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Investigating Work Conditions for Claimant



STATE OF OHIO
THE INDUSTRIAL COMMISSION OF OHIO
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July 19, 1976

Risk #SI-2331

Legal Section
Industrial Commission of Ohio
Ohio Departments Building
Columbus, Ohio 43215

Re: OD 10033-22
Addie Metheney

Attn: Mr. James G. Clymer

Dear Mr. Clymer:

On January 20-21, 1976 and February 4-5, 1976, visits were made to the facilities of Goodyear Tire and Rubber Co., 1144 Market Street, Akron, Ohio and Plant #2, Martha Avenue, Akron, Ohio to check conditions under which the claimant had worked. There are approximately 8,000 employees at the Akron facilities.

This company manufactures rubber and plastic products.

According to company records, the claimant's experience is as follows:

August 3, 1943	Synthetic Operator
July 1, 1944	Solution Make-up
March 6, 1945	Baler
April 18, 1945	Solution Make-up
June 18, 1945	Coagulation
November 7, 1945	Styrene Stripping Rotation
November 16, 1945	Dryer Rotation Job
February 8, 1946	Production Balance
March 25, 1946	Styrene Stripping Rotation
June 4, 1946	Refiner Operator - Plant 2
April 19, 1961	Waldron Dip Unit Helper
April 26, 1961	Refiner Operator
October 7, 1963	Waldron Dip Unit (1st man)
July 24, 1964	Refiner Operator
August 20, 1964	Calendar Helper
February 22, 1965	Refiner Operator
July 13, 1967	Waldron Dip Unit (1st man)
July 21, 1971	Voluntary layoff

The claimant began working in plant #2 on June 4, 1946. Prior to this he worked in a government owned plant.

Medical records were not readily available.

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The claimant's duties as the Waldron Dip Unit Operator in Department 237 F consisted of the following:

1. Turns oven on.
2. Pumps dip formulation into applicator tank.
3. Places fabric roll into the letoff of the machine.
4. Sews fabric to lead line.
5. Activates machine.
6. Repeats fabric rolls. Coats from 10 to 15 rolls per day.

In brief, the operation consists of automatically conveying a roll of fabric through an unventilated applicator or dip tank where the fabric is coated with one of several types of dip formulations. Soon after emerging from the applicator tank, the coated fabric enters a rather long ventilated oven, exits the opposite end of the oven, and is then wound in a roll. The cured fabric is then removed by two of the dip unit operator's helpers. Another roll of fabric is placed on the machine letoff and the operation repeated.

The dip formulations used to coat the fabrics are concocted at Goodyear's #1 plant. According to Mr. Chuck Ludel, Goodyear Chemist, 7 formulations were used between 1967 and 1971. At least 2 of these formulations have been discontinued since 1971. The 2 formulations discontinued were referred to as a butyl latex formulation and a Hylene MP formulation. There are currently 4 formulations in use, and 3 of these formulations were allegedly used by the claimant. The 4th formulation is a recent addition. All formulations, past and present, are referred to as RFL (Resorcinol-Formaldehyde-Latex) dips and alleged to be rather similar except for several different types of latex used and varying but still considered low percentages of the other ingredients, all of which are in an aqueous medium. The discontinued Hylene MP, however, contained approximately 2 percent by weight of an isocyanate that, according to DuPont, when heated above 300° F., would evolve MDI (Diphenylmethane 4, 4-diisocyanate), a respiratory irritant that may cause asthmatic breathing. This material is not associated with liver damage; however, phenol would also be liberated at temperatures above 300° F. (the oven would have to be operated at a temperature above 300° F. for the necessary desired product result to occur) and can cause liver damage. However, any possibility of a significant worker exposure to MDI or phenol would appear to necessitate a breakdown or other occurrence in the oven's ventilation system that would cause significant emissions to enter the work room. Vinylpyridine is another ingredient of the dip formulations and will be elaborated on later.

The operator and helpers of the Waldron dip unit claim that the formulations are not similar in regard to odor and irritancy. For unconfirmed reasons the Waldron dip unit must be shut down occasionally because of irritating and odorous emissions; in fact, the unit was shut down on February 22, 1975 and the operator and his helpers went home because of the emissions.

The oven through which the coated fabric passes is steam heated and consists of 5 unit "heaters"; 3 of the units were operated at 250°F. and the other 2 at 235°F. on the sampling dates. Some spillage was observed at the helper's end of the oven, and a ceiling exhaust fan adequately controlled these emissions.

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No unusual odor or irritation was experienced during the sampling periods, and the dip formulation being used was one of the ones, SBR latex, often used by the claimant. The equipment and operation, not including the dip formulations, allegedly have not changed since the claimant's departure. Employees stated that the two sampling dates were typical of the normal operation and usual emissions experienced with the Waldron dip unit.

Breathing zone air samples were obtained for formaldehyde, resorcinol, vinylpyridine, acrolein, pyridine, benzene, hexane, ethylene dichloride, dioxane, acrylonitrile, ethyl benzene, and other organic vapors capable of adsorption on and analysis from activated charcoal. All breathing zone air samples were obtained with personal sampling pumps. In addition to the pumps midget impingers with 1% sodium bisulfite solutions were used for formaldehyde and acrolein samples and midget impingers with distilled water for resorcinol and vinylpyridine samples; activated charcoal tubes were used for the remainder of the organic compounds sampled. Sample results are as follows:

<u>OPERATION</u>	<u>AIR CONTAMINANT</u>	<u>EMPLOYEE EXPOSURE, TWA*</u>	<u>ACGIH** TLV***</u>
Waldron Dip Unit Operator	Formaldehyde	1.11 ppm****	***** C 2.0 ppm
" " " "	Resorcinol	Negative	10.0 ppm (proposed)
" " " "	Vinylpyridine	Negative	None
" " " "	Acrolein	0.02 ppm	0.1 ppm

The activated charcoal tube sample results were negative for the remainder of the organic vapors mentioned.

- *TWA = Time-Weighted Average
- **ACGIH = American Conference of Governmental Industrial Hygienists
- ***TLV = Threshold Limit Value
- ****ppm = Parts Per Million
- *****C = Ceiling Value (The TLV of 2 ppm should not be exceeded for any period of time).

One of several formaldehyde samples obtained was slightly over the ceiling value of 2 ppm. This 43 minute sample resulted in 2.07 ppm formaldehyde.

The following comments, unless otherwise mentioned, relative to the toxicological effects of the dip formulation ingredients and acrolein were taken from The Encyclopedia of Occupational Health and Safety, The International Labor Office, Geneva, Switzerland, and Industrial Hygiene and Toxicology, Volume II, Patty:

Formaldehyde: Exposure to low atmospheric concentrations of formaldehyde causes irritation, especially of the eyes and respiratory tract. Due to the solubility of formaldehyde in water, the irritant effect is limited to the initial section of the respiratory tract. A concentration of 2 - 3 ppm causes slight formation of the eyes, nose and pharynx; 4 - 5 ppm, discomfort rapidly increases; 10 ppm is tolerated with difficulty even briefly; between 10 and 20 ppm, there is severe difficulty in

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breathing, burning of the eyes, nose and trachea, intense lacrimation and severe cough. Exposure to 50 - 100 ppm produces a feeling of restricted chest, headache, palpitations and, in extreme cases, death due to oedema or spasm of the glottis. Asthmatic symptoms may occur due to allergic sensitivity to formaldehyde, even at low concentrations.

Inhalation of formaldehyde by animals causes prompt and severe irritation of the eyes and respiratory tract. Skog found edema and hemorrhages of the rat lung, and signs of hyperemia and perivascular edema in the liver and kidneys. Changes similar to these were reported by Salemand Cullumbine.

The effect of formaldehyde on certain oxidative enzymes has been studied in vitro. It was found that formaldehyde inhibits succinic acid oxidase, choline oxidase, L-proline oxidase, and sarcosine oxidase in liver homogenates. In equal concentrations, it has no effect on the amine oxidase and cytochrome oxidase of liver or D-amino acid oxidase of kidney. The prior addition of substrate protects the enzymes from the formaldehyde for a short period of time. Source: Proceedings of the Society for Experimental Biology and Medicine, Bernheim F.

Vinylpyridine: Brief exposure to the vapor has caused eye, nose and throat irritation and transient headache, nausea, nervousness and anorexia. Skin contact causes burning pain followed by severe skin burns. Sensitisation may develop. The precautions recommended for pyridine should be adopted and particular care is needed to prevent inhalation and skin contact. A NIOSH vinylpyridine and liver damage search was negative.

Acrolein: Inhalation presents the most serious hazard. It causes irritation of nose and throat, tightness of the chest and shortness of breath, nausea and vomiting. The bronchopulmonary effect is very severe. No cases of chronic toxicity are known. Acrolein is not an ingredient of the dip formulations.

Resorcinol: Industrial exposures are rather rare, but could occur in any industry utilizing the compound. Pathology reported for man includes marked siderosis of the spleen and marked tubular injury in the kidney. Becker reported fatty changes and anemia of the liver, degenerative changes in the kidney, fatty changes of the heart muscle, moderate enlargement and pigmentations of the spleen, and edema and emphysema of the lungs. Resorcinol is readily absorbed from the gastroenteric tract and, in a suitable solvent, is readily absorbed through the human skin. The cutaneous application of solutions or salves containing from 3 to 25 per cent of this compound may result in local hyperemia, itching, dermatitis, edema, corrosion, and the loss of the superficial layers of the skin. These changes, if they are severe, may be associated with some or all of the following effects: enlargement of regional lymph glands, restlessness, methemoglobinemia, cyanosis, convulsions, tachycardia, dyspnea, and death.

The acute oral lethal dose of resorcinol for experimental rats was 301 mg/kg. Signs of intoxication included fibrillation, tumors, convulsions, salivation, dyspnea, sedation, emaciation, and death. In those rats who died, hemorrhages of the lung, inflammation of the gastrointestinal tract and hyperemia of the liver were observed. Source: Industrial Bio-Test Laboratories, Inc., Northbrook, Illinois.

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Laboratory test and interviews of workers at an Armed Forces Examining and Entrance Station, using or working near a copying machine based on a diazo developing process, resulted in findings suggestive of a relationship between the diazo copying process and abnormal liver function. The strongest association observed was between mixing the diazo developer and relative eosinophilia. No evidence was found between the copying process and clinical illness. Reference is made of the fact that hydroquinone and resorcinol, two chemicals present in the diazo developer, have been reported to cause liver abnormalities. Source: Journal of Occupational Medicine, Vol. 17, No. 8, pages 502 - 505.

Resorcinol is a solid at room temperature that is soluble in water. Under normal operating conditions this material would not be expected to be evolved from the applicator tank.

According to the claimant, the sporadic occurrences of highly irritating airborne chemical concentrations in the workroom is believed to have occurred because of downdrafting of the oven's ventilation system. These events may have been caused by unusually high negative pressure in the building and/or certain outdoor atmospheric conditions. The possibility of occasional downdrafting appears likely, and this event would cause the dip solution volatiles that are driven off by heat to spill out of the slot where the coated fabric enters the oven and into the workroom rather than being discharged to the outdoors. Chemicals in addition to formaldehyde could also be emitted from the oven into the workroom. If the discontinued Hylene MP dip solution was in use during possible spillage from the oven, the claimant would have been exposed to concentrations of phenol and MDI.

According to Occupational Diseases, A Guide To Their Recognition, U. S. Department of Health, Education, and Welfare, "acute phenol poisoning is mainly characterized by central nervous system manifestations including tinnitus, vertigo, tremor, excitement, and convulsions. Pneumonia often follows. Chronic phenol poisoning is characterized by headache, fatigue, cough, anorexia, insomnia, nervousness, paresthesias, weight loss, and cachexia. Renal and hepatic damage frequently follow phenol intoxication."

The Industrial Hazards Control Bulletin No. 46, The Boeing Company, Industrial Relations Department concerning the health hazard of exposure to vapors of phenol states:

- (1) Slightly toxic at room temperature. May be highly toxic if liquid is heated or atomized.
- (2) Inhalation may cause symptoms of headache, nausea, and vomiting, and tremor.
- (3) Damage may occur to the liver, kidneys, lungs, and central nervous system.

During the claimant's experience as a Refiner Operator for approximately 15 years, he occasionally received batches of rubber that were stuck together. Although infrequent, according to the claimant, he applied

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benzene between the slabs of rubber to separate them. He allegedly had sporadic exposure to benzene vapors over this 15 year period.

Recognized authorities have stated that exposure to benzene vapors may cause liver damage.

"At one time, benzene was quite widely used in rubber processing operations. This is no longer true, largely because of its insidious health hazards. It has been supplanted, for the most part, by either toluene or xylene so that its present uses are of a quite specialized nature. The acute effects of all three are narcosis.

More importantly, however, from an industrial standpoint, are the longterm chronic effects. In this respect, benzene must be regarded as highly hazardous and much more severe than either of the other two. This is based upon many years of experience. The principal effect of chronic exposure to benzene is damage to the blood forming process. Blood dyscrasias may result, with the most serious being aplastic anemia - this may be fatal. There appears to be a wide variation in susceptibility of individuals and this is unpredictable. Symptoms may occur after exposure has ceased. In recent years, a further incurable manifestation of the toxic action of benzene - the onset of leukemia - has been reported."

The claimant does not recall exposure to airborne chemicals during his experience as Synthetic Operator, Baler, Styrene Stripping Rotation or Calendar Helper. He did work with chemicals during his experience with Solution Make-Up from July 1, 1944 to March 6, 1945 and from April 18, 1945 to November 7, 1945. The types of chemicals could not be learned; however, exposure to sulfuric acid mist and hydrogen sulfide may have occurred during his experience with Coagulation.

The rubber industry is a huge consumer of chemicals using many different types from highly hazardous to innocuous. The claimant may have had exposure to commonly used chemicals such as chloroprene, carbon tetrachloride, ethylene dichloride, trichloroethylene, perchloroethylene, and methyl chloroform. Carbon tetrachloride like benzene is insidious, and all of these chemicals can produce liver damage. Various other chemicals used by the rubber industry can also cause liver damage; the toxicology of many others used is unknown, and there is always the possibility of additive effects or even synergism from combinations of the various chemicals used.

"Historically, there has always been an interest in the rubber industry; initially because of the acute health effects observed primarily in Europe and; subsequently because of the advent of many hundreds of new chemicals introduced in the rubber industry in the United States and throughout the world. This interest has been augmented by some implications derived from animal experimentation, with only a limited number of these compounds, and the basic realization that, in fact, the long-term biologic effects on humans of these chemicals individually or in combination are not known, with but relatively few exceptions. Moreover, the introduction of new chemicals has become a continuous pattern, as new rubber and related products are developed, increasing the task and the need for systemic epidemiologic studies."

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In summary, sample results for the dates of visit were below the TLV's for formaldehyde and other materials listed. These dates were considered normal in regard to employee exposure; however, on occasion, very irritating and odorous emissions occur with the operation of the Waldron dip unit. The reason for these events is unconfirmed but believed to be caused by occasional downdrafting of the oven's ventilation system, thus, causing heated dip solution components to be discharged into the workroom. The heated volatiles may consist of chemicals in addition to formaldehyde and possibly have an additive or synergistic effect. If the oven's exhaust system downdrafted during the use of the discontinued Hylene MP solution, the claimant would have also been exposed to concentrations of phenol and MDI. Phenol is known to produce liver damage. The claimant was exposed to sporadic unknown concentrations of benzene, also known to produce liver damage, during his approximate 15 years as Refiner Operator. The chronic effect of benzene poisoning may be insidious and symptoms may occur after exposure has ceased. There appears to be wide variation regarding individual susceptibility to benzene. Under adverse conditions, known to occasionally occur with the Waldron dip unit, resorcinol, known to cause liver abnormalities, may also be evolved into the workroom air. It is probable that the claimant was exposed to dusts, fumes, vapors, mists, and gases from many chemicals, many of which have unknown toxicological effects, during his approximate 28 years as a rubber worker not only from his own operations but past exposures to adjoining or other intradepartmental operations. The claimant also allegedly operated a vapor degreaser in the past; these devices usually utilized a chlorinated hydrocarbon such as trichloroethylene, and many of these chlorinated hydrocarbons have been linked with liver abnormalities. Trichloroethylene is currently suspect as a liver carcinogen. The claimant has had exposure and potential exposure to various chemicals known to produce liver abnormalities such as benzene, vapor degreasing solvents, phenol, and resorcinol and possibly to chemicals that have additive or synergistic effects. His exposure to these agents was both of a chronic and acute nature.

Sincerely yours,



Ron Sherman
Industrial Hygienist

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