MR1435

AUTHORS: Taylor J R

DATE: 1972

TITLE: Radiation protection special study # 42-053-71-- Microwave oven instrumentation Narda model 8200.

SOURCE: Springfield, Virginia, US Dept of Commerce, National Technical Information Service, 9 pp (NTIS # AD 902853)

MAIN SUBJECT HEADING:

AN	HU	AT	IH	M
ANALYTICS	HUMAN EFFECTS	ANIMAL TOXICITY	WORKPLACE PRACTICES-ENGINEERING CONTROLS	MISCELLANEOUS

SECONDARY SUBJECT HEADINGS: AN HU AT IH M

Physical/Chemical Properties

Review

Animal Toxicology

Non-occupational Human Exposure

Occupational Exposure

Epidemiology

Standards

Manufacturing

Uses

Reactions

Sampling/Analytical Methods

Reported Ambient Levels

Measured Methods

Work Practices

Engineering Controls

Biological Monitoring

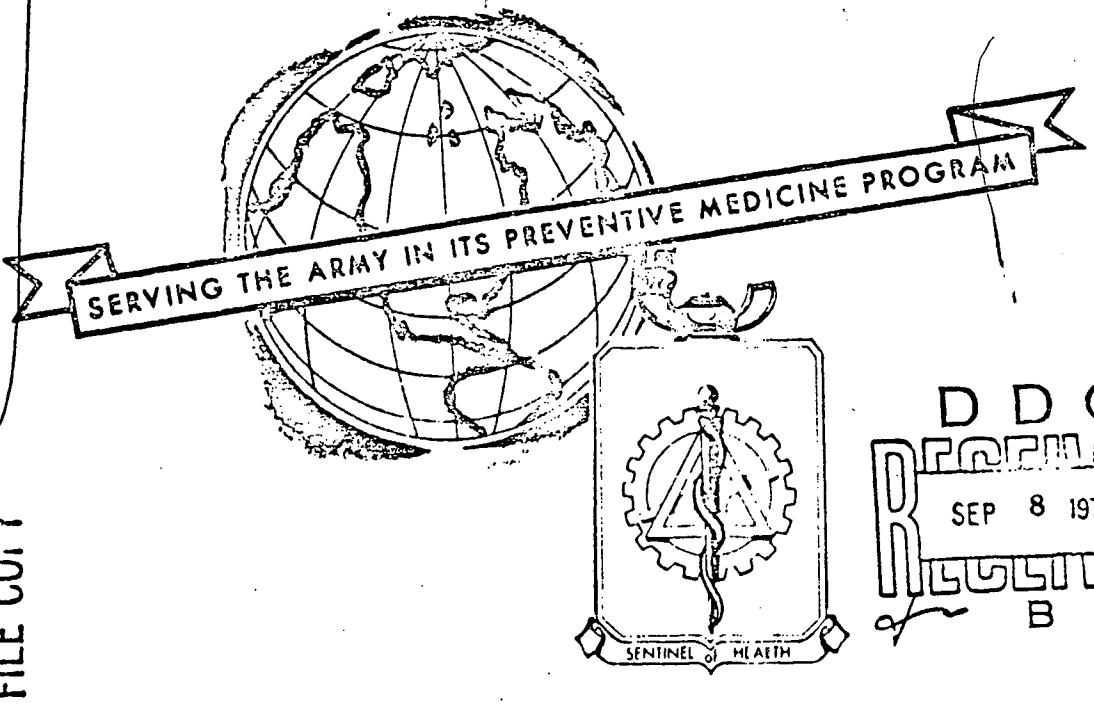
Methods of Analysis

Treatment

Transportation/Handling/Storage/Labelling

PPR 1435

RADIATION PROTECTION SPECIAL STUDY NO. 42-053-71
MICROWAVE OVEN INSTRUMENTATION
NARDA MODEL 820C



US ARMY
ENVIRONMENTAL HYGIENE AGENCY
EDGEWOOD ARSENAL, MD. 21010

DEPARTMENT OF THE ARMY
U. S. ARMY ENVIRONMENTAL HYGIENE AGENCY
OFFICE OF THE COMMANDER
EDGEWOOD ARSENAL, MARYLAND 21010

USAEHA-RL

RADIATION PROTECTION SPECIAL STUDY NO. 42-053-71
MICROWAVE OVEN INSTRUMENTATION
NARDA MODEL 8200

ABSTRACT

The information contained in this study of the Narda Model 8200, Radiation Monitor, "Mini-Surveyor" was obtained by field measurements and laboratory studies. The instrumentation design makes it suitable for safe use by personnel in measurement of microwave leakage emanating from a microwave oven. When properly used the instrumentation accuracy and the variations in readings due to field perturbations are within acceptable limits. The Model 8200 with Antenna Probe Model 8221 will provide adequate coverage of all proposed and current microwave leakage measurement standards. The antenna probes are subject to burn out when inserted into a high power density field, therefore, proper use of the instrument is essential.

DEPARTMENT OF THE ARMY
U. S. ARMY ENVIRONMENTAL HYGIENE AGENCY
OFFICE OF THE COMMANDER
EDGEWOOD ARSENAL, MARYLAND 21010

USAEHA-RL

RADIATION PROTECTION SPECIAL STUDY NO. 42-053-71
MICROWAVE OVEN INSTRUMENTATION
NARDA MODEL 8200

1. REFERENCES.

a. Letter, MEDPS-PO, OTSG, to Executive Director, Army and Air Force Exchange Service, 9 April 1970.

b. DF, MEDPS-P, OTSG, subject: Surveillance of Microwave Cooking Ovens and Food Vending Services, 8 June 1970, with inclosed letter from USAMC, 27 May 1970.

c. Federal Register, pages 7901-7902, Volume 35, No. 100, 22 May 1970, subject: Proposed Federal Performance Standard.

2. PURPOSE. To evaluate the Narda Model 8200, Radiation Monitor "Mini-Surveyor" and its suitability as an instrument for measuring leakage emanating from a microwave cooking oven.

3. BACKGROUND.

a. Accurate measurement of electromagnetic radiation leakage emanating from a microwave cooking oven required the development of a more sophisticated instrument than was currently available. The problems associated with close-in measurements of microwave energy being transmitted through a small slot-like opening, such as that located around the periphery of the oven door seal, emphasized the need for instrumentation with a receiving antenna which has a small sampling area and an antenna probe which would produce minimal disturbance when inserted in the field to be measured. The accuracies required in these measurements dictated that the small sampling probe be maintained at a minimum distance of one half wavelength from the source to avoid errors induced in the readings by the near field reactive terms.

b. Several instruments have been developed to allegedly meet the requirement of near field measurements in the vicinity of a microwave cooking oven. The majority of these instruments did not exhibit the required accuracy and/or reliability necessary for these measurements. One of the instruments developed which did contain the essential parameters necessary for oven measurements is the Narda Model 8100, Electromagnetic Radiation Survey Meter. This unit is completely acceptable for measurements in the near field as well as the far field. However, the complex

operation and proper use of this instrument and its relative high cost prevented it from being generally accepted as a field survey instrument. The Narda Microwave Corporation has developed a similar instrument, Narda Model 8200, "Mini-Surveyor", which provides essentially the same capability as the Model 8100 but is more of a field type unit. The Model 8200 is discussed further throughout this report.

c. The Model 8200, "Mini-Surveyor", has been evaluated as to its capability in measuring microwave leakage emanating from a microwave cooking oven. Because of time limitation and the availability of the instrument, only a cursory analysis was performed and then only one such unit was available for test.

d. Included with this instrument is a foamed, polyethylene spacer two inches long. This spacer is to be fitted on the end of the probe to maintain a distance of two inches between oven leakage area and antenna element throughout the oven measurements.

4. FINDINGS.

a. The Narda, Model 8200, Radiation Monitor is a small, lightweight instrument which appears to be quite suitable for measuring leakage emanating from a microwave cooking oven. Its size and construction provides ease of handling for field personnel while measuring microwave leakage without such personnel being subjected to the radiated field.

b. The metering unit contains three controls which does simplify its operation. Incorporated in one switch is the unit on-off and battery test positions, a second switch contains two range multiplication positions, X1.0 and X10 positions. The third control is the metering zero adjust knob.

c. A brief outline of the Model 8200 specifications is as follows:

(1) Calibration frequency - 2450 Mhz

(2) Power reading ranges - Full scale:

10 mW/cm^2 and 100 mW/cm^2 with probe Model 8223
2 mW/cm^2 and 20 mW/cm^2 with probe Model 8221

(3) Accuracy of probe calibration - $\pm$ 1 dB

(4) Probe time constant - 0.5 seconds

(5) Accuracy of instrumentation - $\pm$ 3% full scale

(6) Probe overload rating - 300 mW/cm^2 with Model 8223
40 mW/cm^2 with Model 8221

(7) Meter scales - Linear scale, marked 0 to 2 and 0 to 10

(8) Battery - 9 volt (transistor radio type)

(9) Size - Probe: 11 inches long, 3/4 inch diameter
Meter: 1 3/4 inches X 4 5/8 inches X 2 5/8 inches
Cable: Coiled - 6 inches long coil
Uncoiled - 43 inches long coil
Weight: Meter and Probe - 1.3 pounds

d. The Model 8200 is calibrated to accurately measure only that microwave radiation being transmitted at the frequency of 2450 MHz. Although there are two predominant frequencies utilized for microwave cooking ovens, 2450 MHz and 915 MHz, the single operating frequency of this instrument does not degrade its overall acceptance as an oven test instrument. There is currently only one manufacturer producing ovens which operate at 915 MHz and these are of limited quantity in the Army.

e. The limited tests performed on the unit available indicated that it was very durable. The instrument was capable of being transported and handled easily and still maintain its calibration. During the conduct of these tests the instrument was compared to the other acceptable instruments in a field testing environment. Between 25-30 ovens were tested and the Model 8200 did not differ from other instrumentation in their readings by more than 1 dB. The difference in readings was well within the accuracy of the instrumentation employed.

f. Tests were also conducted to determine what effect placing the hand on the probe would have on the reading. These tests were conducted with the probe in a fixed position, measurements were made with the hand on and off the probe. Results of these tests pointed out that as long as the hand was placed on the grip provided, the variations in readings were within acceptable limits, less than a few percent. When the body was inserted in the field or when the hand was placed off the grip end of the probe, perturbation of the field resulted thereby producing erratic readings.

5. DISCUSSION.

a. To avoid interference of near field reactive terms and to standardize the leakage measuring process a probe distance of 5 cm (two inches) has been established. In addition the size or quantity of load to be inserted into the oven cavity during these measurements must be

determined. The load should consist of an electrically nonconductive container of water. The quantity of water varies depending upon the rf power being transmitted into the oven cavity. The greater the number of rf generating tubes (magnetron tubes) the greater the power level. For an oven power level of 1000 watts or less, 100 milliliters of water are required; between 1000 and 2000 watts, 200 milliliters are required. With further increase in power greater quantities of water would be required. The oven should not be tested with the cavity empty.

b. The present criteria for microwave cooking ovens is to have the purchaser place in the procurement contract the requirement that the maximum level of microwave leakage acceptable from a new oven delivered to the place of installation is to be 1.0 mW/cm^2, measured at a distance of two inches from the oven door seal area. Also, throughout the oven's warranty period the level of leakage must be less than 10 mW/cm^2 measured at the same distance. According to the proposed Federal Performance Standard for Microwave Ovens (published in the Federal Register, pages 7901-7902, Volume 35, No. 100, 22 May 1970) all ovens manufactured after July 1971 will require leakage levels to be less than 1.0 mW/cm^2 measured prior to sale to a purchaser and, thereafter 5.0 mW/cm^2 at any point five centimeters (two inches) or more from the external surface of the oven.

c. The Model 8200 antenna probes employ identical characteristics and accuracies as those utilized with the Model 8100. The antenna probes are subject to burn out when inserted into a high power density field, the field could be emanating from an oven or other microwave generating sources, such as radar units. Therefore, careful handling and proper use of the instrument is recommended to maintain the unit in good operating condition. The two probes, Models 8221 and 8223 provide coverage to measure power densities from 0 to 100 mW/cm^2 according to the ranges 0-2 mW/cm^2, 0-20 mW/cm^2 (Model 8221) and 0-10 mW/cm^2, 0-100 mW/cm^2 (Model 8223). The three standards 1.0 mW/cm^2 (new ovens), 5.0 mW/cm^2 (proposed rejection level by Federal specifications) and 10 mW/cm^2 (current rejection level, US Army) are all covered by the Model 8221 probe and within that portion of the metering scale which is most accurate. The Model 8223 probe does not provide any additional essential information in testing microwave ovens since knowing the exact amount of leakage which exceeds the 10 mW/cm^2 level is not necessary. The 0-20 mW/cm^2 range of the Model 8221 will indicate when 10 mW/cm^2 is exceeded.

6. CONCLUSIONS. If this instrument is to be considered for field use in evaluating microwave cooking ovens, there are several factors which should be considered prior to procurement for routine use:

a. Personnel should be instructed on its proper use to prevent damage to the probes and provide as accurate a reading as possible.

b. The field instrument should consist of the metering unit, a two inch spacer and two Model 8221 probes. The additional Model 8221 probe should be obtained in place of the Model 8223 probe to provide back-up in the event damage occurs to one probe or there is a question concerning the probe's accuracy.

c. A calibration program should be established where the instrument accuracy is determined periodically.

John R. Taylor
JOHN R. TAYLOR
Electronic Engineer
Laser-Microwave Division

APPROVED:

William A. Palmisano
WILLIAM A. PALMISANO
Chief, Laser-Microwave Division

James E. Roy
JAMES E. ROY, JR.
MAJ, MSC
Director, Radiation Services

UNCLASSIFIED
Security Classification

DOCUMENT CONTROL DATA - R & D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author)

US Army Environmental Hygiene Agency
Edgewood Arsenal, Maryland 21010

2a. REPORT SECURITY CLASSIFICATION
UNCLASSIFIED

2b. GROUP

3. REPORT TITLE

~~RADIATION PROTECTION SPECIAL STUDY NO. 42-053-71~~
(6) MICROWAVE OVEN INSTRUMENTATION.
NARDA MODEL 8200.

4. DESCRIPTIVE NOTES (Type of report and inclusive dates)

Radiation Protection Special Study

5. AUTHOR(S) (First name, middle initial, last name)

(12) John R. Taylor

6. REPORT DATE
11 1972

7a. TOTAL NO. OF PAGES
~~5~~ 11 (12)

7b. NO. OF REFS
~~3~~

8a. CONTRACT OR GRANT NO.

b. PROJECT NO. ~~42-053-71~~ (14)

c.

d.

9a. ORIGINATOR'S REPORT NUMBER(S)
USAEHA [redacted] 42-053-71
~~42-053-71~~

9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)

10. DISTRIBUTION STATEMENT
Distribution limited to US Government agencies only. Test and Evaluation; Other requests for this document must be referred to CO, US Army Environmental Hygiene Agency, Edgewood Arsenal, MD 21010.

11. SUPPLEMENTARY NOTES

12. SPONSORING MILITARY ACTIVITY
Department of the Army
Office of The Surgeon General

13. ABSTRACT

The information contained in this study of the Narda Model 8200, Radiation Monitor, Mini-Surveyor[1] was obtained by field measurements and laboratory studies. The instrumentation design makes it suitable for safe use by personnel in measurement of microwave leakage emanating from a microwave oven. When properly used, the instrumentation accuracy and the variations in readings due to field perturbations are within acceptable limits. The Model 8200 with Antenna Probe Model 8221 will provide adequate coverage of all proposed and current microwave leakage measurement standards. The antenna probes are subject to burn out when inserted into a high power density field; therefore, proper use of the instrument is essential.

038 150

DD FORM 1 NOV 68 1473 REPLACES DD FORM 1473, 1 JAN 68, WHICH IS OBSOLETE FOR ARMY USE.

UNCLASSIFIED
Security Classification

14 KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Narda Model 8200 Microwave Leakage Monitor						