U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
CENTER FOR DISEASE CONTROL
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
CINCINNATI, OHIO 45226

HEALTH HAZARD EVALUATION DETERMINATION
REPORT NO. 74-98-399

THE GOODYEAR TIRE & RUBBER COMPANY
PLANT NO. 1
1144 EAST MARKET STREET
AKRON, OHIO

JUNE 1977

I. TOXICITY DETERMINATION

It has been determined that the solvent vapors (excluding benzene) and air suspended particulates generated from the spray paint application are not toxic to the employees of Department 153-G at the concentration measured during evaluations conducted April 9, 1975, and September 16, 1975. Two spray painters, one letter painter and one cureman were exposed to benzene vapor concentrations slightly above the revised and current NIOSH recommended permissible exposure level of one part per million (ppm) benzene in air as a ceiling value representing a two hour sample. This determination is based on environmental measurements, observations, medical studies and interviews with 16 affected employees.

It should be noted that NIOSH in August 1976 issued Update Criteria and Recommendations for a Revised Benzene Standard and recommended to the Department of Labor that for regulatory purposes, benzene be considered carcinogenic in man and that exposure be kept as low as possible. One ppm represents the lowest level at which a reliable estimate of occupational exposure to benzene can be determined at this time, in consideration of the limitations of biologic and air measurement techniques. NIOSH recommends that occupational exposure be controlled so that no worker will be exposed to benzene in excess of one ppm (3.2 mg/cubic meter) in air as determined by an air sample collected at one liter/minute for two hours. OSHA has issued an emergency temporary standard reducing the permissible workplace exposure limit to 1 ppm benzene (8-hr. time-weighted average) with a ceiling level of 5 ppm (for any 15 minute period during the 8 hour day) - this standard became effective May 21, 1977. Measured vapor concentrations in several areas exceeded this OSHA standard.

Improved work practices, engineering modifications to improve spray booth exhaust efficiency or use of water based paint or paint containing no benzene should be considered. Bulk analysis of the mold-release paint compound indicated benzene concentration was approximately 5.0% by weight.

The problems of worker exposure to tire-curing fume were not specifically addressed in this hazard evaluation. In light of recent work by Fine and Peters[10,11] showing respiratory impairment in some workers with fume exposure, a program of medical surveillance should be instituted. Recommendations follow in this report.

II. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this Determination Report are currently available upon request from NIOSH, Division of Technical Services, Information and Dissemination Section, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After 90 days the report will be available through the National Technical Information Service (NTIS), Springfield, Virginia. Information regarding its availability through NTIS can be obtained from NIOSH, Publications Office at the Cincinnati address. Copies of this report have been sent to:

a. Goodyear Tire and Rubber Company, Akron, Ohio
b. Authorized Representative of Employees
c. U.S. Department of Labor, Region V
d. NIOSH Regional Consultant for OSHA

For the purpose of informing the "30 affected" employees, the employer will promptly "post" the Determination Report for a period of 30 calendar days, in a prominent place near where the affected employees work.

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 (NIOSH) received such a request from a representative of employees (Committeeman-United Rubber, Cork, Linoleum and Plastic Workers of America, Local 2) regarding the use of "inside and outside tire paint" in Plant #1, Department 153-G of the Goodyear Tire and Rubber Company, 1144 East Market Street, Akron, Ohio 44316. Employees felt that "exhaust of dust and paint fumes were polluting the workroom air".

IV. HEALTH HAZARD EVALUATION

A. Plant Process - Conditions of Use

The Goodyear Tire and Rubber Company, Akron, Ohio manufactured tires for automobile, racing, truck and construction vehicles, as well as other rubber products for industry. Approximately 1500 people were involved in manufacturing, research and development, and marketing of tires. In building #1, Department 153-G completes the final manufacture or building of custom racing tires. All tires completed in this department are custom made specifically for auto racing at the Indianapolis 500, Ontario Motor Speedway, etc. The work in this department is performed by specialists who have been selected for their training, experience and meticulous work. The following job titles apply: painter-cureman; cureman; mold changer; trim and inspect; letter painter;service and utility trucker.

Uncured, laid up, racing tires received by Dept. 153-G, are sprayed inside and outside with a solvent based paint compound used as a mold release agent. The tires are then placed in a mold, where heat and pressure form and cure the tire. The tire is then removed from the mold, allowed to cool, inspected, mold blo-hole projection trimmed, letter painted and prepared for shipment.

Plant personnel stated a water based paint for mold release was being tested at the time of this survey.

The air-spraying of the tires is accomplished in a dry spray booth which is power ventilated to exhaust vapor to the outdoors. However, the area to which the booth is exhausted is a tunnel between buildings. The end of the exhaust duct is normally capped with a burlap bag to entrap particulates, but was quite often punctured by sprayers to "gain spray booth efficiency". It is possible that any vapors and/or particulates exhausted to the out-of-doors will reenter the building through over head windows which line the width of the wall and open into the tunnel.

B. Evaluation Design

1. Initial Survey

On November 18 and 19, 1974, NIOSH representatives conducted an observational survey of the racing tire spraying, as well as subsequent operations in Dept. 153-G. Pertinent information was obtained from the employer and union representatives relating to plant processes. All employees in Dept. 153-G were interviewed and work procedures were observed.

Interviews were conducted with 16 Dept. 153-G employees to determine possible adverse health effects relating to emissions from the tire spray painting process. Symptoms which were reported to be the result of employment included; six complaints of eye, nose and throat irritation, three complaints of slight headache during periods when strong paint odors are present, and two complaints of nose bleed. Of those employees interviewed, no complaint was received regarding emissions from the tire mold area. Two employees complained of sinus problems but they did not feel their symptoms were brought on by the environmental conditions of their employment.

Ventilation measurements and visual observations with smoke tubes were made at the inside and outside tire spray paint booth. The ventilation system for the spray booth appeared to collect and exhaust the overspray adequately with no noticeable solvent odor in the surrounding area. The employees interviewed reported that spray painters would occasionally cut the burlap bag dust arrestor which was located at the end of the duct from the paint booth exhaust, in order to increase the flow rate and thereby exhaust the overspray more adequately. Ventilation measurements taken using an Alnor Jr. Air velocity meter and smoke tube observations demonstrated the paint booth exhaust system performed adequately even with the burlap bag intact, providing the bag is clean and replaced periodically to ensure adequate air flow through the paint booth exhaust duct.

The major complaint, as noted during the employee interviews was related to personal comfort (heat, cold and general ventilation). These complaints, although addressed on the original Health Hazard Evaluation Request, could not be treated during this evaluation due to the fact they are not "substances" as defined in title 42, Chapter 1, Sub-Chapter G, Part 25, Para. 85.2 (h).

2. Environmental Survey

On April 9, 1975 and September 16, 1975, atmospheric samples were collected to determine the concentration of organic vapors and suspended particulate matter from the "inside and outside tire paint". Because all workers in Dept. 153-G were potentially exposed to "inside and outside tire paint", personal samples were taken on one-half of all workers during each of the four (six-hour) shifts.

C. Evaluation Methods

1. First Environmental Survey

In order to simultaneously collect spray paint particulates and vapors for personal sampling, two separate samplers were worn by each worker selected. Particulates were collected using AA o.8μ pre-weighed membrane filters mounted in 3-piece plastic cassettes connected to a sampling pump operating at 1.5 liters per minute (lpm).

Solvent vapors were collected by drawing air through activated charcoal tubes using low flow Sipin pumps. Personal samples represented 4 different job categories; letter painters, spray painters, curemen and trim and inspect. Sampling times ranged from two to five hours. Particulate and vapor samples were also obtained from fixed locations in the mold change/rest area.

Bulk samples of the "outside and inside" paint solvents and the experimental "inside" water based paint, were obtained from plant management. These samples were analyzed by NIOSH Physical and Chemical Analysis Branch through a contract with Analytical Research Laboratories, Inc., Monrovia, California. Using charcoal tube bulk air samples and subsequent analysis with a gas chromatograph, the bulk samples were analyzed for benzene, hexane, toluene and xylene. [1]

Twenty three filters were analyzed to determine total weight of the particulates collected. All samples indicated total airborne particulate concentrations to be below the currently accepted level for carbon black (3.5 mg/M^3), most toxic of the particulates present in the "inside and outside paints." A more detailed discussion of the findings regarding particulate concentrations and toxic determination criteria will be found in section IV, E. of this report.

The charcoal tubes could not be analyzed due to administrative errors which resulted in charcoal tubes shipped to the laboratory in the same container with bulk samples. Possible contamination of the activated charcoal from vapors of the bulk samples may have invalidated concentration data of a subsequent analysis.

2. Second Environmental Survey

Failure to obtain sampling data for solvent vapor concentrations during the April 9th survey, required a return visit to Dept. 153-G, which was scheduled for September 16, 1975.

Twelve personal samples were collected from employees on the second, third and fourth shifts. The sampling method utilized was similar to that described for the first environmental survey conducted in April. An area sample for total particulates and solvent vapors was collected using a personal sampling pump operating at 1.5 lpm; positioned near the spray paint booth with an activated charcoal tube in the sample line down stream from a PVC filter. Collection for the area sample took place during a third shift.

Solvent vapors were collected using activated charcoal tubes. Sampling methods employed were identical to the procedures used during the first environmental survey. Air samples for total particulates were collected on VM-1 filter media. VM-1 filters which were less deliquescent than AA filters, registered a change in weight more representative of the actual weight of particulates which had been collected.

Solvent vapors collected on the activated charcoal tubes were desorbed with carbon disulfide and analyzed using a gas chromatograph with a flame ionization detector to determine the solvent vapor concentrations for benzene, hexane, heptane, toluene and xylene. Bulk samples of the spray paint were taken from the spray painter's pressurized paint containers and used by the laboratory for analysis of the charcoal tubes.

A summary of the airborne concentration levels measured for the "inside and outside" spray paint particulates and solvent vapors are reported in Tables 1 and 2.

3. Medical Survey

On November 6 and 7, 1975, a non-directed and directed medical questionnaire was administered by NIOSH physicians to 25 of a total of 30 employees in Dept. 153-G. There were approximately seven workers on each of four, six-hour shifts. There were four shifts in a twenty-four hour workday; and a five day work week. There were three administrative personnel in this department.

Five of the 30 workers in the department were excluded from the study because they would not be available for all phases of the examination, or they declined to participate in some portion of the survey. Each worker provided blood for a complete blood count and differential blood count and a urine specimen for specific gravity, creatinine, hippuric acid, urobilinogen, and phenol content.

NIOSH physicians obtained urine samples for controls from four office personnel not exposed to chemicals in the Racing Tire Department.

NIOSH physicians collected, by sterile needle puncture, 10 cc's whole blood in anticoagulant tubes from each of the 25 workers. Prior to mixing with oxalate anticoagulants, the blood from each worker was used to prepare two slides for subsequent staining to determine the blood differential count.

The oxalated blood was refrigerated and sent to Medical Diagnostic Services, Cincinnati, Ohio for processing. No controls were used because the normal values for blood morphology are well established.

Urine was collected as follows: following the administration of the medical questionnaire each worker was presented with the 125 ml. bottle and asked to collect a urine specimen in the adjacent lavatory and return this specimen to the Medical Officer immediately. These specimens were refrigerated for transportation to NIOSH Laboratories, 1014 Broadway, Cincinnati, Ohio. Urine controls were collected, refrigerated and transported to the lab in the same way.

Urine specimens were analyzed for hippuric acid, creatinine and specific gravity by NIOSH Laboratories. Analysis for Urobilinogen was performed using the Ames dip-stick method by NIOSH Medical Officers in the field. Urine specimens for phenol analysis were frozen for analyses at a later date by NIOSH Laboratories.

D. Evaluation Criteria [2,3,4,5]

1. Toxic Effects

The principle agents of concern in this hazard evaluation are: xylene, toluene, benzene, and hexane.

Xylene

Xylene is a clear colorless flammable liquid having an aromatic odor similar to that of benzene and toluene. Xylene is an irritant to mucous membranes but apparently does not produce severe hematological changes.

Exposure to xylene can cause headaches, nausea, gastrointestinal disturbances, dizziness, irritation to the eyes, mucous membranes, and the skin.

Toluene

Toluene is a clear colorless non-corrosive liquid with a sweet pungent benzene-like odor. Toluene like xylene is a methyl derivative of benzene and may cause irritation of the conjuctiva and the upper respiratory tract mucosa. Capellini and Allessio reported (1971) the results of several man-years of exposure to high toluene levels in a plant manufacturing belts for industrial machinery and noted there were no changes in the blood constituents for liver function. Browning, based on a large number of blood examinations of many persons exposed to toluene, found no effects in the blood of workers. Von Oettingen, reporting on a controlled eight-hour exposure of three humans, twice a week for three months, reported headaches, nausea, dizziness, as well as irritation to eyes, mucous membranes and the skin. As toluene is an excellent fat solvent, repeated or prolonged skin contact with liquid toluene may remove the natural lipid from the skin, causing drying, fissuring and dermatitis. Gerard, in 1960, reported that toluene is poorly absorbed through the intact skin so that systemic toxication by percutaneous absorption is highly improbable.

Benzene

Benzene is an aromatic hydrocarbon used extensively as a solvent. Acute exposures may cause irritation of the eyes, nose, respiratory tract and upon continued exposure may cause exhilaration followed by dizziness, headaches, nausea and narcotic-like effects. The most significant toxic effects of benzene are insidious and often irreversible blood changes; the most severe being aplastic anemia and leukemia.

Hexane

Hexane is a clear colorless volatile liquid highly flammable with a faint characteristic odor. It is used as a solvent in the extraction of edible fats and oils and may be contaminated with benzene. Hexane may cause narcosis and mucous membrane irritation. Nausea, headache, eye and throat irritation and dizziness are generally reported in exposed workers. It may also produce peripheral neuropathy.

2. Environmental Criteria

Criteria used in determining the bases for toxicity for the substances identified in the environmental evaluations are the threshold limit values (TLV) as issued by the American Conference of Governmental Industrial Hygienists (ACGIH) as documented in the "Threshold Limit Values for Chemical Substances and Physical Agents in Workroom Air-With Intended Changes for 1976". Toxic substances contained in the "inside and outside tire paints" were identified through laboratory analysis and information provided by the Goodyear Tire and Rubber Co.

Solvent Vapors

Substance	Environmental Criteria * in ppm	Notes
Heptane	400	2
Hexane	100	2,3
Toluene	100	1,2,4
Xylene	100	1
Benzene	1	6,1,4

Particulates

Substance	Environmental Criteria* in mg/M^3	Notes
Mica	6.0	5
Talc	6.0	5
Carbon Black	3.5	

* "Threshold limit values refer to time-weighted average concentrations for an 8-hour workday and 40-hour workweek. They should be used as guides in the control of health hazards and should not be used as finelines between safe and dangerous concentrations."

Note 1: Criteria Document published - TLV indicated is also the NIOSH recommended standard.

Note 2: TLV indicated more stringent than U.S. Occupational Standard presently enforced by OSHA.

Note 3: Substance found in greater quantity (highest % by weight of total solvent) than that found for other substances during laboratory analysis of solvent bulk samples and collected solvent vapors.

Note 4: Industrial grade toluene and 90/120 grade toluene may contain significant quantities of benzene.

Note 5: TLV for mica and talc is 20 million particle per cubic foot (mppcf). Assuming the average density for silica containing dust is approximately 2.5 gms/cm^3 with an average respirable mass particle size of 1.5 um, 6 mppcf $\tilde{=}$ 1 mg/M^3, 20 mppcf $\tilde{=}$

$3mg/M^3$ (respirable mass) $\tilde{=}$ $6\ mg/M^3$ (total mass).[6]

NIOSH has recommended that occupational exposure level for benzene should not be greater than one ppm as determined by an air sample collected at one 1 lpm for two hours. This revision was the result of conclusive clinical and epidemiological evidence that benzene is leukemogenic. The exposure level at which a reliable estimate of occupational exposure to benzene can be determined at this time. OSHA on April 29, 1977 issued a temporary emergency standard for 1 ppm benzene in air (8 hr. TWA).

When two or more hazardous substances are present, their combined effect, rather than each individually should be considered. Past research regarding the toxicological effects of solvent mixtures has been supportive to the conclusion that the combined effects of solvent vapors are additive. That is, the sum of the fractions, concentration divided by the TLV for each ($C_1/TLV_1 + C_2/TLV_2 \ldots C_n/TLV_n$) should not exceed unity (must equal 1.0 or less). Using this concept, no employee in Dept. 153-G was found to have significant exposure to the solvent vapor mixture. (See Table 2)

E. Results and Discussion

Evaluation

1. Environmental

Laboratory analysis of the total particulate samples collected on April 9, 1975 and September 16, 1975, revealed airborne concentrations which ranged from less than 0.1 to 1.7 mg/M^3. The highest concentration measured during this survey was obtained from a 3-hour and 40-min. personal sample of a cureman.

In summary, overall airborne concentrations of total paint particulates in Dept. 153-G are below the current environmental criteria for talc, mica and carbon black, which make up a portion of the particulate matter contained in the "inside and outside tire paint". Total particulate concentration as measured for each job performed during sampling are contained in Table 1.

Employee exposure to paint solvent vapors was found to be of greater significance than paint particulates. Using the mixture formula discussed in the evaluation criteria section of this report, and applying current ACGIH TLV's for each type vapor measured in the mixture, the highest mixture concentration collected had a combined exposure value below the criteria for assessing the combined exposure level (less than one). However, when considering the revised NIOSH recommendations for benzene exposure (1ppm); 4 of 12 workers had been exposed in excess of that value.

2. Medical 7,8

The average age of the workers (all male caucasions) in this department was 46 years. The average length of employment in the Racing Tire Department is five and one-half years.

Table 3 gives the symptom complaints obtained by NIOSH physicians. The greatest number of complaints were related to dry or sore throat and coughing up phlegm. The workers associated their complaints with either breathing the hot mold fumes or working in the mold-release painting area. Seventy-six percent of the workers were smokers or had smoked cigarettes or cigars. Twenty-four percent denied ever smoking.

The results of the analysis for hippuric acid and phenol performed on urine samples appear in Tables 4, & 5 respectively. Two methods for reporting hippuric acid in urine were used, the results by both methods are included. One method involves reporting as milligrams of hippuric acid corrected to a urine specific gravity of 1.024. Another method bases the results on milligrams of hippuric acid per milligram of urine creatinine. The method used in this study measures total hippuric acid and includes both toluene and xylene metabolites and the metabolites of any dietary substance that can be metabolized to benzoic acid. Such substances as aspirin, and sodium benzoate (food preservatives) can cause an elevation in urine hippuric acid. Therefore an isolated elevated hippuric acid may not represent occupational exposure. Table 4 shows the mean value of hippuric acid of exposed workers by both methods exceeds submitted controls and previous NIOSH controls.

Table 5 shows the results of the urine specimens analyzed for phenol. Twenty-five specimens were from workers in the Dept 153-G areas and four were office controls. The specimens were analyzed by gas chromatography using a modified method described by Sherwood and Carter.[9] Results are reported in mg phenol corrected to specific gravity 1.024 or mg phenol per gram creatinine. Phenol concentrations in workers were higher than controls. The highest concentrations were found in curemen and painters. Certain drugs, such as aspirin, can interfere with the results.

Table 6 shows the results of the complete blood counts (CBC) performed on the workers in Department 153-G at Goodyear. The values reported show no markedly abnormal parameters in the complete blood counts. However, there are a number of individuals who have hemoglobin values between 13 and 14 gram %. The laboratory normals for adult males are 14-18 grams hemoglobin. The measurement in question may represent normal variations or they may represent abnormalities in the hematopoetic system. If they are indeed abnormal, it is impossible to assess there relationship to occupational exposure. A CBC should be part of the periodic examinations performed on these workers to obtain baseline "normals" for that individual.

RECOMMENDATIONS:

A. All workers assigned to the Racing Tire Department should receive pre-placement and periodic medical examinations.

B. A training program should be instituted with joint responsibility between management and workers. This training program should fully discuss the hazardous nature of the toxic substances used, including the precautions necessary for safe handling, emergency procedures and the need for strict compliance with hazard standards. Each new employee should receive this instruction prior to assignments to the Racing Tire Department and existing workers should receive a refresher course at least annually.

C. Administrative and/or engineering controls should be established so that workers will not be exposed to emissions from hot tire molds when they are opened after tire curing.

D. The burlap bag dust collector should be intact during operation of the inside and outside tire painting booth. Maintenance should provide periodic inspection to assure proper air flow through the bag.

E. Employee exposure to benzene should be reduced to the lowest extent possible, through engineering modifications of spray booth ventilation systems, improved work practices and/or use of water based paint or paint which will contain no benzene impurities.

F. Management should monitor benzene exposure by air sampling according to procedures contained in the emergency standard.[12]

G. In addition to the routine medical examinations, NIOSH reccommends performing pre-placement and periodic pulmonary function studies on the workers in Department 153-G. The studies should include measurment of forced vital capacity (FVC), forced expiratory volume in one second (FEV_1), and maximal mid-expiratory flow rates (MMEF 25-75). These examinations should be performed because of recent studies by Fine and Peters [10,11] indicating the presence of progressive respiratory impairment in some workers with chronic exposure to tire-curing fume. While this problem was not specifically addressed in this Health Hazard Evaluation, the information available to us at this time would indicate the need for pulmonary function studies as an integral part of a comprehensive medical surveillance of these workers.

VI. REFERENCES

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2. American Conference of Governmental Industrial Hygienists: AMA Arch. of Ind. Health 18:179.

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4. Criteria for a Recommended Standard for Occupational Exposure to Toluene, HEW, CDC, PHS, NIOSH (HSM-11023) Cincinnati, Ohio 45202.

5. Nelson, K.W., J. Ind. Hyg. and Tox. 25:282.

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10. Fine, L.J., Peters, J.M., Respiratory Morbidity in Rubber Workers, Number 1, Archives of Environmental Health Jan/Feb 1976, pgs 5-9.

11. Fine, L.J., Peters, J. M. Respiratory Morbidity in Rubber Workers, Number 2, Archives of Environmental Health Mar/Apr 1976, pgs 10-14.

12. DOL/OSHA Emergency Temporary Standard for Occupational Exposure to Benzene: Title 29, Section 1910.1028 issued April 29, 1977 - Effective May 21, 1977.

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TABLE 1

Results of Environmental Sampling for Paint Particulates
Goodyear Tire and Rubber Co., Akron, Ohio

Job Classification	Type of Sample	Sampling Time April 9, 1975	Exposure in mg/M^3	Job Classification	Type of Sample	Sampling Time Sept. 16, 1975	Exposure in mg/M^3
Spray Painter	Personal	5 hr. 23 min.	0.929	Spray Painter	Personal	2 hr. 51 min.	0.94
Cureman	"	5 hr. 14 min.	0.552	Cureman	"	2 hr. 43 min.	0.82
Cureman	"	2 hr. 29 min.	0.939	Cureman	"	2 hr. 38 min.	0.72
Letter Painter	"	2 hr. 21 min.	0.284	Letter Painter	"	2 hr. 15 min.	0.74
Mold Change/Rest Area	Area	2 hr. 33 min.	0.621	Letter Painter	Personal	3 hr. 13 min.	0.07
Letter Painter	Personal	3 hr. 39 min.	0.518	Cureman	"	5 hr. 2 min.	0.00
Cureman	"	3 hr. 37 min.	0.277	Cureman	"	5 hr. 25 min.	0.26
Mold Change/Rest Area	Area	3 hr. 24 min.	0.220	Spray Painter	"	5 hr. 9 min.	0.24
Cureman	Personal	3 hr. 40 min.	1.727	Letter Painter	Personal	3 hr. 52 min.	0.37
Cureman	"	3 hr. 28 min.	0.417	Cureman	"	2 hr. 5 min.	0.96
Spray Painter	"	2 hr. 35 min.	1.077	Cureman	"	2 hr. 19 min.	1.20
Trim & Inspect	"	2 hr. 16 min.	0.441	Cureman	"	2 hr. 41 min.	1.57
Mold Change/Rest Area	Area	3 hr. 53 min.	0.200				
Cureman	Personal	2 hr. 39 min.	0.792	Near Spray Booth	Area	4 hr. 47 min.	0.14
Cureman	"	2 hr. 27 min.	0.500				
Letter Painter	"	2 hr. 57 min.	0.075				
Trim & Inspect	"	3 hr. 7 min.	0.214				
AS #13	Area	3 hr. 28 min.	0.320				

Summary of Environmental Sampling Results for Solvent Vapors Conducted Sept. 16, 1975
Goodyear Tire and Rubber Co., Akron, Ohio

Job Classification	Type of Sample	Sampling Time	Exposure in ppm					Combined Exposure Value
			Hexane	Heptane	Toluene	Xylene	Benzene	
Spray Painter	Personal	2 hr. 51 min.	37	19,0	2,0	*<.1	1,5 ****	0.59
Cureman	"	2 hr. 43 min.	10	2.0	*<0.1	*<.1	*<.1	0.10
Cureman	"	2 hr. 38 min.	8	1.0	*<0,1	*<.1	*<.1	0.08
Letter Painter	"	2 hr. 15 min.	3	1.0	0,2	.2	1.4 ****	0.18
Letter Painter	Personal	3 hr. 13 min.	1,5	1.0	0.1	*<.1	*<.1	0.02
Cureman	"	5 hr. 2 min,	3	1,0	*<0.1	*<.1	*<.1	0.03
Cureman	"	5 hr. 25 min.	16	4.5	0.4	*<.1	0.3	0.18
Spray Painter	"	5 hr. 9 min,	37	17.0	2,0	*<.1	1.3 ****	0.56
Letter Painter	Personal	3 hr. 52 min,	1	0.5	0,1	*<.1	*<.1	0.01
Cureman	"	2 hr. 5 min,	2	0,5	*<0,1	.1	*<.1	0.02
Cureman	"	2 hr. 19 min.	10	3,0	0.3	*<.1	0,3	0.14
Cureman	"	2 hr. 41 min.	61	26.0	0.2	*<.1	2.0****	0.70
Near Spray Booth	Area	4 hr, 47 min.	3	4.0	1,0	<.1	0,2	0,07
Current Environmental Criteria ***			100	400.0	100.0	100	10	**1.0

Mixture formula	Hexane Exposure / 100	+ Heptane Exposure / 400	+ Toluene Exposure / 100	+ Xylene Exposure / 100	+ Benzene Exposure / 10	= Combined exposure value

< = less than
\+ Values less than 0.1 ppm were not significant and not used in mixture computation
** If combined exposure value is less than 1.0, TLV for mixture is not considered exceeded
*** As recommended by ACGIH as a TLV for 1976.
**** Benzene exposure exceeds revised NIOSH recommendation of 1 ppm.

TABLE 3

REPORTED HISTORY OF
SYMPTOMS/COMPLAINTS ASSOCIATED WITH WORK

Goodyear Tire and Rubber Co., Akron, Ohio
November, 1975

	PERCENT	NUMBER WORKERS
Dry or Sore Throat	44	11
Tearing of the Eyes	16	4
Runny Nose	20	5
Chest tightness, soreness or heaviness	20	5
Shortness of Breath	16	4
Dizziness	12	3
Burning or Itching Eyes	24	6
Stuffy Nose	32	8
Coughing (phlegm)	44	11
Wheezing or whistling in your chest	12	3
Headaches	20	5

Table 4

Hippuric Acid in Urine

Goodyear Tire and Rubber Co., Akron, Ohio
November, 1975

	Corrected to a Specific Gravity of 1.024 mg/ml			Corrected as mg hippurate / mg creatinine		
	N	Mean	Range	N	Mean	Range
Submitted Controls	4	0.97	0.58-1.38	4	0.72	0.43—1.20
Exposed Workers	25	1.84	0.65-3.72	25	1.22	0.37—2.37
Previous "Normals" (NIOSH LABS)	23	1.11	0.47-2.20	7	0.90	0.43—1.80

FOOTNOTE: Control specimens submitted are in agreement with previous controls analyzed. The method used was that of Tomokuni and Ogata, Clinical Chemistry 18, 349 (1972).

TABLE 5

Summary of Phenol Data

	Mg per liter of urine phenol corrected to a Specific Gravity of 1.024			Mg Phenol per gm Creatinine	
	N	Mean	Range	Mean	Range
Submitted Controls	2	3.1	2.4 - 3.8	2.2	1.3 - 2.5
All Exposed Workers	25	8.4	2.8 - 18	5.4	1.3 - 10
Cureman	10	9.1	5.6 - 12	5.3	3.2 - 9.0
Painters	3	13	9.3 - 18	8.1	6.0 - 9.8
Normals (NIOSH)	12	4.2	3.5 - 5.0	2.2	1.6 - 2.6

Two control specimens were not added to the summary data, because one showed an abnormally high phenol level, and the other had a low specific gravity and contained less than 40 mg creatinine per l. Control specimens submitted are in agreement with normal controls analyzed at NIOSH, previously.

NORMAL RANGE JOB	4.8-10.8 WBCx10^3	4.7-6.1 RBCx10^6	14-18 Hgbg/DL	42-52 HCT%	80-94 MCVu^3	27-31 MCHµµg	32-36 MCHC%	35-55% SEG'S	25-45% LYMPH	5-10% MONO	0-5% EOS	0-3% BASO
1 Cureman	10.7	5.08	14.6	45.1	088.0	28.4	32.7	55	41	4	0	0
2 Trim & Inspect	03.4	4.58	13.2	41.1	089.0	28.4	32.4	49	42	7	2	0
3 Cureman	04.7	4.76	13.7	41.2	086.0	28.4	33.5	55	36	5	4	0
4 Cureman	05.3	4.05	13.1	40.4	099.0	32.0	32.7	29	65	4	2	0
5 Letter Painter	07.0	4.87	13.5	42.7	087.0	27.4	32.0	50	43	5	1	1
6 Trim & Inspect	10.5	4.81	15.3	45.7	094.0	31.4	33.9	61	33	6	0	0
7 Cureman	05.9	4.57	13.9	41.9	091.0	30.0	33.4	69	24	3	3	1
8 Trim & Inspect	09.3	4.87	15.3	46.3	094.0	31.0	33.4	51	43	3	3	0
9 Utility Trucker	08.4	4.56	14.0	42.5	092.0	30.3	33.3	40	57	3	0	0
10 Letter Painter	04.7	4.72	15.5	43.9	092.0	32.3	35.5	61	33	5	1	0
11 Cureman	05.5	5.02	15.0	45.7	090.0	29.5	33.2	58	38	4	0	0
12 Cureman	04.9	4.96	15.8	46.5	093.0	31.3	34.2	53	39	4	4	0
13 Cureman	07.0	5.07	15.6	47.3	092.0	30.3	33.2	56	39	3	2	0
14 Trim & Inspect	04.6	4.66	14.0	42.6	091.0	29.7	33.1	65	30	3	2	0
15 Tire Painter	06.7	4.84	14.5	44.0	090.0	29.5	33.2	45	48	5	2	0
16 Cureman	03.9	4.39	12.9	39.9	090.0	29.1	32.7	47	45	5	3	0
17 Cureman	11.1	5.46	15.6	46.8	085.0	28.2	33.6	65	32	2	1	0
18 Cureman	05.3	4.94	16.3	50.5	101.0	32.6	32.5	63	30	6	1	0
19 Utility Trucker	07.9	5.33	16.2	48.3	090.0	29.9	33.7	61	38	0	1	0
20 Letter Painter	06.5	5.07	15.7	46.9	092.0	30.6	33.8	52	45	3	0	0
21 Cureman	06.0	4.36	13.5	41.1	093.0	30.7	33.2	49	42	5	4	0
22	04.3	4.55	13.9	42.8	093.0	30.1	32.7	56	36	3	5	0
23 Cureman	06.2	4.82	14.2	42.9	088.0	29.0	33.3	46	49	4	1	0
24 Cureman	04.8	5.37	15.3	47.7	088.0	28.0	32.3	62	36	1	1	0
25 Cureman	05.6	5.17	15.0	45.2	087.0	28.6	33.5	61	37	2	0	0