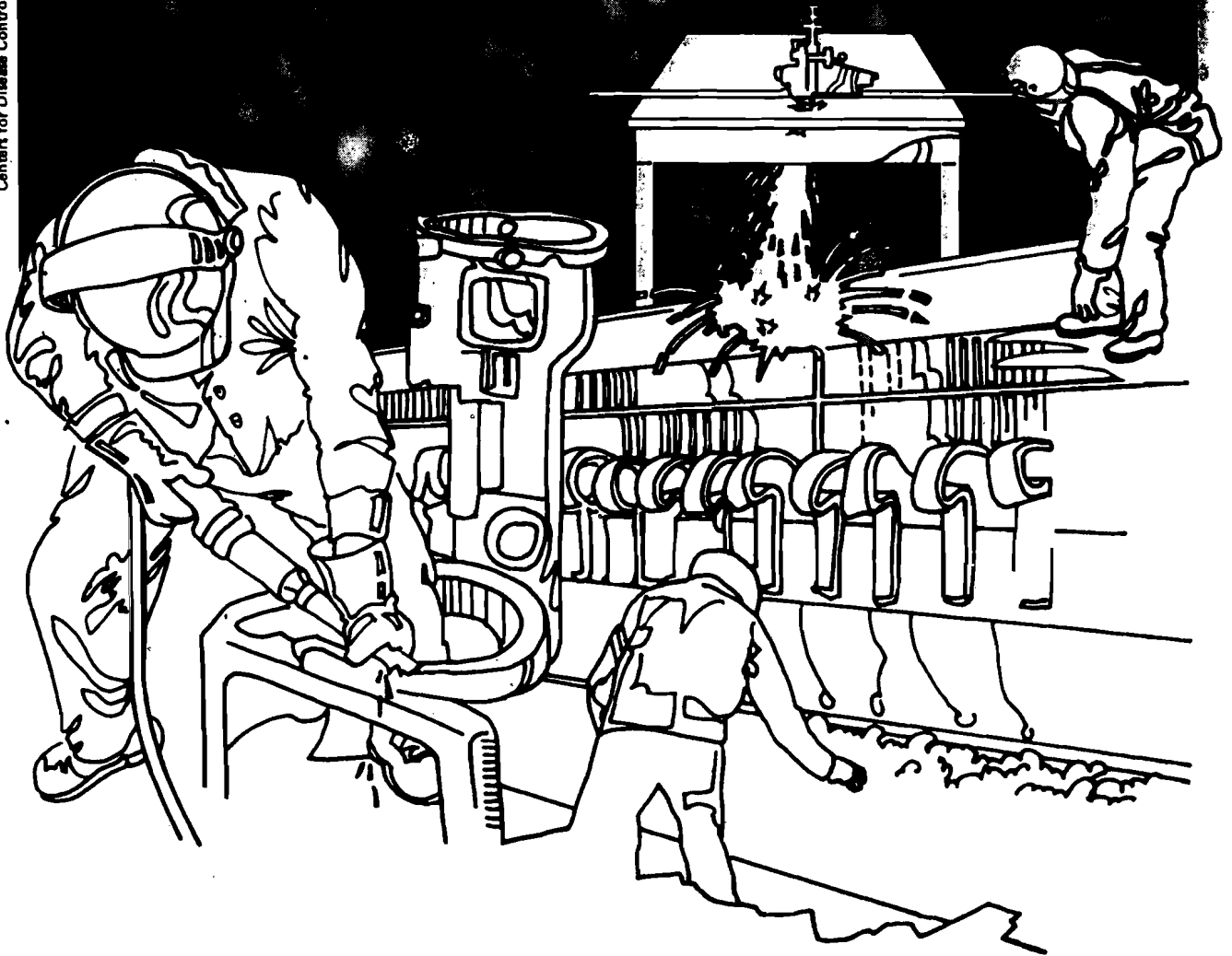


NIOSH



Health Hazard Evaluation Report

TA 80-121-919
KELLY-SPRINGFIELD TIRE COMPANY
FREEPORT, ILLINOIS

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.

Mention of company names or products does not constitute endorsement by the National Institute for Occupational Safety and Health.

I. SUMMARY

In September 1980, the Occupational Safety and Health Administration (OSHA) requested technical assistance from the National Institute for Occupational Safety and Health (NIOSH) to sample and analyze for airborne N-Nitrosamines at the Kelly-Springfield Tire Company, Freeport, Illinois.

On October 16, 1980, NIOSH performed personal and area air sampling for airborne amines, nitrosamines, and oxides of nitrogen. NIOSH also reviewed company chemical records concerning consumption of N-Nitrosodiphenylamine (a rubber retarding agent), observed work practices and work conditions, and took ventilation measurements.

Sixteen air samples were taken: 14 for nitrosamines, and 2 for amine compounds. Three of the samples were for personal exposure to nitrosamines; the remainder were process or general area samples. N-Nitrosomorpholine (NMOR), N-Nitrosodimethylamine (NDMA), N-Nitrosodiphenylamine (NDPhA), N-Nitrosopyrrolidine (NPYR), and N-Nitrosodiisopropylamine (NDiPA) were detected in samples taken from this plant. All five nitrosamine compounds were detected in process samples taken at the Banbury #1 batch-off area, and at the tire sidewall and "hump" (under-tread) stock extruder.

Process samples for the Laminator (rear form tractor tire tread) and Tuber head (sidewall and hump stock) had the highest nitrosamine concentrations of all samples taken. In the Laminator area, NDPhA was found at 17.0 ug/M³, and at the Tuber head NMOR was found at 11.0 ug/M³. Personal sample results were highest for the Feedmill and Calender operator (1.6 ug/M³ NMOR), lower for the Laminator operator (1.4 ug/M³ NMOR), and lowest for the Banbury operator (0.54 ug/M³ NMOR).

Seven amine compounds were found during sampling at this tire company. The most prominent of these were morpholine (2394 ug/M³), triethylamine (488 ug/M³), and dimethylamine (116 ug/M³). Lower levels of trimethylamine, isopropylamine, N-propylamine, and diethylamine were also found.

Oxides of nitrogen (NO_x) were detected in two of three areas sampled: the Laminator (0.25 parts per million), and the Tread and Sidewall area (0.5 ppm). NO_x was not detected in the Banbury area. Forklift trucks appeared to be the NO_x source. There was no apparent correlation between NO_x from forklift trucks and generation of nitrosamines.

Four interesting findings resulted from this study. First, NDiPA is reported here for the first time as ever being detected in a tire plant. Second, this plant had the highest level of NDPhA yet found in any tire plant survey performed by NIOSH. Third, seven amine compounds were found, of which three, morpholine, isopropylamine, and dimethylamine, may serve as precursors for nitrosamine formation. Fourth, NO_x from forklift trucks does not appear to be the primary nitrosating agent responsible for reacting with dialkylamines to form nitrosamines.

Although these nitrosamine levels are not high compared to nitrosamine concentrations previously found at a similar tire plant, their presence may present a health hazard to the worker. In addition, NDPhA is used very frequently in tractor and truck tire batches in this plant. Therefore, the potential to generate high levels of nitrosamines, particularly NMOR, is great. Since all the nitrosamines found in this plant are potent animal carcinogens and potential human carcinogens, we highly recommend that the use of NDPhA be discontinued, and local exhaust ventilation improved where nitrosamines are found, especially in the Laminator area where there is no local exhaust ventilation. Specific recommendations are found in section VIII of this report.

KEYWORDS: SIC 3010 (Tire Manufacturing), N-Nitrosamines, N-Nitrosodimethylamine, N-Nitrosomorpholine, N-Nitrosodiphenylamine, N-Nitrosopyrrolidine, N-Nitrosodiisopropylamine, Oxides of Nitrogen.

II. INTRODUCTION

In September 1980, an Occupational Safety and Health Administration representative from Region 5 requested technical assistance from NIOSH to sample for N-nitrosamines at the Kelly-Springfield Tire Company in Freeport, Illinois. The request was made to benefit from NIOSH expertise in sampling for nitrosamines in tire plants, to compare side-by-side sample results between OSHA and NIOSH, and to make recommendations to reduce nitrosamine exposures based on environmental results and observation of work conditions.

III. BACKGROUND INFORMATION

The tire plant in Freeport, Illinois, is one of five Kelly-Springfield plants located in this country and is a subsidiary of the Goodyear Tire and Rubber Corporation. This plant was built about 25 years ago, and all tire production is on one floor. It employs 1,235 hourly and 265 salaried workers. It operates three shifts per day, 6 days per week, and produces approximately 21,000 passenger and 1,000 tractor and truck tires per day.

Workers are potentially exposed to volatilized nitrosamines during the manufacture of tires in hot process areas where rubber is heated, plasticized, and cured. N-Nitrosodiphenylamine, a rubber retarding agent, is added to tractor and truck tire batches in varying amounts (1.2 to 2.3 pounds per 500-pound batch) to control the rate of cure. Recently, NDPhA was found to cause bladder cancer in laboratory animals.¹ Also, NIOSH found that this compound thermally decomposes during truck tire manufacturing and may transnitrosate with a morpholine compound to generate N-Nitrosomorpholine.^{2,3}

Research and recommendations by NIOSH at another Kelly-Springfield tire plant resulted in improved local exhaust ventilation and successful use of a substitute chemical for NDPhA. Implementation of recommendations reduced NMOR levels in this plant 200-fold and eliminated N-Nitrosopyrrolidine.³ For readers unfamiliar with tire manufacturing, a tire manufacturing flow chart is shown in Figure 1, and a cross-section of tire showing its components is shown in Figure 2.

IV. EVALUATION DESIGN AND METHODS

NIOSH took 16 air samples in five different areas: the Laminator area - where tractor tire tread is rolled onto the tire carcass, the #1 Banbury, extruder for sidewall and under-tread stock, Feedmill and Calendaring, and Tractor Tire Curing Press. A variety of chemicals added in these stocks were examined, and where there was potential for nitrosamine generation samples were obtained.

