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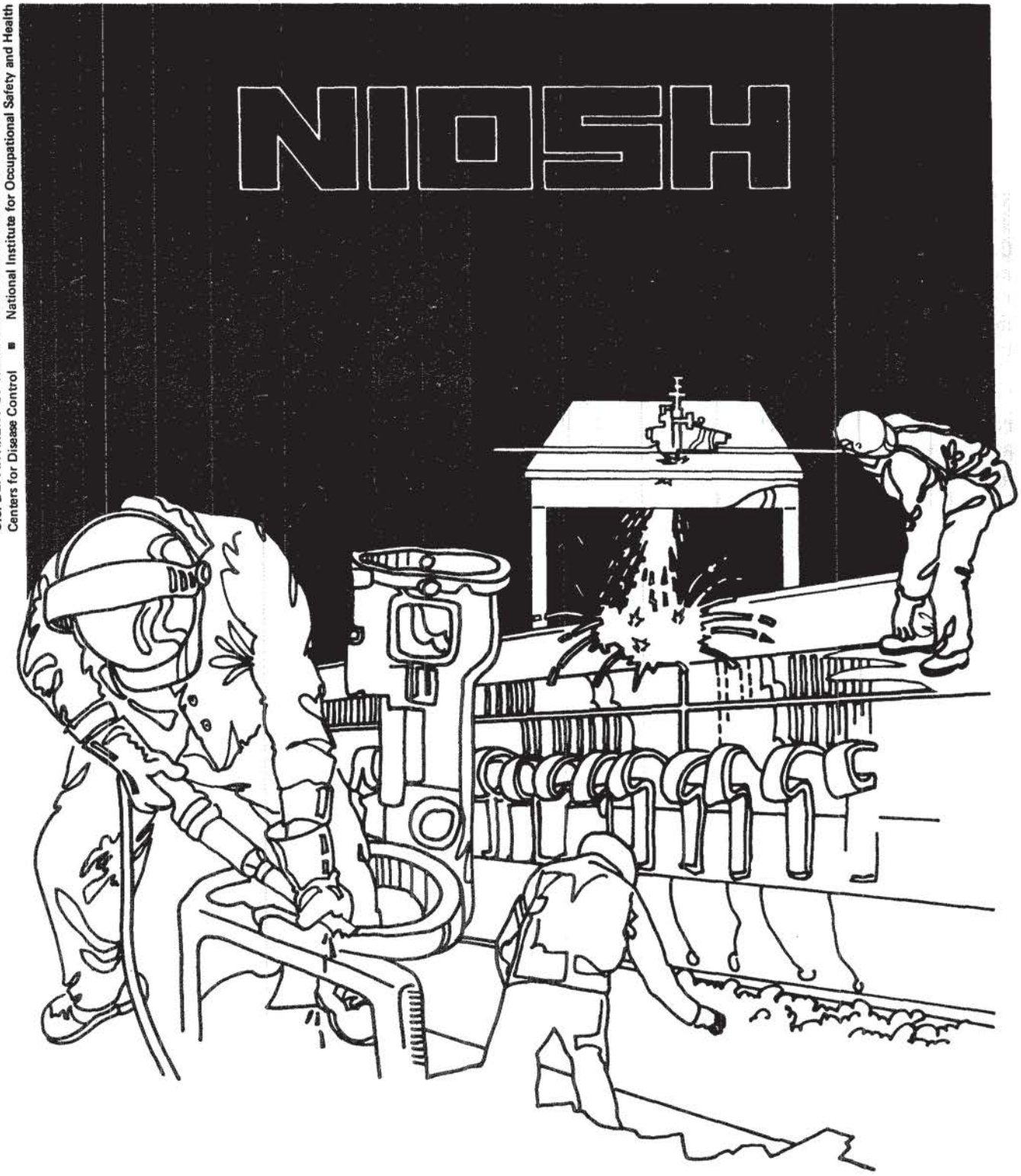

Health Hazard Evaluation Report

HETA 81-004-975
WEATHERKING PRODUCTS, INC.
EAST GREENWICH, RHODE ISLAND

PREFACE

The Hazard Evaluations and Technical Assistance Branch of NIOSH conducts field investigations of possible health hazards in the workplace. These investigations are conducted under the authority of Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669(a)(6) which authorizes the Secretary of Health and Human Services, following a written request from any employer or authorized representative of employees, to determine whether any substance normally found in the place of employment has potentially toxic effects in such concentrations as used or found.

The Hazard Evaluations and Technical Assistance Branch also provides, upon request, medical, nursing, and industrial hygiene technical and consultative assistance (TA) to Federal, state, and local agencies; labor; industry and other groups or individuals to control occupational health hazards and to prevent related trauma and disease.

HETA 81-004-975
OCTOBER 1981
WEATHERKING PRODUCTS, INC.
EAST GREENWICH, RHODE ISLAND

NIOSH INVESTIGATORS:
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I. SUMMARY

On September 24, 1980, NIOSH received a request for technical assistance from the Rhode Island Department of Health to aid in the evaluation of radiofrequency (RF) radiation exposures at Weatherking Products, Inc., East Greenwich, Rhode Island.

On January 14, 1981, electric (E) and magnetic (H) field strength measurements of RF radiation were taken at neck, waist, and knee positions of operators of RF heat sealers. Exposures, when corrected for frequency response and duty cycles of the machines, ranged up to 4.28×10^3 V^2/m^2 for the E field and up to 0.39 A^2/m^2 for the H field. The current OSHA Standard of 10 mW/cm^2 is equivalent to 4×10^4 V^2/m^2 for the E field, and 0.25 A^2/m^2 for the H field.

When corrected for the duty cycle and frequency response the RF radiation exposures from the High Frequency mdl F5-10A and the continuous feed Thermatron unit heat sealers did not exceed the OSHA exposure limits. NIOSH has concluded that there is no RF radiation hazard to employees working at or near these units However, the magnetic field measurements for the Thermatron mdl KF-75 exceeded the OSHA standard. Recommendations are made to reduce RF radiation for this model

KEYWORDS: SIC 3079 (Fabricated Plastic) heat sealers, nonionizing radiation (radiofrequency)

II. INTRODUCTION

On September 24, 1980, NIOSH received a request for technical assistance from the Rhode Island Department of Health, Division of Occupational Health and Radiation Control, to aid in the evaluation of radiofrequency (RF) radiation from heat sealers. The request from the State of Rhode Island was made as part of an "OSHA on-site consultative services survey" at Weatherking Products, Inc., East Greenwich, Rhode Island. The workplace was evaluated by surveying a sample of heat sealers and reviewing production practices.

III. BACKGROUND

Ten radiofrequency (RF) heat sealers are currently used at Weatherking to manufacture polyvinylchloride swimming pool liners. Intermittent sealers are either of standard design consisting of a movable (+) electrode with a stationary (-) electrode or of a newly developed design consisting of a movable (-) electrode plane with a stationary (+) electrode plate as the work table; a continuous-feed type sealer was also used. One to two persons operate each RF heating device.

The design and operating characteristics of the sealer models are as follows:

1. Manufacturer - Thermatron Co. Model KF-75. Power output $7\frac{1}{2}$ KW. Frequency - tagged 27.12±0.16 MHz, measured 26.9 MHz. Workers are located on each side of the heat sealing unit and position the plastic to be fused on the table. A movable bar above the table acts as the (+) electrode; the table area acts as the (-) electrode.

2. Manufacturer - High Frequency Technology Co., Inc. Model FS-10A. Power output, 10 KW. Frequency - tagged 27.12 MHz, measured 26.98 MHz. Workers are located on each side of the heat sealing unit and position the polyvinylchloride to be fused on the table. The bar sealer acts as the (+) electrode and is positioned in the table top; a movable bar above the table acts as the (-) electrode.

3. Manufacturer - Thermatron, Model continuous. Operating power output, 4 KW. Frequency - tagged 27.12 MHz, measured 27 MHz. Workers operate the machine at a distance of approximately 55 inches from the RF source. The machine is used to continuously feed and fuse a 1-inch strip of polyvinylchloride to the side of the pool.

IV. METHODS

The operation of concern to this investigation was inactive at the time the measurements were made, so operations were simulated for this investigation. RF measurements were made in neck, waist, and knee positions where workers would be located during operation.

Electric field measurements were taken with Holaday instruments, the Model HI-3001 meter (S/N 26004) and two probes, the green probe (S/N 014) and the red probe (S/N 015). The probes were calibrated on September 14, 1980, and were used to measure the electric field strength in volts squared/meter squared (V^2/m^2). The minimum detectable limit for the green probe was 5 V^2/m^2 and for the red probe it was $5x10^3$ V^2/m^2. For the green probe, the maximum detectable field strength was 10^4 V^2/m^2 and for the red probe it was 10^7 V^2/m^2. The overall accuracy of both probes was $\pm$2.0 dB, corresponding to +59 and -37 percent in the frequency range of 0.5 MHz to 1,000 MHz.

Magnetic field measurements were taken with Narda instruments, the Model 25540 meter (S/N 04022) and the Model 8635 probe (S/N 01008). The probe was calibrated May 30, 1980 and was used to measure the magnetic field strength in amperes squared/meter squared (A^2/m^2). The minimum detectable limit was 0.1 A^2/m^2 with an overall accuracy of $\pm$3.0 dB, corresponding to +100 and -50 percent, in the frequency range of 10 to 300 MHz.

To identify the frequency of any detectable RF radiation found emanating from the sealers, a Hewlett-Packard Model 53038/5300B, S/N 1520A02460/1452A0228 Frequency Counter/Measuring System mainframe and a Singer Model 90700-2 antenna loop with an upper limit of 525 MHz were available.

V. EVALUATION CRITERIA

For nonionizing radiation in the radiofrequency and microwave range of 10 MHz to 100 GHz, OSHA specifies, in 29 CFR 1910.97, a power density exposure limit of 10 milliwatts/centimeter squared (mW/cm^2) averaged over any possible 6-minute period. In the far field this power density corresponds to $4x10^4$ V^2/m^2 for the electric field and 0.25 A^2/m^2 for the magnetic field.

On December 4, 1979, NIOSH and OSHA issued a joint Current Intelligence Bulletin entitled, "Radiofrequency (RF) Sealers and Heaters: Potential Health Hazards and their Prevention." While not recommending a change in the current exposure limit, it did recommend precautionary measures to protect workers from unwarranted exposures to RF energy.

VI. RESULTS AND CONCLUSION

The radiation measurements (Table 1) from the three types of RF sealers ranged from nondetectable to $3.5x10^5$ V^2/m^2 for the E field, and from nondetectable to 6.5 A^2/m^2 for the H field. While some of the measurements indicate the potential for excessive exposures, the measured radiation must be corrected for frequency calibration and duty cycle before comparisons can be made with permissible exposure standards.

The frequency calibration factor for the Narda 8635 H-Field probe at $27MH_2$ was 1.17 and for the Holaday E-field probe was 1.07.

The correction factor for the duty cycle is calculated by dividing the power on-time by the total time the power is on and off during a duty cycle. An operator's exposure for the day is the product of the measured radiation and the duty-cycle correction factor. Since the duty cycle could not be observed under actual working conditions, it was calculated from company experience. According to Weatherking, 440 seals are made in a 7 1/2-hour work day (27,000 seconds). For each seal, the RF power is applied for 3 seconds. The total on-time for the machine is 1,320 seconds (3 seconds/seal x 440 seals). From these data an average duty-cycle correction factor for the Thermatron KF-75 and High Frequency machines of about 0.05 (1,320/27,000) was calculated.

Since the other Thermatron machine operates continuously, no correction is needed for the duty cycle. When the duty-cycle/calibration corrections are made, the exposures (Table 1) range from nondetectable to 4.28×10^3 V^2/m^2 and from nondetectable to 0.39 A^2/m^2. The E-field measurements are well below the OSHA standard, (4×10^4 V^2/m^2) but the H-Field measurements for the Thermatron KF-75 unit is above the OSHA Standard of 0.25 A^2/m^2.

VII. RECOMMENDATIONS

The following recommendations are made to keep exposures at a minimum:

1. Shielding should be installed to minimize occupational exposures to emissions of stray RF energy where employees may walk or stand.

2. The distance between the worker and the source of RF energy should be maintained at the greatest distance possible by means of physical barriers.

3. Additional recommendations for hazard control covering (a) Warnings and Information, (b) Medical Monitoring, and (c) Exposure Measurements are covered in Appendix V of the Joint NIOSH/OSHA Current Intelligence Bulletin[1]. These recommendations should be reviewed and implemented where appropriate.

VIII AUTHORSHIP AND ACKNOWLEDGEMENTS

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IX. DISTRIBUTION AND AVAILABIILITY OF REPORT

Copies of this report are currently available upon request from NIOSH, Division of Standards Development and Technology Transfer, Technical Information Branch, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After 90 days the report will be available through the National Technical Information Service (NTIS), Springfield, Virginia. Information regarding its availability through NTIS can be obtained from NIOSH, Publications Office, at the Cincinnati address.

Copies of this report have been sent to:

1. Rhode Island Department of Health
2. Weatherking Products, Inc.
3. OSHA, Region I
4. NIOSH, Region I

For purposes of informing the employees, a copy of this report shall be posted in a prominent place, accessible to the employees, for a period of thirty (30) calendar days.

X. REFERENCES

1. Radiofrequency (RF) Sealers and Heaters: Potential Health Hazards and their Prevention, Current Intelligence Bulletin 33, DHEW (NIOSH) Publication No. 80-107, Cincinnati, Dec. 4, 1979, 18 pp.

TABLE I

RADIOFREQUENCY MEASUREMENTS ON HEAT SEALERS
WEATHERKING PRODUCTS, INC.
EAST GREENWICH, RHODE ISLAND
JANUARY 14, 1981
HETA 81-004

Sealer	Location	Inches from Heating Element	E-Field Meter Reading V^2/m^2	E-Field Average Exposure (Duty-Cycle/Frequency Corrected) V^2/m^2	H-Field Meter Reading A^2/m^2	H-Field Average Exposure (Duty-Cycle/Frequency Corrected) A^2/m^2
Thermatron (Model KF-75)	Right Side*	36				
	neck		3.2×10^5	1.71×10^4	6.5	0.39
	waist		8.0×10^4	4.28×10^3	6.5	0.39
	knee		2.5×10^4	1.34×10^3	0.9	0.12
	Left Side*	32				
	neck		3.5×10^5	1.87×10^4	3.5	0.21
	waist		8.0×10^4	4.28×10^3	4.2	0.25
	knee		1.0×10^4	5.35×10^2	3.5	0.21
Frequency (Model FS-10A)	Right Side*	15				
	neck		7.5×10^3	4.0×10^2	0.3	0.02
	waist		5.0×10^3	2.7×10^2	0.4	0.02
	knee		1.5×10^3	0.75×10^2	0.1	0.01
	Left Side	15				
	neck		2.4×10^4	1.28×10^3	0.9	0.06
	waist		8.0×10^3	4.28×10^2	1.1	0.07
	knee		1.5×10^3	0.75×10^2	0.6	0.04
Thermatron (Continuous)	Receiving End	55				
	neck		2.5×10^2	2.5×10^2	0	0
	waist		2.0×10^2	2.0×10^2	0	0
	knee		5.0×10^1	5.0×10^1	0	0
OSHA standard (equivalent 6-min. average)				4×10^4		0.25

*. Facing the heat sealer unit.

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