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HETA 95-0162-2536
RCA Rubber Company
Akron, Ohio

Joseph E. Burkhart, CIH

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 an employer or authorized representative of the employees, to determine whether any substance normally found in the place of employment has potential 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 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. Mention of company names or products does not constitute endorsement by the National Institute for Occupational Safety and Health.

ACKNOWLEDGEMENTS AND AVAILABILITY OF REPORT

This report was prepared by Joseph E. Burkhart, CIH, Industrial Hygienist, of the Clinical Investigationss Branch, Division of Respiratory Disease Studies. Field assistance was provided by Chris Piacitelli, IH., Clinical Investigations Branch and Dan Yereb, IH, Environmental Investigations Branch, Division of Respiratory Disease Studies. Desktop publishing by Pat Lovell.

Copies of this report have been sent to employee and management representatives at the RCA Rubber Company, the United Rubber Workers of America, Local 8, and the OSHA Regional Office. This report is not copyrighted and may be freely reproduced. Single copies of this report will be available for a period of three years from the date of this report. To expedite your request, include a self-addressed mailing label along with your written request to:

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For the purpose of informing affected employees, copies of this report shall be posted by the employer in a prominent place accessible to the employees for a period of 30 calendar days.

Health Hazard Evaluation Report 95-0162-2536
RCA Rubber Company
Akron, Ohio
October 1995

Joseph E. Burkhart, CIH

SUMMARY

On February 13, 1995, the National Institute for Occupational Safety and Health (NIOSH) received a management request for a health hazard evaluation (HHE) from the RCA Rubber Company of Akron, Ohio. The HHE request was for an industrial hygiene evaluation of potential occupational exposures to press operators and millmen to N-nitroso compounds and dusts generated during the manufacturing of rubber flooring.

On March 30, 1995, two NIOSH industrial hygienists conducted an initial site visit to the RCS Rubber Company. During that site visit, an opening conference was held by the NIOSH representatives to explain the HHE program and discuss the request made by RCA Rubber Company. Attending that opening conference were representatives from the RCA Rubber Company and representatives from the United Rubber, Cork, Linoleum and Plastic Workers of America, Local Union 8.

Type Findings Here

The results of the environmental samling conducted at the time of this survey did not indicate that a health hazard existed for either mixing or pressing employees. No specific exposures to the substances sampled were in excess of evaluation criteria. Based on the environmental data collected during this investigation, the mandaatory use of respiratory protection by mixing and press personnel should be reviewed by company officials.

Keywords: SIC 3069, rubber, flooring, nitrosamines, dust, crystalline silica, elemental metals, formaldehyde, carbon monoxide, sulfur dioxide, Banbury Mixer.

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INTRODUCTION

AOn February 13, 1995, the National Institute for Occupational Safety and Health (NIOSH) received a management request for a health hazard evaluation (HHE) from the RCA Rubber Company of Akron, Ohio. The HHE request was for an industrial hygiene evaluation of potential occupational exposures to press operators and millmen to nitrosamines and dusts generated during the manufacturing of rubber flooring.

BACKGROUND

AThe principal products manufactured by the RCA Rubber Company are floor tiles, rubber runners, and rolls of rubber flooring. Approximately 200 workers are employed at RCA; approximately 60 workers having jobs with a potential for exposures to dusts and nitrosamine compounds. Production occurs during three shifts per day, seven days a week. The company has been in business at the same location in Akron, Ohio, for over 60 years.

Nitrosamines

Personal breathing zone air samples for nitrosamines were collected on production workers during the three day investigation. Nitrosamines samples were collected using solid sorbent ThermoSorb/N™ air samplers (Thermo Electron Corporation, Waltham, MA 02154) connected by tubing to battery powered air sampling pumps calibrated at a flowrate of 2.0 liters per minute (lpm).

Each sample was analyzed for N-nitrosodimethylamine (NDMA), N-nitrosodiethylamine (NDEA), N-nitrosodipropylamine (NDPA, N-nitrosodibutylamine (NDBA), N-nitrosopyrrolidine, (NPRY), etc.

Respirable Dust and Silica

Personal breathing zone samples for the estimation of respirable dusts and respirable quartz dust exposure, were collected on pre-weighed, 37 millimeter (mm) diameter, 5-micron (μm) pore size, polyvinyl chloride (PVC) membrane filter, mounted in series with 10 mm Dorr-Oliver nylon cyclone. Air was drawn through the filter at a flow rate of 1.7 lpm using a battery powered sampling pump.

Elemental Metals

Work area samples for the estimation of exposure to elemental metals were collected on 37-mm (diameter), 0.8-μm (pore size) cellulose ester membrane filters, mounted in open-face cassettes. Air was drawn through the filters at a flow rate of 1.7 lpm using a battery powered sampling pump. All air samples collected for elemental metals analysis were digested according to NIOSH Method 7300[(1)]using a scanning inductively oupled plasma emission spectrometer.

Formaldehyde

Full shift work area samples for formaldehyde were collected on solid sorbent tubes (ORBO-23) using a constant flow sampling rate of 100 cubic centimeters per minute (cc/min). The collected samples were analyzed for formaldehyde utilizing a gas chromatograph equippped with a nitrogen-phosphorus detector according to NIOSH Analytical Methods 2541.[(1)]

Carbon Monoxide

Air samples for the estimation of carbon monoxide (CO) exposures were collected using Dräger diffusion detector tubes (Catalog No. 67 33191, National Dräger, Pittsburgh, Pennsylvania). These tubes were used to determine work area exposures to CO. These tubes operate on the diffusion properties of gases (Fick's Law of Diffusion); therefore, a sampling pump is not required for the measurement. The tube contains a yellow indicating layer that reacts with CO to change to a grayish blcak. Concentration of CO, in parts per million (ppm), is calculated by dividing the length of the discoloration, scaled in ppm-hours, by the time in hours that the tube was exposed. The detection range of this sampling method is 6 to 75 ppm for an 8-hour sampling duration. The accuracy for this method, as reported by the manufacturer, is ± 25%.

Sulfur Dioxide

Air samples for the estimation of carbon monoxide (CO) exposures were collected using Dräger detector tubes (Catalog No. 8101091 National Dräger, Pittsburgh, Pennsylvania). This detector tube, similar to the CO tube, also operates by passive diffusion. The indicating layer changes from a bluish violet to pale yellow when exposed to SO_2. Concentration of SO_2 is calculated by dividing the length of the discoloration, scaled in ppm-hours, by the time in hours that the tube was exposed. The detection range of this sampling method is 0.7 to 19 ppm for an 8-hour sampling duration. The accuracy for this method, as reported by the manufacturer, is ± 25%.

Evaluation Criteria

To assess the hazards posed by workplace exposures, NIOSH investigators use a variety of environmental evaluation criteria. These criteria suggest exposure levels which most workers may be exposed for a working lifetime without experienciing adverse health effects. However, because of wide variation in individual susceptibility, some workers may experience occupational illness even if exposures are maintained below these limits. The evaluataion criteria do not take into account individual hypersensiitivity, pre-existing medical conditions, or possible interactions with other workplace agents, medications being taken by the worker, or environmental conditions. The primary sources of evaluation criteria for the workplace are: NIOSH Criteria Documents and Recommended Exposure Limits (RELs),[2] the Occupational Safety and Health Administration (OSHA) Permissible Exposure Limits (PELs),[3]and the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs).[4] The objective of these criteria for chemical agents is to establish levels of inhkalation exposure to which the vast majority of workers may be exposed without experiencing adverse health effects.

Nitrosamines

Nitrosamines are compounds characterized by the -N--N=O functional group. They result from the combination of primary, secondary, or tertiary amones with nitrite. These reactions can occur in the laboratory; in various food, household, or industrial products; in industrial processes; and in vivo. Because of the variety of amines and reaction conditions possible, there are hundreds of nitrosamines; and because of the large number of exposure sources, including formation in vivo, there is a complicated matrix of total nitrosamine exposure. Occupational exogenouos exposures have been observed in rubber industries, leather tanning industries, metal working industries, chemical industries, mining, pesticide production, detergent production, and fish factories.

Particulates, not otherwise classified

In contrast to fibrogenic dusts which cause scar tissue to be formed in the lungs when inhaled in excessive amounts, so-called "nuisance dust" now termed "Particles Not Otherwise Classified, PNOC" have a long history of little adverse effects on lungs and do not produce significant organic disease or toxic effect when exposures are kept under reasonable control. Such dists have been called (biologically) "inert" dusts, but the latter term is inappropriate because there is no dust which does not invoke some cellular response in the lung when inhaled in sufficient amount. However, the lung-tissue reaction caused by inhalation of nuisance dust has the following characteristics: the architecture of the air spaces remains intact; scar tissue is not formed to a significant extent; nd, the tissue reaction is potentially reversible.

Silica (Quartz, Cristobalite)

Crystalline silica (quartz) and cristobalite have been associated with silicosis, a fibrotic disease of the lung caused by the deposition of fine particles of crystalline silica in the lungs. Symptoms usually develop insidiously, with cough, shortness of breath, chest pain, weakness, wheezing, and non-specific chest illnlesses. Silicosis usually occurs after years of exposure, but may appear in a shorter period of time if exposure concentrations are very high.[16] The NIOSH RELs for respirable quartz and cristobalite, published in 1974 are 50 $\mu g/m^3$, as TWAs, for up to 10 hours per day during a 40-hour work week.[17] These RELs are intended to prevent silicosis. However, evidence indicates that crystalline silica is a potential occupational carcinogen and NIOSH is currently reviewing the data on carcinogenicity.[188-20] The OSHA PELs and the ACGIH TLVs for respirable quartz and cristobalite are 100 and 50 $\mu g/m^3$, as 8-hour TWAs, respectively.

Formaldehyde

Formaldehyde is a colorless gas with a strong odor. Exposure can occur through inhalation and skin absorption. The acute effects associated with formaldehyde are irritation of the eyes and respiratory tract and sensitization of the skin. The first symptoms associated with formaldehyde exposure, at concentrations ranging from 0.1 to 5 parts per million (ppm), are burning of the eyes, tearing, and general irritation of the upper respiratory tract. There is variation among individuals, in terms of their tolerance and susceptibility to acute exposures of the compound.[21]

Carbon Monoxide

Carbon monoxide (CO) is a colorless, odorless, tasteless gas produced by incomplete burning of carbon-containing materials; e.g., natural gas. The initial symptoms of CO poisoning may include headache, dizziness, drowsiness, and nausea. These initial symptoms may advance to vomiting, loss of consciousness, and collapse if prolonged or high exposures are encountered. Coma or death may occur if high exposures continue.[24-28]

Sulfur Dioxide

Sulfur dioxide is intensely irritating to the eyes, mucous membranes, and respiratory tract. It can cause burning of the eyes and tearing, coughing, and chest tightness. Exposure may cause severe breathiing difficulties. It forms sulfurous acid on contact with moist membranes.[30] NIOSh, OSHA, and ACGIHI have set an exposure limit of 2 ppm for sulfur dioxide.

METHODS

A

EVALUATION CRITERIA

As a guide to the evaluation of the hazards posed by workplace exposures, NIOSH field staff employ environmental evaluation criteria for the assessment of a number of chemical and physical agents. These criteria are intended to suggest levels of exposure to which most workers may be exposed up to 10 hours per day, 40 hours per week for a working lifetime without experiencing adverse health effects. It is, however, important to note that not all workers will be protected from adverse health effects even though their exposures are maintained below these levels. A small percentage may experience adverse health effects because of individual susceptibility, a pre-existing medical condition, and/or a hypersensitivity (allergy). In addition, some hazardous substances may act in combination with other workplace exposures, the general environment, or with medications or personal habits of the worker to produce health effects even if the occupational exposures are controlled at the level set by the criterion. These combined effects are often not considered in the evaluation criteria. Also, some substances are absorbed by direct contact with the skin and mucous membranes, and thus potentially increase the overall exposure. Finally, evaluation criteria may change over the years as new information on the toxic effects of an agent become available.

The primary sources of environmental evaluation criteria for the workplace are: (1) NIOSH Recommended Exposure Limits (RELs)[1], (2) the American Conference of Governmental Industrial Hygienists' (ACGIH) Threshold Limit Values (TLVs)[2] and (3) the U.S. Department of Labor, OSHA Permissible Exposure Limits (PELs)[3]. In July 1992, the 11th Circuit Court of Appeals vacated the 1989 OSHA PEL Air Contaminants Standard. OSHA is currently enforcing the 1971 standards which are listed as transitional values in the current Code of Federal Regulations; however, some states operating their own OSHA approved job safety and health programs continue to enforce the 1989 limits. NIOSH encourages employers to follow the 1989 OSHA limits, the NIOSH RELs, the ACGIH TLVs, or whichever are the more protective criterion. The OSHA PELs reflect the feasibility of controlling exposures in various industries where the agents are used, whereas NIOSH RELs are based primarily on concerns relating to the prevention of occupational disease. It should be noted when reviewing this report that employers are legally required to meet those levels specified by an OSHA standard and that the OSHA PELs included in this report reflect the 1971 values.

A time-weighted average (TWA) exposure refers to the average airborne concentration of a substance during a normal 8-to-10-hour workday. Some substances have recommended short-term exposure limits (STEL) or ceiling values which are intended to supplement the TWA where there are recognized toxic effects from higher exposures over the short-term.

RESULTS

Nitrosamines

A total of 79 personal breathing zone and work area samples were collected and analyzed for the seven nitrosamine compounds previously mentioned. Appendix I shows the results of all the nitrosamine samples collected during this investigation. Of those 79 samples, 66 (85%) were personal breathing zone samples, 12 (15%) were collected

at varous work locations throughoiut the plant, and 1 (1%) was voided. Twenty-three of the personal breathing zone amples (including the one voided sample) and five work area samples were collected on employees involved in mixing operations. Forty-four personal breathing zone and seven work area samples were collected on employees involved in pressing.

Respirable Dust and Crystalline Silica

A total of 62 personal breathing zone and work area samples were collected and analyzed for respirable dust and crystalline silica exposure. Appendix II shows the results of all the respirable dust and crystalline silica samples collected during this investigation.

Elemental Metals

During this investigation, 12 work area amples were collected and analyzed for 28 different elemental metals. Results of that analysis indicated only trace quantities of metals present. The primary metals observed on the samples were iron (Fe), aluminum (Al), copper (Cu), caalcium (Ca), magnesium (Mg), titanium (Ti), and Zinc (Zn). All sampling results for the metals identified were far below any existing exposure criterial;

Formaldehyde

Workers were concerned that an emulzion, Dow Corning® 36, used as a releasing agent iin the presees could release formaldehyde. A label on the emulsion container states that when the emulsion is heated above 300°F that formaldehyde vapors could be produced. The presses operate at 300°F.

Carbon Monoxide

Eight area samples for carbon monoxide were collected throughout the mixing and press areas. Of those eight samples, three samples showed trace quantities of carbon monoxide. The highest carbon monoxide level measured near the #3 Banbury mixer was 8 ppm. None of the carbon monoxide samples exceeded any existing exposure criteria.

Sulfur Dioxide

Sixteen area samples for sulfur dioxide were collected throughout the plant. Of those samples, only four samples showed trace amounts of sulfur dioxide. The highest sulfur dioxide level, 0.3 ppm, was measured near the A-F presses. Many of the sulfur dioxide samples collected near the presses showed an interference in the length of color stain and were voided. The interference observed was most likely due to the steam (water vapor) coming from the presses. None of the sulfur dioxide samples exceeded exposure criteria.

CONCLUSIONS/RECOMMENDATIONS

During this survey, results of the environmental sampling did not indicate that a health hazard existed for either mixing or pressing employees. Personal breathing zone samples were collected on production employees involved

in either mixing or pressing operations. None of the samples collected exceeded any of the existing exposure criteria.

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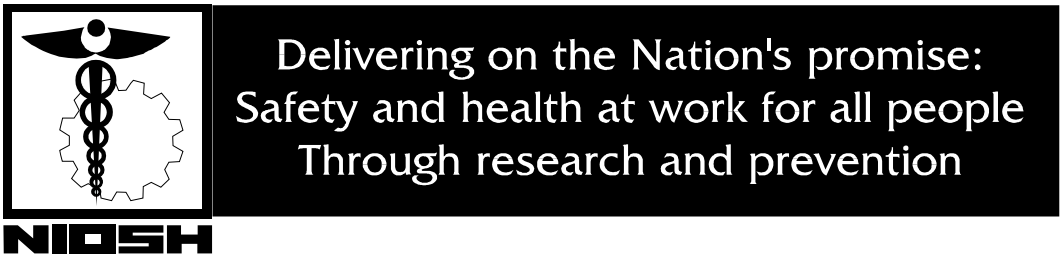
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