U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
CENTER FOR DISEASE CONTROL
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
CINCINNATI, OHIO 45202

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HEALTH HAZARD EVALUATION DETERMINATION
REPORT NO. 75-15-250

CONVERSE RUBBER COMPANY
MALDEN, MASSACHUSETTS

DECEMBER 1975

I. TOXICITY DETERMINATION

Environmental surveys and employee interviews were conducted at the Converse Rubber Company on June 3-5 and September 3-5, 1975. On the basis of data collected during these surveys, it has been determined that employees in the compounding room and in the doubling room are exposed to excessive concentrations of airborne particulates. It was not possible to determine whether the employees in the compounding room are exposed to potentially hazardous concentrations of silica due to the lack of a suitable analytic method given the specific environmental conditions in that area. Airborne particulates measured by the lining calender are not believed to be a health hazard at the concentrations measured during this evaluation. However, brief, periodic exposures to higher concentrations of zinc stearate may produce irritation of the upper respiratory tract. Ammonia concentrations measured during this study have been determined to be capable of producing sensory irritation. Since these exposures are short-term and occur intermittently, they are not believed to be likely to produce any long-term health effects. Methylene chloride has been determined to be non-toxic under normal operating conditions. Short-term potentially toxic exposures may exist during maintenance procedures requiring mold cleaning with a compound containing methylene chloride. Methylene-di-(4-phenylisocyanate) (MDI) was found to be non-toxic at concentrations measured during this evaluation.

Recommendations pertaining to the amelioration of existing hazards have been offered for consideration by the company.

II. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this determination report are available upon request from the Hazard Evaluation Services Branch, NIOSH, U.S. Post Office Building, Room 508, 5th and Walnut Streets, Cincinnati, Ohio 45202. Copies have been sent to:

a) Converse Rubber Company, Malden, Massachusetts
b) Authorized Representative of Employees
c) U.S. Department of Labor - Region I
d) NIOSH - Region I

For the purposes of informing the approximately 20 "affected employees", the employer shall promptly "post" the Determination Report in a prominent place(s) near where exposed employees work for a period of 30 calendar days.

III. INTRODUCTION

Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669 (a)(6) authorizes the Secretary of Health, Education, and Welfare, following a written request by an 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 National Institute for Occupational Safety and Health received such a request from an authorized representative of employees regarding exposure of employees to zinc stearate, lead oxide, ammonia, and pre-polymer at the Converse Rubber Company in Malden, Massachusetts. The request alleged that employees at the Urethane Unit had complained of skin rash, mill room and compound room workers were exposed to excessive dust, and that some unit production assemblers were exposed to ammonia.

IV. HEALTH HAZARD EVALUATION

A. Process Description - Conditions of Use

The Converse Rubber Company manufactures approximately 14,000 pairs of rubber footwear per day at their Malden facility. The plant, which employs approximately 700 people, consists of three buildings, each 66 years old. The areas of the plant which were surveyed include the polyurethane unit, the vulcanizers, and compound room, and certain specific locations in the mill room.

Raw materials are stored, weighed, loaded onto a conveyor, and added to the Banbury mixer in the compound room, also called the powder room. There are 35 chemicals which are used in various combinations to make the different rubber parts of the sneakers, with about 16 different components used in each batch of rubber. Three persons work in this area: the compounder and compound helper are responsible for weighing and assembling the appropriate chemicals and the Banbury operator adds them to the Banbury mixer. There is local ventilation at the entrance to the Banbury, but clouds of dust were still visible and work surfaces were all coated by a fine white powder. Two other persons work on the first floor, underneath the Banbury: the mill operator and the stocker.

Five people are employed at the lining calender in the mill room where the rubber used for toe caps is rolled through zinc stearate. One man throws scoops of zinc stearate powder onto the rubber as it is being rolled to keep the layers from sticking to each other. Zinc stearate is also used in the doubling area of the mill room where rolls of rubber are put together in several plies in order to cut the material in many layers at a time. Two persons normally work in this area.

The polyurethane unit is a recently added injection molding operation for making the outsoles of sneakers. Methylene-di-(4-phenylisocyanate)(MDI) and a resin are pumped from two separate tanks into a mixing chamber then simultaneously injected into a mold. These are then heated for curing. The upper part of the sneaker forms the top of the mold chamber. Therefore, when the reaction between MDI and the resin is complete, the mold chamber is opened and the outsole is a permanent part of the shoe. A silicone release agent, containing methylene chloride, is sprayed on the molds so that the outsoles won't adhere to them. The molds are cleaned with a solution that also contains methylene chloride. The urethane unit is less than a year old and new local ventilation was added in March of this year.

After the shoes are assembled, they are cured in one of four vulcanizers with ammonia and steam at approximately 270^{o}F and 32 psi. The vulcanizers are large cylindrical chambers, each with a single door on one end. After the shoes are cured, a vent is opened on the top of the vulcanizer thereby releasing the pressure and allowing most of the steam and ammonia to escape. The vents on two of the vulcanizers open near the windows of an adjacent building and employees in this adjoining area reportedly complained of the "ammonia fumes". The odor of ammonia is also apparent when the doors of the vulcanizer are opened to unload the cured shoes. Three persons are employed in this area on the day shift, and three persons on the night shift.

B. Evaluation Design and Methods

Four substances were specified as the alleged toxic substances on the request for a hazard evaluation: ammonia, pre-polymer, lead oxide, and zinc stearate. Therefore, environmental air samples were obtained in the areas in which these substances were used for these specified substances and for other substances which were judged to be possibly present or used in sufficient quantity to merit evaluation.

Environmental investigations were performed on June 3-5, 1975 and September 3-5, 1975 by NIOSH industrial hygienists.

In the compound room, a variety of dusty compounds including zinc oxide, calcium carbonate and silica containing compounds are added to natural or synthetic rubber.

On the initial plant visit, personal sampling pumps and pre-weighed AA filters were used to collect breathing zone and general area samples to be analyzed both gravimetrically for total dust and by atomic absorption for zinc, calcium, and lead (although the use of lead compounds had been discontinued). Gravimetric analysis was done by NIOSH laboratories in Cincinnati; the filters were subsequently sent to Salt Lake City for atomic absorption analyses.

Bulk samples were also collected of two substances used in the compound room which were allegedly amorphous silica. These were sent to NIOSH laboratories in Salt Lake City to be analyzed by x-ray diffraction to determine if there were any free silica (crystalline silica) present.

General area and breathing zone air samples were collected by the lining calender using personal sampling pumps and pre-weighed AA filters for total dust and zinc analysis.

Breathing zone and area samples for pre-polymer (MDI) were collected near the urethane unit using impingers containing 15 ml of absorbing solution prepared according to the Marcali method.[1] The solutions were transferred to glass vials and sent to Salt Lake City for colorimetric analysis.

Ammonia concentrations were measured on the initial survey with Draeger detector tubes at several locations around the vulcanizers and near the windows of the second floor of the adjacent building.

Medical questionnaires were administered to employees during the initial visit to the plant to determine whether there were any work-related health problems.

On a subsequent environmental survey of the plant, breathing zone and area samples were obtained in the compound room to be analyzed for free silica. Three employees each wore a personal sampling pump set at a flowrate of 1.7 liters per minute with a 10 mm nylon cyclone and 2-piece filter cassette containing an FWSB filter. Some area samples were collected with identical sampling apparatus, and two general area samples were obtained using a 1/2 inch metal cyclone and an FWSB filter with a Gast pump drawing air through a critical orifice at a flowrate of 9 liters per minute. All samples were sent to Salt Lake City for x-ray diffraction analysis.

Ammonia concentrations were measured near the vulcanizers and on the second floor of the adjacent building using midget impingers containing 10 ml of 0.1 N sulfuric acid. Five to ten-minute samples were collected, corresponding to peak exposures when the vulcanizers were opened.

Air samples were obtained by the urethane unit for methylene chloride analysis, using charcoal tubes and Sipin pumps. Breathing zone exposures of the two operators as well as general area concentrations were monitored at several locations around the room. Breathing zone exposures to total dust and zinc of the five employees at the lining calender were determined using personal sampling pumps and VM-1 filters. The filters were re-weighed and then analyzed by atomic absorbtion for zinc.

C. Evaluation Criteria

1. Environmental Standards

The U.S. Department of Labor promulgates Occupational Health Standards which are designed to protect the health and safety of workers exposed to any of approximately 400 chemical substances for an 8-hour workday, 40-hour week, over a working lifetime (29 CFR 1910.93, Tables G-1, G-2, and G-3). The Federal standards applicable to the substances evaluated during this survey are presented in the following table. Also included in this table are the Threshold Limit Values recommended by the American Conference of Governmental Industrial Hygienists representing airborne concentrations of substances under which it is believed "nearly all workers" may be exposed without adverse effect. The last column of the table refers to standards of occupational exposure which have been developed and are recommended by NIOSH.

Substance	Federal Standard	ACGIH TLV	NIOSH Recommended Standards
Ammonia	50 ppm	25 ppm	50 ppm[1]
Nuisance Dust[2] - total	15 mg/M^3	10 mg/M^3	-
- respirable	5 mg/M^3		
Methylene Chloride	500 ppm[3]	200 ppm[4]	
MDI	0.02 ppm	0.02 ppm	-
Crystalline Silica - total	$\frac{30 \text{ mg/M}^3}{\% \text{ SiO}_2 + 2}$	$\frac{30 \text{ mg/M}^3}{\% \text{ SiO}_2 + 3}$	
- respirable	$\frac{10 \text{ mg/M}^3}{\% \text{ SiO}_2 + 2}$	$\frac{10 \text{ mg/M}^3}{\% \text{ SiO}_2 + 2}$	50 μg/M^3
Amorphous & Silica - total	$\frac{80 \text{ mg/M}^3}{\% \text{ SiO}_2}$	3 mg/M^3	
- respirable		1 mg/M^3	

1 - Recommended as a Ceiling Value as determined by a 5-minute sampling period
2 - Zinc stearate, zinc oxide dust, and calcium carbonate are considered to to be nuisance dusts
3 - With a ceiling of 1000 ppm and an acceptable maximum peak above the ceiling of 2000 ppm for no more than 5 minutes in any 2 hours
4 - Proposed change for 1975

2. Toxicologic Effects

a) Ammonia

There is no evidence of acute or chronic health effects other than sensory irritation from exposure to ammonia except at very high concentrations.[2] Ammonia is soluble in water and is removed from inspired air by contact with the first moist tissue it reaches. Therefore, the epithelium and mucous membranes of the upper respiratory tract and the conjunctiva are most affected by exposure to ammonia.[2,3] It has been reported that workers could not remain in atmospheres containing 100 ppm for long periods of time without experiencing irritation of the eyes and upper respiratory passages.[4] Short exposures to approximately 400 ppm have produced throat irritation and to about 700 ppm have produced eye irritation.[5] At sufficiently high concentrations (5,000 - 10,000 ppm), the irritation of the upper respiratory tract elicits a reflex action consisting of general vasoconstriction and an increase in breathing, and such exposures may be fatal.[3] Since there are no known adverse effects below concentrations producing irritation, current standards have been designated so as to protect workers from eye and respiratory tract irritation.

b) Nuisance Dust

Particulates are classified as nuisance dust where they have been found to have little adverse effect on the lungs and where there is no known specific toxicity from inhalation. In sufficient quantities they may produce irritation just by their chemical or mechanical action on the skin or mucous membranes, they may accumulate in the respiratory passages, or they may reduce visibility. However, lung deposition of nuisance particulates does not result in a significant amount of scar tissue formation, nor does it destroy the architecture of the alveoli. Also, the tissue reaction is potentially reversible.[6] The compounds evaluated at the Converse Rubber Company which come under this category include zinc oxide, zinc stearate, and calcium carbonate.

c) Methylene Chloride

Methylene chloride is primarily a central nervous system depressant. Sensory irritation is usually absent and the first symptoms of exposure may be light-headedness, sleepiness, weakness, fatigue, and headache.[7,8,9,10] These may be accompanied by shortness of breath, chest pain, and an increase in respiratory rate and heart beat.[8,9,10]

In recent studies, carbon monoxide has been found in exhaled breath, and elevated blood carboxyhemoglobin levels have been found following exposures to methylene chloride. Experimental investigations have shown that carboxyhemoglobin levels are a function of exposure concentration and time.[7,11] Elevated carboxyhemoglobin levels have also been found in workers occupationally exposed as well as experimentally[12] and such observations indicate a need to control methylene chloride exposure in order to maintain acceptable carboxyhemoglobin levels.

d) Methylene-di-(4-phenylisocyanate)(MDI)

The isocyanates are irritating to the mucous membranes of the eyes, nose, throat, and respiratory passages and can cause severe dermatitis. They can produce allergic skin sensitization and asthma-like reactions in some people. In one study of 44 isocyanate-exposed and unexposed workers, individuals experienced varying degrees of eye, mouth, throat, and bronchial symptoms. Concentrations ranged from 0 to 0.53 ppm.[13] The standard for MDI is identical to that for TDI (0.02 ppm) however MDI is generally considered to be less of a hazard because it has a lower vapor pressure.

e) Silica

The crystalline forms of silica can cause severe tissue damage when inhaled. Silicosis is a form of pulmonary fibrosis caused by the deposition of fine particles of crystalline silica in the lungs. Symptoms usually develop insidiously, with cough, dyspnea, chest pain, weakness, wheezing, and non-specific chest illnesses.[14,15] Silicosis usually occurs after years of exposure, but may appear in a shorter time if exposure concentrations are very high. This latter form is referred to as rapidly-developing silicosis, and its etiology and pathology are not as well understood.[15] Silicosis is usually diagnosed through chest roentgenograms, occupational exposure histories, and pulmonary function tests. The manner in which silica effects pulmonary tissue is not fully understood, and theories have been proposed based on the physical shape of the crystals, their solubility, cytotoxicity to macrophages, or their crystalline structure. There is evidence that cristobalite and tridymite, which have a different crystalline form from that of quartz, have a greater capacity to produce silicosis.[14]

E. Evaluation Results

1. Environmental

The results of the analyses for total dust, zinc, and calcium are presented in Table 1. The use of lead had been discontinued and there was no lead detected on 21 of the 22 filters. One sample showed 0.01 mg/M^3 of lead, but this was most likely a contaminant on the filter. Total particulate weights were found to range from 0 to 50.83 mg/M^3 with the highest dust concentrations generally observed in the compounding area. Concentrations measured in the compound room on the first survey ranged from 0.88 mg/M^3 to 18.67 mg/M^3 as determined by area samples, and 7.56 to 50.83 mg/M^3 for the personal samples. Dust samples collected on FWSB filters during the second plant visit showed concentrations of respirable particulates ranged from 2.1 mg/M^3 to 19.1 mg/M^3 on two area samples. Since employees in the compounding room will leave the area upon completion of a specified number of batches, these concentrations represent the average levels of particulate to which these workers were exposed in the compound room. Zinc concentrations ranged from "none detected" to 3.44 mg/M^3 and calcium concentrations were 0.02 to 5.02 mg/M^3. In the area below the Banbury, exposures ranged from 1.00mg/M^3 to 4.92 mg/M^3. Personal and area samples for total dust taken at the lining calender ranged from 1.30 to 3.90 mg/M^3 on the initial visit and "none detected" to 6.56 mg/M^3 on the subsequent survey. Concentrations of zinc were 0.043 mg/M^3 to 0.821 mg/M^3 for the two days sampled. In the Doubling Room total dust measurements ranged from 2.94 mg/M^3 to 28.15 mg/M^3, zinc concentrations were from "none detected" to 2.30 mg/M^3, and calcium varied from "none detected" to 0.41 mg/M^3.

The calcium and zinc weights account for only a fraction of the total dust on the filters. The stearate part of the zinc stearate molecule is approximately 8.7 times heavier than the zinc, and the carbonate part of calcium carbonate is about 1.5 times heavier than calcium. These, along with small quantities of dust from the other substances added to the Banbury, account for the large amount of dust which is not specifically reported as zinc or calcium.

Breathing zone and area samples for MDI were analyzed colorimetrically[1] and all but two were found to be below the lower limit of detection for MDI. One of the employees at the urethane unit was found to be exposed to 0.005 mg/M^3 (0.0004 ppm) and one area sample, located at the injection molding head was the same concentration.

Ammonia concentrations were measured with Draeger detector tubes during the initial plant visit, at several locations around the vulcanizers and near the windows on the second floor of the adjacent building. On a subsequent visit, impingers were used to characterize peak exposures as determined by 5 to 10-minute personal and area samples. During the first survey, the odor of ammonia was easily detected and concentrations were found to range from 0 to >100 ppm by the vulcanizers. Five ppm were measured at the window of the adjacent building, but the vents were not open at that particular time. During the second survey, the odor of ammonia was not detectable and 6 of 8 samples were below the lower limit of detection. The other two were 0.36 ppm and 1.80 ppm. These results are presented in Table 2.

Methylene chloride concentrations were measured in the area around the urethane unit. The lowest concentration was 5.1 ppm and the highest was at least 390 ppm (the charcoal was saturated). Methylene chloride concentrations are listed in Table 3.

Bulk samples of two substances used in the compounding area, which were allegedly amorphous silica, were analyzed by x-ray diffraction and one was found to contain 8.6% cristobalite and the other was 4.4% cristobalite. Area and personal respirable dust samples were collected to determine worker exposure to free silica. However, because there was a great deal of other dust present, and because there was amorphous silica as well as crystalline silica, there was no analytical method capable of specifically determining the airborne free silica concentrations.

2. Medical

Of the thirteen persons interviewed, five worked in the compounding area or underneath the Banbury, three worked at the lining calender, one was employed in the doubling area, two operated the urethane unit, and two worked near the vulcanizers. None of the interviewed employees who worked either in the compound room, below the Banbury, or in the doubling area complained of any health problems at or related to their work. One person employed at the lining calender complained of severe coughing and a dry, sore throat; another said he sneezed occasionally; the third stated that he developed sore throats at times and a skin rash from the zinc stearate when his skin was chapped. One of two men interviewed at the urethane unit had burning eyes on a daily basis and sometimes developed a rash around his eyes, both of which he attributed to the silicone release agent. A review of the plant's records on Occupational Injuries and Illnesses indicated that there had been other employees with similar complaints attributable to the mold release agent. An employee working at the vulcanizers stated that he coughed and had burning eyes when the vent was opened.

F. Conclusions and Recommendations

Several measured concentrations for total and respirable particulate were found to exceed both the Federal standard for nuisance dust as promulgated by OSHA and the TLV recommended by the ACGIH. Exposures were the highest in the compounding area, with one personal sample indicating an exposure concentration greater than five times the recommended TLV for nuisance dust. As previously mentioned, exposure times vary in the compounding area depending on the amount of time needed to complete the task. However, environmental concentrations were found to be sufficiently high such that even if workers were to go to a less dusty area for the remainder of the workday, it is likely that their total exposures would exceed recommended limits for exposure to nuisance particulates. Local exhaust ventilation should be added in this area and in the interim period, all compound room employees should be provided with and should be required to wear NIOSH approved respirators for protection against pneumocomiosis producing dusts.

It was not possible to determine whether the employees in the compounding room are exposed to potentially hazardous concentrations of silica because of the lack of a suitable analytical method. However, since the raw materials which were found to contain free silica were believed to be amorphous silica, it is assumed that crystalline silica is not a necessary component in the rubber. For this reason, it is recommended that a material which is truly amorphous silica be substituted for the compounds presently in use. At the same time, it is recommended that suitable engineering controls be installed to reduce the dust exposure of compound room employees.

Particulate concentrations by the lining calender were found to be within the established standards for nuisance dust. As zinc stearate is added to the rubber, a cloud of dust is formed which dissipates in a matter of seconds as the particles settle. This is an intermittent process which may be responsible for the symptoms of sneezing, coughing and a dry, sore throat which were reported by employees in that area. It is believed that the intermittent exposures to zinc stearate dust are responsible for the subjective symptoms of upper respiratory tract irritation, but that long-term, chronic health effects are not likely at the concentrations measured during this evaluation.

Zinc stearate is also used in the doubling room. One person was found to be exposed to 28.15 mg/M^3 of total particulate; the other three samples ranged from 2.94 to 7.59 mg/M^3. The exposure here is similar to that by the lining calender in that clouds of dust are intermittently released. The total time of the process is shorter, but the room is smaller and more zinc stearate dust is generated during the doubling procedure, as evidenced by the higher environmental concentrations measured. No health effects were reported by employees in this area, however, based upon the environmental concentrations measured, it is believed that a potential health hazard does exist from brief exposures to excessive concentrations of dust.

Concentrations of ammonia measured by the vulcanizers during the initial survey did exceed the current Federal standard, the ACGIH threshold limit value, and the NIOSH recommended ceiling level. When the pressure in the vulcanizer was released, the ammonia became noticeably irritating to the eyes and upper respiratory tract and concentration measurements exceeded 100 ppm. On the subsequent survey, ammonia was not detectable either by air sampling nor by its effects on the sensory organs. Since exposures to ammonia are brief and occasional, it is not believed that any long-term health effects are likely. However, sensory irritation can and does occur in some instances when the pressure in the vulcanizers is released. Because injuries to the eyes, skin and respiratory tract can result from accidental or repeated exposures to high concentrations, it is recommended that protective equipment, eye wash, and safety shower be readily available. This should not preclude the addition of adequate ventilation to remove the vapors from the work area. The exhaust for the ventilation should not be near the intake of any ventilation system nor should it be located at window level of the adjacent building. Additionally, there should be medical surveillance of any employee adversely affected by exposure to ammonia.

Concentrations of methylene chloride were found to vary considerably. Personal breathing zones samples varied from 8.6 to 390 ppm, and area samples ranged from 5.1 to 181 ppm. The highest concentration was detected on a personal breathing zone sample from the worker who was spraying the mold release agent onto the molds to clean them while the urethane unit was undergoing maintenance. Since this was not a routine activity and since the other concentrations were within the concentration limits generally considered to be non-hazardous, it has been determined that under normal operating conditions, methylene chloride is not a health hazard. Some potentially toxic concentrations may exist during maintenance procedures when the molds are cleaned. It is believed that these occasional exposures are responsible for the eye irritation experienced by a few employees. Therefore, it is recommended that an air purifying or supplied air respirator with a full face mask be used during maintenance procedures where molds are cleaned with methylene chloride. Detailed information on the selection and use of respirators can be obtained from the respiratory protection devices manual published by the AIHA and ACGIH in 1963 or from the NIOSH publication of certified personal protective equipment.

Based upon analyses of personal breathing zone and general area samples from the vicinity of the urethane unit, it has been determined that concentrations of MDI as normally encountered are not toxic to employees.

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Table 1

Particulate Concentrations at Converse Rubber Company

June 4, 1975

Location	Job Title	Sampling Period	Total Dust (mg/M3)	Zinc mg/M3	Calcium (mg/M3)
Compounding Room	Compound Helper	7:38-11:23	13.25	0.06	0.67
Compounding Room	Banbury Operator	7:40-11:26	11.12	0.19	2.39
Compounding Room	Banbury Operator	11:26-13:45	7.56	0.16	1.04
Compounding Room	Compounder	7:39-11:23	50.83	3.44	5.02
Below Banbury	Mill Operator	7:34-11:32	2.70	0.07	0.36
Below Banbury	Mill Operator	11:32-13:45	1.00	0.04	0.14
Below Banbury	Stocker	7:48-11:30	4.92	0.02	0.36
Below Banbury	Stocker	11:30- 1:45	3.55	0.03	0.69
Compounding Room	Area behind Banbury	8:07-11:27	18.67	.07	3.61
Compounding Room	Area next to Banbury	8:10-11:28	2.15	0.14	N.D.
Compounding Room	Area behind Banbury	11:27- 2:45	7.14	0.07	0.96
Compounding Room	Area next to Banbury	11:28- 2:45	0.88	.02	0.10
Doubling Room	Doubler 1	9:23-10:01	3.16	.25	0.09
Doubling Room	Doubler 2	9:25-10:01	28.15	2.30	0.09
Doubling Room	Area A	9:28-10:02	2.94	N.D.	N.D.
Doubling Room	Area B	9:27-10:03	7.59	0.09	0.41
Lining Calender	Calender Operator	7:53-10:00	2.20	0.17	0.05
Lining Calender	Winding Helper	7:54-11:30	1.73	0.05	.02
Lining Calender	Winding Helper	7:54-11:30	3.61	.33	.03
Lining Calender	Back Tender	7:55-11:30	2.91	.07	.02
Lining Calender	Mill-man	7:57-11:32	3.90	0.20	.06
Lining Calender	Area A	8:15-11:35	1.30	0.04	.02
Lining Calender	Area B	8:17-11:37	3.80	0.33	.02

N.D. = none detected. (less than 0.001 mg/sample for zinc, and less than 0.004 mg/sample for calcium)

Table 1 (Cont'd)

Particulate Concentrations of Converse Rubber Company

September 4, 1975

Location	Job Title	Sampling Period	Total Dust (mg/M^3)	Zinc (mg/M^3)
Lining Calender	Calender Operator	9:50-13:20	1.85	0.25
Lining Calender	Back Tender	9:55-13:20	N.D.	N.D.
Lining Calender	Winding Helper	9:53-13:20	4.35	0.50
Lining Calender	Mill Man	9:55-13:20	1.94	0.22
Lining Calender	Winding Helper	10:00-13:20	2.10	0.29
Lining Calender	Area	10:05-13:25	6.56	0.82
Lining Calender	Area	10:05-13:25	3.23	0.40
			Respirable Dust	Total Dust
Compounding Room	Area	7:30-11:20	19.1	27.1
Compounding Room	Compound Man	7:10-13:14	6.2	-
Compounding Room	Area	11:32-13:20	19.0	31.1
Compounding Room	Banbury Operator	7:20-13:14	2.1	-
Compounding Room	Compound Helper	7:20-13:14	3.1	-

Table 2

Concentrations of Ammonia

Sample Description	Sampling Period	Ammonia Concentrations (ppm)	Comments
June 4:			
Detector Tube	-	0	Door closed
			Vulcanizer 1:
Detector Tube	-	>100	Pressure released
Detector Tube	-	>100	Pressure released
Detector Tube	-	70	Pressure released
Detector Tube	-	>100	Pressure released
Detector Tube	-	60	Door opened
Detector Tube	-	70	Door opened
			Vulcanizer 2:
Detector Tube	-	>100	Leaking 2nd floor, window of adjacent building:
Detector Tube	-	5	
September 4:			
Impinger-personal	1:05-1:16pm	N.D.	Opened vulcanizer
Impinger-personal	1:08-1:15pm	N.D.	Pushes carts
Impinger-personal	1:10-1:15pm	N.D.	Pushes carts
Impinger-area	1:10-1:16pm	N.D.	Next to vulcanizer
Impinger-personal	2:15-2:23pm	1.80	Opened vulcanizer
Impinger-personal	2:18-2:24pm	N.D.	Pushes carts
Impinger-personal	2:18-2:24pm	0.36	Pushes carts
Impinger-area	2:15-2:22pm	N.D.	2nd floor, window of adjacent building.

N.D. - none detected (less than 0.009 mg/sample)

Table 3

Concentrations of Methylene Chloride at the Polyurethane Unit

September 4, 1975

Sample Description	Sampling Period	Methylene Chloride (ppm)
Breathing zone Personal - Operator 1	7:25-11:25 11:35-14:45	>390.2[1] 8.6
Breathing zone Personal - Operator 2	7:27-11:32 11:35-14:45	17.0 24.9
Area - between Methylene chloride tanks	7:30-11:22 11:22-14:45	91.7 80.3
Area - near injection head	7:30-11:30 11:30-14:45	5.1 6.8
Area - bench near unit	7:30-11:27 11:27-14:45	181.8 11.5

1 - Minimum concentration: charcoal tube was saturated