HETA 92-064-2222
MAY 1992
OHIO VALLEY LITHO COLOR, INC.
FLORENCE, KENTUCKY

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SUMMARY

On November 14, 1991, the National Institute for Occupational Safety a Health (NIOSH) received a confidential worker request for an evaluatio occupational exposure to electrical currents produced when operating a industrial papercutter. The request was prompted by a case of a brain in a papercutter operator employed by Ohio Valley Litho-Color, Inc (OV Complaints were also voiced by the requestor about previous air qualit problems experienced while working at other plant locations.

Workers using the OVLI papercutters had electrical currents (of the di current mode) passing through the body ranging from 9.7 to 160 micro- amperes (µA) from a low-voltage circuit. No standards presently exist deal with current flow of this magnitude in the body, and no informati the relationship of low-level chronic direct current on the body and b tumor development can be found in the scientific literature.

On the days of this evaluation, the current levels resulting from employees' contact with the papercutter at two different locations present no acute electrical hazard, such as electrocution and/or bu On the other hand, data are not available to support or refute the possibility that low-level currents, delivered over years, are a causative factor for chronic diseases, such as brain tumors or canc A prudent recommendation that will eliminate this exposure is given

Keywords: SIC 2752 (Commercial Printing, Lithographic) electrical cur brain tumor, papercutter.

INTRODUCTION

On November 14, 1991, the National Institute for Occupational Safety a Health (NIOSH) received a confidential request for an evaluation of occupational exposure to electrical currents produced by industrial papercutting machines installed at the Ohio Valley Litho-Color, Inc (O facility located in Florence, Kentucky. The request was prompted by a a brain tumor in a papercutter operator employed by OVLI. Complaints also voiced by the requestor about air quality problems at this and ot plant locations. Visits were made to this site on January 7, 1992, ar January 28, 1992.

BACKGROUND

OVLI uses industrial papercutters to prepare various types of advertis material for their clients. At least two of the cutting machines are manufactured in Germany by Schneider-Werk GmbH and are the Senator mod

Contact was made with the United States distributor of the Schneider S to obtain additional background information. The NIOSH investigators told that these units had been distributed in the United States for ab 20 years. The unit, which can make a 45-inch cut in various stock mat operates on 60 hertz (Hz). The blade circuit is rectified to 24 volts form a resistive circuit; that is, the human operator completes the ci Contact needs to be made with the sensor button for about 2 to 4 secor make a complete cut, and the current passing through the body would be 10 microamperes (µA), depending on the impedance of the body. Figure a picture of a typical papercutter in operation and Figure 2 is a typi schematic of the electrical circuit controlling the sensor buttons.

A preliminary visit was made to the facility on January 7, 1992. Afte opening conference, the NIOSH investigators made a walk-through survey plant. During the walk-through, we observed the papercutters at work. of several MSDS on compounds that were either observed to be near the papercutters or were actually used in the cutting process were request

On January 17, 1992, NIOSH made preliminary electrical current measure at a local facility that serviced the Schneider Senator units. These preliminary measurements were conducted to verify measurement techniqu January 28, 1992, the NIOSH investigators returned to the OVLI to perf detailed current measurements on two Schneider Senator cutting machine

MATERIALS AND METHODS

Electrical current and voltage measurements were made by using a Fluke 8060A digital multimeter. Current measurements were made by connectir end of a test lead to the input terminal of the Fluke (DC current mode contacting one of the two blade-controlling sensor buttons located on front of the papercutter. Another test lead was connected to the outp terminal of the Fluke (DC current mode) and held tightly in the operat hand. The operator's other hand contacted the remaining sensor buttor Voltage measurements were made by connecting the test leads from the F (DC voltage mode) across the two sensor buttons.

The human resistance was estimated by connecting the two test leads fr Fluke (DC resistance mode) to a worker's skin area equivalent to the s that the fingers would make in contact with the sensor button. Severa additional current measurements were made such as current flow to grou various places on the exterior of the papercutter.

All current and voltage measurements were made when the papercutters w cutting the same loads. Measurements were performed both with dry and hands, and on both NIOSH and papercutter personnel at all facilities. of both dry and wet hands simulated the range of possible current flow worker.

EVALUATION CRITERIA

The only Occupational Safety and Health Administration (OSHA) regulati applicable to this evaluation, are found in 29 Code of Federal Regulat Part 1919.301 Subpart S entitled Electrical 1910.303. 1910.303(g)(2)("Except, as required or permitted elsewhere in this subpart, live part electric equipment operating at 50 volts or more shall be guarded agai accidental contact by approved cabinets or other forms of approved enc or by any of the following means...."[1] Neither NIOSH nor the America Conference of Governmental Industrial Hygienist (ACGIH) has adopted ar exposure criteria recommendations that are applicable.

RESULTS

The results obtained from the current measurements made on three diffe Schneider Senator papercutters are shown in Table 1. Measurements of current passing through workers ranged from 9.7 to 160 µA, depending c whether the hands in contact with the buttons were wet or dry. The cu level measured with no operator ranged from 0.93 to 1.3 milliampere (m Finally, the level of current found between one of the buttons and any surface of the papercutters ranged from 54 µA to 4.2 mA.

The NIOSH investigators made visits to OVLI on two different days and detect any unusual odors or air quality problems on either visit. Air sampling was not conducted. The requestor had some concerns about the use of OVLI solutions containing isopropyl alcohol and benzene at othe locations; however, neither of these substances were in use at the OVL facility visited by NIOSH. During the walk-around phase of the evalua the NIOSH investigators observed several compounds (shrinkwrap, glue, lubricant, and cutting oil) near the papercutters. The Material Safet Sheets (MSDS) for all these compounds were reviewed by the NIOSH investigators. It was the opinion of the investigators that the manne and small quantitites involved of these compounds did not warrant furt evaluation.

DISCUSSION

A limitless number of human electrical sensation thresholds can be def depending upon the location selected on the body and the nature of the contacts made with the body location. No thresholds can be said to ap all individuals. The tongue, for example, can detect as low as 4 µA c current.[2] Cuts or even needle punctures on hands or fingers signific decrease the current required for perception, and currents almost too measure can often cause pronounced pain when they flow in an open cut wound.

The usual entry of electric current into the body is through the skin. resistance of the skin varies with thickness of the skin and the condi the skin at site of contact, i.e. wet or dry conditions. A well-callo dry hand can have a resistance of 1 Megaohm, while a moist hand's resi may be as low as 1000 ohms.[3]

The realistic evaluation of what constitutes a safe human threshold fo electrical stimulation requires data on the minimal amount of electric that is just strong enough to produce some type of measurable physiolo response. What information that does exist on this topic originates f sources such as: perception of electric current flow, uncontrollable contraction, and death. Most of this type of biological information i on acute exposure scenarios, such as stimulation of nerve, skeletal mu and cardiac muscle. Adequate quantitative data for other responses, s might occur in chronic exposure situations, are not available.

Under present OSHA standards, as described in Section 1910.303, live p electric equipment operating <u>below</u> 50 volts are not required to be gua against contact made by workers during their job. In this evaluation, DC voltage supplied to the sensor button circuit on the papercutter is 50 volts. Therefore, it may be inferred from Section 1910.303 that th circuit would <u>not</u> fall under OSHA coverage. Notice that the reason fo guarding this circuit is based on applied voltage and <u>not</u> on the magni electrical current passing through the body.

It is apparent from the NIOSH measurements that currents passing throu worker's body making contact with the sensor button are below 1 mA, th that is reported by Dalziel as producing no sensation on hands (males) reported the human (male) perception threshold for DC current as 5.2 m This means that workers making contact with the papercutter's sensor b under normal conditions, would not perceive electricity. The only pos exception might be the perception felt by a worker with a finger that cut or bruised (this situation was reported to have occurred by the requestor).

Nevertheless, whether the current was perceived or not, the measuremer in this evaluation suggest that small electrical currents, in the rang 10-160 mA, do flow in workers making contacts with the sensor button o papercutter. The NIOSH investigators do not believe it is in the best interest of occupational safety to have workers being intentionally ex live currents. Conservative occupational safety programs would requir "zero-current flow" policy for workers.

CONCLUSIONS AND RECOMMENDATIONS

Based on the levels of electrical current measured from three papercut two different locations, it can be concluded that on the days of measu no acute electrical hazard, such as electrocution and/or burns, existe the other hand, data are not available to support or refute the possib that low-level currents, delivered over many years, are a causative fa chronic diseases, such as brain tumors or cancers.

We suggest that conventional electromechanical switch buttons be insta replace the present sensor button. The adaption of this technique wou the existing "low-current flow" problem into a "zero-current flow."

REFERENCES

1. Code of Federal Regulations (OSHA). Occupational Safety and Heal Administration Standards, Subpart S-Electrical, 29CFR 1910.301-.3 Washington, DC: U.S. Government Printing Office, Office of the F Register.

2. Keeney JC, Letcher FS [1970]. Human thresholds of electric shock power transmission frequencies. Arch Environ Health V1(7):547-55

3. Bonney SC [1978]. Electrical injuries. Occupational Safety and Symposia, U.S. Department of Health, Education, and Welfare, Cinc Ohio, DHEW (NIOSH) Publication No. 78-169, pp. 236-247.

4. Dalziel CF [1956]. The effects of electrical shock on man. IRE transactions on medical electronics (PGME-5).

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Table I

Measured current through worker's arms during papercutting activities

Ohio Valley Litho Color Company
Florence, Kentucky
January 17 and 28, 1992
HETA 92-064

MEASUREMENT TYPE	PRELIMINARY MEASUREMENTS	FACILITY'S MEASUREMENTS	
		UNIT #1	UNIT #2
DC CIRCUIT VOLTAGE	23.8 V	18.6 V	23.4 V
DC CURRENT ACROSS BUTTONS W/NO OPERATOR	1.275 mA	0.933 mA	1.29 mA
DC CURRENT ACROSS BUTTONS W/OPERATOR #1	11.8 µA	---	* 160 µA
#2	9.7 µA	---	---
#3	---	13.9 µA	19.2 µA
#4	---	67 µA	22.1 µA
DC CURRENT BETWEEN BUTTONS AND ANY METAL SURFACE OF MACHINE	54 µA	2.8 mA	4.2 mA

* Measurements made with wet hands

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	#2	9.7 uA	--	--
	#3	--	13.9 uA	19.2 uA
	#4	--	67 uA	22.1 uA
DC CURRENT BETWEEN BUTTON AND ANY METAL SURFACE OF MACHINE		54 uA	2.8 mA	4.2 mA