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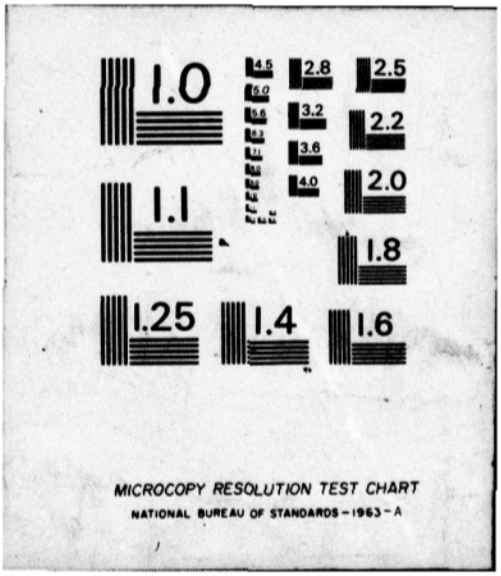
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Biological Effects of Nonionizing Electromagnetic Radiation

VOLUME I
NUMBER 1
OCTOBER, 1976

A DIGEST OF CURRENT LITERATURE

A Quarterly Publication
Produced for
Office of Telecommunications Policy
and
United States Navy

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Bruce H. Kleinstein, Ph.D., J.D.
Elena P. Saboe

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Biological Effects of Nonionizing Electromagnetic Radiation is a publication researched and prepared by the Franklin Institute Research Laboratories, under a contract with the U.S. Navy and administered by the Office of Telecommunications Policy.

This digest serves as a vehicle through which current documentation of research highlights on the biological effects and health implications of nonionizing electromagnetic radiation (microwave and radiofrequency radiation) are compiled, condensed, and disseminated on a regular basis. It is intended to be a highly useful current awareness tool for scientists engaged in research or related activities. The great number and diversity of relevant publication make imperative the availability of this service to persons whose work requires that they keep abreast of current developments in the field.

Biological Effects of Nonionizing Electromagnetic Radiation is published quarterly. The issues of Volume 1, and future volumes, will include materials received during the preceding three months. Each issue will include news items and announcements, a listing of meetings and conferences, abstracts of current literature, and a directory of current research. Materials for which full text is not available will be included as summary abstracts.

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Elena P. Saboe

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by
Biomedical Group, Science Information Services Department

Bruce H. Kleinstein, Ph.D., J.D., Project Manager
Elena P. Saboe, Production Manager, Editor

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BIOLOGICAL EFFECTS OF NONIONIZING ELECTROMAGNETIC RADIATION

October, 1976 Volume 1, Number 1

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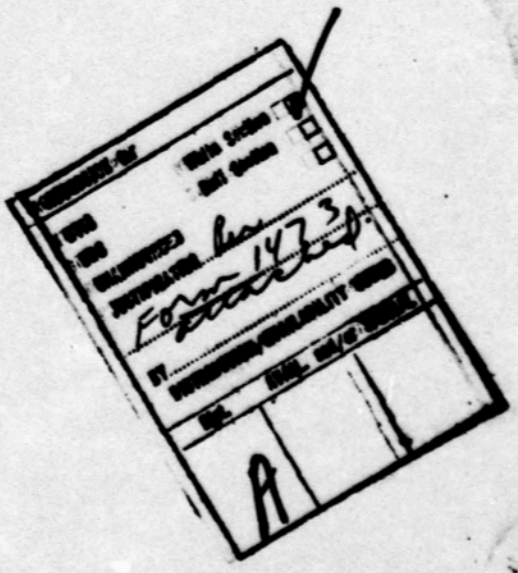
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PREFACE

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ABBREVIATIONS AND ACRONYMS

A, amp - ampere
BRH - Bureau of Radiological Health
C - centigrade
cm - centimeter
cps - cycles per second
dB - decibel
EPA - Environmental Protection Agency
ERDA - Energy, Research and Development Agency
FDA - Food and Drug Administration
g - gram
G - Gauss
GHz - gigahertz
HEW - Health, Education, and Welfare
hr - hour
Hz - hertz
IEEE - Institute of Electronic and Electrical Engineers
IMPI - International Microwave Power Institute
IU - international units
J - joule
k - kilo--
l - liter
m - meter
m - milli--
M - mega--
mho - unit of measurement of conductivity
min - minute
mo - month
NBS - National Bureau of Standards
NIH - National Institutes of Health
nm - nanometer
NSF - National Science Foundation
NIOSH - National Institute for Occupational Safety and Health
NTIS - National Technical Information Service
Oe - oersted
OSHA - Occupational Safety and Health Administration
OTP - Office of Telecommunications Policy
PHS - Public Health Service
rad - radiation absorbed dose
R - Roentgen
rpm - revolutions per minute
sec - second
UHF - ultra high frequency
USAFSAM - U.S. Air Force School of Aerospace Medicine
USDA - U.S. Department of Agriculture
UV - ultraviolet
VA - Veterans Administration
W - watt
WHO - World Health Organization
wt - weight
yr - year

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NEWS ITEMS

WHAT LEADS A TERMITE THROUGH A MAGNETIC FIELD?

Dr. Gunther Becker, one of the world's leading experts on termites claims that termites possess a natural ability to detect weak electric and magnetic fields. This ability would account, in part, for termites' remarkable social organization. A reaction to the earth's magnetic field has been suspected for some time, since it has been observed that certain termite mounds are flattened vertically along an E/W direction. To demonstrate the influence of alternating magnetic fields on termites, Becker placed a small plastic container of termites more than 3 m away from a room heater generating a 50 Hz field. Although the field was of such low intensity that it could only be measured up to 10 cm from the source, the termites built vertical galleries at the edges farthest away from the source. The termites must therefore have been able to perceive the minute differences in the strength of the alternating magnetic field within the confines of their container. Another experiment showed that termites can influence each other by their own "biofields". Becker demonstrated that termites were able to communicate through 5 mm of plastic foam but could not communicate when shielded by 5 mm of aluminum. Becker believes biofields are probably alternating electric fields enabling termites to construct galleries at the borders of nesting areas where the insects need to forage. Such biofields would enable termites to avoid serious competition for food. Becker's research poses the question as to whether one could put a magnetic field around a house to protect it from termite damage.

New Scientist 71(1014): 391; 1976

MICROWAVE EXPOSURE LEVELS FROM MARINE RADAR EVALUATED

The Division of Electronic Products of the Bureau of Radiological Health has conducted a study of the range and magnitude of microwave radiation exposure resulting from marine radar units used on small pleasure boats. Investigators surveyed 33 marine radar units in actual use and compiled information concerning 43 different models. Laboratory measurements were performed in the Division's anechoic chamber, and calculated emission levels were compared with experimentally measured values. According to a recently published report on the study, personnel exposure to microwave emissions from the radar units probably will not exceed 1 mW/cm^2 average power density under normal operating conditions. However, significantly increased emission levels might be encountered if a unit is operated with the antenna rotation stopped. The report recommends that exposure under such conditions be avoided. Another finding was that instantaneous peak microwave emissions in the region surrounding the antenna might be quite high. Although any possible biological hazards associated with these emission levels are uncertain at present, the possibility of interference phenomena in critical devices, such as cardiac pacemakers, seems to warrant caution. Therefore, the report suggests that care be exercised to limit the unnecessary use of marine radar in areas of high population density--for example, when docked in harbor. The U.S. Coast Guard has reviewed the report and has agreed to a program of cooperation with the Bureau on the safety aspects of marine radar. The report is available from the National Technical Information Service, as indicated under "New Bureau Publications."

BRH Bulletin 10(1): 3-4; 1976

VISITING SCIENTIST JOINS BUREAU STAFF

Dr. Przemyslaw Cerski has accepted an appointment with the Bureau of Radiological Health to work with the Division of Biological Effects on a program to determine the effects of microwaves on the blood-forming system. He comes to the Bureau from Poland's National Research Institute of Mother and Child where he is a Professor of Genetics and Head of the Department of Human Genetics. This department has been designated a World Health Organization Collaborating Center for Bioeffects of Nonionizing Radiation, and Dr. Czerski serves as the Center's Head. He also has served as adviser on nonionizing radiation protection to the Polish Ministry of Health and Social Welfare.

BRH Bulletin 10(1): 2; 1976

MICROWAVE SAFETY LEVEL STILL TOO HIGH?

In experiments performed for the Environmental Protection Agency, Dr. Andrew Huang of Duke University Medical Center has detected changes in the white blood cells of hamsters exposed to microwave doses as low as 5 mW/cm^2--half the maximum dose set by Food and Drug Administration regulations for microwave ovens. Huang exposed hamsters to 15 minutes of microwave radiation (at 2.45 and 9.00 GHz) per day for seven days. The ability of the animal's lymphocytes to transform into antibody forming cells, when stimulated in the test tube, was impaired by the microwave radiation. This preliminary experiment raises the possibility that the immune response of hamsters to infection is likely to be decreased as a result of microwave radiation exposure. Huang has become seriously concerned about the safety of the rapidly growing number of microwave ovens now being sold in the U.S. He believes that if what he finds true in hamsters is true in humans, existing ovens could pose a potential threat in the home. Ironically, the radiation levels in a typical kitchen equipped with a microwave oven far exceed those recently beamed into the U.S. Embassy in Moscow, which, it was feared, endangered the health of Embassy employees.

New Scientist 69(987): 323; 1976

EFFECTS OF MICROWAVE ON THE NERVOUS SYSTEM

A contract in the amount of $176,065 has been awarded to the University of Utah, Salt Lake City, by the National Institutes of Health, Bethesda, Maryland, to study the effects of chronic exposure to low intensity (5 mW/cm^2) microwave radiation on rat behavior, EEG, and blood and urine biochemistry. The animals will be irradiated eight hours per day, in five-day per week sessions at 915 and 2450 MHz. The project, under the direction of Dr. Om Gandhi, will try to answer questions on the disparate safety levels of radiation followed in the U.S. and the Eastern-block countries. The work will be performed jointly with the University of Washington, Seattle.

Utah Bioengineering Newsletter 3(5): 1-2; 1976

ITEMS FROM THE COMMERCE BUSINESS DAILY

☐ **FURTHER RESEARCH ON THE NEUROPHYSIOLOGICAL AND BEHAVIORAL EFFECTS OF CONTINUED WAVE AND PULSED MICROWAVES IN RODENTS AND OTHER LABORATORY ANIMALS.**

The Office of Naval Research, Arlington, Virginia, has contracted with the Board of Regents of the University of Washington, Seattle, for the above study. (January 30, 1976)

☐ **INVESTIGATION OF ELECTRIC FIELDS.**

The National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Texas, has contracted with the Stanford Research Institute, Menlo Park, California, for the above study. (August 11, 1976)

☐ **EXPANSION OF STUDY ON THE EFFECTS OF MICROWAVE RADIATION ON THE CENTRAL NERVOUS SYSTEM.**

The Department of Health, Education, and Welfare, Food and Drug Administration, Rockville, Maryland, has contracted with George Washington University, Washington, D.C., for the above study. (July 21, 1976)

☐ **RESEARCH ON MICROWAVE BIOTISSUES.**

The University of Maryland, College Oaks, will perform the above study. (July 2, 1976)

MICROWAVE/RADIOFREQUENCY BIOEFFECTS BIBLIOGRAPHY

The eighth supplement to the "Bibliography of Reported Biological Phenomena ('Effects') and Clinical Manifestations Attributed to Microwave and Radio-Frequency Radiation," published in August 1976, is available from the National Technical Information Service (Springfield, VA 22151) as AD 734-391. This report, prepared by Dr. Zorach R. Glaser and Patricia F. Brown of the Naval Medical Research Institute Detachment, Naval Surface Weapons Center/Dahlgren Laboratory, Dahlgren, Virginia, contains approximately 350 references. Particular attention is paid to the effects of microwave and radiofrequency radiation on man.

AD 734-391; August 1976

MEETINGS AND CONFERENCES

OPERATIONAL HEALTH PHYSICS SYMPOSIUM

Date: February 9-12, 1976
Place: Denver, Colorado
Sponsor: Health Physics Society
Requests for Information: Mr. J. B. Martin, P.O. Box 3229, Boulder, Colorado 80303

MICROWAVE POWER SYMPOSIUM 1976

Date: July 27-30, 1976
Place: Louvain, Belgium
Sponsor: International Microwave Power Institute
Requests for Information: Mr. V. Decareau, P.O. Box 247, Amherst, New Hampshire 03037

EUROPEAN MICROWAVE CONFERENCE

Date: September 14-17, 1976
Place: Rome, Italy
Sponsor: Italian Association of Electrical and Electronics Engineers
Requests for Information: Microwave Exhibitions and Publishers Ltd., Temple House, 36 High St., Sevenoaks, Kent TN13 1JG, England

INTERNATIONAL IEEE ANTENNAS AND PROPAGATION SYMPOSIUM

Date: October 11-15, 1976
Place: Amherst, Massachusetts
Sponsor: IEEE, URSI
Requests for Information: R. E. McIntosh, Electrical and Computer Engineering Department, University of Massachusetts, Amherst, Massachusetts 01002

Selected Bibliography of Papers Presented:

LYMPHOCYTE TRANSFORMATION INDUCED BY MICROWAVE RADIATION. A. T. Huang (Dept. Medicine, Duke Univ. Medical Center, Durham, NC), M. E. Engle and J. A. Elder.

EFFECTS OF PULSED MICROWAVES ON THE HEMATOPOIETIC SYSTEM OF MICE. H. A. Ragan (Biology Dept., Battelle, Pacific Northwest Lab., Richland, WA 99352) and R. D. Phillips.

LOW INTENSITY MICROWAVE EFFECTS ON THE SYNTHESIS OF THYROID HORMONES AND SERUM PROTEINS. W. D. Travers (Bionucleonics Dept., Sch. Pharmacy and Pharmacal Sciences, Purdue Univ., West Lafayette IN 47907) and R. J. Vetter.

CAN ELECTROMAGNETIC WAVES CAUSE CONGENITAL ANOMALIES? R. Rugh (U.S. Dept. Health, Education, Welfare, Public Health Service, Food, Drug Admin., Bureau Radiological Health, Rockville, MD) and M. McManaway.

MICROWAVE-INDUCED TERATOLOGY IN THE RAT. M. E. Chernovetz (Tulsa Univ., Tulsa, OK), A. F. Oke, and D. R. Justesen.

THE EFFECT OF REPEATED MICROWAVE EXPOSURE IN NEONATAL RATS. R. Guillet (Dept. Radiation Biology and Biophysics, Sch. Medicine and Dentistry, Univ. Rochester, Rochester, NY) and S. Michaelson.

RADIOLOGICAL SOCIETY OF NORTH AMERICA SCIENCE ASSEMBLY AND ANNUAL MEETING

Date: November 14-19, 1976
Place: Chicago, Illinois
Sponsor: RSNA
Requests for Information: Ms. A. Swenson, Executive Director, Radiological Society of North America, 15th Floor, One Mony Plaza, Syracuse, New York 13202

NATIONAL TELECOMMUNICATIONS CONFERENCE

Date: November 29 through December 1, 1976
Place: Dallas, Texas
Sponsor: IEEE
Requests for Information: J. H. Tilley, Collins Radio Company, North Alma Road, Richardson, Texas 75080

THE CHEMICAL SOCIETY SYMPOSIUM ON NEWER ASPECTS OF MOLECULAR RELAXATION PROCESSES

Date: December 13-14, 1976
Place: London, United Kingdom
Sponsor: The Chemical Society (Faraday Division) [U.K.]
Requests for Information: Mrs. Y. A. Fish, Faraday Division, The Chemical Society, Burlington House, London, W1V OBN, United Kingdom

INTERNATIONAL RADIATION PROTECTION CONGRESS

Date: April 24-30, 1977
Place: Paris, France
Sponsor: IRPA
Requests for Information: G. Bresson, BP 33, 92260-Fontenay-aux-Roses, France

Biological Effects Nonionizing Electromagnetic Radiation 1(1), October 1976

MICROWAVE POWER SYMPOSIUM 1977

Date: May 25-28, 1977
Place: Minneapolis, Minnesota
Sponsor: International Microwave Power Institute
Requests for Information: Mr. O. P. Snyder, University of Minnesota, Department of Food Science and Nutrition, Saint Paul, Minnesota 55108

IEEE-MIT INTERNATIONAL MICROWAVE SYMPOSIUM

Date: June 21-23, 1977
Place: San Diego, California
Sponsor: IEEE
Requests for Information: R. Casey, Code 1300, NELC, San Diego, California 92152

ELECTROMAGNETIC COMPATIBILITY SYMPOSIUM AND EXHIBITION

Date: June 28-30, 1977
Place: Montreux, Switzerland
Sponsor: Swiss PTT
Requests for Information: Mr. T. Dvorak, Hochfrequenztechnik, 8092 ETH Zurich, Switzerland

ENGINEERING IN MEDICINE AND BIOLOGY CONFERENCE

Date: November 5-9, 1977
Place: Los Angeles, California
Sponsor: Alliance for Engineering in Medicine and Biology
Requests for Information: Mrs. P. I. Horner, Assistant Director and Conference Coordinator, Alliance for Engineering in Medicine and Biology, Suite 1350, 5454 Wisconsin Ave., Chevy Chase, Maryland 20015