor does it seem to be a planning tool of the individual agencies involved in bioeffects research.

Occupational Safety and Health Administration

Bob Curtis of OSHA's Salt Lake City office organized a training session for two members of each of OHSA's ten regional offices to teach them how to measure radiofrequency and microwave radiation levels in the workplace. As a result of the December 3-4 sessions, held in Salt Lake City, workers will have a greater opportunity to check their on-the-job exposures to non-ionizing radiation.

Helping Curtis were Michael Larsen and Alfred Owyand of OSHA and Edward Aslan of Narda.

Radiation Policy Council

The US Radiation Policy Council, the interagency group created by the President in February 1980, has issued its "Progress Report and Preliminary 1981-1983 Agenda." (No. RPC-80-001, September 30, 1980).

The Report concentrates on ionizing radiation to the virtual exclusion of non-ionizing radiation. Beyond intending to grapple with general radiation policy which may (or may not) spill over

(continued p. 4)

MICROWAVE NEWS is published monthly. • P.O. Box 1799, Grand Central Station • New York, NY 10163 • (212) 794-9633 • Editor: Louis Slesin, Associate Editor: Martha Zybko • Subscription: $165 per year (overseas $200) • © Copyright 1981 by Louis Slesin • Reproduction in any form is forbidden without written permission.

BIOLOGICAL RESEARCH

Frey Reworks BBB Data

Allan Frey of Randomline Inc. believes he has resolved some of the contradictions in the experimental results of the blood brain barrier (BBB) research. Writing in the November 1980 issue of the *Bioelectromagnetics Society Newsletter*, Frey argues that the use of inappropriate statistical analysis explains why many researchers erroneously concluded that microwaves do not change the permeability of the BBB.

At least three teams of researchers, including one led by Frey himself, have shown that microwaves can cause certain dyes to pass through the BBB into the brain. In one of the most significant studies, Oscar and Hawkins discovered that pulsed 1.3 GHz radiation could change the permeability of the BBB at average power densities of only 0.03 mW/cm² (*Brain Research, 126*, 281, 1977).

However, three groups of scientists cast doubt on these results by reporting no microwave effects on the BBB for various exposure conditions. Frey has taken the published data of two of the groups, and, by applying what he thinks are more appropriate statistical tests, found that the opposite conclusions hold: they demonstrate increased permeability. One set of results by Merritt *et al.* now supports Frey's original paper, and another by Preston *et al.* confirms Oscar and Hawkins' work. Frey also speculates that the third group, Spackman *et al.*, may have also used inappropriate statistical analyses and a faulty experimental design.

As Frey concludes: "The supposed conflicting and controversial data actually are quite consistent and indicate that something is happening in the brain under low intensity microwave energy exposure."

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New Review Article

Richard Lerner has published a comprehensive review of current research on health effects of non-ionizing radiation, with special emphasis on low-level effects, in the December 1980 issue of *IEEE Spectrum*: "RF Radiation: Biological Effects." The article also details some of the controversy surrounding the new ANSI standard.

EPA Funds Teratological Study

The Environmental Protection Agency's Health Research Laboratory has awarded Dr. Mary Ellen O'Connor and Dr. Robert Strattan of the University of Tulsa a contract to study the teratological effects of microwave radiation.

The two-year, $230,377 study will consist of exposing mice *in utero* throughout the gestation period with 2450 MHz continuous wave radiation. The irradiation will stop after they are born. The experiment will begin with exposures to power levels of 30 mW/cm²; the levels will decrease to 10, 1, and 0.1 mW/cm² until no effects are observed. The mice will be monitored for fetal weight and developmental abnormalities.

Dr. O'Connor is with the Department of Psychology and Dr. Strattan is with the Electrical Engineering Department.

New Idea about Cataract Formation

A new explanation for cataract formation has been developed by a group of physiologists at Rush University in Chicago (*Science, 209*, 1007, August 29, 1980). The group has rejected the view that the lens of the eye is a homogeneous mass. Instead, based on a combination of biophysical techniques and mathematical models, the scientists have proposed that the interior cells of the lens have imperbeable membranes that block the entry of small ions. These fibrous cells can stop the flow of sodium and water into the lens' interior, thereby preserving its volume and transparency.

Microwave Hearing

How do people hear pulsed microwaves? The mechanism for the perceived buzzing or clicking sound is still a mystery; various hypotheses continue to be proposed, rejected, and defended. In a tart exchange of views in *Science* (*209*, 1143, 5 September 1980), two opposing camps reaffirmed their positions. One group led by C.K. Chou of the University of Washington Medical School maintains that hearing results from a tiny pressure wave in the head when the radiation pulse is converted to thermal energy. Allan Frey and Elaine Coren of Randomline, Inc. continue to offer the hypothesis that microwave hearing is the result of the thermoacoustic expansion within the cochlea, the small snail-shaped region of the inner ear.

GOVERNMENT *(continued from p. 3)*

to the non-ionizing portion of the spectrum, the RPC agenda promises little attention to microwave, radiofrequency, or ELF radiation.

Included in the report are summaries of the RPC public meetings held across the country during 1980, and the public comments submitted to the Council.

Three of the public comments address non-ionizing radiation:

- AFL-CIO, Food and Beverage Trades Department: strengthen occupational exposure standards for microwave and radiofrequency radiation from microwave ovens and sealing equipment, and radiation emanating from video display terminals. (p. E-12)
- Natural Resources Defense Council: Examine both ionizing and non-ionizing radiation since many of the problems that have hindered past work on ionizing radiation are also obstacles in the study of non-ionizing radiation. (p. E-4)
- Raytheon Corporation: Encourage EPA to develop a mandatory Federal standard on exposure of the general public to non-ionizing radiation or recommend a definition of current consensus standards (ANSI C95) by Congress as a mandatory national standard until formal Federal standards are developed. Ensure active participation by federal agencies in legitimate efforts of public education in the area of non-ionizing radiation. (p. E-8)

If you want to be on the RPC mailing list, write to: US Radiation Policy Council, Room 3026, New Executive Office Building, 726 Jackson Place, NW, Washington, DC 20503.

RF Radiation, A New Tool in Cancer Treatment

Radiofrequency radiation is a promising weapon against cancer, according to a December 1980 *IEEE Spectrum* article. "RF Therapy for Malignancy" explains how this treatment works and describes equipment design and function, tissue models used in research, and various hyperthermia methods.

Radiofrequency induced heating of tissue (42 to 43.5°C) is used alone or in conjunction with radiation (ionizing) therapy or chemotherapy to treat malignancies. A range of frequencies is used; higher ones—up to 2450 MHz—are easier to focus than the lower frequencies which can penetrate more deeply into the body. Because solid tumors generally have poor blood circulation, a tumor can be selectively heated without significantly increasing the temperature of surrounding, healthy tissue. The authors state that for localized treatment, there are no serious side effects from radiofrequency hyperthermia.

VDT's

The *Columbia Journalism Review* will feature a story on VDT's in the newsroom in its January-February issue. The article looks at both the health hazards associated with the machines and the reporting of this story by the press.

Electrotherapy Controversy

New York Magazine, in a two-part article that ran November 23 and December 1, detailed the controversy over the use of low-level electricity for bone healing.

The story began as a profile of Arthur Pilla, a chemical engineer at Columbia University. Pilla, who claimed to have played a major role in developing the electrical technology to treat fractures that previously would not heal, piqued the reporter's interest by claiming that the device was now being tested for its efficacy in treating cancer and that human applications could start within the year.

Dr. Andrew Bassett, a doctor at Columbia's medical school, cautioned that Pilla was overstating the prospects and further, downgraded Pilla's contributions in their research.

Bassett had worked with Dr. Robert Becker, then at the VA Hospital in Syracuse, New York, to show that stress applied to any bone is translated into electricity. Bassett's later cooperation with Pilla resulted in a practical, non-invasive electrical coil device, which Pilla and another colleague patented. They all formed a private corporation, Electro-Biology, Inc. of Fairfield, New Jersey with the financial backing of Wall Street entrepreneurs.

Zimmer-USA, Inc. and Telectronics Proprietary Ltd. offer other bone-growth stimulators, although Electro-Biology's is the only one which does not require implanting an electrode under the skin.

Dr. Bassett received more than $1 million in government grants in the course of his research. The writer, Lally Weymouth, raised questions about transferring medical research paid for by public funds to profit-making private companies. She noted that the government gets a share of Zimmer-USA royalties because its product was underwritten by the Navy.

New Reports

Two major studies of the Department of Energy's SPS system are nearing completion. Each will contain an analysis of the impact of microwave radiation on human health and the environment.

One study by the National Research Council (NRC) is due to be completed by the end of June 1981, with a draft report by early January 1981. The other by the Congressional Office of Technology Assessment (OTA) was due to be published by the end of January 1981, but is running late.

NRC

The Environmental Studies Board (ESB) of the NRC appointed a Committee on Satellite Power Systems to provide an independent review of DOE's assessment of the SPS concept. Towards this end, the ESB organized a "Workshop on Mechanisms Underlying Effects of Long-term, Low-level, 2450 MHz Radiation on People." A workshop summary, prepared by Christopher Dodge of the Science Policy Research Division of the Library of Congress, was released last fall. (See box for conclusions of workshop participants.)

OTA

The two-year OTA project was requested by the House Committee on Science and Technology. The completed study will compare the impacts of beaming energy from collecting satellites by lasers, microwaves, and reflected light. With respect to microwaves, the study will look at both the DOE reference system and a solid state system which would use lower power densities and smaller rectenna sites.

SRI

Last summer, SRI International completed a study for the Environmental Protection Agency, "An Assessment of the Potential Impact of Microwave Radiation from a Solar Power Satellite." This then became the basis for a chapter in the DOE report, "Environmental Assessment of the Satellite Power System (SPS) Concept Development and Evaluation Program (CDEP)," prepared by Anthony Valentino of Argonne National Laboratory (No. DOE/ER-0069, August 1980).

CONCLUSIONS OF SPS-NRC WORKSHOP

A. There are relatively little microwave health and bioeffects data available of direct relevance to the radiation parameters of the proposed SPS. What data are available are difficult to evaluate in terms of a potential health impact of the SPS.

B. There is no presumptive evidence in the data available that exposure of the general public to 0.1 mW/cm² or lower at the frequency of 2450 MHz generated by the SPS will result in any health decrements. However, because a number of functional phenomena of known significance have been reported in response to exposure to low-intensity microwaves, further research and evaluation...is necessary in order to decrease present uncertainties about potential low-level microwave health effects.

Georgia Power Challenged on Microwaves

A group of 27 residents of rural Clayton, Georgia, have filed suit in county court to prevent Georgia Power Company from erecting a 180-foot microwave tower on top of nearby Screamer Mountain. Citizens Against Microwaves, led by homeowner David Kraft, brought the case in September, shortly after the Rabun County Commission approved the tower in a 2-1 vote before a packed hearing room.

The suit, which names the power company and the two county commissioners who approved the tower, charges that allowing Georgia Power to build on land seized by the county for nonpayment of taxes is a violation of covenant, will create a health hazard and constitutes an improper disposal of county property. *Atlanta Weekly*, the Sunday magazine of the *Atlanta Constitution*, ran a long article on the controversy in its November 23, 1980 issue.

HBO Cancels Out

In late November, Home Box Office (HBO), Time-Life's subscription TV network, withdrew its application to build a satellite communications complex in Rockaway Township, New Jersey.

The HBO proposal was under intense scrutiny by the Rockaway Board of Adjustment which had to grant a variance before construction could begin. The Concerned Citizens' Committee of Rockaway Township was formed to oppose the HBO proposal. The Committee was worried about the siting of a major source of microwave radiation in a residential area, only 1000 feet from a neighborhood school. The Board had held 16 hearings since last spring, and another 30 were scheduled.

Edward Horowitz, HBO vice-president of studio and network operations, explained that while "the local Board was responsive and HBO was overcoming the local opposition, we could not afford the delay."

The cancellation will not hurt HBO's immediate programming. The Rockaway site would have provided the pay TV system with added flexibility. As for a new site, Horowitz said that HBO will look for suitable areas across the country: "The primary interest is in the New York-New Jersey Metropolitan area, but once away from here, it doesn't really matter where you go."

California OSHA

California's Occupational Safety and Health Standards Board has proposed a substitution in the State's General Industry Safety Orders on non-ionizing radiation. The standard remains at 10 mW/cm^2; the purpose of the change is to make it more enforceable. Cal OSHA held a public hearing on the proposal on November 19, 1980.

Dr. Daniel Cahill of the Environmental Protection Agency's Health Effects Research Laboratory in Research Triangle Park, North Carolina, has been awarded the Public Health Service Commendation Medal. Dr. Cahill, the Director of the Lab's Division of Experimental Biology was cited for: "Outstanding research and research management in the areas of ionizing and non-ionizing radiation health effects in the environment."

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Mays Swicord, Chief of the Electromagnetics Branch at the Bureau of Radiological Health, was awarded his doctorate last month from the Electrical Engineering Department at the University of Maryland. He completed the thesis: "Studies of Microwave Absorption in Liquids by Optical Heterodyne Detection of Thermally Induced Refractive Index Fluctuations" in November. The objective of the research was to develop a spectroscopic method, flow spectroscopy, to look at microwave absorption of specific molecules. Swicord investigated DNA and found enhanced absorption as predicted by E.W. Prohofsky of Purdue University.

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COMAR wants to make a movie about microwaves. **John Osepchuk** of the Raytheon Corporation and **Don Justesen** of the VA Medical Center in Kansas City, two active members of the Institute of Electrical and Electronics Engineers' (IEEE) Committee on Man and Radiation (COMAR), are exploring the idea of producing a 30-minute film on non-ionizing radiation for public television. The project is in its early stages of development and must still be approved by the IEEE. Once the go ahead is given, Dr. Osepchuk estimates that it will take a year and a half to complete.

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Over a hundred colleagues and friends of Professor **Herman Schwan** gathered at the University of Pennsylvania in Philadelphia last November 24-25, to wish him a happy 65th birthday.

Those who attended the two-day *Festschrift*, "The Interaction of Acoustical and Electromagnetic Fields with Biological Systems," funded by the Office of Naval Research, heard twenty presentations. The proceedings will be published in a special issue of *Bioelectromagnetics*, the Journal of the Bioelectromagnetics Society.

Professor Schwan is currently on sabbatical at the Max Planck Institute of Biophysics in Frankfurt, Germany.

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A profile of **Dr. Andrew Marino** of the Veterans Administration hospital in Syracuse, New York, "Law with a Spark," appeared in the September 29, 1980 issue of the *National Law Journal*. Marino, who is both a biophysicist and an attorney, does research on the bioeffects of ELF and at the same time is participating in various cases involving high voltage transmission lines. The article was written by Jill Jonnes.

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MOSCOW *(continued from p. 1)*

Follow-Up Studies

If the State Department decides to discontinue formal follow-up studies of Moscow employees, the decision would be at odds with the earlier advice of Professor Abraham Lilienfeld of Johns Hopkins University who completed an epidemiology of the Moscow employees in 1978, and of the Senate Commerce Committee. Both urged the State Department to pursue the health studies.

Dr. Herbert Pollack, a medical consultant to the State Department, did say, however, that he and Dr. Charles Brodine were continuing to monitor those employees present during the period of maximum exposure (May 1975-February 1976). "We have a complete roster of all those exposed, and every time they get a medical check up, one of us reviews their complete medical history," Pollack emphasized.

"a follow-up would buy a sense of security."
— Lilienfeld

In a recent interview, Professor Lilienfeld agreed that from a scientific point of view he would not expect to see any deleterious effects at such low doses. But from a political and personal point of view, he felt that continued examinations would be a "prudent thing to do." "It's a matter of judgment," he said, "a follow-up would buy a sense of security." Professor Lilienfeld pointed out that the major costs had already been spent and future surveys would be comparatively cheap.

The ERMAC advice could have some effect on pending claims by former embassy workers. John Parker Hills, an attorney who is handling four claims, said that up to now the State Department has been basically "ignoring" him. Hills has two claims before the Workmen's Compensation Board and two before the State Department, one of which is a class action on behalf of all women irradiated in Moscow. According to Justice Department and Veterans Administration spokesmen, neither agency has any Moscow-related claims pending.

ERMAC took up the question of a follow-up to the 1978 epidemiology at the request of the State Department, which paid the expenses for the ERMAC meeting. In a January 16, 1980 letter to Henry Geller, the State Department asked whether there was any basis for continued study. Mr. Geller referred the matter to ERMAC. According to Pollack, the State Department is waiting for the ERMAC recommendation before responding to any Moscow claims.

Before debating the merits of a follow-up investigation, ERMAC heard R.C. Mallalieu of Johns Hopkins University's Applied Physics Laboratory describe the results of his attempt to reconstruct the radiation levels on the upper floors of the embassy. According to Mallalieu's report ("A Model of the Microwave Intensity Distribution Within the US Embassy in Moscow, 1966 to 1977," No. FS-80-166, JHU-APL, August 1980), the most intense microwave exposures occurred between May 1975 and February 1976, with average levels of continuous wave radiation of 3.5 to 5.0 uW/cm² and average peak intensities due to multiple reflections of 7 to 10 uW/cm². The largest recorded power density was 24 uW/cm². From 1966 to 1975, the average signal strengths for those rooms with the greatest exposure was about 1.5 uW/cm² with maximum levels of 4 uW/cm², though there were transient peaks of as high as 20 uW/cm². Areas more distant from the radiation sources had microwave levels of less than 0.1 uW/cm². In February 1976, protective shielding was installed which reduced all exposures to 0.1 uW/cm² or less. Based on these data, the State Department has estimated that over a 22 year period, about 240 employees were exposed to average power levels of about 1.5 uW/cm² for about 2 hours during the workday. ("Exposure of Model Personnel," State Department, August 26, 1980.)

Lilienfeld Study

The Lilienfeld epidemiology failed to identify any major differences in either mortality or morbidity between Moscow embassy personnel and a comparative population working in other embassies in Eastern Europe. Lilienfeld had only minimal information on the signal strength inside the embassy building, though he did know that the maximum exposure took place during the nine months ending in February 1976. The radiation surveys were classified until after his study was released. Since only a short time has elapsed between the period of maximum exposure and his study, Lilienfeld recommended that "it would seem desirable that this particular study population should be contacted at periodic intervals, of 2 to 3 years, within the next several years, in order to ascertain if any health effects would appear." He went on: "it would be important to develop a surveillance system for deaths in the entire study population to be certain that no mortality differences occur in the future and to monitor the proportion of deaths due to malignancies, especially among the women."

"every time they get a medical check up, one of us reviews their complete medical history," — Pollack

In an April 1979 report, the Senate Committee on Commerce, Science and Transportation "urged" that the State Department pursue this Lilienfeld recommendation, especially for those people exposed between June 1975 and February 1976. ("Microwave Irradiation of the U.S. Embassy in Moscow") The Committee noted that its recommendation reflected a "precautionary attitude."

A subcommittee made of Dr. Marylou Ingram (chairwoman), Professor Cleary, Professor Mary Ellen O'Connor and George Wilkening wrote up the ERMAC recommendations, which are now circulating among the full ERMAC membership. A statement is expected to be released in January.

CONFERENCES

NEWS

BEMS

More than 300 people attended the second annual meeting of the Bioelectromagnetics Society in San Antonio, Texas, last September. Some 160 papers were presented providing a rich blend of new research findings and open discussion.

In the months ahead, *Microwave News* will feature a series of articles on some of the important topics covered in San Antonio. The first in this series, "Microwave-Drug Synergy," will appear next month. Later, we will run a piece on Professor A.W. Guy's long-term experiment which began last fall at the University of Washington in Seattle.

VDT's

A one day conference on "Health Hazards of VDU's" was held at the Human Sciences and Advanced Technology Research Group, Department of Human Sciences, Loughborough University in Leicestershire, England on December 11, 1980. (VDU is the European equivalent of our VDT.) Among the papers presented were two reports of skin rashes among VDT operators in England and Norway.

IMPI

The International Microwave Power Institute (IMPI) held a symposium on "The Washington Impact: How It Affects Microwave Users" on November 13-14, 1980. A host of government officials briefed the more than two dozen attendees on what the government agencies are doing.

The proceedings of the symposium will be available from IMPI for $40.00 for members and $50.00 for non-members. Order from: IMPI, 211 East 43rd Street, New York, NY 10017.

PROCEEDINGS

Now Available:

Proceedings of a Workshop on Thermal Physiology, held in Rockville, Maryland, March 29, 1979. Edited by Dr. T. Whit Athey, Bureau of Radiological Health, sponsored by the Radiofrequency and Microwave Committee of the Interagency Regulatory Liason Group. Dated March 1980. Available from BRH, Rockville, MD 20857.

Non-Ionizing Radiation, Proceedings of a Topical Symposium held in Washington D.C., November 26-28, 1979, sponsored by the American Conference of Governmental Industrial Hygienists. Order from: ACGIH, P.O. Box 1937, Cincinnati, OH 45201.

Proceedings of the International Symposium, *Electromagnetic Waves and Biology,* held in Jouy en Josas (outside Paris) France, June 30-July 4, 1980. Send $40.00 to Dr. A.J. Bertaud, CNRS, 2 rue H. Dunant, 94329 Thiais, France.

CALENDAR

• January 12-16: *National Radio Science Meeting,* University of Colorado, Boulder, CO. Sponsored by the US National Committee of IEEE Societies. Contact: Center for Conferences and Management/Technical Programs, 970 Aurora Avenue, University of Colorado, Boulder, CO 80302.

• February 16-17: *Treatment of Cancer by Radiofrequency and Microwave Thermotherapy,* Princess Kaiulani Hotel, Honolulu, HI. A short course arranged by the Bioelectromagnetics Corporation of Rockville, MD. Fee: $495. Contact: Dr. S.S. Stuchly, Department of Electrical Engineering, University of Ottawa, Ottawa, Canada K1N6N5.

• April 13-15: Annual *Conference and Trade Show of the International Association of Satellite Users,* Washington Hilton Hotel, Washington DC ($95 IASU Members; $195 Others). Contact: A. Fred Dassler, IASU, 6845 Elm Street, Suite 710, McLean, VA 22101.

• June 9-12: 16th Annual *Symposium of the International Microwave Power Institute,* Royal York Hotel, Toronto, Canada. Contact: IMPI, 211 East 43rd Street, New York, NY 10017.

• June 15-19: *IEEE and URSI Symposium,* Bonaventure Hotel, Los Angeles, CA. Sponsored by the Antenna and Propagation Society and the Microwave Theory and Techniques Society of the IEEE and four Commissions of URSI. Contact: IEEE, 245 East 47th Street, New York, NY 10017.

• June 30-July 4: *International Symposium on Biomedical Thermology,* Palais de la Musique et des Congres, Strasbourg, France. Includes sessions on hyperthermia in cancer treatment (July 3) and bioelectromagnetics (July 1). Simultaneous translation in English, French, and German. Contact: Dr. M. Gautherie, Laboratoire de Thermologie Biomedicale, Faculte de Medicine, Universite Louis Pasteur, 11 rue Humann, 67085 Strasbourg, France.

• August 10-12: 3rd Annual *Bioelectromagnetics Society Meeting,* Washington DC. Contact: BEMS, P.O. Box 3651, Arlington, VA 22203.

• August 10-19: 20th *General Assembly of the International Union of Radio Science (URSI),* Hyatt Regency Hotel, Washington DC Includes a series on "Interaction of Electromagnetic Waves with Biological Systems," on August 13-14, chaired by Professor Saul Rosenthal of Polytechnic Institute of New York, and an "Open Symposium on Millimeter and Submillimeter Waves." Contact: Mr. Richard Y. Dow, Organizing Committee of URSI General General Assembly, National Academy of Sciences. 2101 Constitution Avenue, NW, Washington DC 20418.

• August 19-21: 3rd Annual *Satellite Communications Users Conference,* Regency Inn, Denver, CO ($145 pre-paid; $195 at the door). Contact: SCUC '81. Satellite Communications Magazine, 3900 S. Wadsworth Blvd, Denver, CO 80235.

MICRO WAVE NEWS

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Because of the abundance of news this month, the second part of our report on the Bioelectromagnetics Society conference will appear next month.

EMC'83: A Booming Business

Problems due to electromagnetic interference (EMI) continue to intensify. It is as if an electronic domino effect is at work. Signals from FM radio and TV stations disrupt computers, whose own emissions may affect avionic systems. High frequency communications impinge on radars and weapon systems; airport radars upset computer operations. CB radios and walkie talkies spoil TV reception and play havoc with industrial machinery, which in turn interfere with aircraft flying overhead. And all of the above may hurt the performance of medical devices.

How serious are these interactions? No one knows for sure, but more and more calls are going out to EMC engineers for diagnoses and cures.

All in all, it's a good time to be in the electromagnetic compatibility business. Attendance at this year's *International Symposium on Electromagnetic Compatibility*, held in Washington, DC, August 22-25, was at near-record levels, with more than 1,000 EMC engineers registering for the technical sessions and hundreds more exhibiting their wares. And if the growing concern over EMI is any guide, there will be plenty of work to go around, transforming what used to be a somewhat arcane specialty into a technological necessity.

Outlined below are selected highlights from the EMC symposium with details on the myriad types of interactions being reported and what is being done to remedy them.

Computer RFI

The issue of susceptibility of computers to RFI was raised by William Rhoades of Xerox Corp. in El Segundo, CA. In his prepared talk, Rhoades said that as more and more digital equipment is used in high-rise buildings, interference from TV and FM stations "will become a growing problem." Similarly, computers in offices built near airports are suffering from radar interference. He said that it is easy to measure fields of 50 V/m three kilometers from an airport radar. He advises that computers be able to withstand fields greater than 1 V/m.

Xerox is not alone. An IBM engineer sitting in the audience remarked that he had encountered difficulties installing computers near Dulles Airport.

When Rhoades was asked how common computer EMI is, he replied that he knows of 15 to 20 cases involving Xerox computers in the last two years; most of these were resolved by moving the computer to a new spot in the building. But the situation may get worse in the future. The proliferation of walkie-talkies, cellular telephones and paging systems will no doubt increase the incidence of computer RFI, he said.

(continued on p. 2)

EMC'83 *(continued from p.1)*

ISM Equipment

Emissions from industrial, scientific and medical (ISM) equipment, believed to be the largest source of man-made radio noise, are the subject of intense negotiations in international circles. US manufacturers are resisting voluntary ISM emission limits adopted by the International Special Committee on Radio Interference (CISPR) as too strict and too expensive, even though US standards are widely recognized as overly lax. Some compromise must be reached in the next few years because a resolution passed at the 1979 World Administrative Radio Conference (WARC) mandates that new limits be agreed upon to protect communications technology and aeronautical navigation equipment.

The International Radio Consultative Committee (CCIR) has set up an Interim Working Party 1/4, under the chairmanship of Professor R.G. Strusak of Poland, to recommend new limits. (FCC's Art Wall is representing the US in these talks.) The working party will prepare a report by the end of 1984 for action by CCIR in 1986. New standards will probably be ratified by an international treaty and will be adopted by the Federal Communications Commission (FCC).

Tests to determine the impact of ISM interference on the Instrument Landing System (ILS) are underway at Ohio University's Avionics Engineering Center in Athens. The fourth harmonic (107.83-109.13 MHz) of ISM equipment operating in the 27 MHz band can impinge on the ILS localizer aeronautical service in the 108-112 MHz frequency band. Principal investigator James Nickum at Ohio University is in the process of measuring radiation levels aboard aircraft flying over factories with ISM equipment. A final report should be ready for the Federal Aviation Administration (FAA) by next summer.

An FAA staffer said that a number of complaints of ISM interference have been received but he could not cite precise statistics.

Computers Aboard Aircraft

Another possible hazard to aircraft operations is interference caused by portable computers used by passengers. A lead article in the August 22 *InfoWorld* reports that Eastern Airlines has banned the use of portable computers on its flights and that some commuter airlines have similar prohibitions. But there are no industry-wide rules, and each air carrier has the discretion to set its own policy. In the August 29 issue, *InfoWorld* editors advise: "Until portable computers have been flight-tested in a reasonable fashion by experts from the aviation, electronics and computer industries, passengers would be better off to leave the computer off and, as one critic put it, 'Sit back and enjoy the flight.'"

Computer EMI aboard aircraft was discussed at last May's Executive Committee meeting of the Radio Technical Commission for Aeronautics (RTCA). Aeronautic Radio Inc. (ARINC), based in Annapolis, MD, has been looking into the issue and weighing the possibility of asking RTCA to set up a special committee to review the need for formal rules. No action has yet been taken however, because, as ARINC's Richard Climie explained to *Microwave News*, "We do not know of any substantiated cases of computers or any other devices causing an [EMI] problem." Climie said that he had heard of some incidents, but they could not be verified. RTCA action is on hold until concrete data are in hand.

Power Lines & Railroads

Railroads have their own EMI problems. Preliminary studies at the IIT Research Institute (IITRI) in Chicago, IL, indicate that power lines sharing the right-of-way with railroads can play havoc with railway signaling systems. In an award-winning paper presented at the EMC meeting, IITRI's Allen Taflove said that he had found a "false clear" failure caused by induced voltages as low as 0.1 volts. A false clear, which occurs when a red light mistakenly changes to green, is the most serious type of signaling error.

While calling these results "most disquieting," Taflove cautioned that his study, funded by the Electric Power Research Institute (EPRI), had only "scratched the surface" of the problem and that his results should be seen as tentative for the present. But he was unequivocal about the need for further testing: "Someone somewhere should do thorough, statistically significant testing —it's a question of public safety."

Taflove was critical of the "total neglect" of this issue, which has cost the utilities millions of dollars. He said that the Department of Transportation (DOT) was unaware of this type of EMI. EPRI will soon issue a three-volume report on the IITRI study.

Taflove did not investigate the EMI to electrified rail systems. This is an area that DOT is addressing. The Rail Transit EMI/EMC Program at DOT's Transportation Systems Center in Cambridge, MA, provides a forum for experts from all over the world to advance the state of the art in subway and trolley transit systems. Those interested in more information should contact Bud Gingrande at the DOT center, (617) 494-2000.

Industrial Machinery

Can stray radio signals affect industrial equipment and robots? John Bloodgood thinks so. Bloodgood, who is a consultant working out of Fond du Lac, WI, is urging expert committees to set standards to relieve a problem he says is "becoming more and more severe."

In a post-symposium presentation to the American National Standards Institute's (ANSI) C63 Committee on Radio-Electrical Coordination, Bloodgood cited these examples: Numerical control equipment at a major producer of farm machinery began starting by itself without any identifiable cause. An investigation later indicated that a CB radio was responsible. In another plant, for no known reason a radio-operated crane began to move on its own, lowering a heavy casting. This latter incident nearly resulted in a loss of life. Bloodgood said that industrial users are worried and are beginning to demand fail-safe systems.

Medical Devices

A task group of ANSI C63 subcommittee 1 is considering the need for setting limits for radiated emissions from medical devices and guidelines for their susceptibility to EMI. Howard Bassen of the Food and Drug Administration (FDA) is in the process of determining whether FDA staff will help develop and write a document on medical device EMI. Al Smith, Jr. of IBM is already preparing a report on test methods for medical devices.

According to Bassen, some years ago McDonnell-Douglas prepared an EMC standard for medical devices under an FDA contract. The standard was heavily criticized, however, and neither the agency nor ANSI adopted it. Industry representatives protested that there was no evident need for it.

Naval Weapons Systems

The US Navy has the most intractable EMI problems. Engineers must find room for scores of radar and communication systems aboard navy ships. Dr. Robert Haislmaier, the navy's EMC coordinator, says this is much harder than siting terrestrial systems. For example, the ship's high frequency (3-30 MHz) transmissions can interfere with radar, TACAN and electronic warfare systems as well as the ship's overall operation.

Haislmaier's strategy is to "institutionalize" EMI control to guarantee combat readiness. The navy has hired half-a-dozen contractors and has commissioned computer programs to help fix problems quickly. Fleet personnel are being trained to increase their awareness of EMI; according to Haislmaier, preventive maintenance is the key to correcting weaknesses before they deteriorate performance. He told *Microwave News* that the Chief of Naval Operations, to whom he reports, is interested in EMC and has directed his staff to develop a program to remedy the situation. Haislmaier predicted that "if we can keep the momentum up the navy will be in a substantially improved posture in five years."

The same concerns were echoed by Milton Kant of RCA, who works on the Aegis weapon system. "There is no doubt that EMC is important," he said, "it is a recognized and continuously examined factor in the ship-building program." He pointed out that EMI is not a major issue with the Aegis because it was designed with compatibility in mind. But, he added, retrofitting can be very expensive and sometimes ineffective. The Aegis is hardened to electromagnetic pulse (EMP) radiation which takes care of HF communications EMI. Kant said that the present trend is to protect all navy ships from EMP.

Neither Haislmaier nor Kant were willing to detail specific navy EMI concerns because of the risks to national security. In fact, some 20 papers scheduled to be presented at the meeting were pulled due to lack of clearance, and one paper on "EMP Hardening of Navy Ships" was torn out of the bound volume of the symposium record. ●

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HIGHLIGHTS

New Soviet RF/MW Standards; US-USSR Bioeffects Workshop

Safety standards for exposures to radiofrequency and microwave (RF/MW) radiation in the Soviet Union are changing. The new occupational standard is 100 uW/cm^2 for two-hour exposures to radiation in the 300 MHz-300 GHz frequency band. A new standard for the general population is expected, although no official announcement of proposed revisions has been made.

In a paper recently received from the USSR, Professor B.M. Savin and colleagues at the Moscow Institute for Industrial Hygiene and Occupational Diseases of the USSR Academy of Medical Sciences state that the validity of an occupational standard of 100 uW/cm^2 "has been proven by 20 years of practice and supported by experimental studies."

Savin concludes that, "Radiation exposure at low levels can be measured via the energy (W) delivered to the organism and expressed through the product of the power density (P) and the exposure duration (T): W = P$\times$ T" and therefore P = W/T. With a 100 uW/cm^2 limit for two hours, the allowed energy load is 200 uW/cm^2 x h. For one hour exposures, the maximum exposure is 200 uW/cm^2; for exposures of 6 to 25 minutes, the limit is 1 mW/cm^2.

The new standard is based on a damage threshold of 1 mW/cm^2 for two hour exposures with a factor of ten safety margin.

These revisions described in "Changes in Microwave Radiation Exposure Standards" are codified in *Amendment No. 1 of 1/1/82 to State Standard 12.1.006-76 "Electromagnetic Radiofrequency Fields: General Safety Requirements."* These changes are in agreement with reports by US scientists who visited the USSR last year (see *MWN*, November 1982).

Dr. Clifford Mitchell of the National Institute of Environmental Health Sciences (NIEHS) in Research Triangle Park, NC, brought Savin's paper back from the USSR in June. It was translated by Drs. Gabriel Jakobson and David Davidson of GTE Labs in Waltham, MA.

Soviet occupational exposure standards below 300 MHz are still being developed, according to Mitchell. He said that experiments are now underway at these frequencies to form the basis of these new limits.

A new Soviet population standard is also in preparation. In an interview at the June Bioelectromagnetics Society meeting in Colorado, Professor Mikhael Shandala of the A.N. Marzeev Research Institute of General and Communal Hygiene in Kiev said that a document with proposed recommendations should be ready by the end of this year. When completed, it will be forwarded to the Ministry of Health in Moscow and undergo peer review by a committee of experts. Once reviewed, Shandala's group in Kiev will revise the document.

The present RF/MW standard for the general population is 5 uW/cm^2. Shandala did not disclose what the new standard might be, nor is it clear when the new standard will be promulgated. He did send *Microwave News* some comments on standard setting in the USSR (see "From the Field" p.12).

Shandala was in the US to attend the *Fourth US-USSR Workshop on the Biological Effects of Physical Factors in the Environment*, held at NIEHS, June 21-22. Thirteen American and five Soviet scientists presented papers and devised a work plan for 1983-1984. A number of Soviet participants, including Professor Inal Akoev of the Institute of Biological Physics in Pushchino, were unable to attend (see *MWN*, June 1983). A fifth workshop will be held in the USSR in 1985. In addition, there are tentative plans to hold a meeting next year, also in the USSR, on the duplicative experiment, in which rats are exposed to 2450 MHz microwaves at 10 mW/cm^2 in both countries (see *MWN*, July/August 1982).

Under the work plan for continued US-USSR cooperation, bioeffects research will continue on the: (1) biological effects of microwave radiation; (2) biological effects of static and low frequency electromagnetic fields; and (3) the duplicative experiment. The new work plan was signed by NIEHS' Dr. Don McRee and Dr. Shandala on June 23.

Specific studies in the US include the development of models of the creation and propagation of solitons in helical proteins; the demodulation of ELF electric fields by cell membranes; behavioral effects of chronic, low-level exposures to 915 MHz radiation; the interaction of microwaves with drugs in the central nervous system; the short and long term effects of ELF (1-60 Hz) on neuron excitability; power frequency electric fields inside the bodies of live rats; and the effects of air ions and electric fields like those from DC transmission lines.

In the USSR, research is planned on the effects of 857 and 1765 MHz pulsed fields; the risks due to exposure to TV broadcast signals (30-300 MHz); the bioeffects, including some studies on mutagenesis, of stationary electric fields (20-80 kV/m), 50 Hz fields (10-100 kV/m) and 7 kHz magnetic fields as well as continued work on the duplicative experiment.

NY Power Lines Project To Fund Two Epidemiological Studies

The Scientific Advisory Panel of the New York State Power Lines Project is negotiating contracts for two epidemiological studies on the relationship between alternating magnetic fields (AMFs) and cancer rates among children and adults.

The panel has selected proposals from Dr. David Savitz of the University of Colorado in Denver and Dr. Lowell Sever of Battelle Pacific Northwest Labs in Richland, WA.

If details can be ironed out, Savitz's project will be similar to Dr. Nancy Wertheimer's study, which indicated an association between AMFs from power lines and childhood cancer. The decision to repeat Wertheimer's 1979 study follows a recommendation by Dr. Annemarie Crocetti, a consultant to the panel (see *MWN*, June 1983). Dr. Richard Hamman will serve as an in-house consultant for Savitz's project. Sever will run a case control study to look at the possible connection between power lines and the rates of a still to be specified type of adult cancer.

According to project administrator Michael Rampolla, budgetary constraints played a key role in the panel's choice. (Proposals from Dr. Tim Byers of the State University of New York at Buffalo and Dr. Jerome Barancik of the Brookhaven National Laboratory in Upton, NY, were also under consideration.) Savitz and Sever have been asked to modify their research designs to trim costs, but the two contracts will still require more than the $600,000 originally slated for epidemiological research.

Rampolla reports that, barring any last minute complications, contracts will be signed in October.

FCC Inquiry on RF Lighting

The Federal Communications Commission (FCC) has issued a notice of inquiry (NOI) on the potential for radiofrequency (RF) lighting devices to interfere with radio communication services.

The commission is evaluating the need for regulations to minimize potential radiofrequency interference (RFI) from the devices and has asked interested parties to respond to some 42 specific questions by October 31. Reply comments are due December 16. Rather than set its own standards to control RF emissions, the FCC would prefer industry to regulate itself with voluntary standards.

RF lighting, in which 60 Hz AC power is converted to RF energy at a frequency above 20 kHz which excites a fluorescent tube, is much more efficient than conventional incandescent and fluorescent lighting. For instance, General Electric has developed an RF light bulb which fits into a conventional socket but uses only one third the energy of an incandescent bulb and lasts four times as long. Other companies producing various types of RF lighting devices are North American Phillips Lighting Corp., International Energy Conservation Systems and a partnership of SoliTronics and Brigham Young University.

With electronic and RF ballasting becoming more cost effective, and with energy costs going up, the FCC anticipates that RF devices could win a significant share of the lighting market, causing more RFI. FCC tests indicate that RF bulbs emit broadband radiation in the frequency range from 10 kHz to 80 MHz which could interfere with AM radio reception.

Under current FCC rules, RF lighting devices are covered under Part 18, Subpart H. The commission believes that these rules were not designed to apply to mass produced consumer goods, and that they are not sufficently strict to prevent objectionable RFI. FCC test data indicate that RF bulbs can meet much tighter limits, similar to those controlling computer emissions (Part 15).

In a separate action, the FCC has granted waivers to three companies to test market a limited number of RF lighting devices. Under the ruling, the companies will be free of the FCC requirement to test the devices every three years, but each must submit reports to the FCC on RFI problems every three months.

For more information contact: Herman Garlan, Office of Science and Technology, FCC, Washington, DC 20554, (202) 653-8247. The NOI and the notice of waivers appear in the August 17 *Federal Register*, 48 *FR* 37235 and 48 *FR* 37217, respectively.

Massachusetts Adopts RF/MW Standard; Town Rule Overturned

Massachusetts has become the first state to adopt a general population exposure standard for radiofrequency and microwave (RF/MW) radiation. The standard approved by the Public Health Council on August 9 limits exposures for the 30-300 MHz frequency band to 200 uW/cm^2 and is five times more stringent than the American National Standards Institute's (ANSI) 1982 guidelines.

Immediately after the council's decision, the State Attorney General's office overturned RF/MW regulations for exposures over 5 uW/cm^2 recently adopted by the town of Wayland (see *MWN*, June 1983). In an August 11 letter, Assistant Attorney General Henry O'Connell told Wayland administrators that under state law the Department of Health's rules for non-ionizing radiation "shall apply *exclusively* throughout the Commonwealth." Citing the new state standard, he concluded that "the proposed [Wayland] bylaw is inconsistent with state action in an area preempted by the state."

The final Massachusetts standard is very similar to earlier drafts (see *MWN*, March and December 1982 and June 1983) but does contain two last-minute additions. Regulators inserted a clause explicitly stating that federal guidelines will supersede state rules, should a conflict arise. Massachusetts has its eyes on the Environmental Protection Agency, which is scheduled to release a draft RF/MW exposure guidance later this year.

The other addition is an assurance that the state will consider other guidelines or regulations not related to public health if requested to do so by Federal Communications Commission (FCC) licensees. Such a request might come from a broadcaster forced to choose between violating FCC power requirements and the standard.

According to Robert Watkins of the state's Radiation Control Program, the regulations will not affect any existing RF/MW sources. Operators intending to alter their facilities, as well as applicants for new sources, must demonstrate compliance, however. The standard covers the spectrum from 300 kHz to 100 GHz: 200 uW/cm^2 for the 30-300 MHz band rising to 1 mW/cm^2 for frequencies above

1500 MHz and to 20 mW/cm² for those below 3 MHz.

The standard, which goes into effect October 1, was published in the *Massachusetts Register*, No. 379, on September 1. The register is available for $1.90, prepaid by check, from the Statehouse Bookstore, Room 116, Massachusetts Statehouse, Boston, MA 02133.

FCC Test Methods for Computer RFI Simplified

The Federal Communications Commission (FCC) has clarified its recommended procedures for measuring radiofrequency (RF) emissions from computers. The procedures were adopted in 1981 to help manufacturers demonstrate compliance with regulations to control RF interference.

The minor alterations released in late July came in response to a 1981 petition from the Computer and Business Manufacturers Association (CBEMA). In addition to adopting several of the trade group's suggestions, the commission announced its intention to publish the measurement procedures as a separate bulletin rather than keep them as an appendix to its Part 15, Subpart J regulations for computer radiofrequency interference.

According to the FCC's Julius Knapp, the changes should add more "flexibility" to the test procedures.

CBEMA spokesman Bill Hanrahan said the group is pleased with the changes, though it does not support separating the suggested measurement methods from the RF emission regulations themselves. CBEMA feels the move will make it more difficult for manufacturers to keep up with future guideline revisions. The commission maintains that separate publication is more efficient because the interested audience is very small.

Among the clarifications and revisions in the recommended test procedures:

- Equipment should be configured to maximize emissions, but not necessarily to an absolute "worst case" condition cited in the original text. The specific configuration is left to the test engineer.
- Manufacturers are no longer advised to test equipment with each cable that may be used. Instead, the commission recommends testing with cable lengths likely to produce maximum radiation emissions.
- Emissions from Class A devices (used by industry or business) may now be measured at a distance of up to 30 meters. The commission recommends limiting the distance for Class B devices (intended for residential use) to 3 meters, but greater distances are acceptable if justified. CBEMA had recommended deleting the original 3-meter distance requirement for both classes.
- The commission clarified how it will treat equipment tested before its RF interference requirements went into effect on July 1, 1981. It reserves the right to evaluate test procedures and to investigate reported problems. As in the original rules, these devices do not need to be retested.

The FCC notice also answers questions submitted over the past two years by other parties.

As noted in the August 1 *Federal Register* (48 *FR* 34748), the test methods will be available soon as Office of Science and Technology Measurement Procedure MP-4, *FCC Methods of Measurement of Radio Noise Emissions From Computing Devices*. The original FCC guidelines were published on April 24, 1981 (46 *FR* 23240). For further information, contact Julius Knapp, Office of Science and Technology, FCC, Washington, DC 20554, (202) 653-8247.

NRPB Reports on RF/MW Sources and Standards

A new report by the UK's National Radiological Protection Board (NRPB) examines exposures from radiofrequency and microwave (RF/MW) radiation sources relative to suggested revisions in safety standards. The NRPB anticipates that the new standards, proposed by the board late last year, would have only minimal impact on radiation emitting technologies. Some industrial heating equipment and radar and weapons systems are possible exceptions.

The Board states that, under the proposed limits, industrial heating is "likely" to be "more costly and possibly impracticable" in certain operations unless it can be established that the human body absorbs much less energy in the near field than in the far field (assuming the same external field strength). The same problems may also exist for some portable and mobile broadcast equipment —unless emission standards are set.

With respect to radar and weapons systems, the NRPB concludes that lowering exposure standards for the general population from 10 mW/cm² to 5 mW/cm² "may require an extension of the existing boundary limits of some controlled areas by 40 percent from the source." But, the board notes this may not be necessary if allowances are made for the "rotation or nodding" movement of the radiating source.

The board calls for further study of "rates of energy absorption related to field intensities at distances well within a wavelength from the radiating sources," and suggests more attention be directed to how the near field is modified by environmental factors.

The NRPB report follows last year's recommendations for revisions in RF/MW safety standards which proposed two sets of exposure limits: one for occupationally exposed adults and one for the general population, including children. The two are identical in the 3-100 MHz frequency band, but the latter is more stringent above 100 MHz. For workers, the maximum allowed exposure would be 1 mW/cm² for 3-100 MHz, rising to 10 mW/cm² at 1 GHz. For the general population, the allowable level would remain at 1 mW/cm² up to 300 MHz and then only rise to 5 mW/cm² at 1.5 GHz. The proposal extends the frequencies covered by the standards from 30 MHz-30 GHz to 3 kHz-100 GHz.

The occupational limits are identical to those adopted by

the American Conference of Government and Industrial Hygienists (ACGIH) in May. Those for the general public are the same as the 1982 American National Standards Institute guidelines.

In a personal communication to *Microwave News*, NRPB's Frank Harlen said that no timetable has yet been set for the adoption of the new standards.

The new limits are based on the assumption that "exposures resulting in a mean specific energy absorption rate in the whole body of less than 0.4 W/kg" are "acceptable" and provide "an adequate margin of safety."

The NRPB also states that exposures to power line frequency (50 Hz in the UK) fields of less than 10 kV/m are "safe although the field may be perceptible at lower values." In addition, the board advises that exposures to fields as high as 30 kV/m are "unlikely to be harmful."

Sources of Exposure to Radiofrequency and Microwave Radiations in the UK (No. NRPB-R144) by S.G. Allen and F. Harlen, *Proposals for the Health Protection of Workers and Members of the Public Against the Dangers for Extra Low Frequency, Radiofrequency and Microwave Radiations: A Consultative Document* and a summary of the proposed standard by F. Harlen and J.A. Dennis published in the NRPB's May 1983 *Radiological Protection Bulletin* (No. 52) are all available from the NRPB, Chilton, Didcot, Oxon, OX11 0RQ, England.

CONFERENCES

September 28-30: ***International Workshop on Electrostatics: How to Manage Electrostatic Problems, Hazards and Applications,*** Llandudno, North Wales, UK. Contact: Ms. Helen Raquet, Oyez Scientific and Technical Services, Ltd. Bath House, 56 Holborn Viaduct, London ECIA 2EX, England.

October 2-5: ***3rd Annual Meeting of the Bioelectrical Repair and Growth Society,*** Golden Gateway Holiday Inn, San Francisco, CA. Contact: BRAGS, 425 Medical Education Building, 36th & Hamilton Walk, Philadelphia, PA 19104.

October 4-6: ***LPTV '83 East,*** Sheraton Washington, Washington, DC. Contact: Conference Management Corp., 17 Washington St., PO Box 4990, Norwalk, CT 06856.

October 4-6: ***7th International Colloquium on Prevention of Occupational Risks due to Electricity: The Prevention of Electrical Accidents by Influencing Human Behavior,*** Cologne, West Germany. Contact: Secretariat of ISSA-Section and Colloquium, Berufsgenossenshaft der Feinmechanik und Elektrotechnik, Gustav-Heinemann-Ufer 130, D-5000 Koln 51, West Germany.

October 16-20: ***Conference on Electrical Insulation and Dielectric Phenomena,*** Buck Hill Inn, Buck Hill Falls, PA. Contact: Dr. J.K. Nelson, Center for Electric Power Engineering, Rensselaer Polytechnic Institute, Troy, NY 12181.

October 27-28: ***Studying Problems Associated with Video Display Systems,*** Skyline Ottawa Hotel, Ottawa, Canada. Contact: Planetary Association for Clean Energy, 77 Metcalfe St., Suite 607A, Ottawa, Ontario, K1P 5L6, Canada.

November 7-9: ***Department of Energy and Electric Power Research Institute Contractors Review,*** Hilton Plaza Inn, Kansas City, MO. Dr. William Wisecup, Aerospace Corp., 955 L'Enfant Plaza, SW, Suite 4000, Washington, DC 20024.

November 7-9: ***1983 Satellite Communications Symposium,*** Hyatt Regency Hotel, Atlanta, GA. Contact: Betsy Crawley, Symposium Coordinator, 3845 Pleasantdale Rd., Atlanta, GA 30340.

November 8-11: ***29th Annual Conference on Magnetism and Magnetic Materials,*** Hilton Hotel, Pittsburgh, PA. Contact: F.E. Werner, Westinghouse R&D Center, 1310 Beulah Rd., Pittsburgh, PA 15235.

November 14-17: ***1983 Radio Technical Commission for Aeronautics Annual Assembly and Technical Symposium,*** Marriott Crystal Gateway Hotel, Arlington, VA. Contact: RTCA Secretariat, One McPherson Square, 1425 K St., NW, Suite 500, Washington, DC 20005.

November 16-17: ***JINA 83,*** (2emes Journees Internationale de Nice sur les Antennes), Nice, France. Contact: J.L. Guiraud, Centre National d'Etudes des Telecommunications, Centre de La Turbie, 06320 Cap D'Ail, France.

December 8-9: ***Radiation and Energy: Confronting the Challenges of the Eighties –Law, Regulation, Risk Liability, Litigation and Compensation,*** New York, NY. Contact: James Lawrence, Lloyd's of London Press, 817 Broadway, New York, NY 10003.

December 12-17: ***8th Annual IEEE International Conference on Infrared and Millimeter Waves,*** Carillon Hotel, Miami Beach, FL. Contact: Dr. K.J. Button, National Magnet Laboratory, Building NW-14, MIT, Cambridge, MA 02139.

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January 16-20: ***Microwave Signatures in Remote Sensing,*** URSI Commission F Specialist Meeting, Toulouse, France. Contact: Dr. Richard Moore, Remote Sensing Laboratory, University of Kansas Center for Research, 2291 Irving Hill Drive, Lawrence, KS 66045.

January 17-19: ***Instrumentation & Measurement Society Technology Conference (IMTC) 1984,*** Aboard the Queen Mary, Long Beach, CA. Contact: Robert Myers, 1700 Westwood Blvd., Suite 101, Los Angeles, CA 90024.

February 6-8: ***NIH Consensus Development Conference on Use of Diagnostic Ultrasound Imaging in Pregnancy,*** National Institutes of Health, Bethesda, MD. Contact: Michaela Richardson,-NIHCD, Bldg. 31, Room 2A32, 9000 Rockville Pike, Bethesda, MD 20205.

February 20-22: ***Office Automation & You,*** Los Angeles Convention Center, CA. Contact: American Federation of Information Processing Societies, Inc., 1815 N. Lynn St., Arlington, VA 22209.

March 13-14: ***1984 National Radar Conference: Radar Technology for the 80's,*** Atlanta, GA. Contact: Dr. Edward Reedy, Georgia Institute of Technology, Engineering Experiment Station, Radar & Instrumentation Lab, Atlanta, GA 30332.

April 2-5: ***3rd Annual Test & Measurement World Expo,*** Brooks Hall, San Francisco, CA. Contact: Meg Bowen, 215 Brighton Ave., Boston, MA 02134.

April 14-19: ***19th Annual Association for the Advancement of Medical Instrumentation Meeting and Exhibit,*** Washington Hilton, Washington, DC. Contact: AAMI, 1901 North Fort Myer Drive, Suite 602, Arlington, VA 22209.

April 24-26: ***IEEE 1984 National Symposium on Electromagnetic Compatibility,*** Hyatt Regency Hotel, San Antonio, TX. Contact: William McGinnis, Southwest Research Institute, PO Drawer 28510, San Antonio, TX 78284.

UPDATES

BIOLOGICAL EFFECTS

New AF Contracts... The Air Force School of Aerospace Medicine at Brooks AFB, TX, has awarded two contracts for studies on VLF (10 kHz to 3 MHz) radiation hazards (see *MWN*, May 1983). Dr. A.W. Guy of the University of Washington, Seattle has received $170,000 and Dr. Om Gandhi of the University of Utah, Salt Lake City has received $90,000 for the 13-month research projects....And the AF has awarded Dr. Robert Lebovitz of the University of Texas Health Science Center in Dallas approximately $150,000 for a two-year study of the effects of microwaves on the reproductive function of rats. Lebovitz will expose rats to 1.3 GHz radiation at SARs of 0.5-10 W/Kg and will investigate sperm production and morphology.

Polycythemia Follow-Up... Last August, 25 cases of polycythemia vera were reported near the Savannah River plant in South Carolina, where weapons-grade plutonium is produced. The implication was that ionizing radiation was responsible for this abnormal incidence of blood disease (see *MWN*, September 1982). Officials from the Center for Disease Control (CDC) set out to track down the cases and to see if there was a common thread linking them. The report caught the attention of the RF/MW community because in 1981 an army pathologist reported what he believed to be an association between microwave exposure and polycythemia (see *MWN*, March 1981). After a year of field work, CDC investigators have failed to locate most of the 25 people involved. CDC's Dr. Jeffrey Lybarger was able to confirm only a very small number of cases —many of them were discredited. CDC's interest lies not only in checking out this cluster but also in doing basic research on polycythemia. Lybarger said that an epidemiological study could still be done, if it is deemed worthwhile by senior CDC staff.

Resources... Allan Frey of Randomline Inc. in Huntingdon Valley, PA, and Alan Segal and Richard Magin of the University of Illinois in Urbana-Champaign exchange views on research on the effects of microwaves on the blood-brain barrier in Volume 2, Number 1 of the *Journal of Bioelectricity*....Dr. Herbert Pollack's paper, "Medical Aspects of Exposure of Radiofrequency Radiation Including Microwaves," appears in the June issue of the *Southern Medical Journal*. Pollack, who is associated with the George Washington University School of Medicine, wrote the article for the general medical practitioner....Drs. Richard Olsen of the Naval Aerospace Medical Research Lab in Pensacola, FL, and James Lin of the University of Illinois in Chicago have published "Microwave-Induced Pressure Waves in Mammalian Brains" in the May issue of the *IEEE Transactions on Biomedical Engineering*....There was a session on microwave standards at the annual convention of the American Psychological Association held in Anaheim, CA, in late August. Drs. Eleanor Adair, Don Justesen, Richard Lovely, Mary Ellen O'Connor and F. Kristian Storm participated in the discussions that were held under the general title "Physiological Psychology Does Impact on Public Concern and Policy."

COMPATIBILITY & INTERFERENCE

More on Immunity... Don Heirman of AT&T Information Systems (the new name for American Bell) presented a status report on ANSI C63's ad hoc committee, which is studying ways of reducing RFI to home electronic equipment, at a C63 meeting on August 26 in Washington, DC (see *MWN*, May and July/August 1983). Heirman plans to have a draft interim standard on radiated immunity, methods of measurement and preliminary performance limits by next April 1. At the C63 meeting there was some discussion of which types of equipment should be addressed after work is completed on the number one priority items, TVs and VCRs. The consensus was that the next order of business should be telephone equipment, including cordless telephones, followed by home security devices. GE's Harold Gauper Jr. has become the ad hoc group's vice-chairman; its next meeting is planned for October 26. The date of the next meeting of ANSI C63 was left up in the air —either next January or April. (See also EMC story on p.1 for some details on C63 deliberations.)

Radio Noise Meeting... There will be a two-day meeting on radio noise in Washington, DC, in mid-October sponsored by the US government. On the agenda will be reviews of available noise models and measurements as well as future R&D needs. Attendance will be limited to American citizens with a "Secret" security clearance. For more information, contact: Ms. J. Brown, SRI International, 1611 N. Kent St., Arlington, VA 22209.

Resources... The IEEE EMC Society has published indexes of all papers published in the *IEEE Transactions on Electromagnetic Compatibility* from 1959 to 1982 and those presented at EMC symposia from 1962 to 1982. The indexes, prepared by Richard Schulz and Andrew Farrar, together with a brief history of the EMC Society on the occasion of its 25th anniversary appear in the August issue of the EMC *Transactions*. Copies are $6 for IEEE members and $12 for non-members from the IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854....The proceedings of the *8th International Aerospace and Ground Conference on Lightning and Static Electricity*, held in Fort Worth, TX, June 21-23, are available from the National Technical Information Service (NTIS), Springfield, VA 22161. Report No. DOT/FAA/CT83/25....Robert Olsen of Washington State University in Pullman has published "Radio Noise Fields Generated by Corona Streamers on a Power Line" in the May-June issue of *Radio Science*....The Electronic Industries Association has released *Interference Criteria for Mic-*

rowave Systems in the Private Radio Services, EIA Telecommunications Systems Bulletin 10-D. It covers both digital and video criteria in addition to analog message interference criteria and should be of interest to licensees and planners of FCC Part 94 microwave systems, as well as those licensees who may be displaced from the 12.2-12.7 GHz band as a result of action in FCC Docket 82-334. Bulletin 10-D, which replaces the 1976 Bulletin IEB 10-C, is available for $17 from EIA's Engineering Dept., 2001 Eye St., NW, Washington, DC 20006.

GOVERNMENT

FMAC...A Frequency Management Advisory Council (FMAC) meeting on July 29 brought members up to date on EPA's RF/MW guidance development and on the recent flurry of major international conferences on spectrum management. An FMAC group headed by Ed Wepplerris now developing recommendations to help NTIA aid industry in avoiding RFI problems. A report on NTIA's efforts should be ready by FMAC's next meeting on September 21. High definition TV and the next International Telecommunications Convention are also on the September agenda.

MEASUREMENT

Satcom Earth Stations...NBS' Electromagnetic Fields Division has revised its *Earth Terminal Measurement Systems Operations Manual* (NBSIR 83-1679). The manual describes in simple English how to measure satellite earth stations for noise and other engineering parameters and can be used even by those unacquainted with the NBS measurement system. A copy is available from the National Technical Information Service, Springfield, VA 22161 for $28. Order No. PB 83-189928.

In the Near Field... In our January/February 1983 issue, we reported that NBS researchers had shown the theoretical feasibility of building a meter that can measure the electric and magnetic fields simultaneously in the near field. Now NBS' Dr. Motohisa Kanda has written a detailed report, complete with illustrations, describing the theory behind this new sensor. NBS Technical Note 1062: *An Electric and Magnetic Field Sensor for Simultaneous Electromagnetic Near Field Measurements –Theory* is available from the Superintendent of Documents, US Government Printing Office, Washington, DC 20402 for $4.50.

MEDICAL APPLICATIONS

Hyperthermia Operator Safety... Operators of the Magnetrode hyperthermia unit who stay more than 1 meter away from the device will not be exposed to radiation levels in excess of the ANSI safety recommendations (4.9 mW/cm^2), according to a report in the July 1983 *Health Physics*. The Magnetrode unit, which operates at 13.56 MHz with an output power of up to 1,000 watts, is used in cancer therapy. M.A. Stuchly, M.H. Repacholi and D.W. Lecuyer ran tests using human-scale phantoms placed inside the Magnetrode's whole body electrode. The minimum safety distance is 2 meters under the Canadian safety code (1 mW/cm^2). They found smaller minimum distances at lower than a 1,000 W power setting, as well as when the unit's neck or thigh electrodes are used. The researchers from the Canadian Radiation Protection Bureau show that magnetic field strengths near the unit are consistently higher than electric field strengths. "To assess whether exposure to the operator is within the recommended limits, it is sufficient to examine the intensities of the magnetic field," they report.

Ultrasound During Pregnancy...NIH and FDA are sponsoring a three-day *NIH Consensus Development Conference on Use of Diagnostic Ultrasound Imaging in Pregnancy,* at NIH in Bethesda, MD, February 6-8. The meeting will address the types of ultrasound in obstetric practice and their risks to mother and fetus. For more information, contact Michaela Richardson, NIHCD, Bldg. 31, Room 2A32, 9000 Rockville Pike, Bethesda, MD 20205, (301) 496-5133.

MILITARY SYSTEMS

Project ELF Suit... The US District Court for Western Wisconsin will hear arguments in the state of Wisconsin's suit against the navy's Project ELF submarine communications system beginning September 20 (see *MWN,* July/August 1983). The judge has scheduled a hearing on Wisconsin's motion for an injunction against the ELF system until the navy prepares a new environmental impact statement as well as a trial on the merits. The state of Michigan has not joined Wisconsin in the case, but Michigan's Marquette County does plan to intervene as a co-plaintiff. Among those testifying for Wisconsin are Drs. Robert Becker and Nancy Wertheimer. The navy plans to call Drs. Annemarie Crocetti, Don Justesen and Anthony Valentino and a number of navy, GTE and IITRI personnel.

More on Microwave Weapons... Last May, we ran an item on the growing interest in EMP and RF/MW weapons. AP reporter Barton Reppert has been looking into this and confirms that the US "is quietly stepping up research on microwave beam weapons." In his August 12 story, Reppert writes that, according to Pentagon researcher John Bachkosky, high power microwave weapons involve fewer technological hurdles than either high energy lasers or particle beams. Bachkosky said that US research efforts in the microwave area are aimed largely at studying the vulnerability of various electronic components and weapon systems to high intensity microwave bombardment. Reppert also cites Edward Brown of the army's Harry Diamond Labs on progress towards the development of a tactical microwave weapon system: "We're in the realm of the possible. We're not in the realm of the probable, yet."

POWER LINES

More from Montana...A deal struck between three environmental groups and the Montana Power Company has cleared the last obstacle to building a 500 kV power line from Garrison, ND to Spokane, OR. The Montana Wildlife Federation, the National Wildlife Federation and Trout Unlimited dropped an appeal to force the National Forest Service to reconsider whether certain land along the route in Montana should be declared a wilderness area in exchange for a $1.65 million fund to limit the line's environmental impact. Montana Power and four other utilities involved in the project will provide the money. The Forest Service issued construction permits to the line's builder, the Bonneville Power Administration (BPA), immediately after the agreement was reached in August. In a separate action reported in our July/August issue, Montana's Board of Natural Resources and Conservation this summer adopted a 1 kV electric field limit at the edge of the line's right-of-way (ROW) on residential or subdivided property. According to BPA's Deputy Chief Engineer Jerry Flick, BPA has not responded to the new requirement because it only applies to the Garrison-Spokane line, which will not pass through any land affected by the ruling. He said BPA would contest the 1 kV limit as too restrictive if the board starts proceedings to make it a state-wide standard. The board made a point of addressing health hazards with the 1 kV limit requiring a 160 foot ROW, but in fact mandated an even greater ROW, to 205 feet in developed areas, to limit noise levels.

DOE-EPRI Meeting... This year, the Department of Energy (DOE) and the Electric Power Research Institute (EPRI) are holding a *joint* meeting to review the research of their contractors. The open meeting will be held at the Hilton Plaza Inn in Kansas City, MO, November 7-9. Abstracts of the reports to be presented will be available before the meeting. Anyone planning to attend or who would like a copy of the abstracts should contact Dr. William Wisecup of The Aerospace Corp. in Washington, DC, as soon as possible, (202) 488-6328.

STANDARDS

Toward a Population RF/MW Guidance...A special panel of EPA's Scientific Advisory Board (SAB) will meet September 22-23 in Washington, DC, for the first public review of the agency's draft report on RF/MW bioeffects. The report will be the basis of EPA's general population exposure guidance (see *MWN*, July/August 1983). The meeting will start at 9:15 AM in Room 2123 at EPA headquarters, 401 M Street, SW. Those wishing to present comments should contact SAB's Dr. Terry Yosie at (202) 382-4126 or Dr. Douglas Seba at (202) 382-2552. To meet a greater than anticipated demand, EPA has printed more copies of its report, *Biological Effects of Radiofrequency Radiation*, No. EPA-600/8-83-026A, which is available from the Center for Environmental Research Information, EPA, Cincinnati, OH 45268, (513) 684-7562....Dr. Daniel Cahill, who preceded Dr. Joe Elder as head of the Experimental Biology Division at EPA's Health Research Lab, has suggested setting an interim federal RF/MW exposure guidance for the general public that is five times lower than ANSI's 1982 revised levels and identical to Massachussetts' recently adopted standard (see story on p.5). In an article appearing in the July *Health Physics*, Cahill concludes that, based on EPA's bioeffects literature review, a maximum specific absorption rate of 0.04 W/kg (equivalent to 200 uW/cm^2 for the 30-300 MHz band and higher for frequencies above and below this range) would provide a factor of ten safety margin against "potentially significant health effects —any increase in core temperature or activation of thermoregulatory response and the development of areas of localized temperature elevations." He warns, however, that the proposed standard "does not mean that further research is not needed, particulary in the areas of mechanisms and frequency-specific and modulation effects." Cahill did not consider these factors because, "The evidence to support [their existence] is too incomplete at this time to influence exposure guidelines." His proposal is based on the assumption that the public is primarily exposed to continous wave radiation in the far field. Cahill left EPA in late 1981 to work at Carolina Power and Light's Harris Energy and Environment Center in New Hill, NC. Opinions presented in the paper are Cahill's and are not official EPA policy.

New Standards... The Consumer Product Safety Commission's safety standard for all omnidirectional CB base station antennas went into effect May 24. The regulations were originally scheduled to apply on February 25, but were delayed until Congress' perogative to veto them expired. For details see the June 28 *Federal Register* (48 *FR* 29682.)...Comments are being solicited for a proposed revision of ANSI/IEEE 145-1973: *Definitions of Terms for Antennas*, which covers both transmitting and receiving antennas. A copy of BSR/IEEE 145-1983 is available for $7 from Ms. M. Lynch, IEEE, 345 East 47th St., New York, NY 10017. Comments are due October 18....The International Electrotechnical Commission's (IEC) Technical Committee 77 on EMC Between Electrical Equipment Including Networks has issued two six-month draft rules: 77(Central Office)20 *Guide to Methods of Measurement of Short Duration Transients on Low Voltage Power and Signal Lines* ($15) and 77A(Central Office)2 *Supporting and Explanatory Guide to Voltage Fluctuation Limits to Household Appliances* ($7). These are available pre-paid from the International Sales Dept., ANSI, 1430 Broadway, New York, NY 10018.

VDTs

UK VDT Study... England's Health and Safety Executive (HSE) has published a booklet on VDT worker health and safety. HSE concludes that, "there is no increased risk from radiation emanating from VDUs [visual display units] over and above that which exists already in office workplaces." The document also downplays VDTs as a cause of photo-

sensitive epilepsy and states that it is unclear whether facial rashes are caused by the units. These topics and additional information on radiation issues are covered in the first part of the booklet. Part two offers guidance on human factors involved in VDT use. Recommendations include early planning for introduction of VDTs, close attention to the quality of the screen image, adjustable seating, detachable keyboards and use of document holders. Proper lighting is also emphasized. HSE concludes that these and other ergonomic measures, "can considerably improve the acceptability of the system as well as its overall effectiveness." *Visual Display Units* is available from the Health and Safety Executive, Baynards House, 1 Chepstow Place, London, W2 4TF, England.

Response to NAS... The National Academy of Sciences report that found VDTs safe for workers' vision (see *MWN*, July/August, 1983) was challenged by the head of the Biomedical and Behavior Science Division at NIOSH, which requested the study in 1981. Dr. Barry Johnson disagreed with NAS's suggestion that further research is unnecessary, though he supported the report's basic findings. Johnson put distance between the study and NIOSH, a move some observers believe is intended to help the agency maintain funding of VDT-related work. The NIOSH scientist won praise for his statement in an August 29 editorial in *Computerworld*. In addition, the editorial emphasized the importance of media coverage of the VDT debate: "as long as the question [of VDT health and safety] remains open, we consider it the media's responsibility to cover the issue in full until the final chapter on VDT safety has been written. There is no telling how long that might take." NIOSH's Johnson was not alone in criticizing the NAS report. The Newspaper Guild's President, Charles A. Perlik, Jr., said the report is misleading and its timing unfortunate —coming before the guild's own eye study is completed. Perlik criticized the study's recommendation against mandatory standards for VDTs and VDT workplaces, and protested that the report is likely to be interpreted as finding no health hazards associated with VDTs "and that's not true at all." A representative of the Communications Workers of America (CWA) said the NAS report is a "real cop-out." David LeGrande called the recommendation against research on the possible tie between VDTs and cataracts "irresponsible," and said the report's finding that radiation emissions are less dangerous than ambient radiation is "an oversimplification of a very difficult concept." Copies of the NAS study, *Video Displays, Work and Vision* are available for $14.50 from the National Academy of Sciences, Room 700, 2101 Constitution Avenue, NW, Washington, DC 20418.

Eyes and Vision... What seems to be distorted color perception after hours of VDT work may be the result of a well-known psychological illusion known as the McCollough effect. A letter to the August 4 *New England Journal of Medicine* explains that one of the authors, an architect at Northwestern University, experienced "an unusual and vivid visual illusion" after several hours of VDT work. "Ordinary white letters and lines on a contrasting background appear to have a pink color," she and two of her colleagues at the university write. Plain white paper might appear to have a pink tint at its edges. The McCollough effect can last for weeks although it is believed to be harmless. Susan L. Greenwald, and Drs. Mark J. Greenwald and Randolph Blake caution that, "physicians should be aware of the phenomenon so as not to mistake it for a hysterical symptom or a manifestation of neurologic disease."...A study of VDT operators' vision commissioned by a manufacturer of ergonomic office furniture found "no direct relationship between serious temporary or permanent eye pathology and VDT use." Dr. Dennis Arinella, an ophthalmologist at the University of Massachusetts Medical Center at Worcester, studied 21 female VDT operators at Wright Line, Inc. All 21 spent at least 30 hours per week at terminals. Arinella and Lee White, Supervisor of Office Services for the company, conclude that minor, correctable problems do exist, "which appear to increase the incidence of eye strain, including lightly pigmented irises, minimal uncorrected refractive errors, mild muscle imbalance and decreased tear production." The study will be presented October 12 at the meeting of the Office Automation Management Association in Washington, DC....The American Optometric Association (AOA) has published *Vision and the VDT Operator,* a brochure offering "advice on how to make VDT work easier on the eyes." The AOA warns that "VDT use can aggravate moderate and more severe vision problems," and recommends a safety checklist to protect terminal user vision. The list includes annual eye examinations, lighting and glare control and 15-minute breaks every two hours.

Some Statistics... Color terminals are rapidly gaining popularity due to falling prices and a growing supply of color-utilizing software, according to a special report prepared for *Computerworld*. Color terminals can cost less than $1,300, compared to more than $10,000 only a short time ago, reports John Witherow in the August 29 issue. Color terminals are likely to replace or complement standard VDTs in many offices, Witherow says. The report notes that, "users working on color terminals reported fewer instances of eye strain as compared to those working on conventional CRTs."...The number of VDT office workstations is expected to increase almost 700 percent, from 3 million currently to more than 20 million by 1992 according to a report on office automation produced by an independent market research organization. *Office Automation Systems Market in the US*, Report No. A1092, is available for $1,275 from Frost & Sullivan, Inc., 106 Fulton Street, New York, NY 10038.

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

FROM THE FIELD

Letter from the Soviet Union

Professor Mikhael G. Shandala of the A.N. Marzeev Institute of General and Communal Hygiene in Kiev visited the US last June (see story p.4). *Before he left, he sent* Microwave News *the following notes on radiofrequency and microwave radiation standard setting in the Soviet Union.*

We thank Christopher Dodge of the Congressional Research Service's Science Policy Research Division at the Library of Congress in Washington, DC, for translating Dr. Shandala's letter.

The basic objective of investigations into the biological and health effects of electromagnetic fields (EMFs) in the USSR is to set safety standards on the basis of sound science. Studies are designed to determine the dose dependency of a number of reported biological responses to EMFs. Dose response data are then applied to realistic radiation exposure scenarios. Experience from occupational histories is one route taken to establish exposure standards for the general population, also taking into consideration younger people, pregnant women and the elderly.

The observation of a new biological response to EMFs is not necessarily construed to mean that it is deleterious in nature. The nature of the response must be evaluated in terms of its significance to the entire organism. We distinguish two responses: adaptive and compensatory. Compensatory responses, characterized by functional stresses over a prolonged period of time, can lead to negative consequences for the organism. Accordingly, occupational exposure standards, involving relatively circumscribed daily times of exposure to EMFs over long periods of time, are based on compensatory responses. On the other hand, adaptive responses (threshold effects) are taken into account in establishing exposure standards for the general population.

Together with the above principles, we also use a number of methodological concepts which include the following:

- Risk-benefit analysis (with emphasis on biomedical data as opposed to economic issues).
- Re-evaluation of present standards and preventive measures.
- Evaluation of basic biological interactions with other physical and chemical factors in the environment.
- Consideration of the entire organism in its natural, domestic and occupational settings.
- Maximum permissible limits of exposure to chemical and physical factors as a function of the parameters of exposure (e.g. frequency, duration, intensity, etc.).
- Thresholds of responses to physical and chemical factors.
- Delayed effects of physical and chemical factors.
- Exposure standards evaluated (peer-review), refined, promulgated and enforced.

Professor Mikhael G. Shandala

A.N. Marzeev Research Institute of General and Communal Hygiene, Ministry of Health of Ukrainian SSR, Kiev, USSR.

SHORT COURSES

October 11-13: EDP Equipment Design Seminar on Coping with the FCC/VDE Regulations on RFI, Boston, MA. Fee: $695. Contact: EMXX Corp., 6706 Deland Drive, Springfield, VA 22152, (703) 451-4619. Repeated • November 8-10: San Francisco, CA.

October 11-13: Current Issues and Trends in Controlling Occupational Exposures to RF/Microwave Radiation, Salt Lake City, UT. Fee: NA. Contact: K. Blosch, Rocky Mountain Center for Occupational and Environmental Health, University of Utah, Salt Lake City, UT 84112 (801) 581-5710.

October 17-18: EMI Workshop, Philadelphia, PA. Fee: $575. Contact: R&B Enterprises, 20 Clipper Road, W. Coshohocken, PA 19428, (215) 825-1960. Repeated • December 5-6.

October 17-21: Communications Satellite Engineering, Washington, DC. Fee: $855. Contact: Continuing Engineering Education, George Washington University (GWU), Washington, DC 20052, (800) 424-9773.

October 18-21: Electromagnetic Compatibility Engineering, San Mateo, CA. Fee: $900. Contact: Center for Professional Advancement, PO Box 964, East Brunswick, NJ 08816, (201) 249-1400.

October 19-21: Fundamental EMI Control Design and Tests, Philadelphia, PA. Fee: $695. Contact: R&B, see October 17 above. Repeated • October 26-28: Boston, MA.

October 22: Physics and Engineering of NMR Imaging, San Francisco, CA. Fee: $85 (IEEE members), $105 (others). Contact: Paul Phelps, Lawrence Livermore National Laboratory, PO Box 5504, L-156, Livermore, CA 94550, (415) 422-8312.

October 24: EMI Control: Emission & Immunity, Oak Brook, IL. Fee: $85. Held at the ***National Communications Forum.*** Contact: NCF, Suite 4808, 505 N. Lake Shore Drive, Chicago, IL 60611, (312) 828-0491.

October 24-25: EMC Laboratory Experience Workshop, Mariposa, CA. Fee: $695. Contact: EMXX, see October 11 above.

October 24-28: Antennas and Arrays, Washington, DC. Fee: $855. Contact: GWU, see October 17 above.

October 25-28: Grounding and Shielding, Sunnyvale, CA. Fee: $815. Contact: Don White Consultants, Inc. (DWCI), State Route 625, PO Box D, Gainesville, VA 22065, (703) 347-0030. Repeated • November 1-4: Philadelphia, PA; • January 24-27: Phoenix, AZ.

October 25-28: Millimeter Wave Radar, Washington, DC. Fee: $780. Contact: GWU, see October 17 above.

November 1-3: An Introduction to EMI/RFI/EMC, Los Angeles, CA. Fee: $815. Contact: DWCI, see October 25 above.

November 1-4: Advanced Radar Concepts, Rockville, MD. Fee: $720. Contact: Linda Billard, Technology Service Corp., 8555 16th St., Suite 300, Silver Spring, MD 20910, (800) 638-2628.

November 4-18: Microwave and High-Speed Digital Integrated Circuits Manufacturing and Applications, Tokyo, Japan. Fee: $4,955. Contact: Kazuo Moro, Technology Transfer Institute, 624 S. Grand Ave., Suite 2407, Los Angeles, CA 90017, (213) 628-9381.

November 7-11: Synthetic Array and Imaging Radars, Los Angeles, CA. Fee: $875. Contact: Short Course Program Office, UCLA Extension, PO Box 24901, Los Angeles, CA 90024, (213) 825-1295.

November 11: Product Safety Seminar: National and International Aspects, San Francisco, CA. Fee: $275. Contact: EMXX, see October 11 above.

November 14-18: Protection Against MW/RF Radiations, Electric and Magnetic Fields, Ispra, Italy. Fee: 350,000 Lira. Contact: Secretariat ISPRA Courses, Centro Commune di Ricerca, 21020 ISPRA (Varese), Italy, (0332) 781128.

November 14-18: Principles of Modern Radar, Atlanta, GA. Fee: NA. Contact: Department of Continuing Education, Georgia Institute of Technology (GIT), Atlanta, GA 30332, (404) 894-2547.

November 15-25: Biological Effects and Dosimetry of Non-Ionizing Radiation: Static and ELF Electromagnetic Fields, Erice, Italy. Fee: NA. Contact: Professor Martino Grandolfo, Instituto Superiore di Sanita, Viale Regina Elena, 299, 00161 Rome, Italy.

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Microwave News invites contributions to *From the Field,* our occasional column featuring news and opinions from the non-ionizing radiation community. Letters from readers are also welcome.

VDT Radiation: Focus on Flyback Pulses

A number of experts now speculate that radiation emissions from video display terminals (VDTs) might be associated with biological effects. Their concern stems from new measurements showing that magnetic field pulses from flyback transformers are similar in shape and intensity to those which can alter the development of chick embryos.

In numerous interviews, researchers and regulators told *Microwave News* that they are aware of Dr. Jose Delgado's experiments — demonstrating that pulsed magnetic fields can be biologically active at extremely low levels — and their implications for the VDT safety debate. No connection between VDT emissions and health problems has been established, however, and none of the experts contacted has suggested that VDT pulsed radiation is associated with the 11 reported clusters of problem pregnancies among VDT operators.

Indeed, many investigators are still skeptical that the Delgado experiments are reproducible. In Sweden, however, Dr. Kjell Hansson Mild's partial replication is prompting new government research on the reproductive hazards associated with VDTs.

Though VDT workers have long been apprehensive about radiation hazards, government and industry experts have steadfastly maintained that the emission levels are too low to be harmful.

The Food and Drug Administration (FDA) is planning to issue a revised policy statement on VDTs in the next few weeks. In it, the agency will discuss the accumulating data on the bioeffects of low-frequency, low-intensity magnetic fields, though it is unlikely that the FDA will significantly change its position on VDT radiation.

The Pulse Waveform

Dr. Arthur Guy, director of the Bioelectromagnetics Research Laboratory at the University of Washington's School of Medicine in Seattle, told *Microwave News* that the intensity of the current induced by VDT magnetic fields is "about the same" as that which was induced in Delgado's experiments. Guy added that the VDT's magnetic field pulse shape is similar to the signal used by Electro-Biology, Inc. (EBI) to heal bone fractures, though the internal currents induced by the EBI coil are much stronger.

Richard Tell, a physicist with the Environmental Protection Agency (EPA), said that the similarities in shape and intensity between VDT pulses and those used by Delgado should be studied closely. Tell compared the time rates of change of VDT magnetic fields to those of the magnetic fields used by Delgado and found them to be of the same order of magnitude. Thus, according to Tell, the possibility of bioeffects cannot be ruled out.

Last year, Delgado and his associates at the Centro Ramon y Cajal Hospital in Madrid, Spain, concluded that pulse shape may be the "decisive parameter" for determining whether pulsed magnetic fields affect the development of chick embryos (see *MWN,* March and November

(continued on p.10)

ELF Bioeffects Studies at BEMS

Extremely low frequency (ELF) radiation emerged as one of the most exciting topics at this year's meeting of the Bioelectromagnetics Society (BEMS) held in Atlanta, GA, in mid-July. Summarized below are the reports from three research groups whose results are particularly noteworthy.

Blackman and the Earth's Magnetic Field

Dr. Carl Blackman's paper was the most provocative of the conference — it provides evidence that the location of frequency windows for calcium efflux from brain tissue is dependent on the Earth's magnetic field. Blackman can now predict which frequencies induce calcium efflux as a function of the *net* static magnetic field.

At the 1982 BEMS meeting, Blackman reported that he had observed calcium efflux at odd multiples of 15 Hz — with no effect at 30 Hz. This year, he said that he could induce efflux at 30 Hz if he doubled the net static magnetic field. Thus, the original discovery of efflux by Drs. Ross Adey and Suzanne Bawin at 15 Hz would shift to 30 Hz, if the Earth's magnetic field were twice as strong.

In the course of his talk, Blackman linked the calcium work to Dr. Jose Delgado's experiments on the effects of extremely weak, pulsed magnetic fields and to Dr. Cyril Smith's work on the influence of magnetic resonance in the Earth's magnetic field.

The new theory is not complete and was described as a "work in progress." Blackman said that he is still unsure whether the underlying physical mechanism for his observations is related to the electric or to the magnetic field. If it is the electric field, he thinks a cyclotronic resonance-like phenomenon may be at work. (Cyclotronic resonance results from the acceleration of an electric charge in a static magnetic field.) Otherwise, Blackman believes he might be observing a magnetic resonance effect.

Whatever the mechanism, Blackman said that the implications are clear: researchers must measure the intensity and orientation of the steady state magnetic field at the sample during the course of a given experiment. He suggested that past failures to replicate weak field interactions may have been due to variations in the magnetic field vector.

"This could explain the problem of an effect that comes and goes depending on the immediate environment," he explained in an interview with *Microwave News*. Blackman is with the Environmental Protection Agency in Research Triangle Park, NC.

Blackman's work supports the increasingly popular hypothesis that the Earth's magnetic field plays a decisive role in causing the weak field interactions discovered by Delgado. Some researchers have been unable to duplicate Delgado's experiments (see *MWN*, March 1983 and June 1984), in which low intensity magnetic fields caused gross alterations in developing chick embryos.

Smith and his colleagues at the University of Salford in England have shown that there are observable changes in dielectric permittivity and loss in biological systems under conditions of magnetic resonance in the Earth's natural field (see *MWN*, October 1983). Blackman has now extended Smith's work to a much more complex system, calcium efflux.

Blackman presented his paper on the opening night of the BEMS meeting at a symposium on magnetic fields and biological systems. Later that evening, Dr. Carl Durney of the University of Utah in Salt Lake City commented that a back-of-an-envelope calculation indicated that the Earth's magnetic field would not be an important variable: the energy of a proton in the Earth's field is nine orders of magnitude (a billion times) smaller than that of thermal interactions (kT) at room temperature, he said.

Nevertheless, Durney was not willing to dismiss Blackman's (or Smith's) findings. In an interview, he said that he found them "puzzling and exciting" and that they could help us better understand basic mechanisms.

Dr. Alwyn Scott of Los Alamos National Lab in New Mexico observed that the apparent difference in magnitude may not be as great as it first seems if the biological system has a way of storing energy from the Earth's magnetic field.

Winters's Tumor Cells

Later in the conference, Dr. Wendell Winters presented details of the experiments he is running with Dr. Jerry Phillips which show ELF radiation can greatly enhance the proliferation of human tumor cells. These results have generated a great deal of interest since first reported at a New York State Power Line Project Panel meeting in March (see *MWN*, April 1984). Winters described this effect as "permanent" because he observed it two to three weeks after the field was turned off.

By the time he came to BEMS, Winters had completed 16 sets of experiments with three different tumor cell types (colon, breast and head/neck). In each case he found the greatest enhancement in growth rate, as measured by the proliferation of cell colonies, when the tumor cells were exposed to electric and magnetic fields together or magnetic fields alone.

Winters reported that in ten experiments in which human colon cancer cells were exposed for 24 hours to an electric field of 300 mA/m^2 (rms) and a magnetic field of 1 gauss, the cells formed 5.6 times more colonies than controls. For magnetic fields alone, the proliferation rate was 5.2 times greater than controls, while for the electric field alone it was only 1.8 times greater. Similar though less pronounced effects were observed with breast and head/neck tumor cells: according to Winters, the growth rates in combined fields and in magnetic fields were statistically significant.

Winters, a cell biologist at the University of Texas Health Science Center in San Antonio, TX, also reported on an experiment with colon cells exposed to a 0.5 gauss magnetic field. The increase in tumor-associated cell surface antigens at 300 mA/m^2 and 0.5 gauss was smaller than the observed increase at 300 mA/m^2 and 1 gauss, though both were larger than the response of control cells.

After Winters's paper there were numerous hallway dis-

cussions on the possible connection between his *in vitro* exposures of cell cultures to 60 Hz electromagnetic fields and the many reports of leukemia among workers and the general population exposed to 50 and 60 Hz fields from power lines. The informal consensus was that it is still too early for any conclusions but that much attention will be devoted to Winters's and Phillips's newly observed effect in the future.

Navy's Second Monkey Study

Dr. W. Gregory Lotz and Jack Saxton of the Naval Aerospace Medical Research Lab in Pensacola, FL, presented the preliminary findings of their replication study on the effects of chronic ELF exposure of young rhesus monkeys. Although they reported a significant increase in the growth rate of exposed males, confirming previous results, subsequent statistical analysis performed after the BEMS meeting did not support this conclusion. In early September, Lotz told *Microwave News* that an overall analysis of variance indicated that the change of growth rate is not significant at the 0.05 level.

At about two-and-a-half years of age, the male monkeys exposed from the age of one month began to gain weight faster than those in the control group. Divergence continued for about a year, at which time the difference in size stabilized. In the last six months of the 54-month exposure protocol, the divergence narrowed. The researchers also identified a trend toward higher testosterone levels among the exposed males as compared to controls.

The 30 monkeys (17 male and 13 female) were exposed to an electric field of 20 V/m and a magnetic field of 2 gauss at frequencies randomly modulated between 72 and 80 Hz.

At the meeting, Saxton and Lotz offered three hypotheses for their observations. First, ELF radiation causes a generalized growth effect; second, the neuroendocrine system is affected; and third, ELF stimulates the testes. They reject the first hypothesis because the growth effect did not occur in young females, and they are leaning away from the testes effect. While the exposures have now ended, the data analysis continues, particularly the results from the neuroendocrine end points.

Lotz said that he was planning to present a more complete picture of their results at the *23rd Hanford Life Sciences Symposium: Interaction on Biological Systems with Static and ELF Electric and Magnetic Fields*, in Richland, WA in early October.

According to Lotz, the Navy is not planning to continue its ELF studies at the Pensacola lab in the fiscal year beginning October 1. Instead Lotz and co-workers will turn their attention to biological interactions at higher frequencies.

Future Unclear for EPA RF/MW Guidance

The future of the Environmental Protection Agency's (EPA) radiofrequency and microwave (RF/MW) radiation exposure guidance became more uncertain last month with the ouster of Glen Sjoblom as director of the Office of Radiation Programs (ORP). ORP handles both ionizing and non-ionizing radiation, and the reason or reasons for the shake-up are unknown. Sources following developments at EPA have noted, however, that Sjoblom was the highest ranking official to support proposing RF/MW exposure limits. Sjoblom now oversees international activities for the Office of Air and Radiation.

As the agency debates whether to scrap the guidance it has spent years developing, the Federal Communications Commission (FCC) plans to act on its proposed rule making on RF/MW safety this fall.

The new director of ORP, Sheldon Meyers, told *Microwave News*, that EPA has no firm schedule for deciding whether to propose general population exposure limits. Meyers said the agency is still reviewing the options laid out in a memorandum from Deputy Assistant Administrator Jack Campbell — options which range from shelving the guidance to proposing a limit of 100 uW/cm^2 at resonant frequencies (see *MWN*, July/August 1984).

EPA Administrator William Ruckelshaus received his first briefing on the guidance September 4, three months after the proposal was scheduled for publication. The proposed rules were completed on time but met stiff opposition from the Office of Policy Planning and Evaluation as soon as internal review began this spring.

The agency has held a series of internal meetings on the guidance this summer and has also received input from the Electromagnetic Energy Policy Alliance (EEPA), a new industry lobbying group. Alliance representatives met with EPA's John Topping, David Janes and Sheldon Meyers on August 30 to express support for federal limits based on the 1982 ANSI guidelines.

Meanwhile, the FCC's Dr. Robert Cleveland reports that "we are moving independently from EPA and hope to consider our rule making at the commission's November 8 meeting." The proposal to extend the FCC's responsibility to include non-ionizing radiation hazards under the National Environmental Policy Act was released on January 28, 1982 (see *MWN*, March and September 1982).

Meyers, an engineer, formerly served as the Deputy Assistant Administrator for Air and Radiation. Meyers has also held a number of other EPA posts, working on solid and nuclear waste issues as well as air quality standards.

NAS Uncertain About EMP Effects

Some electronic systems may be susceptible to electromagnetic pulse (EMP) radiation, according to a study committee of the National Academy of Sciences (NAS). In a report released on August 8, the committee concluded that electronic systems can be protected from a high altitude

nuclear blast, but that the degree of vulnerability is difficult to estimate.

The NAS committee, chaired by Caltech's Dr. John Pierce, "strongly favored" shielding electronic equipment from EMP by placing subsystems in specially-designed copper lined buildings or metallic boxes, commonly known as Faraday cages, which electromagnetic waves cannot penetrate. It was "skeptical" about "tailored hardening" (in which components are individually shielded) because of some unpredicted failures.

No reliable test data on EMP vulnerability are available because atmospheric testing of nuclear weapons was banned in 1963. To gather needed information, the Navy is planning to build an EMP simulator called EMPRESS II in the Chesapeake Bay (see *MWN*, July/August 1984).

The NAS committee concluded that because "there is no way to base an analytical estimate of EMP vulnerability on first principles, there can be no substitute for the best physical simulations possible." It did not specifically endorse EMPRESS II, however. According to Dr. John Richardson, the principal NAS staff officer on the study, EMPRESS II was not an issue during the committee deliberations.

The study was requested by the Defense Nuclear Agency. Copies of *Evaluation of Methodologies for Estimating Vulnerability to Electromagnetic Pulse Effects* are available free from the Energy Engineering Board, NAS, 2101 Constitution Ave., NW, Washington, DC 20418.

The committee's recommendations on the engineering and statistical aspects of building EMP-resistant military systems are reprinted below.

Recommendations

Engineering Aspects

- There should be a continued reappraisal of the threat, its consequences, and the best near-term practices and longer-term research needed for meeting it.
- Adequate analyses should be made of what systems, subsystems and support systems are essential to completion of mission.
- There should be great emphasis on achieving assessability by promptly developing better and cheaper means for virtually complete and effective shielding of systems essential to the completion of mission. This objective should include a strong emphasis on early use of standardized shielded boxes interconnected with optical fibers.
- There should be a program to study and devise and evaluate the best and most economical way for continual testing to assure the maintenance of hardness.
- There should be a better understanding of the mechanisms of component failure and better and more insightful component tests and interpretation of test data.
- There should be increased emphasis on thoroughgoing analysis, testing and comparison of analysis with test at the level of functional circuit aggregations, or "boxes."
- A long-range program should be initiated and directed toward the systematic validation of prediction methods. The TRESTLE and comparable high-level simulators constitute a promising avenue to that end. These simulators generate pulses that are similar in many ways to, but also significantly different from, the expected EMP event. Important insights into the credibility of prediction methods themselves could be obtained by employing these methods to predict the response of components and systems to the fields known to be produced by the simulators and by confirming those predictions with experiments using the simulators.

Statistical Aspects

- The EMP community, including its management, should be better educated on the key ideas and procedures of statistics and reliability. Improved standardization of statistical terminology used by the EMP community should be pursued in order to reduce confusion with respect to its interpretation and uses.
- The government should utilize qualified and experienced personnel, well trained in statistics, to oversee contractors' bids and work that involve statistics.
- Collaboration among statisticians, engineers and physicists working in the field of EMP protection and assessment should be encouraged. The statisticians on such teams should be well versed in the latest techniques and developments in statistical methodologies and reliability.
- Contractual specifications that may be interpreted to require survival with probability equal to one (that is, certainty) should be avoided. Such specifications can lead to misunderstanding and legal problems, as well as to a poor choice of contractors. We recommend, rather, a collection of tests such that passing all will be acceptable as satisfaction of EMP requirements.
- Because fault tree analysis is a useful management tool, it should be utilized in EMP work where it is applicable. Both empirical and theoretical work may be required to tailor fault trees to the particular needs of the EMP problem.
- The Defense Nuclear Agency should establish a number of postdoctoral fellowships closely integrated with the field of EMP protection and assessment. The fellowships could be administered so as to encourage interdisciplinary collaboration, attract new talent to the field, and supplement the ongoing programs.

Seatbelts On, Cigarettes Out and Computers Off?

The chairman of a panel examining the risks of electromagnetic interference (EMI) to aircraft communication and navigation systems has suggested that airlines bar the use of portable electronic devices during takeoffs and landings.

In a memorandum to members of the Radio Technical Commission for Aeronautics' (RTCA) Special Committee 156 on possible EMI to aircraft electronics, Committee Chairman Frank White wrote: "It would, in my view, be logical to prohibit the use of passenger-operated electronic devices during takeoffs and landings when seatbelts were on, tray tops closed and seat backs vertical. This would affect passenger use of portable devices for perhaps 10-15 minutes of time...These are times when navigation and communication are the most critical to flight safety." (See also *MWN*, October 1983, April and June 1984).

White is not convinced that an EMI-related safety problem really exists, arguing in his memo to the committee that, "If we could find just one device that could be carried into an aircraft and cause interference we would have a case to build on." White also argued that it is not worth revising RTCA's 1963 Report DO-119, *Interference to Aircraft Electronic Equipment from Devices Carried Aboard,* because the emission limits proposed there have been "almost totally ignored." The limits later proposed by the Federal

Communications Commission (FCC) were unrelated to the RTCA work.

White suggested that the FCC afford greater protection to that portion of the spectrum used by aircraft. Those bands include: 10-25 kHz (Omega), 100-1750 kHz (ADF), 108-137 MHz (VOR/ILS/VHF), 329-335 MHz (glide scope) and public telephone band(s) above 400 MHz. He also raised the possibility of protecting the 2-30 MHz band. White proposed adding 10 dB or more to the present FCC limits — the exact value would be chosen after careful study.

White's memo was distributed on July 24, after the committee's last meeting on June 12-13, and his proposals will be taken up at its September 18-19 meeting.

Among the key decisions reached by the committee at its June meeting are:

- An incident file on all cases of aircraft-related EMI will be set up.
- More testing should be done in the Omega band.
- Acceptable path data can be generated without having to fly an aircraft.
- The aircraft fuselage cannot be relied upon to provide sufficient shielding of airborne receivers from RF levels allowed from FCC class B devices.
- While measurement data indicate that class B devices can be used without causing EMI, there may be some variation among different aircraft.

In addition, David Hantulla, formerly with Apple Computer and now an independent EMI consultant, observed that the interference reports received to date indicate that radios and cassette players were greater sources of EMI than computers. He argued that the committee should start classifying devices according to their EMI potential.

At its September meeting, the committee will look at the inverse problem: the possibility that an aircraft's high frequency (HF) transmissions could interfere with a passenger's electronic device.

Project ELF Study Continues Despite Court Ruling

Committee selection for the American Institute of Biological Sciences' (AIBS) literature review on extremely low frequency (ELF) radiation bioeffects is in its final stages, with experts in seven out of eight topic areas on board. As of early September, however, AIBS had yet to pin down who will write summary research papers for the study, despite the October 31 due date for a preliminary draft report.

The Navy's $319,000 contract with AIBS for an analysis of the post-1977 literature was to be part of a court-ordered supplemental environmental impact statement (SEIS) for Project ELF, a land-to-submarine communications system now under construction in Wisconsin and Michigan (see *MWN*, July/August 1984). Although AIBS will complete its study, the court order was overturned in August, and it is now unclear whether the Navy will file a SEIS.

The AIBS report committee is chaired by Dr. H.B. Graves of Pennsylvania State University. The other members, and their topic areas are: Dr. Ralph Smialowicz, hematopoietic and immune systems; Dr. Asher Sheppard, cellular and in vitro systems; Dr Neil Chernoff, growth/reproduction/development; Dr. David Savitz, human studies; Dr. Robert Lindberg, environmental biology; Dr. Thomas Tenforde, magnetic studies; and Dr. Lionel Jaffee, bone growth and fracture repair.

As we go to press, an expert on physiology/neuroendocrine systems has yet to be chosen, and AIBS Project Director Don Beem said it is possible that this slot will be eliminated and the material handled by other members.

The committee's work will be reviewed by an advisory group composed of private consultants Fred Dietrich and Dr. William Wisecup and Battelle's William Kaune and Dr. Richard Phillips.

The summary research papers on specific ELF bioeffects areas, along with material from a literature search being conducted by IIT Research Institute in Chicago, are key elements in the AIBS review. Although AIBS seems confident that it will enlist a strong field of contributors, at least one researcher who was asked to participate is dissatisfied with the composition of the report committee and its advisory group. In a strongly worded letter to Beem, Dr. Robert Becker backed out of writing the paper on bone growth, challenging the objectivity of a number of study participants.

Wisconsin Drops Suit

On August 20, the Seventh Circuit Court of Appeals in Chicago overturned a lower court order requiring a SEIS for the Project ELF system. The 43-page decision (Wisconsin v. Weinberger, 84-1569) from Judges Cummings, Wood and Cudahy included a partial dissent from Cudahy, who believes a new EIS is needed.

The majority opinion concluded that the information provided by the State of Wisconsin and Marquette County, Michigan, the plaintiffs, "falls short of the threshold of 'significance' at which the duty to prepare a SEIS is triggered." Judges Cummings and Wood reasoned that: "Were we to require the Navy formally to reassess its proposed action with a SEIS every time some bit of new information appeared, we would be unjustifiably interfering with the Navy's mission."

Further, they noted that: "The Soviet Union allegedly is already advanced in this low frequency submarine communications technique. The district court gave no consideration to these serious circumstances."

Judge Cudahy, on the other hand, found that district court Judge Crabb "reviewed an extensive administrative record and heard testimony concerning controversial scientific research, and her conclusions from that evidence are precise and sound." Cudahy concluded that the public scrutiny accompanying the SEIS process "is the best available means for ensuring the Navy does indeed give the new information full consideration."

In a June 13 order, the appeals court suspended the district court's injunction against further construction on the project (see *MWN*, July/August 1984).

As a final blow to Project ELF opponents, Wisconsin and Marquette County lost their bid to have the U.S. Supreme Court reinstate the construction ban. On August 17, shortly before the appeals court issued its decision, Justice John Paul Stevens denied their petition without comment.

Study Discounts Vernon, NJ Birth Defect Fears

A recently completed study of birth defects in the town of Vernon, NJ, found no evidence to support local fears that ambient radiofrequency and microwave (RF/MW) radiation in the community is a health hazard. The long-awaited report from the New Jersey State Department of Health has been sharply criticized by the community group which requested the investigation, however, and is unlikely to quiet community opposition to new RF/MW sources.

A health department team led by Dr. George Halpin reported that the incidence of birth defects in Vernon Township (34.5 per 1000 pregnancies) "was not statistically different from the rate observed in the rest of Sussex County (32.2 per 1000 pregnancies)." The study covered live births and fetal deaths occurring in the county after twenty weeks of pregnancy from 1975 through 1981, a period encompassing the startup of the first satellite communications station in Vernon. The town now has three major satcom stations (see *MWN*, November 1982).

In an interview with *Microwave News*, Halpin, the director of the department's Division of Parental and Child Health, said he was confident that the study "was sufficiently powerful to detect whether something is going on."

Citizens Against the Tower (CAT), a group of Vernon residents opposing new broadcast facilities, disagrees. According to CAT spokeswoman Elise Kreindler, the study was too general to address the community's chief concern: potential clusters of birth defects in several Vernon neighborhoods, including an area close to RCA Americom's satcom station.

Members of CAT also believe that the study failed to pick up many birth defect cases. For example, Kreindler said she has documented six cases of Down's syndrome within the "cluster" areas of Vernon while the Department of Health only turned up three. Finding the report "wholly inadequate," Kreindler said the group will seek independent analysis of the study data to prove its case.

No specific type of defect occurred at a higher rate in Vernon than in the county, but the report states that "the difference in the incidence of chromosomal anomalies between the two areas approached statistical significance." Four of the eight reported cases of defects resulting from chromosomal abnormalities were in Vernon.

Halpin believes the only potentially important factor left uncovered is ambient radiation levels. The state, lacking measuring equipment of its own, had asked the Environmental Protection Agency to perform a survey of the county but was turned down. As a result, the report states that "at no time did this study attempt to answer any question as to the etiology or causation of any of the defects identified," although it did determine that the incidence of defects in Vernon was within the expected range.

Investigators reviewed hospital records for 86.5 percent of the 1632 births in Vernon and 94.4 percent of the births in the rest of the county.

For more information, contact Tom Hagy, New Jersey Department of Health, CN360, Trenton, NJ 08625, (609) 984-7160.

SHORT COURSES

October 15: **EMI Susceptibility Guidelines for Computing Devices,** Boston, MA. Fee: $295. Contact: Greg Gore, R&B Enterprises, 20 Clipper Rd., West Conshohocken, PA 19428, (215) 825-1965. **Repeated** November 7: Philadelphia, PA.

October 15-18: **Fundamentals of Numerical Solution Methods in Electromagnetics,** Oxford, MS. Fee: $550. Contact: Division of Continuing Education, University of Mississippi, University, MS 38677.

October 16-17: **Magnetic Analysis Program,** Milwaukee, WI. Fee: $495. Contact: A.O. Smith Engineering Systems, 8901 N. Kildeer Court, Milwaukee, WI 53209, (800) 558-6980, ext. 2860. **Repeated** November 13-14; December 11-12.

October 16-19: **Electronic Warfare,** Bethesda, MD. Fee: $730. Contact: Linda Billard, TSC, 962 Wayne Ave., Suite 600, Silver Spring, MD 20910, (800) 638-2628, or (301) 565-2970 in MD.

October 20: **Microwave Cooking,** Troy, MI. Fee: $35-45. Contact: International Microwave Power Institute, 301 Maple Ave. West, Vienna, VA 22180, (703) 281-1515.

October 22-26: **Antennas and Arrays,** Washington, DC. Fee: $875. Contact: Continuing Engineering Education, George Washington University (GWU), Washington, DC 20052, (800) 424-9773, or (202) 676-6106 in DC.

October 22-26: **Radiowave Propagation for Communications Systems Design,** Washington, DC. Fee: $875. Contact: GWU, see October 22 above.

October 23-25: **Introduction to EMI/RFI/EMC,** Washington, DC. Fee: $815. Contact: Don White Consultants, Inc. (DWCI), State Route 625, PO Box D, Gainesville, VA 22065, (703) 347-0030.

October 23-26: **Grounding & Shielding,** Atlanta, GA. Fee: $815. Optional fourth day for $235. Contact: DWCI, see October 23 above. **Repeated** November 13-16: Sunnyvale, CA; December 4-7: New York, NY.

October 24-25: **Seminar on Frequency Measurements,** Boulder, CO. Fee: $400. Contact: Mike Lombardi, Division 524, National Bureau of Standards, Boulder, CO 80303, (303) 497-3212.

October 29-November 2: **Electromagnetic Interference and Control,** Washington, DC. Fee: $875. Contact: GWU, see October 22 above.

October 31-November 1: **EEPA Seminar,** Chicago, IL. Fee: $250 (members), $275 (others). Contact: Richard Ekfelt, Electromagnetic Energy Policy Alliance, 1800 M St., NW, Washington, DC 20036, (202) 452-1070.

November 5-8: **Millimeter-Wave Engineering and Applications,** Washington, DC. Fee: $795. Contact: GWU, see October 22 above.

November 5-15: **Bioelectrochemistry II: Membrane Phenomena,** Erice, Italy. Fee: $500. Contact: Dr. M. Blank, College of Physicians & Surgeons, 630 West 168th St., New York, NY 10032.

UPDATES

BIOLOGICAL EFFECTS

Special Issues... The latest issue of the *Journal of Bioelectricity* (Vol.3, No.1&2, 1984) is a special symposium issue: it features seven papers on "Mechanisms of Bioelectrical Growth and Repair" edited by Dr. Betty Sisken of the Wenner Gren Research Lab at the University of Kentucky in Lexington, and eight papers presented at the *1st Annual Meeting of the International Society for Bioelectricity,* held in Boston, MA, last October 1, edited by the journal's editor Dr. Andrew Marino of the Department of Orthopaedic Surgery at Louisiana State University Medical Center in Shreveport. In addition, the volume contains seven regular papers. The journal is published by Marcel Dekker, Inc., 270 Madison Ave., New York, NY 10016....The August 1984 *IEEE Transactions on Microwave Theory and Techniques* is a special issue devoted to "Electromagnetic Wave Interactions with Biological Systems." The issue, edited by Dr. James Toler of Georgia Tech in Atlanta, features two dozen papers on dosimetry, bioeffects, measurements, imaging and hyperthermia. A copy is available for $6.00 (IEEE members) or $12.00 (non-members) from IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854.

Annotated Bibliographies... Dr. J. Patrick Reilly of Johns Hopkins University's Applied Physics Lab has completed the fourth edition of *Human Reactions to ELF Electric and Magnetic Fields –An Annotated Bibliography of Current Literature,* (No. PPSE T-30; June 1984). A limited number of copies are available from Reilly at JHU-APL, Johns Hopkins Road, Laurel, MD 20707....The Air Force School of Aerospace Medicine has issued two new volumes in its series, *USAFSAM Review and Analysis of Radiofrequency Radiation Bioeffects Literature.* The first two reports were released in 1982 (see *MWN,* July/August 1982) and a fifth is expected before the end of the year. The five volumes will contain analyses of about 200 papers selected from over 1,000. Each citation includes an abstract and a "critique" written by Louis Heynick and Dr. Peter Polson of SRI International in which the paper is evaluated with respect to the methodology, validity and significance of the reported findings. Copies of the reports are available from the National Technical Information Service (NTIS), Springfield, VA 22161. (The third report is No. USAFSAM-TR-84-6, March 1984, NTIS No. AD A111190; the fourth is No. USAFSAM-TR-84-17, May 1984, NTIS No. AD A116139)....Vol.VIII, No.2 of *Biological Effects of Non-Ionizing Electromagnetic Radiation* (January 1984) has been published by the Office of Naval Research. A limited number of copies are available from ONR, Code 441, 800 N. Quincy St., Arlington, VA 22217. Be sure to include a self-addressed mailing label.

COMPATIBILITY & INTERFERENCE

FCC Computer RFI Rules... On July 30, the FCC denied a petition filed by Glen Dash of Dash, Straus & Goodhue, Inc. in Boxborough, MA, requesting changes in the commission's measurement procedures for radiated emissions from computing devices. Soon after the FCC issued new test procedures (commonly known as MP-4) last summer (see *MWN,* September 1983), Dash asked for some additional revisions. Dash, who is both an engineer and a lawyer, wanted a testing requirement specifying that all interface cables be left unterminated — MP-4 requires that peripherals be connected to the host computer via interface cables. The FCC rejected this option, arguing that "it is more important to simulate the conditions of actual use..." and that it was too soon to make such a "major shift in measurement philosophy." Other proposals made by Dash on the positioning of the cables during testing were also rejected by the commission. CBEMA had opposed the Dash petition. In a telephone interview, Dash said that his petition was "nothing more than a suggestion to streamline the testing procedure." He went on to call the MP-4 revisions a "tremendous leap forward" and said his petition was simply "asking the commission to go one step further." In retrospect he added, "I should have simply written the FCC a letter."...Responding to another petition on the same day, the FCC denied CBS Inc. an exemption from the commission's computer rules (Part 15, Subpart J) for electronic and pipe organs used primarily by churches. The organs use digital electronics for tone generation and for the operation of the console in controlling such variables as volume. (Though CBS is best known as a broadcaster, it also is in the organ business.) The FCC noted that CBS did not submit any measurement data to support its case for an exemption and decided that there was no justification for the exemption, especially given what it called the "minimal" requirements of its *verification* rules. The FCC concluded: "We believe that it is important for manufacturers to be made aware that digital electronic circuitry is capable of emitting considerable levels of radio noise which should be properly considered and controlled at the design stage."

Low Power Devices... The FCC has denied a July 1982 petition by RF Power Labs for an exemption from the commission's rules to allow the operation of a portable low power audio-video transmitter in the 471-507 MHz band. Five parties opposed the petition on the grounds that the proposed device would interfere with the reception of UHF TV channels 14-20. For more information, contact FCC's Alvin Reiner, (301) 725-1585.

INTERNATIONAL

Power Line Exposures in USSR... Drs. I.P. Kozyarin and Yu.D. Dumanskiy of the Institute of General and Communal Hygiene in Kiev have advocated a maximum permissible dose of 12 kV/m "for occasional, short-term" exposures of up to 30 minutes a day and 5 kV/m for "daily short-term exposures" to 50 Hz electric fields. In addition, they favor a requirement that 500 and 750 kV power lines be at least 300-500 meters from inhabited areas, and that any human activity requiring frequent exposure within this zone be prohibited, like farming. The paper is written in Russian and was published in the November 1983 *Gigiyena I Sanitariya* in Moscow. An English abstract appears in the

May 18, 1984 issue of *USSR Report: Life Science: Biomedical and Behavioral Sciences,* published by the Joint Publications Research Service (JPRS) which is available from the National Technical Information Service, Springfield, VA 22161. (Note that JPRS has discontinued its *USSR Report: Life Sciences: Effects of Non-Ionizing Electromagnetic Radiation* and is now publishing abstracts on NIER in the report cited above.)

Documentaries in the UK... Central Independent Television, based in London, has prepared a three-part series on non-ionizing radiation, called *The Good, the Bad and the Indefensible* for Channel 4 in the UK. The three shows and their air dates were: "Hidden Potential" (August 25); "Currently at Risk" (September 1); "Opening Pandora's Box" (September 8). The series was produced by David Jones and directed by Richard Belfield. Part 1 focussed on medical applications, including bone and ulcer healing and the treatment of lung and chest cancers with electric current. Part 2 was about the risks associated with power line radiation. Among those interviewed on the show were Dr. John Bonnell of the Central Electricity Generating Board, Dr. Stephen Perry, a general practitioner who has investigated the possible association between power lines and suicide, and Dr. Robert Becker, who has been an active participant in the health effects of ELF debate. Part 3 covered a number of topics related to the politics of non-ionizing radiation: the beaming of radiation at the US embassy in Moscow, Project Pandora, the Soviet Woodpecker over-the-horizon radar, Joe Towne of the Radar Victims Network, EMP radiation and VDTs. For further information, contact: Jean Denham, Press Office, Central Independent Television, 35-38 Portman Square, London W1A 2HZ, England, (01) 486-6688.

MEETINGS

Low Level Effects... Eugene Findl of Brookhaven National Lab is organizing a two-and-a-half day workshop on the interaction of low level electromagnetic and ultrasonic fields with cells on December 9-12. The main objective of the meeting, which is by invitation only, is to explore possible mechanisms. The proceedings of the workshop will be published. For more information, contact Findl at Brookhaven National Lab, Upton, Long Island, NY 11973, (516) 282-4907...Because of the number of conferences already scheduled, ONR's Dr. Mike Marron has decided against holding a workshop on low frequency magnetic field effects (see *MWN,* June 1984). "There are so many other meetings that I just couldn't schedule another one," Marron told *Microwave News.* Instead, he is planning a joint FDA-ONR review session to identify future research directions in basic science, applications and hazards assessment. The session will be held in November. Marron added that he expects ONR to fund more research on low frequency field effects in the future.

Call for Papers... The *17th Annual Meeting of the Conference of Radiation Control Program Directors* in Milwaukee, WI, May 19-23. Contact: CRCPD, 71 Fountain Place, Frankfort, KY 40601, (502) 227-4543....The *1985 IEEE International Microwave Symposium* in St. Louis, MO, June 4-6. Contact: Stephen Honickman, STG Electrosystems, 720 Manchester, Suite 215, Ballwin, MO 63011....The *International Aerospace and Ground Conference on Lightning and Static Electricity,* in Paris, France, June 10-12. In the US, contact: Lawrence Walko, AFWAL/FIESL, Wright Patterson AFB, Dayton, OH 45433; others: Dr. Joseph Taillet, ONERA, BP 72, 92320 Chatillon, France....The *1985 International Symposium on Microwave Technology in Industrial Development – Brazil,* Campinas, Brazil, July 22-25. Contact: Attilio Jose Giarola, UNICAMP-CCPG (Reitoria), CP 1170, 13100 Campinas, SP, Brazil....The *1985 International Symposium on Electromagnetic Compatibility* in Wakefield, MA (near Boston), August 20-22. Contact: Dr. Donald Weiner, Department of Electrical and Computer Engineering, 111 Link Hall, Syracuse, NY 13210.

MILITARY SYSTEMS

TEMPEST Revisions... The Defense Communications Agency (DCA) has announced plans to upgrade its Circular 370-D195-2. The circular governs the activities of the Data Communications TEMPEST Working Group (DTWG) in evaluating equipment for certification for use in the Data Communications portion (AUTODIN) of the Defense Communications System. DCA is soliciting views to streamline the certification process as well as to make it more economically efficient. For more information, contact: Louis Gnecco, chairman, DTWG, DCA, Attn: B665, Washington, DC 20305, (202) 692-4603. Note that because the TEMPEST program is classified, only those with the proper security clearances can participate....Of related interest, see James Schultz's article, "NSA and Industry Experience TEMPEST Growing Pains," in the June *Defense Electronics.*

OCCUPATIONAL HEALTH

RF Sealer Guidelines...FDA will soon propose draft, voluntary guidelines for radiation exposures from RF dielectric heaters and sealers. FDA's Center for Devices and Radiological Health will recommend the ANSI levels of 60 V/m and 0.16 A/m for electric and magnetic fields, respectively. Though some heaters and sealers operate at frequencies below 30 MHz, FDA will propose flat guidelines instead of ANSI's frequency dependent levels, which are less stringent below 30 MHz. A meeting has been scheduled for November 15-16 to allow interested parties to comment on the FDA proposal. An explanatory notice will appear in the *Federal Register.* For more information, contact Howard Bassen, acting deputy director of the Division of Physical Sciences, HFZ-130, CDRH, Rockville, MD 20857, (301) 443-6536.

PEOPLE

Dr. **Richard Phillips** is leaving Battelle to become the di-

rector of the Experimental Biology Division at EPA's Office of R&D in Research Triangle Park, NC. Phillips will leave his post as program director for bioelectromagnetics at Battelle's Pacific Northwest Labs in Richland, WA, at the end of October and expects to be at EPA by the end of November. He will be taking over from Dr. **Joe Elder** who has been filling in as acting division director since January 1982 when Dr. **Dan Cahill** left EPA for a job with Carolina Power and Light. Elder will continue as chief of the division's cellular biophysics branch...Dr. **Geoffrey Voss** of the University of Alberta in Canada, has replaced Dr. **Satish Kashyap** as the editor of the *Journal of Microwave Power*. In a telephone interview, Voss said that he planned to beef up the IMPI journal and expand coverage in a number of areas, including patents, R&D, new products, medical applications and standards. His goal, he said, is to make the publication complementary to *Bioelectromagnetics*, the BEMS journal....Dr. **Robert Patterson** has taken over Dr. **Robert Kavet's** post as manager of EPRI's project on the biological effects of electric fields. Patterson has been with EPRI for three years and before that was at SRI International. Patterson will report to Dr. **Gordon Newell**...On August 6, Dr. **Abraham Lilienfeld** died of a heart attack in Baltimore, MD, at the age of 63. Lilienfeld was a leading epidemiologist and is best known to the RF/MW community as the principal investigator on the study of employees who were exposed to microwaves at the American embassy in Moscow.

STANDARDS

San Diego Weighs ANSI Limits... An advisory panel has recommended that San Diego County, CA, adopt the 1982 ANSI standard for RF/MW radiation. This is one of a number of recommendations, including changes in zoning and site development policy, made by the Telecommunications Task Force in its recently completed final report to the county's Board of Supervisors. Late last year, the board declared a moratorium on new broadcast construction permits and established the task force. This group's recommendations "are intended to serve as the basis for the development of a regional telecommunications policy," according to the report, because, "while criteria and guidelines have been recommended which will mitigate site-specific development impacts, issues regarding alternative site locations are likely to involve multi-jurisdictional decisions." Part of the task force effort included commissioning a study on *Potential Hazards of Radio and Microwave Frequency Radiation –An Overview*, from the Tinton Falls, NJ, consulting firm of Booz, Allen and Hamilton, Inc. The firm's 19-page report concludes that "there appears to be no radiation hazard to the public" from existing RF/MW sources in the county. The board is scheduled to act on task force recommendations on September 12, the day before the moratorium expires. For more information, contact Bill Chatham, Department of Planning and Land Use, County of San Diego, 5201 Ruffin Road, Suite B, MS 0650, San Diego, CA 92123, (619) 565-3023.

EMC in Canada... The Canadian Standards Association's (CSA) steering committee on EMC is without a chairman. Max Melnyk of the federal Department of Communications has been reassigned and has given up the chairmanship. According to CSA's Brian Weir, no replacement has yet been named. Meanwhile, one of the groups working under the EMC steering committee is developing an immunity standard for data processing equipment which should be ready in 1985. Last year, the subcommittee, chaired by Sam Wong of Delphax Systems in Mississauga, Ontario, issued standard C108.8, *Recommended Limits and Methods of Measurement of EMI from Data Processing Equipment and Electronic Office Machines*. For more information, contact Wong at (416) 624-2643 or Weir at (416) 747-4363. A copy of C108.8 is available for $16.00 (Canadian), prepaid from CSA, 178 Rexdale Blvd., Rexdale, Ontario M9W 1R3, Canada, (416) 747-4044. You can use Visa, MasterCard and American Express.

Are Public RF/MW Health Standards Needed?... This is the question raised by Jane Clemmensen in her new book, *Non-Ionizing Radiation: A Case for Federal Standards?* Clemmensen concludes that there is no *a priori* need for a national RF/MW exposure standard because of an "absence of evidence of jeopardy to public health." Her 90-page analysis explores the risks to emerging technologies of an unscientific standard, the costs of delays and litigation in the absence of officially recognized guidelines and possible alternatives to a national standard. Dr. Arthur Guy wrote the preface to the paperback book, which is available for $7.50 from San Francisco Press, Box 6800, San Francisco, CA 94101.

IEEE Dictionary...A revised and expanded edition of the *IEEE Standard Dictionary of Electrical and Electronics Terms* has been issued. Designated ANSI/IEEE Standard 100-1984, the 1173-page book contains nearly 24,000 definitions. The volume, now in its third edition, also features some 15,000 acronyms. The text is chock-full of diagrams and equations and is a most useful reference. Copies are $33.75 for IEEE members ($37.50 for non-members) until December 15, when the price goes up to $44.95 and $49.95, respectively (add $2.00 handling and shipping charge per order). Available from IEEE Service Center, CP Dept., 445 Hoes Lane, Piscataway, NJ 08854, (201) 981-0060.

CISPR ITE Rule... The new CISPR six months' draft rule on information technology equipment is now available. This standard could have a major impact on FCC Part 15 rules on computer emissions (see *MWN*, May 1984). *CISPR/B(Central Office)16 Second Draft –CISPR Recommendation No. ...: Information Technology Equipment: Limits of Interference and Measurement Methods* can be ordered from Sales Dept., ANSI, 1430 Broadway, New York, NY 10018. Send a check for $31.00 with your order (price includes postage).

1983). The most powerful effects were found using pulses with a 42 usec rise time, though significant effects also occurred using pulses with a 2 usec rise time. Delgado used very weak magnetic fields ranging in intensity from 0.1-100 microtesla (uT). (By comparison, the Earth's static magnetic field is approximately 50 uT.) At least three groups are trying to replicate the experiments though only Mild, of Sweden's National Board of Occupational Safety and Health, has been successful (see *MWN*, June 1984).

Very low frequency (VLF) radiation emissions are produced by the VDT's flyback transformer, which controls the electron beam's movement across the inside face of the display screen. Recent measurements, described below, indicate that there is a long magnetic field pulse associated with the horizontal tracing of a raster line from left to right and a very short electric field pulse associated with the rapid return to the left to start a new line.

The magnetic field waveform from the flyback has a rise time of approximately 45 microseconds (usec). The observed values vary according to the flyback frequency — the pulse repetition rate can change from 15-20 kHz. There also appears to be a fast magnetic field pulse associated with the short electric field pulse, which has a rise time of about 5 usec.

The shape of the electromagnetic pulse determines the time rate of change of the magnetic field; time-varying magnetic fields induce electric currents. It is not clear, however, whether induced currents or other mechanisms — possibly direct magnetic interactions — cause the Delgado effect. For instance, in a paper published earlier this year, Dr. Abraham Liboff of Oakland University in Rochester, MI, showed that weak alternating magnetic fields could alter DNA synthesis and that the effect was independent of the induced current (see *Science, 223*, 818, 1984, and *MWN*, October 1983).

Guy's Data

At a conference on "Office Hazards: Awareness and Control" in Seattle, WA, on June 1, Guy reported that the magnetic field pulses from VDTs have rise times of approximately 40-60 usec and fall times of 10 usec, "characterized by a sawtooth-wave shape." Average (rms) field strengths at the surface of terminals were on the order of 1 A/m, decreasing to 0.02-0.14 A/m at a distance of 25-30 cm from the screen.

Guy also measured the electric fields produced by flybacks. These were in the form of 10 usec wide pulses separated by 50-70 usec intervals. The peak amplitudes were approximately five times greater than the average. "For typical VDTs, the peak electric field levels may be as high as several thousand volts per meter [V/m] at the surface of the unit nearest the flyback transformer and near 10 V/m at 25-30 cm from the screen," Guy wrote in the abstract of his conference paper. He noted some significant exceptions, however: "these values can be ten to twenty-five times greater for some older models."

In a subsequent telephone interview, Guy said that the electric fields at 25-30 cm from the screen were approximately 5 V/m for new VDTs and about 50 V/m for old ones.

Guy advised in his abstract that, "Though there is concern about the health hazards of the emissions, the levels are far below accepted safety standards, and energy coupled to a user of the device is very small."

Guy told *Microwave News* that Delgado's experiments indicated the VDT pulse shape might not be biologically active. He said that he had observed a small ripple on the top of the VDT's magnetic field waveform; when Delgado added a ripple to the 42 usec pulse it was no longer teratogenic.

Guy tested terminals made by Digital Equipment Corporation (DEC), Hazeltine, Televideo and others and found similar pulse shapes for all units. Flyback frequencies varied between 15 and 18 kHz.

Guy has been studying VDT radiation for IBM. The company hired him to analyze the available literature and to suggest methodologies for measuring non-ionizing radiation emissions from VDTs. He took his own measurements when he found inconsistencies in the literature. An IBM spokeswoman would not say whether company officials had seen Guy's waveforms. A report Guy submitted to the company has been returned for revisions, she said. IBM is not planning to release the final report.

The conference proceedings, including Guy's abstract, are available from the Department of Environmental Health, University of Washington, SC-34, Seattle, WA 98195.

EPA Measurements

Tell, who works at EPA's radiation lab in Las Vegas, NV, described his measurements of the magnetic field pulses at the Bioelectromagnetics Society (BEMS) meeting in July.

Tell tested Wang and Hewlett-Packard VDTs and a Sony television set (used as a computer monitor), reporting the magnetic flux density for the short magnetic pulse in terms of microtesla (uT). (For comparison with Guy's results, Tell's values are also given in ampere/meter (A/m), using the conversion factor of 1 uT=0.8 A/m.) Peak magnetic field readings ranged from 1.44 uT [1.15 A/m] for the Hewlett-Packard to 6.48 uT [5.18 A/m] for the Sony. Maximum time rates of change for the magnetic fields, measured near the flybacks at the rear of the units, were 0.222 T/sec for the Hewlett-Packard, 1.12 T/sec for the Wang and 0.926 T/sec for the Sony.

At 5, 10, 15 and 20 inches from the screen, the time rates of change dropped off sharply. At the furthest distance, however, they were all still in the range used by Delgado.

Delgado did not publish the time rates of change for his

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

experiments, but according to Tell's calculations they ranged from 0.0029 T/sec to 0.29 T/sec.

Tell reported that he observed the magnetic field pulse rise times to be on the order of a few usec. Neither Guy nor the researchers from Ontario Hydro found this fast pulse. Guy told *Microwave News* that, "I feel certain that the 2 usec pulse is peculiar to the particular VDTs studied." Tell was visiting Delgado's lab in early September and could not be reached for further comment.

Ontario Hydro and FDA

Murray Walsh, of Ontario Hydro in Pickering, Ontario, described measurements of some of the VDTs used at the utility company in a paper presented on August 29 at an *Open Symposium on the Interaction of Electromagnetic Fields with Biological Systems* held during the general assembly of the International Union of Radio Science (URSI) in Florence, Italy. In his "Assessment of the Hazards from Video Display Units," Walsh said that Ontario Hydro had "completely characterized the electromagnetic waveforms" as part of a major project to assess VDT hazards (see *MWN*, April 1984).

Explaining these data in a subsequent telephone interview, Walsh, who is manager of the company's Technical Safety Standards Section, said that the magnetic field pulses had rise times of approximately 40 usec and fall times of approximately 4 usec.

Walsh and Harvey measured the magnetic fields along three orthogonal axes near the VDTs. Along one of these, Murray noted, the waveform was very complex.

Walsh also described 17 kHz electric field pulses as having short rise and fall times —approximately 4 usec each— separated by an estimated 52 usec. The wave shape was triangular, and the overall pulse duration was 60 usec. (A sample electric field waveform is pictured in a report on Ontario Hydro's findings in *Bioelectromagnetics, 5,* 1, 1984.)

In a telephone interview, FDA's Paul Ruggera said he had made some preliminary measurements of waveforms from two VDTs a few years ago. He explained that the magnetic field levels were so low that he did not measure them directly; instead he studied the spectral distribution of the signals.

Ruggera's data are published in *An Evaluation of Radiation Emissions from Video Display Terminals,* published by FDA in February 1981 (No. FDA 81-8153). The report is reprinted in the record of the May 1981 hearings of the House subcommittee on investigations and oversight of the Committee on Science and Technology, *Potential Health Effects of VDTs and RF Heaters and Sealers.*

A fifth set of measurements has been released in Canada but was not available at press time. In a study requested by the Hospital Employees Union of British Columbia, Dr. Hari Sharma of the University of Waterloo in Ontario measured radiation from VDTs at the Surrey Memorial Hospital in Vancouver. The hospital was the site of one of the eleven reported clusters of problem pregnancies (see *MWN*, July/August 1982). ●

CONFERENCES

October 2-4: **Interaction of Biological Systems with Static and ELF Electric and Magnetic Fields,** Holiday Inn, Richland, WA. Contact: Patricia Bresina, Battelle Pacific NW Labs, PO Box 999, Richland, WA 99352, (509) 376-0100.

October 2-4: **6th Annual Electrical Overstress/Electrostatic Discharge Symposium,** Marriott Hotel, Philadelphia, PA. Contact: EOS/ESD Symposium, PO Box 9172, Fort Collins, CO 80525, (303) 221-8059.

October 5-6: **1st Congress of the European Society of NMR in Medicine,** Geneva, Switzerland. Contact: Dr. M.-A. Hopf, 1 route de Florissant, CH-1206 Geneva, Switzerland, (41)(22) 472547.

October 10-12: **Symposium on Electromagnetic Field Measurements for Hazard Assessment,** Hacienda Resort Hotel and Casino, Las Vegas, NV. Contact: Sheri Marshall, Dynamac Corp., PO Box 2198, Kensington, MD 20895, (301) 468-2500.

October 16-18: **1984 International Symposium on Electromagnetic Compatibility,** Tokyo, Japan. Contact: Professor T. Takagi, Dept. of Communications, Tohoku University, Sendai, 980, Japan, (0222) 22-1800, ext. 4266.

October 21-24: **1984 Conference on Electrical Insulation and Dielectric Phenomena,** Wilmington Hilton Hotel, Clayton, DE. Contact: Steven Boggs, Ontario Hydro Research, 800 Kipling Ave., Toronto M8Z 5S4, Canada, (416) 231-4111, ext. 6735.

October 21-26: **Managing the Electromagnetic Environment,** Pocono Hershey Resort, White Haven, PA. Contact: Harold Comerer, Engineering Foundation, 345 East 47th St., New York, NY 10017, (212) 705-7835.

October 22-23: **International Conference on Microwave Tubes in Systems: Problems and Prospects,** London, England. Contact: Institution of Electrical Engineers, Savoy Place, London WC2R 0BL, England, (01) 240-1871, ext. 222.

October 22-24: **International Symposium on Noise and Clutter Rejection in Radars and Imaging Sensors,** Sasakawa Hall, Tokyo, Japan. Contact: Professor T. Musha, Dept. of Applied Electronics, Tokyo Institute of Technology, 4259 Nagatsuta, Midori-ku, Yokohama, 277, Japan, (045) 922-1111, ext. 2546.

October 22-26: **9th International Conference on Infrared and Millimeter Waves,** Osaka, Japan. Contact: Professor A. Mitsuishi, Dept. of Applied Physics, Osaka University, Yamada-Oka, Suita, Osaka 565, Japan.

October 31-November 2: **Conference on Medical and Biological Effects of Light,** Barbizon Plaza Hotel, New York, NY. Contact: New York Academy of Sciences, 2 East 63rd St., New York, NY 10021, (212) 838-0230.

November 5-7: **DOE-EPRI-NYS Contractors Review: Research on Bioeffects of Transmission Lines,** Sheraton St. Louis, MO. Contact: Dr. William Wisecup, Aerospace Corp., Suite 4000, 955 L'Enfant Plaza, SW, Washington, DC 20024, (202) 488-6328.

November 5-8: **4th International Meeting of the Bioelectrical Repair and Growth Society,** Holiday Inn, Kyoto, Japan. Contact: BRAGS, 425 Medical Education Building, 36 and Hamilton Walk, Philadelphia, PA 19104, (215) 898-8653.

November 13-15: **JINA'84: International Symposium on Antennas,** Nice, France. Contact: Secretariat JINA'84, CNET-PAB Centre de la Turbie, 06320 Cap d'Ail, France.

FROM THE FIELD

University of Washington on Microwave-Cancer Study

Last month, we featured a report on a study by Dr. Arthur Guy at the University of Washington School of Medicine, which linked microwaves to the promotion of cancer. In response to our report and numerous other news stories appearing nationwide, the university's Health Sciences News and Information Services issued a press release on August 24.

Reprinted below is the full text of the University of Washington press release.

The stories also drew a critical response from the Electromagnetic Energy Policy Alliance (EEPA), an association of manufacturers and users of systems which employ non-ionizing radiation. In a September 8 release, EEPA Vice-President George Wilkening stressed the preliminary nature of the Guy results and noted that "there is nothing definitive...to support a conclusion that continuous exposure to radiofrequency and microwave fields is harmful to humans at the protection guide levels specified by the American National Standards Institute in 1982." Wilkening works for AT&T Bell Labs.

Over the past three years the Bioelectromagnetics Research Laboratory at the University of Washington has conducted, under the School of Aerospace Medicine's sponsorship, a biological screening study of the effects of continuous long-term exposure to low levels of microwave radiation. The major emphasis was to expose a group of rats to microwaves throughout their lifetimes and to monitor them for possible cumulative effects on general health and longevity. Two hundred animals were studied, one hundred being exposed and one hundred serving as controls.

Literally thousands of measurements were taken during the course of the study, covering many areas such as behavior, blood chemistries, metabolism, the immune system, weight and survival. All animals were also investigated at necropsy for the occurrence of lesions.

The overwhelming majority of the measurements showed that there was no difference between the animals exposed to microwaves and the controls, and in particular, there was no difference in survival between the two groups. However, several differences did emerge which merit further study:

1. There was some evidence of altered immune function, based on 10 exposed and 10 control animals sacrificed midway through the experiment, though this was not seen in animals sacrificed at the end of the experiment.

2. There was a suggestion of an increase in the weight of the adrenal glands in the exposed group, based on 10 exposed and 10 control animals sacrificed at the end of the experiment; however, this was not seen in animals sacrificed midway through the experiment.

3. There was a possible increase in the number of exposed animals with malignant tumors, which occurred in 16 of 100 animals in the microwave group and 4 of 100 control animals.

There are several reasons why these differences cannot be regarded as being definitively established. First, in a screening study such as this, with so many aspects being investigated, it is inevitable that some differences will appear by chance in the data obtained from the two groups, even if microwaves have absolutely no biological effect. Second, we have not completed the analysis of the results and, in particular, have not finished exploring the relationships between measurements and possible anomalies in the data. Third, with regard to tumors, the incidence is not significantly different in the exposed group compared to that in other unexposed groups of the same type of animals reported in the scientific literature. Finally, there wasn't a substantial increase in any specific type or location of tumor, differences emerging only when all tumors are considered, leaving biological interpretation open to question.

Nonetheless, the implications for public health of these results are such that further studies need to be done, designed specifically to address the issues raised by our research results.

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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.)

VDT Health and Safety Publications

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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STOP PRESS

The New York State Workers' Compensation Board upheld Yannon decision and award. Details next month.

RARE BLOOD DISORDER LINKED TO MICROWAVES

An Army pathologist has observed an asssociation between microwave exposure and polycythemia, a rare blood disorder. Polycythemia victims suffer from an excess of red blood cells, and are believed to stand an increased risk of developing leukemia.

Dr. Hylar Friedman, a pathology resident at the William Beaumont Army Medical Center in El Paso, Texas, reported his observation in a letter to the *New England Journal of Medicine* (February 5, 1981). Friedman's preliminary analysis indicated an incidence rate of three cases per year, or 18.7 per 100,000 men over forty—as compared to an average rate of 1.5 to 5.6 per 100,000 men between the ages of 40 and 59. Friedman himself identified seven male patients with polycythemia, who had "strong histories of past and present chronic exposures to microwaves."

The letter took the microwave research community by surprise. No prior connection between microwaves and polycythemia had been reported; many scientists have been directing their attention to the white rather than the red blood cells. As one researcher pointed out, the finding may not be so hard to explain since both types of cells originate in the bone marrow.

Dr. Charlotte Silverman of the Bureau of Radiological Health (BRH) in Rockville, Maryland, a co-author of the only epidemiology of Navy radar workers (*American Journal of Epidemiology 112,* 39, 1980), said that she found the letter "extremely interesting," and that BRH would be following up this new lead. The letter prompted Silverman to check the data in her radar study: she found no indication of polycythemia as a cause of death or as a secondary condition. She noted that there were some leukemias among the radar workers, but that poly-

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ANSI News

Committee Fails to Agree on New RF/MW Safety Standard

Meeting in New York City on February 26, 1981, the C95 Committee on Radio Frequency Radiation Hazards of the American National Standards Institute (ANSI) could not agree on a new RF and microwave safety standard. Professor Saul Rosenthal of the Polytechnic Institute of New York, the C95 chairman, sent the standard back to Subcommittee IV in a final attempt to reach consensus. Now Professor A.W. Guy of the University of Washington will try some new language, and circulate it among the subcommittee members before bringing it back to the full Committee for approval.

Microwave News will have a full report on the ANSI meeting and the sources of disagreement in our next issue.

Editorial Note

As the items that follow show, VDT operators continue to worry about radiation emissions from their sets. A central question in this controversy is: where does the radiation come from and what are its characteristics?

There is general agreement that the flyback transformer circuit, which has a fundamental frequency of 15 to 20 kHz, is the principal source of the radiation. (This frequency corresponds to the number of lines the machine traces a second.) The number and strength of the associated harmonics is less certain, however. Some sources said that the harmonics frequencies vary up to the 100 kHz range, while others say they may go even higher.

Dr. Samuel Hopfer, vice-president and director of R&D at the General Microwave Corporation in Farmingdale, New York, offered the following explanation for the distribution of the harmonics frequencies. They depend on the flyback or retrace time, that is the time interval in which the voltage goes from the full value to its starting value: the faster the retrace time, the richer the content of the harmonics. Normally the higher harmonics have a weaker intensity. A precise frequency distribution can only be experimentally determined with a spectrum analyzer. Furthermore, according to antenna theory, as you increase the frequency, the possibility of radiation emissions also increases. (This relationship only holds up to a point: in this case somewhere above 50 MHz.)

Microwave News *will continue to cover this story, and invites comments on the question posed above.*

RADIATION MEASUREMENTS

Holaday Warning

Holaday Industries of Eden Prairie, Minnesota, has issued a bulletin warning against the use of its HI-3001 E-field probe to measure VDT radiation. The company bulletin (#026), dated January 26, 1981, reads:

> WARNING!!!!!
> DO NOT ATTEMPT TO MEASURE E-field levels
>
> around video display terminals, television sets or any CRT. All of these units do emit low frequency, low level signals and do have a relatively high voltage which can induce false readings into the HI-3001 monitor. Any significant field strength can be characterized as having most of its energy spectrum well below the usable frequency range of the HI-3001 E-field probe. These fields will cause a reading, however, at this time it does not appear that this reading can be related to a meaningful value.

(According to the Holaday HI-3001 specification sheet, the meter's range is 0.5 MHz to 300 MHz.)

New York Post

In a survey of 16 VDTs at the *New York Post* on January 12, the National Institute for Occupational Safety and Health (NIOSH) recorded a 1500 V^2/m^2 reading at a Harris 1740 terminal with a Holaday HI-3001 meter. Levels of about 500 V^2/m^2 were found at several Burroughs terminals. The significance of these readings is uncertain, however, since the HI-3001 is not recommended for measuring frequencies below 0.5 MHz. (See above.) Dr. Wordie Parr and Bill Murray of NIOSH's Physical Agents Effects Branch in Cincinnati, who took the readings, had not seen the manufacturer's warning.

Parr had initially planned to investigate the terminals, although NIOSH does not think the reported levels pose any health risk. The high readings from the Harris particularly perplexed Parr because it is a solid state model, without a flyback transformer that is the usual source of radiation (15 kHz) emissions from VDTs.

NIOSH must now re-evaluate the *Post* results. In an interview last month, Murray said, "We are aware of measurement problems with VDTs, but we have not seen the Holaday warning letter. We are reconsidering our measurement data." Instrumentation clearly poses difficulties. Murray confessed, "We still don't know which meter to measure VDT radiation with."

Shields: Metal v Plastic

Radiation measurements from three VDT models used at the *Lexington Herald-Leader* in Kentucky have prompted the Newspaper Guild to recommend installing protective metallic shields around all plastic-cabinet VDT models as a precautionary measure.

NIOSH recorded high readings from the back of Ontel OP-1 and OP-1/16 and Systems Integrated ET960 models last August while measuring a sample of the *Herald-Leader's* VDTs. NIOSH dismissed these measurements as false readings, however, and concluded that there was no radiation hazard. The levels were attributed to electrical interactions between the Narda 8619 meter and the flyback transformer of the units. (NIOSH Technical Assistance Report 80-105-757, October 1980)

The Guild is not convinced the machines are safe. David Eisen, research and information director for the union, issued a memo to local presidents this January advising them to insist on either a shield for the Systems Integrated model, or a test indicating no radiation leaks exceeding 1 mW/cm^2. The Guild had already made this recommendation for the two Ontels and another plastic-bodied model, the Teleram 2277 Mark 1, after NIOSH tests found the same high readings from these terminals. Eisen stated, "By this time, it is clearly possible to generalize this recommendation to apply to all plastic-cabinet VDTs."

Montreal *Gazette*

Radiation readings from VDTs at the Montreal *Gazette* have alarmed the paper's unions despite government assertions that VDTs do not pose a health risk.

Quebec's Ministry of Environment, using a Raham Model 4 meter, checked about 24 *Gazette* VDTs on January 7. The readings were very low except for those taken from plastic-bodied Sperry-Univac UTS 400 and PSI Lobbyist (portable) models. According to John Saunders, a business reporter at the *Gazette*, some measurements from these models went "right off the dial"—over 20 mW/cm^2.

Since these measurements were taken, the VDTs in question have been rigged with makeshift aluminum foil shields. A second check made on January 21 showed these effectively reduced these readings, except for one terminal.

The significance of the initial measurements, however, is disputed. Dr. Maria Stuchly, an expert at the federal radiation protection bureau in Ottawa, insists the Raham meter must have been out of order. "There is no other explanation," she said. The Ottawa bureau did extensive tests on the same type of VDTs at the *Gazette*'s Ottawa office and recorded only low levels.

UK Survey

The United Kingdom's National Radiological Protection Board has completed a comprehensive field survey of all types of VDTs currently manufactured or marketed in the UK. More than 200 different termin-

als were tested for radiation emissions from the RF through the X-ray frequencies.

The maximum recorded readings were: X-ray: less than 10 microrems per hour; UV: none detected above 336 nanometers and 12.4 uW/cm² otherwise; visible: 0.25 mW/cm²; near IR: 5 uW/cm²; far IR: only hot body radiation.

In the microwave and radiofrequency range, a reading of 0.5 mW/cm² was found at one unit using a Narda 8300, while all the rest gave readings below 0.1 mW/cm². (The Narda's frequency range is 300 MHz-18 GHz.) Using a Raham 12 meter, 14 terminals gave responses greater than 10 mW/cm², with the maximum "approaching" 100 mW/cm². Using an EFS 1 meter, 39 units gave readings over 200 V/m, with a maximum over 300 V/m.

An outside contractor tested four of the terminals that had indicated electric field intensities above 300 V/m with a spectrum analyzer. The measurements, taken close to the line output transformer, showed field intensities above 1000 V/m at the fundamental and harmonics frequencies of the line scan frequency up to about 150 kHz. On all the units, the level fell rapidly to 1 V/m between 150 kHz and 3 MHz and to less than 0.2 V/m at 30 MHz. (The electric and magnetic field measurements were equivalent.)

The detailed readings were consistent with those taken with the EFS 1 meter and led the Board to conclude that the Raham 12 readings were "spurious."

E.A. Cox reported these results in his paper, "Radiation Emissions from Visual Display Units," presented at the Loughborough University conference last December. Given that an operator would be exposed to less radiation than that measured under test conditions of properly functioning VDTs, Cox concluded that "the radiation normally emitted from a VDU (video display unit) does not pose a hazard to operators either in the long or short term."

STUDIES

Mount Sinai Study

The Newspaper Guild and the Mount Sinai School of Medicine in New York City have announced plans for an epidemiological study of the health effects of VDTs. The study, coordinated by Dr. Arthur Frank at Mount Sinai, will include eye examinations, radiation tests, and a survey questionnaire. Approximately 2,000 employees, including both VDT users and controls, from four to six Guild locals will participate.

A questionnaire developed by Mount Sinai's Environmental Sciences Laboratory with assistance from the Guild will be tested soon at the Vancouver-New Westminster and the Los Angeles Newspaper Guilds. The full survey should begin this summer or fall.

If the questionnaire response indicates a need, Mount Sinai will seek funds for an additional study phase of full medical examinations for affected employees.

Charles Perlik, Jr., president of the Newspaper Guild, believes the study should help to determine if VDTs are responsible for eye damage or other radiation effects.

Baltimore *Sun* Study

Ophthamological tests are underway in a study of VDT operators at the Baltimore *Sun*. Dr. Shiro Tanaka of NIOSH is conducting the study in cooperation with the local Newspaper Guild, which requested the investigation, and the Baltimore Typographical Union.

The study includes a brief questionnaire and eye examinations performed by the University of Maryland. Up to 500 union members will be tested by mid-April. Tanaka says a report on the study results may be issued as early as this July. (See also *Columbia Journalism Review* story, March/April 1981.)

HEALTH EFFECTS

Toronto Star Follow-Up

News that four women working on VDTs at the *Toronto Star* had given birth to children with defects stirred widespread concern last summer. Calls requesting radiation checks for VDTs flooded the radiation protection service of Ontario's Ministry of Labor. The anxiety continued even after the Ministry's measurements of all 296 terminals at the *Star* failed to find any radiation.

The cause, if there is one linking the four defects, has remained undiagnosed. Checks for insufficient ventilation and hazardous chemicals have also turned up nothing.

John Brooks, director of communications at the *Star*, stressed that the paper "will take whatever further and reasonable steps are necessary to reassure our own employees and the public that there are no known environmental factors at the *Star* that contribute to birth abnormalities." This year the *Star* will consult three health experts, including an epidemiologist, for recommendations on possible ways to settle this case.

The announcement of this decision closely followed criticism from the City's Department of Public Health of the paper's initial follow-up study. After the Department ruled out radiation from VDTs as a possible cause of the defects last June, Dr. Murray Cathcart, the *Star*'s medical director, prepared a lengthy questionnaire to investigate other factors that might be responsible. Only two of the four women filled out the survey, however.

Gerald Caplan, coordinator of the Advocacy Unit of the Public Health Department, told Brooks that he considered the survey "quite unsatisfactory" and urged the *Star* to conduct a broader epidemiological survey that would include all *Star* employees.

The Southern Ontario Newspaper Guild welcomed the Health Department's concern. The Guild is still not convinced that no radiation hazard exists. It has set up its own ophthmalogical study of VDT operators and intends to "continue demanding testing for and monitoring of radiation as a right of all VDT users," according to John Bryant, executive officer of the Guild.

Toronto Cataract Case

An Ontario government employee has filed a claim with the Workmen's Compensation Board seeking compensation for cataracts, which she believes were caused by radiation from VDTs. Ms. Darlene Weiss's case is the first of its type before the Board.

Weiss, who is 40, said she first noticed problems with her vision while using VDTs at the Ministry of Transportation and Communications. An eye examination taken before she began her job at the Ministry did not indicate any abnormalities. Now, according to the Ontario Public Service Employees Union (OPSEU), Weiss has cataracts that must be surgically removed. She worked on terminals for 19 months, beginning in August 1978.

Dr. Milton Zaret, a well known ophthamologist specializing in nonionizing radiation effects, examined Weiss and is convinced her cataracts are radiation-induced.

The Ministry of Labor's occupational health and safety division must check the VDTs Weiss worked on before a decision from the Board can be reached. (One of these terminals was lost after its return to Bell Canada for checks, but it has since been found.)

According to Robert DeMatteo, occupational health and safety coordinator for the union, the Provincial government does not have the equipment to take detailed radiation measurements OPSEU thinks are necessary. Therefore, the union is hiring a private contractor to perform

(continued p. 4)

comprehensive tests on the Viewcom 3 and the three Sycor terminals Weiss used at the Ministry.

The union has also commissioned Zaret to design a questionnaire for its members who work on VDTs. This survey should get underway in mid-March.

Rashes

Reports from Europe are linking facial rashes to VDT use. Dr. H.H. Tjønn of the Norwegian Directorate of Labor Inspectorate in Oslo has verified that 16 cases of rash among VDT operators during 1979 and 1980 were related to the work environment.

According to Tjønn, Dr. Walther Cate Olsen at the Christian Michelsens Institute in Bergen, Norway, is researching the possible role of static electricity and airborne dust in causing the skin reaction. All of the reported cases occured during the winter in workplaces with low relative humidity and synthetic fiber carpets, factors that helped produce high measured levels of static electricity.

Radiation from the units was among the factors checked and ruled out as possible causes.

The rash symptoms are itching followed by redness on the cheeks, and sometimes the chin and forehead. Redness appears at the office, and usually disappears a few hours after work.

Four similar cases at one English office were observed by Drs. R.J.G. Rycroft and C.D. Calnan, from St. John's Hospital for Diseases of the Skin in London.

The Norwegian and English reports were presented at the Loughborough University Conference on VDTs last December.

Meanwhile, across the Atlantic, twelve cases of facial rashes among VDT operators have been reported to the Ontario Public Service Employees Union in the past 18 months. Robert DeMatteo, at the Union, says the Ministry of Labor does not think these complaints require radiation check of the VDTs in question.

The cause of this unusual problem remains undiagnosed.

Government Assurances

US and Canadian government officials assert there is no radiation hazard from VDTs. Commenting on the Weiss case and the *Toronto Star* incident, M.H. Repacholi, head of the non-ionizing radiation section in Ottawa, stated, "I cannot conceive of cataracts or birth defects coming from VDTs." David Conover of NIOSH's Physical Agents Branch in Cincinnati also argues there is nothing to worry about. He stressed that there is little field-body coupling and little absorption at 15-20 kHz, the frequencies most often emitted from VDTs.

BRIEFS

The long awaited **NIOSH Bay Area VDT study** will go to the printers soon. Copies of the report have been sent to the participating companies and unions...the **Bureau of Radiological Health** (BRH) is putting the final touches on its study, *An Evaluation of Radiation Emissions from Video Display Terminals.* The report of BRH's investigation of ultrasound, RF, microwave, X-ray and light emissions is due out by April...This month, **Dr. Steven Sauter** at the University of Wisconsin Department of Preventative Medicine and Wisconsin State officials are discussing possible State action on VDTs. Sauter may assist the State in designing a training program for public employees in proper VDT use and in developing a design standard for terminals used by the State...The **Cold Type Organizing Committee** has written a pamphlet, *Don't Sit Too Close to the TV: VDTs/CRTs and Radiation.* Copies are available for $1, or $1.50 by mail from the Committee at P.O. Box 40, Jerome Avenue Station, Bronx, NY, 10468...Visual fatigue and VDTs will be the focus of a sesesion at the 1981 **American Industrial Hygiene Conference,** May 24-29 in Portland, Oregon.

James H. Stebbings, Jr. Sc.D., has been selected as the tenth member of the Scientific Advisory Panel for the New York State Overhead Power Lines Project. Stebbings is an Associate Professor at the University of Minnesota School of Public Health.

Final approval of the Panel, which will oversee and evaluate a five year study on the health effects of electromagnetic radiation from the lines, is expected soon.

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The **Bioelectrical Repair and Growth Society** announced its formation "as a result of the burgeoning interest around the world in electrical mediation of biological repair and growth." The current president is Dr. **Carl T. Brighton,** while Dr. **Joseph Watson** is president-elect pro tem. (See conference calendar for address.)

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The **Georgia Institute of Technology** is seeking a new director for its **Electromagnetics Laboratory** at the Engineering Experiment Station. The laboratory has 65 research professionals studying such areas as millimeter/submilimeter wave technology; microwave solid-state technology; infrared/electro-optical systems; remote sensing, and physical sciences. All inquiries to D.W. Robertson, principal research engineer, Engineering Experiment Station, Georgia Institute of Technology, Atlanta, GA 30332.

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History Professor **Nicholas H. Steneck** of the University of Michigan, Ann Arbor, is continuing his work on the development of microwave radiation safety standards. Steneck's chronicle of events up to 1960 was published last summer: "The Origin of US Safety Standards for Microwave Radiation," *Science, 208,* 1230, 13 June 1980, and "Early Research on the Biological Effects of Microwave Radiation: 1940-1960," *Annals of Science, 37,* 323, 1980. Funded by a National Science Foundation grant, Steneck will be bringing the microwave history up to the present.

Steneck would like to hear from anyone who can help him reconstruct the events leading to the microwave standard: Professor Nicholas Steneck. Department of History, University of Michigan, Ann Arbor, MI 48109. (313) 763-2230.

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Four researchers have joined the US Environmental Protection Agency's Experimental Biology Division at Research Triangle Park in North Carolina. They are: Dr. **James A. Rabinowitz,** a research physicist in the cellular biophysics branch, where he will study the interaction of microwaves with molecular systems. Dr. **Ronald J. Spiegel,** an electronics engineer in the bioengineering branch, whose studies center around the development and verification of numerical models to predict induced power densities and the thermal response to exposure to electromagnetic fields. Dr. **Christopher J. Gordon,** a physiologist in the developmental biology branch, who is interested in the effects of microwaves on the temperature regulation in test animals. And Dr. **William P. Watkinson,** also a physiologist in the developmental biology branch, who will be working on the cardiovascular effects of environmental agents on laboratory animals.

AGENCIES

The implications of the Reagan budget cuts for radiation programs are still unclear. As of the end of February, rumors were rampant in the Capitol, but federal agency officials were unwilling to speak "on the record" about the extent and impact of the cuts. *Microwave News* will have a complete report next month.

Bureau of Radiological Health

BRH has granted the Finessa Corporation of Threvos, Pennsylvania a variance from the microwave oven performance standard for the Microwave Tunneloven, model 7800-03/15 manufactured by Kreis AG in Switzerland. (46 *Federal Register* 7444, January 23, 1981) The variance is effective for two years.

The oven has a conveyor belt and can heat food on a continuous basis. Its main use is intended to be in hospital and hotel kitchens to reconstitute chilled food. The unit may also be used as an industrial heater for grain and cereal products.

The variance was granted under the conditions that permanent warning labels be attached to the oven, that the oven have three safety interlock switches on two different circuits, that there be microwave-absorbing material in both entry and exit channels and that the user and service manuals contain appropriate cautionary instructions.

Federal Trade Commission

The final FTC order requiring Litton Industries to stop making unsubstantiated claims about its microwave ovens, and forcing it to keep accurate records of any tests and surveys on oven performance used in such claims, has been published in the *Federal Register* (46 *FR* 8445, January 27, 1981). See *Microwave News*, February 1981.

National Cancer Institute

NCI has issued a request for proposals (RFP: NCI-CM-17480) to assess the performance of at least two heat generating and at least two thermometry systems. At least three patients with tumors in each of the major anatomic sites (e.g. brain, neck and head, lung, deep lymph nodes, etc.) must be treated with each system, and the temperature measured at multiple locations. A detailed analysis will be required, as well as the development of guidelines for the use of the equipment. Copies of the RFP may be obtained by submitting a request, in writing, to: Harold Thiessen II, Treatment Contracts Section, Research Contracts Branch, NCI, Room 228, Silver Spring, MD 20910.

RARE BLOOD DISORDER *(continued from p. 1)*

cythemia was not linked as a co-existing condition in the death certificates. Silverman had also looked through the Moscow epidemiology and found only one case of polycythemia; the case involved an individual who had not been exposed to microwaves.

Silverman warned that the reason her epidemiology had not picked up an increase in polycythemia may be that only a limited amount of morbidity data was collected for discharged Naval personnel. Her study would have picked up only those veterans who were treated in Navy or VA hospitals or who had service connected disabilities. Thus, a more extensive follow-up would be needed to indicate the presence or absence of such a rare disease.

In a telephone interview, Dr. Friedman said that he had originally met with considerable opposition to the publication of these findings; "The military was quite concerned—many people thought that it was premature to publish such unsubstantiated findings." Indeed, the Army had pointed to the negative data in the radar epidemiology as grounds for withholding publication.

After numerous written appeals, Friedman's Commander approved the letter. Friedman said that he had received considerable support from Captain Paul Tyler, director of the Armed Forces Radiobiology Research Institute, and Colonel Lawrence Larsen of the Walter Reed Army Institute of Research.

Friedman is planning to pursue his research on polycythemia by asking the patients to complete a questionnaire. He is especially interested in gaining information about microwave exposures. In order to protect his study against spurious symptoms suggested by microwave exposure, Friedman plans to confine his review to physical findings.

In his letter, Friedman noted that his patient population included many microwave exposed workers from the US Army Defense Center and the White Sands Missile Range.

Next month, Friedman is going overseas for more training and will return at the end of May.

On learning of the letter, Dr. Arthur Frank, an epidemiologist at the Mount Sinai School of Medicine, advised that the new results should be evaluated by doing complete blood counts on a large number of microwave exposed workers.

Harrison's *Principles of Internal Medicine* (seventh edition) describes polycythemia rubra vera, that is the type of polycythemia that does not develop in response to a known stimulus as a "disease of unknown cause, insidious onset, and chronic course. It is characterized by a striking absolute increase in the quantity of circulating red corpuscles and usually also by evidence of increased production of myeloid leukocytes and platelets." The symptoms are described as, in part:

> The onset is insidious and the progress gradual. Headache, dizziness, ringing in the ears, or visual disturbances; dyspnea lassitude, or weakness; skin or mucous membrane hemorrhages; pruritis, especially after a hot shower or bath; a sense of weight in the abdomen because of the enlarged spleen; or irritability, depression, forgetfulness, or vague symptoms suggesting neurasthenia are complaints which may be encountered in many patients. Various gastrointestinal symptoms, such as fullness, belching, or constipation may be present, or symptoms of peptic ulcer may be found. Sometimes the symptoms are those attributable to increased metabolism: lassitude, increased sweating, and loss of weight. Swelling and pain in the extremities may be very troublesome. However, in still other patients the symptoms are so insignificant that the polycythemia is discovered only accidentally.
>
> The face is a deep red rather than truly cyanotic....The blood pressure is more often normal than elevated. Enlargement of the liver is frequent, and spenomegaly is found in at least 75 percent of cases.

Confusion and Controversy in New York City

The new broadcast antennas atop the World Trade Center (WTC) in New York City continue to radiate confusion and controversy.

The twin 110-floor towers of the WTC—owned and operated by the Port Authority of New York and New Jersey (PA)—will eventually house most of the TV and FM stations in the New York metropolitan area, as well as many other specialized transmitters. Relocation of broadcast facilities from the Empire State Building—where the bulk of them have been until now—downtown to the $20 million master antenna at the WTC has touched off disputes about radiation levels near the antennas, and the radiation safety standards that should apply to them.

The shrinking TV broadcast range and loss of reception that followed the move, combined with citizen apprehension over microwaves, have produced an anxious situation for the broadcasters and the public alike. To a point, the PA is caught in the middle as the reluctant landlord.

Radiation Measurements

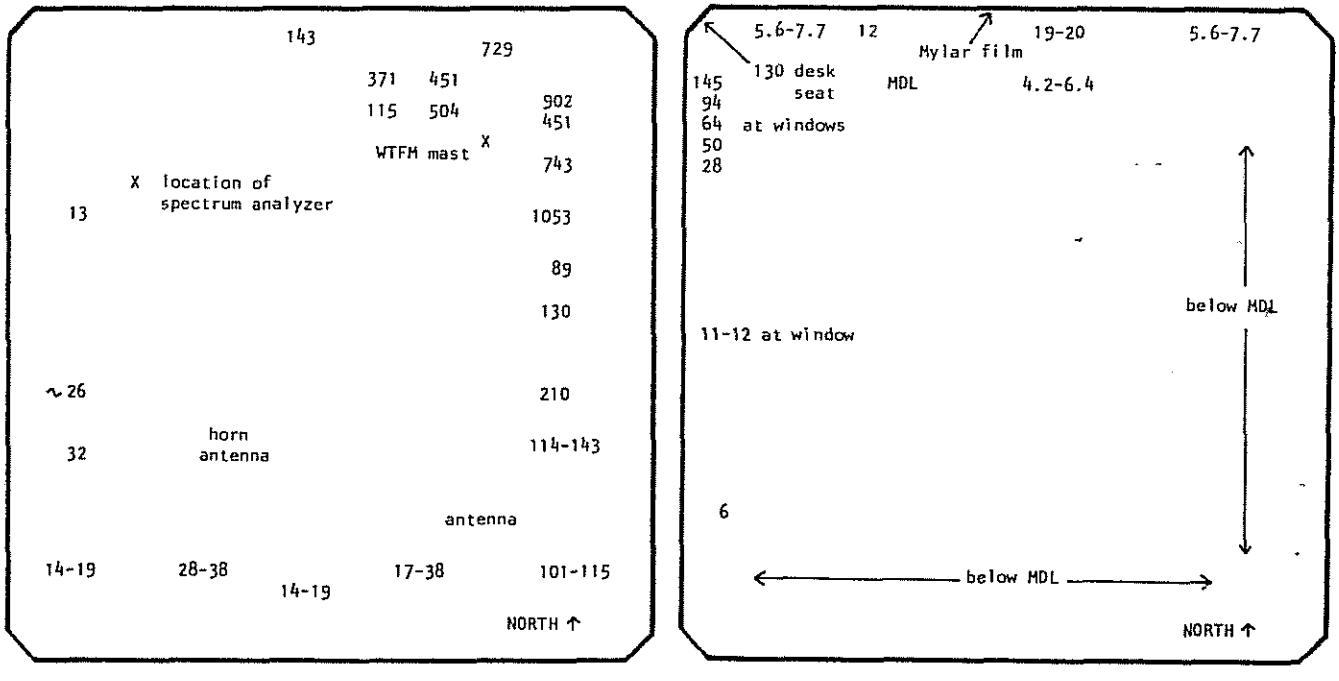
The only WTC radiation measurements now available were taken by Richard Tell, of the Environmental Protection Agency (EPA), during the early morning hours of July 16, 1980, and released to *Microwave News* in late January. At that time, two VHF TV stations (WCBS-2 and WNEW-5) and two UHF stations (WXTV-41 and WNJU-47) were broadcasting from the master antenna on the north tower; one TV translator (W60A1) and one FM station (WTFM) were broadcasting from the south tower. (Since then, WABC-7, located on the master antenna, the main mast, has been turned on.) Tell took a series of readings with a broadband Holaday meter (HI-3001) on the public observation deck on the roof and on the 107th floor observatory of the south tower. Due to high winds, Tell could make only one set of roof measurements of the individual station signals with a spectrum analyzer.

The maximum reading on the roof was 1053 uW/cm², due largely, according to Tell, to WTFM. Exposures below on the 107th floor fell in the 6-17 uW/cm² range generally, but peaked as high as 145 uW/cm² near the windows. A level of 130 uW/cm² was identified at a desk in the far northwest corner. (See accompanying diagrams for full set of measurements.) No readings were taken on the north tower, home of the main antenna.

Before and after the EPA survey, the PA's consultant, Robert Silliman, of Silliman and Silliman in Washington DC, took detailed measurements. They have not been released. Some of the numbers did reach the New York papers last February ("Making (Micro)waves over Trade Center TV," *Daily News,* February 25, 1980, and "Microwave Threat Stalls Trade Center TV Tower," *New York Times,* February 26, 1980). The resulting commotion prompted the PA to install mylar reflecting material on some windows in the northwest corner of the south tower. The mylar was already in place by the time Tell arrived. Though Silliman's numbers are still confidential, The PA maintains that they are significantly lower than Tell's EPA measurements.

Joyce Feldman, EPA's radiation representative in New York,

Broadband power densities (uW/cm²) measured by EPA's Tell on the south tower roof (left), and the 107th floor observatory (right). All dimensions are approximate. (MDL = Minimum Detectable Level)



explains that a report on the Tell measurements has not been issued because they are now out-of-date. After Tell's visit, the PA installed a protective shield, known as a wagonwheel, on the WTFM mast on the south tower. The wagonwheel has changed the radiation patterns on the towers.

Contradictory Results

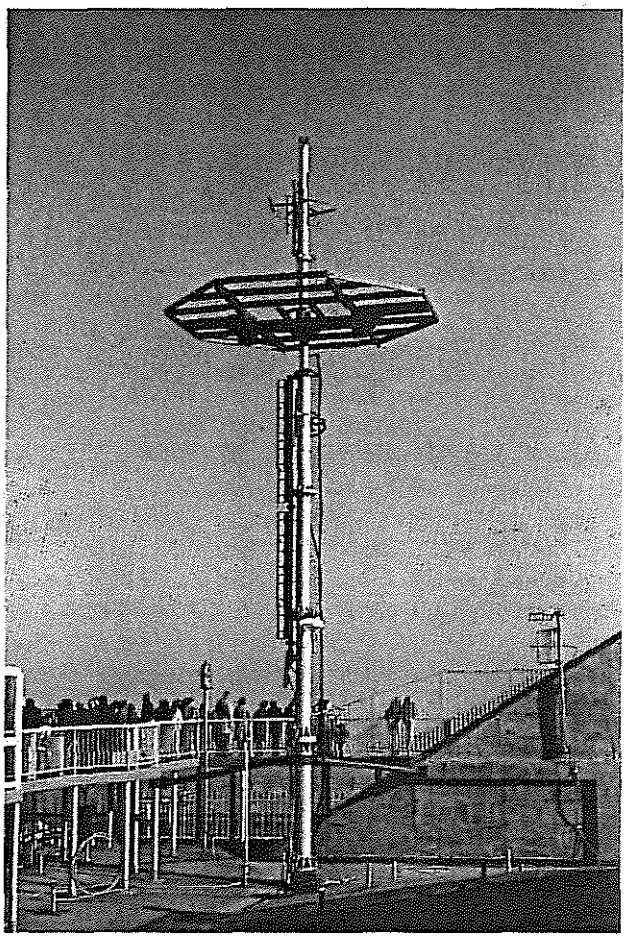
At a February meeting, PA officials, including Franklin Bass from the general counsel's office, Joseph Milano, manager of telecommunications and information systems, and Thomas Sorensen, broadcast coordinator, told *Microwave News* that the Tell numbers were "wrong" and "unreliable." In a yet to be released letter, Silliman had written the PA arguing that Tell's readings were really peak values, which had to be divided by an empirically derived factor of 1.54. The 1.54 factor was required because Tell, according to Silliman, had used the "peak hold" button on the Holaday meter when taking his readings. Silliman also wrote that any measurements of TV signals had to be further corrected to discount for synchronization pulses.

Speaking from his office in Las Vegas, Tell denied using the peak hold button. And Reed Holaday, president of Holaday Industries in Eden Prairie, Minnesota, said that his 3001 meter does not respond to TV "synch pulses."

On hearing about Tell's and Holaday's responses, Silliman withdrew his 1.54 conversion factor, and said, "There is some doubt that my point [about the meter] is valid."

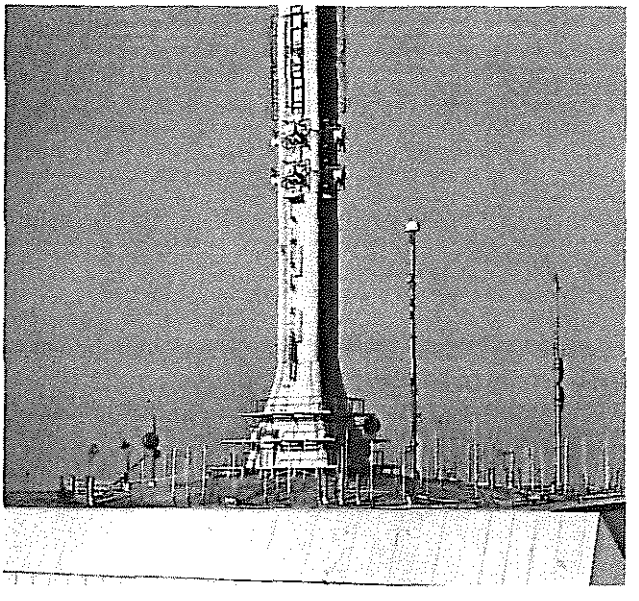
The PA and Silliman now explain the differences between the two reports by the method each used to take measurements. Tell surveyed a number of small areas and identified local maxima while Silliman took his readings at specific locations along a predetermined grid.

EPA's Feldman offered the same explanation. But no one outside the PA—including EPA—has yet seen the Silliman reports. Asked about all the confusion over the radiation levels, Feldman said that in the absence of federal standards, she had no legal authority to intervene, and that communication problems arose when so many people were involved in such an informal way.



Station WTFM mast with "wagonwheel" protective shield on the south tower. Behind, tourists enjoy New York views.

The base of the master antenna on the north tower.



The wagonwheel shield, installed to reduce WTFM radiation, had an unanticipated result. Signals from WKCR, an FM station originally located on the same mast under WTFM, were reflected downward by the wagonwheel. Silliman said that while local peaks had changed, the general radiation levels were about the same. WKCR-FM is not now operating from the WTC. The PA stressed that, before WKCR begins broadcasting, it will be moved to another antenna.

The PA claims to have spent more than $50,000 on monitoring—or a total of $200,000 when corrective action is included. Future PA surveys are planned, but no firm dates have been set.

At the end of his report, Tell recommended that a "more exhaustive field survey be accomplished to determine the absolute contribution of fields from the various broadcast frequencies."

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He also advised: "a survey of field levels inside the offices of several top floors would be worthwhile." Tell said that he could not predict if, or when, he would be able to return to the WTC to do such follow-up surveys for EPA. Federal travel budgets have been slashed, and he could not come to New York before the next fiscal year. If he does return, he wants to take a detailed set of measurements over the course of several days.

Safety Standards

The PA has consistently maintained that it will meet a 100 uW/cm² general population exposure standard. This level, set for the PA by Dr. Paul Tyler, director of the Armed Forces Radiobiology Research Institute in Bethesda, Maryland, is purely voluntary. The EPA has not issued any guidance for public exposures to non-ionizing radiation.

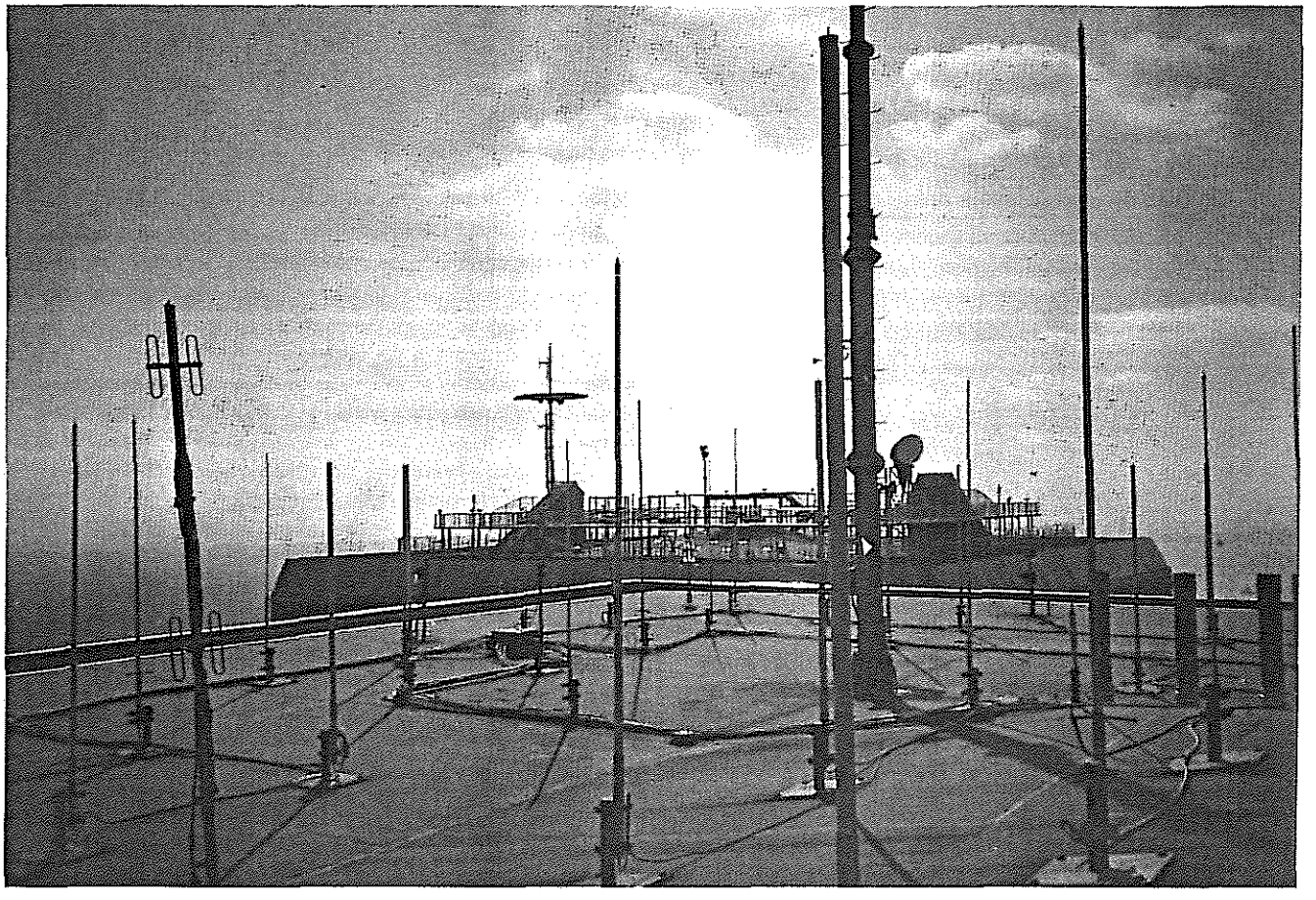
At a New York State Senate committee hearing, held last summer at the WTC, Patrick Falvey, general counsel and assistant executive director of the PA, testified that the PA "has undertaken a moratorium wherein no new broadcasting will be permitted from the [WTC] unless it can meet this strict standard."

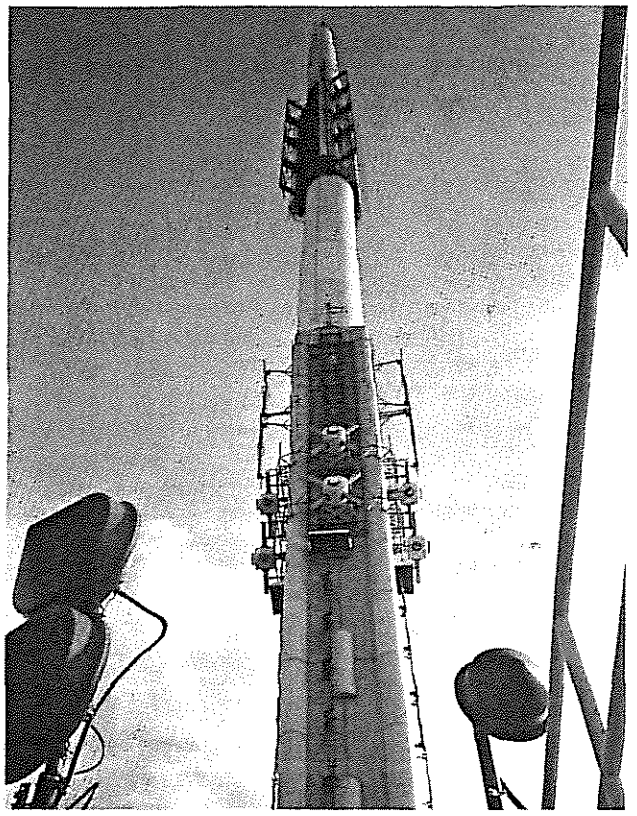
The PA's safety standard is twice as high as the 50 mW/cm² level proposed by Dr. Leonard Solon, the director of the City's Bureau for Radiation Control. The broadcasters, on the other hand, feel that the PA standard is far too stringent. Otis Freeman of WPIX, and a member of the TV Broadcasters All Industry Commitee—an organization of New York City's TV stations—says "100 is much too low." In Freeman's view, such a standard would interfere with the TV industry, disrupting the City's—and if applied generally, the nation's—communications system.

Attempting to meet its standard, the PA has kept the UHF stations (41 and 47) operating at only 50 percent power, and has turned away many other potential clients. Bass, the PA attorney, complained of losing a lot of money from unrented space as a result. He added that one of the UHF stations was lobbying the State legislature to force the PA into letting them turn up the power. Some, tired of the delays, are threatening to sue the PA for breach of contract.

In some ways the PA is a reluctant landlord. It agreed to house the antenna in 1967, but only after public reaction to TV interference that could have been caused by the WTC threatened to block the towers' construction. The PA wound up having

The south tower from the base of the master antenna on the north tower. In the foreground, various specialized communications antennas.





Master antenna on the north tower, flanked by receiving antennas.

to pay for moving the antenna downtown to the Empire State Building. As the WTC neared completion, however, the PA sought a review of its commitment. It was rejected by the Federal Communications Commission.

Two more TV stations (WOR-9 and WPIX-11) plan to move into the WTC by late March, and two more (WNBC-4 and WNET-13) by Labor Day. The dates for moving the five FM stations (WNYC, WPIX, WNEW, and WPAT) onto the master antenna have yet to be announced. WKCR will not go on the air until it is moved to another antenna, being built for the Coast Guard by Motorola.

TV Reception

The stricter the safety standard, the lower the broadcast power and hence the smaller the audience that can be reached. Ironically, stations threatened with losing their outlying markets due to weak signals also face troubles close to the antenna. As TV stations move to the WTC, viewer complaints follow. When WCBS moved, it began to receive 100 calls a day; people grumbled about fuzzy reception, ghosts, and poor color. Jim Baker, chief engineer at WABC, reports that his station heard from some 2000 disgruntled customers. WABC has since distributed 7500 pamphlets, "How to Improve Television Reception on Channel 7."

Part of the problem is that viewer antennas are still pointed towards the Empire State Building. Freeman of WPIX said that the biggest mistake was moving the stations piecemeal: They should have all gone to the WTC at the same time.

Local Apprehension

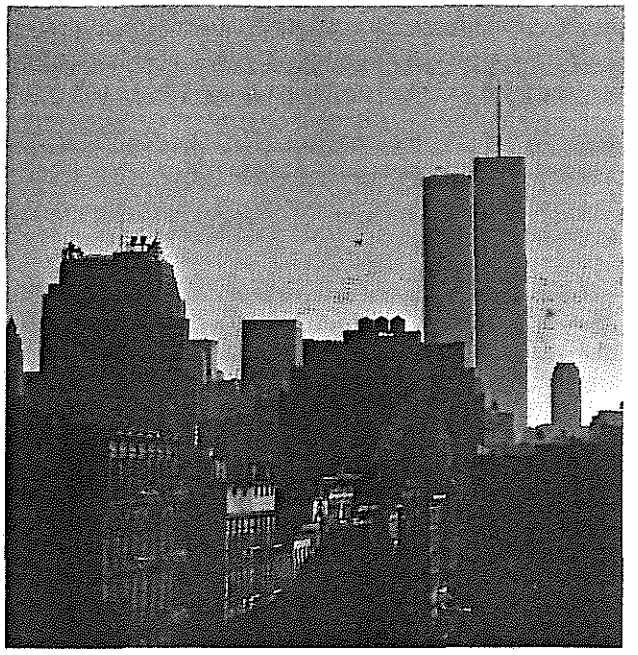
Meanwhile, residents living in neighborhoods near the WTC are worried about the potential threat of microwave radiation. On January 29, Community Board No. 1 in lower Manhattan sponsored a briefing session on microwaves. Some eighty residents heard the EPA's Feldman and a representative of Solon's Bureau for Radiation Control explain that the radiation levels emitted by the WTC antennas were very low. But one reaction from the audience summed up the prevailing attitude: "Do we have cause for concern or not? That is why we came here, the numbers don't mean anything to us."

* * * * *

This article very nearly became academic. According to news stories released February 26, an Argentinian Boeing 707 jet, with 58 people aboard, just missed crashing into the WTC mast last February 20. The jet was less than a minute and a half away from the bottom of the 350 foot mast (each of the towers is 1350 feet high), when an air traffic controller ordered it to turn and climb out of danger.

As we go to press, the PA has agreed to release the Silliman data to Microwave News. *They will be featured in the April issue.*

The World Trade Center, as seen looking south from lower Manhattan.



CONFERENCES

PROCEEDINGS

Now Available:

Thermal Characteristics of Tumors: Applications in Detection and Treatment, papers presented at a conference at the New York Academy of Sciences, March 14-16, 1979. Edited by Rakesh K. Jain and Pietro M. Gullino. *Annals of the New York Academy of Sciences, 335*, 1980.

•

The Mechanisms of Microwave Biological Effects, a report of a workshop held at the University of Maryland, College Park, Maryland, May 14-16, 1979. Edited by Leonard S. Taylor and Augustine Y. Cheung. Available free from the Office of Naval Research, Code 441, Arlington, VA 22217: enclose a self-addressed label.

•

Direct Broadcast Satellite Communications, a symposium conducted by the Board on Telecommunications-Computer Applications and the Space Applications Board on April 8, 1980. Available from the Space Applications Board, National Research Council, 2101 Constitution Avenue, NW, Washington DC 20418.

•

Health Hazards of VDUs?, a conference held on December 11, 1980. Available for £5 from the HUSAT Research Group, Department of Human Sciences, Loughborough University of Technology, The Elms, Elms Grove, Loughborough, Leics. LE 11 1RG, England.

CALENDAR

• April 13-15: Annual *Conference and Trade Show of the International Association of Satellite Users*, Washington Hilton Hotel, Washington DC. Contact: A. Fred Dassler, IASU, 6845 Elm Street, Suite 710, McLean, VA 22101.

• May 31-June 4: 29th Annual Scientific Meeting of the *Radiation Research Society*, Hyatt Regency Hotel, Minneapolis, MN. Contact: Office of the Executive Director of the Society, 4720 Montgomery Lane, #506, Bethesda, MD 20014.

• June 9-12: 16th Annual *Symposium of the International Microwave Power Institute*, Royal York Hotel, Toronto, Canada. Contact: IMPI, 211 East 43rd Street, New York, NY 10017.

• June 15-19: *IEEE and URSI Symposium*, Bonaventure Hotel, Los Angeles, CA. Sponsored by the Antenna and Propagation Society and the Microwave Theory and Techniques Society of the IEEE and four Commissions of URSI. Contact: IEEE, 245 East 47th Street, New York, NY 10017.

• June 27-July 2: 6th International Symposium on *Bioelectrochemistry and Bioenergetics* and 1st Meeting of the *International Bioelectrochemical Society*, Kibbutz Kiryat Anavim, Israel. Contact: Mrs. R. Goldstein, Secretary, Bioelectrochemistry Symposium, The Aharon Katzir-Katchalsky Center, The Weizmann Institute of Science, Rehovot, Israel.

• June 30-July 4: *International Symposium on Biomedical Thermology*, Palais de la Musique et des Congres, Strasbourg, France. Includes sessions on hyperthermia in cancer treatment (July 3) and bioelectromagnetics (July 1). Simultaneous translation in English, French, and German. Contact: Dr. M. Gautherie, Laboratoire de Thermologie Biomedicale, Faculte de Medicine, Universite Louis Pasteur, 11 rue Humann, 67085 Strasbourg, France.

• July 13-16: 10th *L.H. Gray Conference: The Biological Action of Radiofrequency, Microwave, and Ultrasonic Radiations*, Oxford England. Contact: Dr. G.R. ter Haar, Physics Division, F Block, Institute of Cancer Research, Clifton Avenue, Sutton, Surrey SM2 5PX, England.

• August 10-12: 3rd Annual *Bioelectromagnetics Society Meeting*, Washington DC. Contact: BEMS, P.O. Box 3651, Arlington, VA 22203.

• August 10-19: 20th *General Assembly of the International Union of Radio Science (URSI)*, Hyatt Regency Hotel, Washington DC. Includes a series on "Interaction of Electromagnetic Waves with Biological Systems," on August 13-14, chaired by Professor Saul Rosenthal of Polytechnic Institute of New York, and an "Open Symposium on Millimeter and Submillimeter Waves." Contact: Mr. Richard Y. Dow, Organizing Committee of URSI General Assembly, National Academy of Sciences, 2101 Constitution Avenue, NW, Washington DC 20418.

• August 19-21: 3rd Annual *Satellite Communications Users Conference*, Regency Hotel, Denver, CO. Contact: SCUC '81, Satellite Communications Magazine, 3900 S. Wadsworth Blvd, Denver, CO 80235.

• September 7-11: 11th *European Microwave Conference*, Amsterdam, The Netherlands. Contact: Microwave Exhibitions & Publishers Ltd., Temple House, 36 High Street, Sevenoaks, Kent TN13 1JG, England.

• November 9-11: 1st Annual Meeting of the *Bioelectrical Repair and Growth Society*, Philadelphia, PA. Contact: Executive Secretary of the Society, 425 Medical Education Building, 36th and Hamilton Walk, Philadelphia, PA 19104.

MICROWAVE NEWS is published monthly. • P.O. Box 1799, Grand Central Station • New York, NY 10163 • (212) 794-9633 • Editor: Louis Slesin, Associate Editor: Martha Zybko • Subscription: $165 per year (overseas $200) • © Copyright 1981 by Louis Slesin • Reproduction in any form is forbidden without written permission.

MICRO WAVE NEWS

Vol. I No. 4 A Monthly Report on Non-Ionizing Radiation April 1981

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NEXT MONTH

The report on the new ANSI standard and the Port Authority's data on radiation levels atop the World Trade Center, originally scheduled for this issue, will appear next month.

CORRECTIONS: March

- In the report on the World Trade Center, the proposed New York City population standard was mistakenly given as 50 mW/cm². The correct value is 50 uW/cm².
- In Cox's UK survey of VDTs, no UV radiation was detected at wavelengths *less* than 336 nanometers—not above 336 nm as originally stated.

MICROWAVE DEATH AWARD UPHELD IN COMPENSATION COURT, NY TEL APPEALS AGAIN

In a precedent setting decision, the Workers' Compensation Board of New York has upheld a previous ruling that Samuel Yannon, a New York Telephone Company radioman, had died of overexposure to microwave radiation. On February 26, the three member Board panel found that "there was a direct causal relationship between decedent's exposure to microwave radiation during his employment and his subsequent disability all of which ultimately resulted in his death." New York Telephone immediately filed another appeal, taking the case to the Appellate Court of New York for review. (See p. 5 for complete text of decision.)

The case, brought by Yannon's widow, Nettie, in 1974, is the first to successfully establish chronic exposure microwave radiation as a cause of death. Yannon spent the last 15 of his 42 years with the phone company adjusting microwave relay equipment on the 87th floor of the Empire State Building.

As a result of the February decision, New York Telephone has paid more than $29,000 in retroactive awards to Mrs. Yannon and will now pay her $45 a week for life, or until she remarries. (Yannon has already received the award, regardless of the appeal, as dictated by a New York State law.) "I never gave up," Mrs. Yannon says of her six-year case against the phone company. "They

(continued p. 4)

Navy May Scrap Project ELF

The Secretary of the Navy has recommended abandoning its controversial, extremely low frequency (ELF) submarine communications system, according to a spokesman for Michigan Senator Carl Levin.

The one-way communication system, known as Project ELF and previously named Project Sanguine and Project Seafarer, is designed to send messages to submerged submarines, especially during a nuclear war. The signal, with a carrier frequency of 76 Hz, would be transmitted by a large underground antenna. The Navy has been trying to find a site for the antenna since the late 1960's, but has met repeated opposition in Wisconsin, Texas, and Michigan. Democratic Senator Levin has been a long-time opponent of the project, and has sought to stop its construction in his home state.

In the past, the Navy has said that the ELF system is essential to the national defense. Now, however, the Navy is no longer in favor of the project because the system would be vulnerable to nuclear attack, according to James Crutchfield, press aide to Senator Levin. Critics have charged that the system is too expensive and may not work. Questions about the biological and ecological effects of the ELF signals have also been raised.

The latest recommendation was made in a letter from Navy Secretary John Lehman and Under-Secretary Robert Murray to Defense Secretary Caspar

(continued p. 8)

GOVERNMENT

BUDGETS

Key agency officials have indicated that non-ionizing radiation programs will not be badly hurt by the proposed Reagan-Stockman budget cuts—though as some noted, the programs were not large to begin with. Through a series of interviews, *Microwave News* compiled the following agency-by-agency analysis:

Bureau of Radiological Health: For FY81, Reagan cut the total BRH budget by $1 million to $26 million, while staff years were cut to 545 from 556. In FY82, staff years were down to 528 from 556 and the budget to $26.6 million from $27.8 million. According to Neil Goldstein, associate director for management and systems, these cuts must now be allocated among the various programs (e.g.: ionizing and non-ionizing radiation, ultrasound, nuclear medicine, etc...) The FY82 planning process has begun, and will be completed over the summer. Goldstein believed the cuts could be met by postponing certain contracts and by retirement and attrition. One early indication of the FY81 cuts is that the publication office has had to delay printing certain reports until FY82.

Environmental Protection Agency: (1) Office of Research and Development: Daniel Cahill's Division of Experimental Biology reports that the 10% reduction in staff and 1.5% budget cut from the original Carter FY82 budget will cause essentially no impact on the non-ionizing radiation technical program at Research Triangle Park. The total FY81 budget is $2.98 million (about $2 million for Cahill's Division). This will now be reduced to $2.94 million in FY82. Full time staff equivalents will go from 27.6 to 24.9. (2) Office of Radiation Programs: No positions were lost in the non-ionizing radiation group, although the office suffered a 35% staff cut, according to David Rosenbaum, deputy assistant administrator for radiation programs. (Non-ionizing radiation has about 6–10% of the staff.) While the Office's contract budget will be reduced to $2 million in FY82 from $8 million in FY81, this will not affect non-ionizing programs too much since they do not depend heavily on contracts, according to Dave Janes, chief of the electromagnetic radiation analysis branch. The Office's equipment budget will rise to $1 million in FY82 from zero in FY81. In sum, as Janes put it: "It doesn't look too bad."

Radiation Policy Council: The FY81 budget was cut from $942,000 to an estimated $600,000, and the FY82 budget of $980,000 was eliminated altogether, according to Carl Gerber, RPC director. The budget of the Council, which was set up after the Libassi report was released in 1979, may still be restored, but the decision will lie with the many high-level officials still to be nominated and appointed. While the RPC has focused almost exclusively on ionizing radiation, if it does survive, the budget cuts will no doubt block it from extending its work to non-ionizing radiation.

National Institute for Occupational Safety and Health: Reagan cut the FY81 budget to $64 million and 835 positions from Carter's proposed $83 million and 928 positions. The FY82 budget was further reduced to $59 million and 773 positions. These cuts have yet to be allocated among the various programs, and so their impact on the development of the MW/RF criteria document and Wordie Parr's Physical Agents Effects Branch in Cincinnati is still unknown. Institute priorities will not be set until a replacement for Anthony Robbins, who was fired by HHS Secretary Schweiker March 5, is in office.

Other Agencies: Spokesmen from the **National Bureau of Standards, the Office of Naval Research,** and the **Naval Medical R&D Command** could not say what the impact of the new budget would be. In each case, non-ionizing radiation is not a line item, and the outcome of the budget deliberations is some months away.

BRIEFS

The Interagency Regulatory Liaison Group (IRLG) published Volume II, Issue II of its *Regulatory Reporter,* dated December 1980, outlining EPA, FCC, FDA, NIOSH & OSHA's on-going and future activities on radiation control....The Frequency Management Advisory Council (FMAC) held a meeting in Washington on February 20. On the agenda were the SPS program, long-range spectrum planning, and FCC rules and regulations (Part 15) on radiofrequency devices....Recent contract awards: $254,179 to Bendix Field Engineering of Columbia, MD, from the Naval Research Lab in Washington for "microwave oceanographic sensing system tasks;" on January 30; $646,700 to a joint venture group of A.D. Ring & Associates, Jules Cohen & Associates, and DataWorld, all of Washington, DC, from the FCC for "conversion of AM station directional antenna radiation patterns to standard patterns;" on March 4; $112,134 to UCLA from DOE, Nevada office, for "microwave experimental simulations"; and $5,807,700 to Eaton Corp. in Farmingdale, NY, from NASA for the delivery of two microwave scanning beam landing system ground stations on February 13; $140,784 to the Franklin Research Institute in Philadelphia from the Bureau of Mines for the "study of RF hazards at low and medium frequencies to blasting in underground mines;" on February 18....The Naval Air Development Center in Warminster, PA, is looking for a contractor to design, fabricate, and deliver test panels of radar absorbing materials....Kirtland AFB in New Mexico is soliciting R&D proposals on "theoretical and analytical investigations and testing of equipment and facilities to effects of EMP phenomenon"....The building housing the non-ionizing radiation office of the Naval Medical R&D Command at the National Naval Medical Center in Bethesda was severely damaged by fire last February, forcing the office to move to another building in the compound. The new telephone number is (202) 295-0134.

MICROWAVE NEWS is published monthly. • ISSN 0275-6595. • P.O. Box 1799, Grand Central Station • New York, NY 10163 • (212) 794-9633 • Editor: Louis Slesin, Associate Editor: Martha Zybko • Subscription: $165 per year (overseas $200) • © Copyright 1981 by Louis Slesin • Reproduction in any form is forbidden without written permission.

UPDATE

VDTs....A bill specifying occupational safety and health requirements for VDT operators has been introduced in the Maine State Legislature. Legislative Document No. 1049 includes requirements for workplace conditions, eye tests and rest periods....*Health Hazards of VDTs? 2, "Some Solutions to the Common Problems",* a second HUSAT conference at Loughborough University, England, was scheduled for March 19. Indirect health effects from VDT use were on the agenda this time....Several presentations on VDTs are scheduled for the May 25–29 American Industrial Hygiene Conference in Portland, Oregon: J.S. Johnson on job stress in office work; R.H. Arndt on telephone operator reactions; and M.S. Gottlieb and co-workers, also on job stress—all from the University of Wisconsin; W. Loew from BRH on radiation emissions; and O. White, Jr. and E.J. O'Connell from Occupational and Environmental Health Analysts and H. Siegel and A. Blayer from the *New York Times* on a mass screening program. For conference information, contact Margaret Jordan, American Industrial Hygiene Association, 475 Wolf Ledges Parkway, Akron, OH 44311, (216) 762-7294.... Canada's Ministry of Labor has issued its report on radiation measurements from the VDTs used by Darlene Weiss, a government employee who is seeking workers' compensation for cataracts she believes are VDT related....WNYC-FM radio in New York City will air a series of five special reports on VDTs April 6–10. Station reporters Tom Vitale and Sandy Tolan interviewed a broad range of experts and workers on the workplace impact and possible health effects of the terminals ....VDTs can cause high-level strain, according to a recent *New York Times* story. On March 24, Edwin McDowell reported that Jimmy Carter "endured several hours of anxiety" when he accidentally erased several manuscript pages from his word processor's memory. The former President is writing his memoirs on a Lanier "No Problem" unit.

Health Effects....A British neurologist believes the flashing display of an electronic space war game, "Astro Fighter", is of a "size, brightness and frequency that can cause seizures in sensitive individuals." In a letter to *Lancet,* the British medical journal (February 28, 1981), D.N. Rushton of the Department of Neurology at King's College Hospital in London wrote that a "multicolored stroboscopic effect, flashing at about 15 Hz," provoked attacks in a 17-year old youth after 20–30 minutes of playing the game.

Around the Country....The Scientific Advisory Panel for New York State's study on the health effects of high-voltage power lines scheduled its first public meeting for March 23 in Albany....The National Park Service of the Department of Interior has prepared a draft environmental impact statement on the Appalachian Power Co. proposal to cross the Blue Ridge Parkway with a 765 kV electric transmission line. Copies available from the NPS, 75 Spring Street, SW, Atlanta, GA 30303, (404) 221-5835....New York City's transit authority cancelled plans to spend more than $500,000 designing a way to protect its ailing subway system from EMP radiation.

LETTERS

To the Editor: Your conclusion that the report of the BENER Task Force*, which I chaired, does not "seem to be a planning tool of the individual agencies involved in bioeffects research," [see *Microwave News,* January 1981, p. 3] is an editorial opinion, not a conclusion based upon careful investigation of the facts.

The process of writing the document was, in and of itself, a planning and coordinating exercise. Note, for instance, statements like the following (which refers to the assessment of occupational exposure):

> BRH will take the lead role in identifying and/or developing appropriate instrumentation and survey techniques. NIOSH has the lead role in the collection of exposure data to support epidemiological studies. OSHA and BRH will continue to conduct field surveys as part of their compliance programs. (p. 21)

Such statements give a clear indication of the roles that the various agencies do or do not plan to assume.

Several new efforts, called for in the task force document, are now underway. For instance, on p. 33, the task force recommended "Future research will need to explore functional and morphologic consequences of NER exposure with an emphasis on the development of quantitative dose-response data." The award of a contract by EPA for conducting such a study was announced on p. 4 of your newsletter. Similarly, the report concluded,

> Developing new or improved instruments for numerically characterizing electric and magnetic fields under near- and complex radiofrequency field conditions represents one of the most important needs in this area and will continue to receive major attention.

At the IMPI symposium, "The Washington Impact: How It Affects Microwave Users;"** Col. Winter announced, "The Navy is developing a personnel dosimeter which will measure and record important variables in an individual's RFR exposure." The National Bureau of Standards is participating in this effort.

I have also been told that the task force report is used by personnel within the federal agencies to demonstrate how their work fits into the larger, more cohesive, national program. In this way, scientists can demonstrate to budget examiners how their work supports the efforts of the larger group and meets the priorities agreed upon by representatives of 16 other federal agencies including the Office of Science and Technology Policy. A number of other uses were specified on p. 5 of the task force report.

In conclusion, I congratulate you on a fine start and thank you for the opportunity to "set the record straight." Finally, I will admit that the report of the BENER Task Force could be an even more effective planning tool if it were to receive a broader distribution.

Howard E. Clark, Ph.D.
Scientific Adviser
Electromagnetic Radiation Hazards
Electromagnetic Fields Division
National Bureau of Standards
Washington, DC 20234

*"Nonionizing Electromagnetic Radiation Safety, A Program of Coordinated Federal Activities Related to Biological Effects of Nonionizing Electromagnetic Radiation (0–300 GHz)," NTIA-SP-80-7, available from Office of Public Information, National Telecommunications and Information Administration, 1800 G Street, NW, Washington, DC 20504.

**Proceedings available from the International Microwave Power Institute, 211 East 43rd Street, New York, NY 10017. $40 for members, $50 for nonmembers.

(continued from p. 1)

wanted me to say there was no connection between Sam's illness and microwaves, but that just wasn't true!"

Speaking from her home in Staten Island, New York, Mrs. Yannon says she expected the appeal victory after the initial favorable ruling by Administrative Law Judge Mary Egan on June 12, 1980. Egan found that Yannon had "sustained an occupational microwave radiation disease...resulting in brain changes, tissue destruction and an acceleration of arteriosclerosis, whose etiology was the exposure to the harmful effects of microwave radiation." Asked about the phone company's latest action she said, "It might take years, but the truth will prevail."

Mr. Angelo Gucciardo, who represented Mrs. Yannon before the Workers' Compensation Board anticipated this appeal and is confident the ruling will be upheld again.

A spokesman for New York Telephone would not comment on the case, beyond confirming the appeal.

RCA Suit

In addition to her case against the phone company, Mrs. Yannon has also brought a third party suit against the RCA Corporation, the manufacturer of relay equipment Yannon used at the Empire State Building. The $3.5 million suit, filed in 1976 in the New York State Supreme Court, Richmond County, charges RCA with breach of warranty and negligence. Mrs. Yannon's lawyer, David Paully, who recommended workers' compensation specialist Gucciardo to her, says the February ruling will be extremely helpful in their action against RCA. This suit, now in pre-trial proceedings, involves a very different burden of proof, however, and may require years to complete.

Neither Donald Dietemann, the RCA attorney handling the case, nor Bower and Gardner, the law firm representing RCA, would comment on the case. However, Mrs. Yannon reports that RCA asked New York Telephone for transcripts of all the hearings in the compensation suit. When the phone company refused to cooperate, Gucciardo agreed to supply them. He also allowed *Microwave News* to review these records, which are otherwise accessible only to concerned parties at the Workers' Compensation Board offices at Two World Trade Center in New York City.

Working At the Empire State Building

During the hearings, Daniel Rieu, a colleague of Yannon's at the phone company, described the 87th floor facilities and the work schedule. (See p. 6 for list of hearing witnesses.) Yannon was there almost continuously from 1954 to 1969. "No one had ever worked up there as long as Sam Yannon," he said. Other employees, including Rieu, had only brief tours at the Empire State Building.

Radiomen spent part of each shift adjusting low power (mostly one watt) transmitters mounted in a separate room on the 87th floor. The number of transmitters operating at any one time varied, but Rieu guessed there were two or three on average, and occasionally as many as 15. Adjustment required removing the rear housing on a unit and tuning the Klystron tube, which converts direct current into RF current. Sometimes a man had to stand in front of a transmitter, but according to Rieu, procedural instructions required cutting off the power before stepping in front of the transmitter dish and into the beam path.

From the hearing testimony, it is unclear exactly what equipment Yannon tuned over the years. RCA transmitters installed after his departure operating at 6 GHz and 11 GHz were similar to previous ones, according to phone company engineer Robert Vuono, but no detailed description of earlier equipment was entered into the record.

Conflicting Diagnoses

Nettie Yannon says her husband began to complain about headaches in 1964. He continued to work his usual long hours, but by 1968 he was persistently plagued by fatigue, eye trouble, sleep problems, forgetfulness, and clumsiness. By the time Dr. Alfredo Santillo of Staten Island examined Yannon in June 1970, he was physically and mentally disoriented. Yannon was unable to write his own name or to recognize his wife, he had very poor vision, and he had lost 30 of his usual 160 pounds. In his testimony before the Board, Santillo said he soon realized that this case "was in a field all by itself." Yannon, at 58, was too young to fit into the category of advanced cerebral arteriosclerosis, a diagnosis Santillo had initially reached.

The phone company terminated Yannon for medical reasons in the same month as Santillo's first examination. Thereafter, his condition rapidly deteriorated. By his death in 1974, Yannon, aged 62, weighed under 70 pounds and had lost almost all sight, memory, speech, and motor coordination. Santillo remained Yannon's doctor until 1973 and finally diagnosed his condition as "chronic brain syndrome with psychotic overtones due to biological brain changes resulting from prolonged exposure to short wave radiation."

New York Telephone has maintained throughout the compensation case the Yannon suffered from retinitis pigmentosa, or pigmentary degeneration of the retina, and pre-senile dementia, probably Alzheimer's disease—a common cause of senility. Neither ailment is known to be associated with microwave radiation. To support this claim, Professor Sol Michaelson and Dr. Robert Herndon from the University of Rochester School of Medicine, and Dr. Paul Tyler, director of the Armed Forces Radiobiology Research Institute, testified for the phone company. "I can find no evidence to suggest that [Yannon's] illness was unusual or mysterious," Herndon said, "and nothing to suggest it was due to microwave irradiation."

Testifying for Mrs. Yannon, Dr. Milton Zaret, a well-known New York ophthalmologist and controversial expert on microwave radiation, supported Santillo's diagnosis. He had no doubt after examining the medical records that Yannon suffered from "an extreme case of microwave radiation sickness, and that it resulted ultimately in his death."

The only neurologist to perform tests on Yannon did not make a definitive diagnosis. In 1969 Dr. Martin Geller, then at St. Vincent's Hospital in Staten Island, examined Yannon. According to Gucciardo, Geller's report suggested looking in-

to Yannon's exposure to microwave radiation for a possible link to his illness. Geller was not called to testify and the phone company's lawyer did not contest Geller's report.

No Exposure Data

The lack of data on the radiation levels at the Empire State Building during Yannon's tenure there, as well as the difficulty of diagnosing his condition, presented problems for both sides of this case. No measurements were taken on the 87th floor prior to Yannon's death. Finally, in 1975 at the request of Mrs. Yannon, Bell Labs helped the Occupational Safety and Health Administration take measurements. But by this time all the equipment Yannon worked on had been replaced. It is now impossible to determine how much radiation Yannon received.

Although the Yannon decision is not the first workmen's compensation award for microwave radiation health damage, Yannon's is the first death attributed to microwaves by a Compensation Board.

Text of Appeal Decision

The self-insured employer seeks review of the Workers' Compensation Law Judge (Referee) decision filed 6/18/80 insofar as findings are made that the decedent sustained a causally related occupational microwave radiation disease within the meaning of Paragraph 30, Section 3, Subdivision 2 of the Workers' Compensation Law, notice and causally related death, and from the awards made pursuant to such findings. The self-insured contends that the decedent suffered from Alzheimer's Disease which was not demonstrated to be occupationally induced and that based on the evidence, the decision in both cases should be rescinded in toto and the claims dismissed.

Case #2308 was indexed on behalf of claimant for exposure to radiation with a subsequent claim filed by widow (case #3602) for death in connection with radiation exposure. Dr. Santillo testified that he treated claimant from 6/24/70 to 2/20/73 with an original diagnosis of premature senility that upon final diagnosis he felt was caused by prolonged exposure to microwaves. Dr. Santillo stated his diagnosis was based on his own questioning and research in medical literature which showed that a hazard exists when working near microwaves, and debilitation can occur. Dr. Santillo stated at time he first saw claimant, he had lost 30 lbs; was unable to care for himself and had almost complete removal of memory and said while there was no test he could carry on the claimant, he felt condition was perhaps very strongly related to microwaves. Dr. Shaner, testifying from N.Y. Telephone Company medical records for the claimant, stated that original diagnosis received from claimant's treating physician was left homonymous hemianopsia with possible disease of the right eye, with a final diagnosis of bilateral encephalopathy (dissection of the brain) degenerative with no evidence whatsoever of any job relationship. Dr. Shaner stated her research showed any exposure severe enough to cause internal damage due to excessive heat would cause so much heat to surface of the skin that person would not stay in the area but admitted her medical experiences were limited to the N.Y. Telephone Company and she was not conversant with any foreign research on the subject of microwave exposure.

D. Rieu, Radioman, testified he worked same job as claimant from May 1955 tuning microwave equipment varying from 2/3 to over 15 microwave lengths at one time. Rieu testified that one would have to go up to unit and open a door to tune the unit inside or walk between a glass area and the dish to fix a feedhorn. Rieu stated that claimant worked an exceptionally long number of years compared to other craftsman in the group; that claimant also worked a good bit of overtime during that time; that he noticed a deterioration of sight, hearing and coordination in claimant and said that Radiomen are issued a sheet cautioning them about the hazards of the equipment. Dr. Santillo on retestimony stated nothing he heard of Mr. Rieu's testimony causes him to change his opinion.

R. Vuono, Sr. Staff Engineer, testified that he had over 24 years experience with microwave irradiation; that he is experienced with physical set up of the facility and that there is a difference between emission and exposure; pointed out the range of emission (power output) from radar (high) to microwave radio used in T.V. pick-up (low); stated that the equipment in use would not produce a power output greater than 1.5 watts and that studies in the U.S. show there is no cumulative effect of even 10 milliwatts and continuous exposure.

C. Hinson, Service Foreman, testified that he worked with claimant as a co-worker; agreed that claimant would be close to a machine about 2-3 times a day, 20 minutes each time; that claimant would be in same room as transmitters about one-half of each day and that for each signal received a transmitter was used. Hinson testified that shields were removed when they were being adjusted; that he did not believe levels that were transmitted could damage one's body but admitted he would not stand in front of one.

O. Tamuzs, NYS Sr. Radiological Health Specialist, testified his testing found radiation levels within Federal guidelines permitted (10 milliwatts per square centimeter permitted; 9 milliwatts per square centimeter found), but admitted some of the information his report was based on was given by Phone Company personnel and that machines were not working except for his testing purpose.

Dr. Zaret testified that in his field of ophthalmology, he performed studies for various departments of the U.S. Government on the effects of exposure of microwaves on the ape, primates, etc. Dr. Zaret testified that the standard accepted by the Federal Government had become void in 1971 and revalidated without further study in 1973; that Soviet standard is around 1,000 times less than U.S. standard and that studies involving microwaves and apes showed some monkeys were being killed at lower intensity than anticipated. Dr. Zaret stated, in answer to a hypothetical question incorporating claimant's work history, activities and autopsy findings, that claimant suffered an extreme case of microwave or radiowave sickness which resulted ultimately in his death. Dr. Zaret stated direct action is one of the two ways microwave radiation can produce the kind of brain damage claimant exhibited and said there are Soviet and American studies documenting this. Dr. Zaret, on retestimony, stated that while claimant's physician's diagnoses were similar in some degree to other conditions, he agreed with Dr. Geller's findings of degenerative disease attributed in some form to microwave exposure.

Dr. Michaelson testified that he is a Doctor of Veterinary Medicine and a Professor of Radiation, Biology and Biophysics; that based on his research with the biologic effect of microwave exposure that there is no reason to believe there is a cause/effect relationship between the injury and microwave frequency exposure. Dr. Michaelson stated safety factor standards were based on some information related to functional change in animals and said that his opinion was based on his review of those records and depositions made available to him. Dr. Michaelson testified he disagreed with the findings of the Bureau of Radiological Health which analyzed and criticized his findings because of lack of adequate evidence to substantiate the conclusions.

Dr. Hendon testified he reviewed claimant's records and concluded that he suffered from retinitis pigmentosa and pre-senile dementia, probably Alzheimer's Disease. Dr. Hendon stated that based on his reading and research work, he finds no material indicating a relationship between microwave exposure and Alzheimer's Disease or cataract

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formation or causal relationship between claimant's work and his disability or death. Dr. Hendon stated he was associated at same school as Dr. Michaelson; was suggested by him as a consultant in the case and had discussed it with him prior to testifying and admitted he had no personal exposure to people who were alleging exposure to or damage from microwaves.

Dr. Tyler testified that he is qualified in radiobiology as a specialist; that he reviewed all records made available to him and agreed with autopsy report which gave immediate cause of death as bilateral lower, low bronchial pneumonia with secondary findings of pre-senile dementia, retinitis pigmentosa and generalized arteriosclerosis. Dr. Tyler stated that retinitis pigmentosa is found with some degenerative diseases of the brain but he found no medical literature associating it with pre-senile dementia; that he finds no relationship between claimant's microwave exposure and diseases found and that he disagrees with Dr. Zaret's diagnosis. Dr. Tyler stated that his clinical impression was claimant had Alzheimer's Disease although it was possible there were two other types of brain disease similar to the above. Dr. Tyler admitted that there was a book in print critical of himself and accusing him of conducting a coverup for Defense Department in relation to microwave exposure and that Dr. Geller, a neurologist, did not diagnosis Alzheimer's Disease in the claimant. Dr. Michaelson, on retestimony, identified studies done by an ad hoc review committee on which he sat which found part of Dr. Zaret's experiments as adequate and part not well done. Dr. Michaelson admitted that he had been contacted by claimant's widow and had recommended that claimant's attending physician would be in best position to give an answer as to causal relationship.

Upon review the Board Panel finds based on the entire record and particularly the testimony of D. Rieu and Drs. Santillo and Zaret, that there was a direct causal relationship between decedent's exposure to microwave radiation during his employment and his subsequent disability all of which ultimately resulted in his death. The Board Panel further finds that the decedent sustained an occupational microwave radiation disease within the meaning of Section 3, Subdivision 2, Paragraph 30 of the Workers' Compensation Law and that his death was causally related to his occupation.

Accordingly, the Workers' Compensation Law Judge (Referee) decision filed 6/18/80 is AFFIRMED and the case is continued.

All concur.

Francis J. Griffin Daniel J. Higgins Ferdinand Tremiti

Workers' Compensation Board

New York City February 26, 1981

Witnesses at the Yannon Workers' Compensation Board Hearings

(In order of appearance.)

Dr. Alfredo Santillo, Staten Island, New York

Dr. Alice Shaner, Medical Specialist, New York Telephone Company

Daniel Rieu, Radioman, New York Telephone Company

Robert Vuono, Senior Staff Engineer, New York Telephone Company

Charles Hinson, Service Foreman, New York Telephone Company

Olgerts Tamuzs, Bureau of Radiological Health, White Plains Regional Office, New York State Department of Health

Dr. Milton Zaret, Scarsdale, New York

Dr. Sol Michaelson, Professor of Radiation Biology and Biophysics, University of Rochester

Dr. Robert Herndon, Center for Brain Research, University of Rochester

Dr. Paul Tyler, Director of Armed Forces Radiobiology Research Institute

LITIGATION

Collecting information on current and past cases involving microwave radiation is difficult: most defendant companies and plaintiff attorneys refuse to comment on on-going litigation, and many cases are settled out of court, leaving few records. Filed complaints are a matter of public record and many plaintiffs and defendants were willing to confirm official details.

A spokeswoman for Western Electric, which has three cases pending, issued a statement to *Microwave News,* stating in part: "We will defend ourselves, and deny the equipment was hazardous and that the equipment caused the injury." She would not comment, however, on the Imoto case, which was settled out of court, saying that this was company policy for cases where more than one company was involved.

The litigation survey presented below was collected during the last couple of months. While we have no reason to doubt its accuracy, because of the secrecy surrounding these matters, we advise the interested reader to check with the attorneys and corporations listed in the appended directories.

Air Traffic Controllers: Young has settled four claims of air traffic controllers with job-related cataracts under the Federal Employees' Compensation Act, winning substantial awards. Eight more cases are pending, seven cataract injuries and one non-operable eye disability. Young's clients are from all over the country.

Ovens: Two women, who claim to have been burned by a microwave oven while working in a restaurant in Spokane, Washington, are suing Litton for $3 million. They are represented by Deglow and Belli.

Moscow: A number of suits have been filed against the US government over the irradiation of the US embassy in Moscow. Two attorneys believed to be handling some of these cases are Hills (see *Microwave News,* January 1981) and Peery.

Radar: Suits over microwave-related injuries are the most common type of litigation. Among the plaintiffs were and are:

- Robert Barbee, a former radar repairman with cataracts, represented by Leavitt, filed a complaint against Bendix, GE, Raytheon, and RCA in federal court in Nevada in November 1979, and against Western Electric in March 1980. Barbee is seeking $500,000 in damages and $5 million in punitive damages.
- Stanley Burgis, a former M-33 radar technician represented by Stopford, alleges microwave-induced cataracts and retina damage in a products' liability claim against Western Electric filed in Pennsylvania state court in summer 1980 (later moved to federal court in eastern Pennsylvania). According to Stopford, Burgis is now blind.
- Robert Engell, a TACAN radar repairman from 1964 to 1975, represented by Moller and Shafner, alleges microwave-induced pancreatic cancer and endocrine disorders. The $4.5 million suit against General Dynamics, ITT, Raytheon, Rockwell, Teledyne, and Varian was filed in federal court in Hartford in 1977 and is still in discovery. A jury trial is due to begin soon.
- William Farnham, represented by Ellison, alleges microwave-induced cataracts sustained aboard USAF aircraft in a complaint against Hughes, Northrop, and Rockwell filed in state court in San Francisco in October 1978.

- Leo Foley, represented by Ellison, alleges radar induced cataracts while aboard an EC-121 constellation in a complaint against GE, Hazeltine, Hughes, Lockheed, Philco-Ford, Raytheon and Telerad-Lionel filed in state court in Sacramento in April 1979.
- Tobias Imoto, a former radar maintenance man represented by Davidson, settled a case out of court against GE, Raytheon, and Western Electric, alleging cataracts as well as skin and brain disorders.
- Roy Josey, represented by Sweeney, developed bilateral posterior subcapsular cataracts after working on radar development at Elgin AFB for Bendix. The AF settled out of court for $171,000 in 1971, with Bendix making a substantial contribution. Josey also won a workers' compensation claim for about $20,000. Five years later Josey, aged 38, died of a brain tumor.
- Ronald Karras, a former radar repairman represented by Phillips, suffers from multiple, serious injuries. While there are reports that this case was just settled out of court, repeated calls to Phillips for confirmation were not returned.
- Joseph Kerch, a pilot for Air America from June 1965 to June 1974, has a case represented by Shafner before a Department of Labor administrative law judge alleging a radiant energy cataract as well as hearing loss. Briefs were filed in December 1980.
- Glenn Lough, represented by Ellison, alleges radar-induced cataracts in a complaint filed against ITT, Raytheon, Sperry Rand, and Western Electric in state court in San Francisco in late 1978.
- Don Turner, represented by Ellison, alleges cataracts sustained aboard US aircraft in a complaint against Hughes, Lockheed, McDonnell Douglas, and Northrop filed in state court in San Francisco in May 1978. The case has since been moved to Los Angeles.

In addition, Spears has just abandoned a case against RCA and Western Electric, alleging radar-induced ocular damage. Leonard and Lyons are both considering bringing legal action. Leonard represents a former B-47 crew chief, who believes he was badly injured by an electronic countermeasure jamming device. Lyons's client is a former EC-121 radar operator, who has assorted serious injuries.

Lyons is interested in forming a bar group for the attorneys representing the victims of radar and microwave injuries.

CORPORATE DEFENDANTS IN MICROWAVE CASES

Air America
Bendix
Ford Motor (Philco Division)
General Dynamics
General Electric
Hazeltine
Hughes Aircraft
ITT (ITT Electron Tube Division)
Lionel (Telerad Division)
Litton
Lockheed
McDonnell Douglas Aircraft
Northrop Aviation
RCA
Raytheon
Rockwell International
Sperry Rand
Teledyne
Varian Associates
Western Electric

DIRECTORY OF PLAINTIFF ATTORNEYS WORKING ON MICROWAVE CASES

Melvin Belli
722 Montgomery Street
San Francisco, CA 94111
(415) 981-1849

Keith Davidson
Louis Davidson & Associates
111 West Washington Street
Chicago, IL 60602
(312) 372-5124

Riner E. Deglow
The Grace Building
North 901 Adams
Spokane, WA 92201
(509) 328-6770

Seymour L. Ellison
1005-1045 Sansome Street
San Francisco, CA 94111
(415) 392-1884

Angelo Gucciardo
Israel, Adler, Ronca & Gucciardo
160 Broadway
New York, NY 10038
(212) 227-1350

John Parker Hills
PO Box 186
Upper Marlboro, MD 20870
(301) 627-8170

Brent E. Leavitt
Leavitt, Graves & Leavitt
229 Las Vegas Boulevard South
Las Vegas, NV 89101
(702) 384-3963

Richard Leonard
Leonard, Prolman & Leonard
5 Prospect Street
Nashua, NH 03060
(603) 883-0928

James F. Lyons
Nixon, Nixon, Lyons & Douglas
225 Main Street
PO Box 368
Bonners Ferry, ID 83805
(208) 267-3133

Marc Moller
Kreindler & Kreindler
99 Park Avenue
New York, NY 10016
(212) 687-8181

David J. Paully
56 Bay Street
Staten Island, NY 10301
(212) 447-6820

Charles E. Peery
Preston, Thorgrimson, Ellis & Holman
2000 IBM Building
Seattle, WA 98101
(206) 623-7580

John Phillips
180 North LaSalle Street
Room 2630
Chicago, IL 60601
(312) 346-4262

Matthew Shafner
O'Brien, Shafner, Bartinik, Stuart & Kelly
Bridge Street at Route One
PO Drawer 929
Groton, CT 06340
(203) 445-2463

Michael Spears
Swofford, Proliakoff, Spears & Skeen
251 Magnolia Street
Spartanburg, SC 29301
(803) 582-5472

Jeffrey M. Stopford
Litvin, Blumberg, Matusow & Young
210 West Washington Square
Philadelphia, PA 19106
(215) 925-4500

John E. Sweeney
800 West First Street
Plaza Level
Los Angeles, CA 90012
(213) 620-0401

Robert G. Young
Webb, Young, Daniel & Murphy
1901 Peachtree Center, Cain Tower
229 Peachtree Street, NE
Atlanta, GA 30303
(404) 522-8841