U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
CENTER FOR DISEASE CONTROL
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
DIVISION OF SURVEILLANCE, HAZARD EVALUATIONS AND FIELD STUDIES
CINCINNATI, OHIO 45202

HEALTH HAZARD EVALUATION DETERMINATION
REPORT NO. 74-7-270

GOODYEAR TIRE AND RUBBER COMPANY
ST. MARYS, OHIO 45885

MARCH 1976

I. TOXICITY DETERMINATION

An evaluation of potential occupational health hazards present in a number of work areas of the Goodyear Tire and Rubber plant in St. Marys, Ohio, has been conducted. National Institute for Occupational Safety and Health investigators made visits to the plant in July, 1974 and March, 1975. The following determinations have been made with regard to potential hazards to employee health:

A. Department 221: Receiving

Carbon monoxide generated by forklift trucks does not present a significant hazard to employees working near transportation aisles. When operated in confined spaces, forklift trucks can generate potentially dangerous concentrations of carbon monoxide. Auxiliary ventilation may be necessary to permit anything but brief (come and go) operations inside truck trailers, railroad cars, etc.

B. Department 231: Richardson System and Banbury

Based on results of air sampling, employee interviews, evaluation of the toxicity of materials handled, and an evaluation of work practices and engineering controls, it has been concluded that employees in this department are potentially at risk to the development of acute and chronic adverse health effects. A full discussion of the data and recommendations for control of the hazards are contained in the body of the report.

C. Department 233: Fabric Coating

Air sampling could not be conducted during either visit due to process down time. It has been concluded from evaluation of work practices, engineering controls and employee interviews that PAPI and process solvents used in this department should not present a significant hazard to employee health as long as continued care is exercised in the handling of these materials and ventilation controls are adequately maintained.

D. Department 273A:

1. Paint Mixing

Breathing zone and work area concentrations of solvents in the the paint mixing room measured during the initial and follow-up visits were not significant. The potential for significant exposure does exist and recommendations regarding use of protective equipment and improved engineering control are made in the body of the report.

2. Paint Spraying

Breathing zone concentrations of solvent vapors measured during the second visit to the plant were found to be insignificant. Information gathered through employee interviews suggested that paint overspray was causing irritant effects in several employees. Recommendations to facilitate control of contact with paint overspray and other recommendations are contained in the body of the report.

3. Vapor Degreasing

Exposure of the degreaser operator to 1,1,1,-trichloroethane was found to be below permissible limits on an 8-hour time-weighted-average basis. In the interest of preventing overexposure during peak work periods and to reduce routine intermittent exposure, several recommendations have been made in the body of the report.

E. Department 273B: Molding (French Oil Presses)

It has been recommended that the company's industrial hygiene staff study the heat and smoke problem to achieve better control. Suggestions for interim control and factors to be considered in final control are presented in the body of the report.

F. Department 274C: Wire Brushing

No significant health hazards were found in this work area. It is recommended that each work station be studied by the company's industrial hygiene staff to assure that the most appropriate forms of eye and face protection are being utilized.

G. Department 285: Reclaim

1. Tocco Unit

No formal evaluation of employee exposures to emissions from this process was made. Improvement of engineering control took place between the first and second visits to the plant. Recommendations

to achieve improved control and reduce the possibility of fire are made in the body of the report.

2. Salt Bath

Exposure of the salt bath operator via inhalation to caustic materials used in the bath was found to be minimal. In the interest of protecting the operator from accidental caustic burns, recommendations for the use of more complete protective clothing have been made in the body of the report.

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) Goodyear Tire and Rubber Company, St. Marys, Ohio
b) Authorized Representative of Employees
c) U.S. Department of Labor - Region V
d) NIOSH Region V

For the purposes of informing the approximately 200 affected employees who work in the plant areas mentioned later in the report, the employer will promptly "post" this Determination Report in a prominent place(s) near where affected 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 (NIOSH) received such a request from an authorized representative of employees regarding potential exposures to a variety of substances in many of the manufacturing departments of the Goodyear Tire and Rubber plant in St. Marys, Ohio.

IV. HEALTH HAZARD EVALUATION

A. Evaluation Progress

1. Initial Plant Visit

The work areas covered by this Determination Report were first visited by NIOSH investigators in July, 1974. At that time, the investigators were conducting follow-up evaluation work in Department 277 and preliminary survey work in several other areas of the plant including the Pliofilm Department. Final Determination Reports covering Department 277 and the Pliofilm Department have been issued to plant management and to employee representatives.

Due to the number and variety of work areas to be examined under this request, the initial visit was oriented toward obtaining basic

process, substance, and exposure information rather than attempting to conduct detailed environmental sampling, etc.

As anticipated, data collected during the initial visit suggested that a more in-depth evaluation of employee exposures would be necessary in several work areas. A few work areas were determined not to require further evaluation.

2. Follow-up Evaluation

A follow-up evaluation of several work areas of the plant was conducted during the week of March 3, 1975. Employee exposures to substances in the various work areas were measured using personal sampling equipment. Employees were privately interviewed to elicit job related health problems. Proprietary information regarding raw material formulations was obtained from the plant to assist the assessment of employee exposures.

B. Description of Process

1. Department 221-Receiving

During the initial visit, employee representative expressed concern that plant employees may be exposed to hazardous levels of carbon monoxide emitted by forklift trucks used in the receiving/shipping areas of the plant and in transportation aisles. Although the potential for significant exposure appeared remote at the time of the initial visit (July, 1974), final judgement was reserved until the follow-up visit when weather was cold and many plant doors and windows were closed.

During the follow-up visit, measurements for carbon monoxide were made near receiving offices at the roll-up doors where forklift trucks pause to wait for the doors to open. Although carbon monoxide levels of 10 to 30 parts per million (ppm) were found near the trucks while they paused at the doors, these carbon monoxide levels quickly dissipated after the trucks moved on. In general, the plant was found to have a background carbon monoxide level of 5 to 10 ppm. In heavy traffic areas, short duration concentrations of carbon monoxide up to 30 ppm were observed.

Gas detector tubes were used to make random carbon monoxide measurements at several locations throughout the plant work areas. It was concluded that under normal plant operating conditions, carbon monoxide from forklift trucks should not present a significant hazard to employees. When operated in confined spaces, forklift trucks can generate potentially dangerous concentrations of carbon monoxide. Auxiliary ventilation may be necessary to permit anything but brief (come and go) operation inside truck trailers, railroad cars, etc.

No further investigation of potential employee exposures to carbon monoxide in receiving/shipping and transportation areas of the plant was deemed necessary. For information used to interpret the significance of measured carbon monoxide concentrations, refer to the "Evaluation Criteria" section of this report.

2. Department 231: Richardson System and Banbury

The Richardson System (RS) consists of a row of bins containing important but relatively minor ingredients utilized in the rubber formulation process. The RS operator measures/weighs quantities of ingredients from the bins into paper bags which are transported to the Banbury mixers. In general, ingredients stored in the RS are in powder or granular form. The RS operator was observed to be wearing a dust respirator with replaceable filter cartridge.

In the Banbury area, batches of minor ingredients from the RS and bulk raw materials (rubber, carbon black, etc.) are fed via belt conveyor into hoppers which feed heated Banbury mixers located one floor below. Bulk ingredients are manually placed on the conveyor. Folded sheets of rubber stock are weighed, cut and placed on the conveyor. Other materials (e.g. carbon black) are received in bags which must be emptied onto the conveyor. Three men are usually assigned to each Banbury unit. The men were observed not to be wearing respirators or impervious protective clothing to prevent repeated and prolonged contact with the various ingredients.

3. Department 233: Fabric Coating

In this work area rolls of fabric (4 feet wide by 400 yards long) are coated with rubber. The coating machinery consists of a spreader section, drying section, and take-up roll, all contained under a large exhaust hood. The fabric receives three coats of rubber, the first two of which contain PAPI (polymethylene polyphenyl isocyanate). Solvents utilized in the coating process are toluene, lactol spirits, and monochlorobenzene. During the initial visit, employee representatives expressed concern that exposure to PAPI may be a problem in this work area.

The fabric coating process was operating during part of the initial visit. An attempt to sample for PAPI was made but the process ran out of solvent shortly before the sampling was to be conducted.

Both of the men operating the process were privately interviewed by Dr. James B. Lucas. Neither of the men reported any symptomatology suggestive of adverse exposure to PAPI or to the solvents utilized in the process.

It was initially judged that PAPI did not present a significant hazard to health in the quantities and manner of use observed in the fabric coating operations. However, since a follow-up visit was to be performed, it was decided to sample for PAPI during that visit. Unfortunately, the fabric coating process was not operating at the time of the follow-up survey and sampling was precluded. In the opinion of this investigator, the fabric coating operation does not warrant further investigation at this time. Continued care should be exercised in handling PAPI and process solvents. It is imperative that the exhaust hood ventilation system be maintained in good working order.

4. Department 273A: Paint Mixing, Paint Spraying, and Vapor Degreasing

Paint mixing is conducted in a small section of the building that also houses Department 277. Four men mix paint over a three shift period. Paint that is received in five gallon buckets is mixed with prepared solvents and then transported to the spray painting areas. All solvent blending and dispensing to mixing buckets is done by hand. As many as fifteen to twenty mixing buckets may be open to the air at once. No local exhaust ventilation is provided anywhere in the mixing room and the only exhaust ventilation available is located at one end near a door which suffers from serious short circuiting when the door is open during warm weather. Paint mixing employees were observed not to wear respirators or impervious clothing. (See Figure 1 for a sketch of the paint mixing area.)

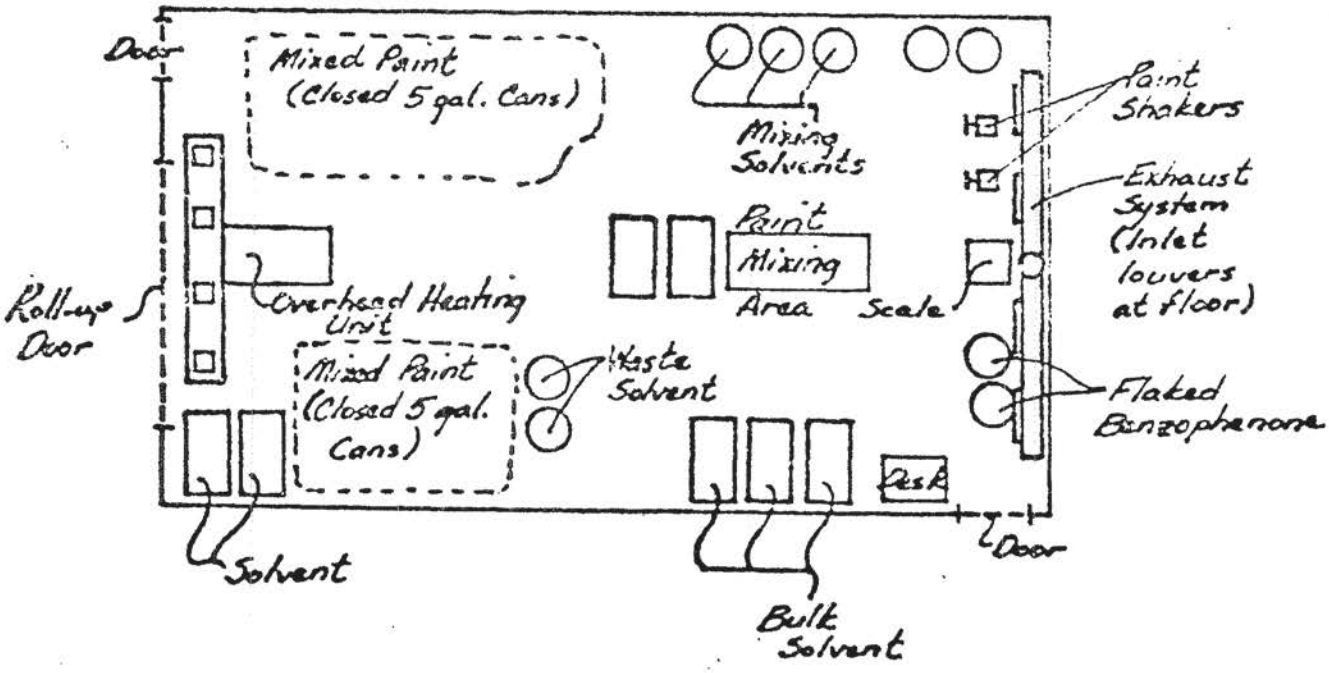

Figure 1: Paint Mixing Room

Spray painting in Department 273A is conducted inside a large enclosed area which contains three waterfall spray booths and several automatic electrostatic painting units. (See Figure 2 for a sketch of the spray painting area.) At the time of the initial survey, approximately fifty persons over three shifts were working in this area. Hand painting was being performed by a total of four steady painters and two relief painters on the day shift. Other personnel were engaged in loading paint pots; maintaining electrostatic paint booths; loading, unloading and inspecting painted parts; and supervising the operation. Parts to be painted were hung on racks which were conveyed through the paint booths and on into the drying area.

Painters and others were observed not to be wearing respiratory protection or impervious gloves. A few employees were observed to be wearing impervious aprons. During cleanup operations when overspray film and sludge was being removed from the waterfall booths, employees were observed to handle the wet sludge with bare hands and forearms.

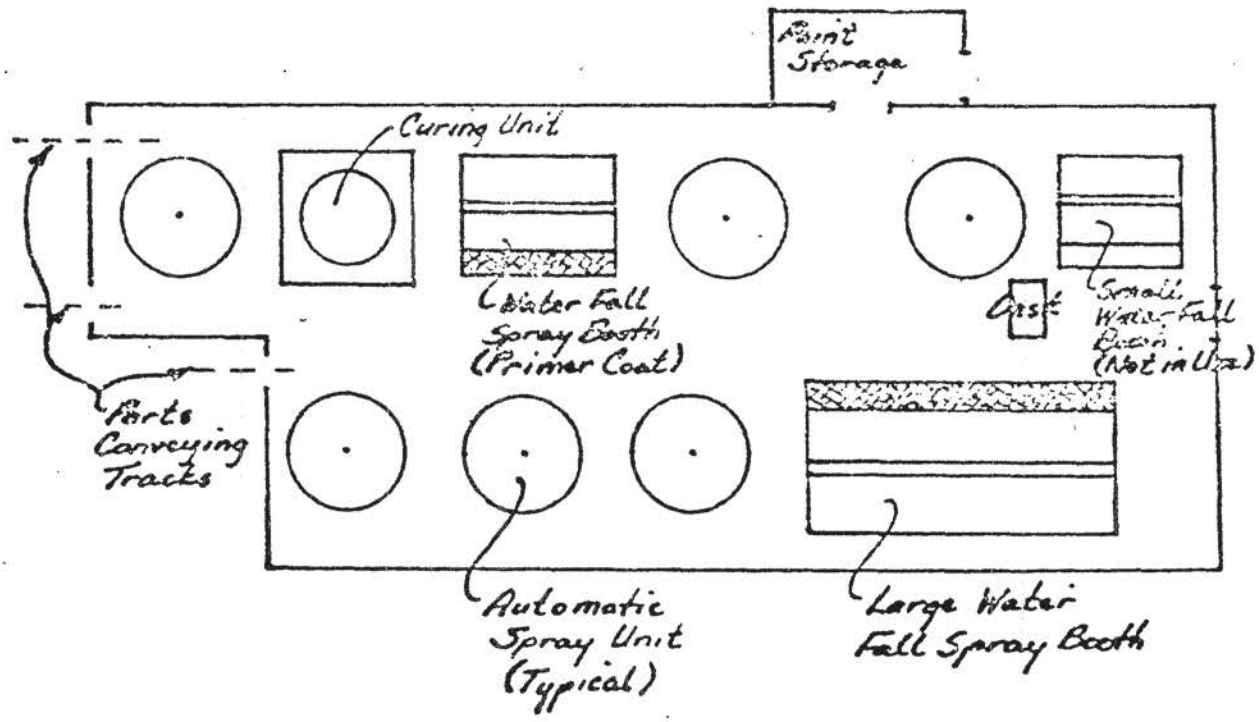

Figure 2: Spray Painting Work Area

Associated with the spray painting operation was a parts rack cleaning operation. Racks used to convey parts through the spray booth were removed to a small room adjacent to the main building, but entered from the yard area. The room contained a 1,1,1-trichloroethane vapor degreaser. Racks were placed inside the degreaser to loosen the caked paint deposits after which the operator hand scraped the racks. The hand scraping was conducted inside the room but outside the degreasing tank.

During the first visit to this operation, the degreasing tank was observed to have poor local exhaust ventilation. Slot pickups extended down the back and one side of the tank. The top of the tank was covered with flat sheets of cardboard.

At the time of the return visit, the degreasing tank was observed to have been equipped with a well designed slot ventilation system. The operator was still observed to remove the racks from the degreaser for hand scraping. No local exhuast ventilation was provided to control vapors from the hand scraping operation. Figure 3 shows a sketch of the degreasing room and degreasing tank with improved ventilation.

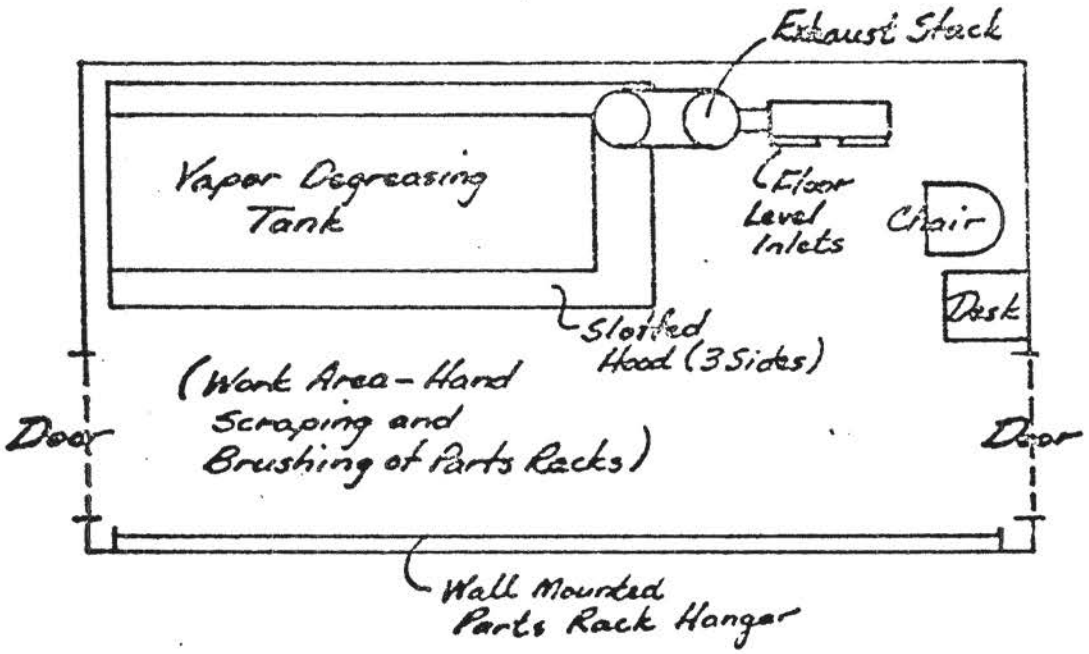

Figure 3: Vapor Degreasing Room

5. Department 273B: Molding (French Oil Presses)

In this department rubber stock is placed in large heated presses which mold the material into a variety of products. Parts freshly removed from the presses are warm and emit vapors and smoke. To control the emissions from pressed products while they cool, ventilated hoods have been installed adjacent to the presses. The presses are equipped with overhead canopy exhaust hoods. Figure 4 shows an aerial view of the French Oil Presses and associated exhaust hoods. The insert shows the configuration of the slotted cooling hoods.

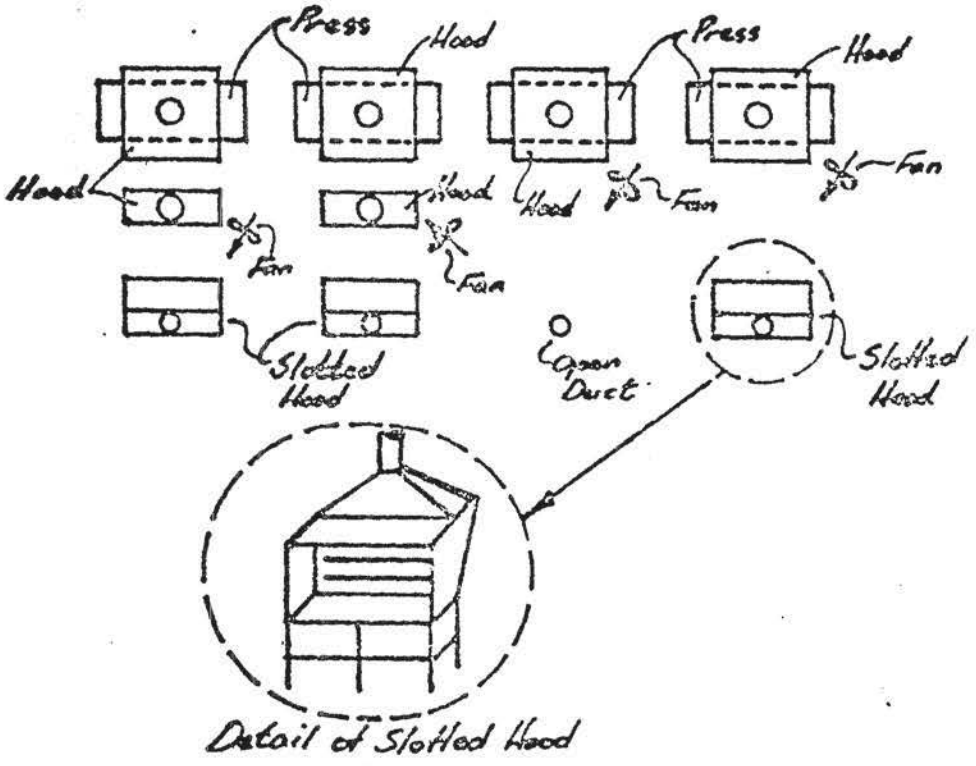

Figure 4: Molding (French Oil Presses)

The presses emit a substantial amount of heat which becomes especially noticeable during warm weather. To help cool employees working in

this department propeller fans have been installed to blow air on the employees as they work.

These propeller fans cause a great amount of air turbulence. The locations of these fans and the direction of air propulsion are shown in Figure 4.

When the propeller fans are operating, the capture characteristics of the slotted cooling hoods are seriously disturbed. Air contaminants are literally blown out of or away from the hoods and dispersed over this area and the adjacent work areas.

The solution to this problem of heat and objectionable air contamination will require the attention of the corporate industrial hygiene staff. Heat stress measurements should be made both during cool and warm weather. Use of heat shielding materials and changes in configuration of presses, hoods, and cooling fans should be studied. The observed situation could be improved on an interim basis by locating propeller fans so that they gently move air into the hoods but do not destroy capture characteristics. With the return of warm weather a more complete solution will be required.

6. Department 274C: Wire Buffing and Grinding

In this work area employees were observed to be buffing and grinding finished parts from Department 277 and other departments. During the initial visit to this work area it was noted that employees were not wearing adequate eye and hand protection. In addition, the guarding on many of the buffers was positioned so that pieces of plastic or rubber were flying back into the operators faces.

At the time of the follow-up visit employees in this area were observed to have better hand protection and the buffer guards were positioned so they did not direct debris into the faces of the operators. Although all employees in this work area presently wear safety glasses, it is recommended that each buffing and grinding station be examined by the corporate industrial hygiene staff to determine whether safety glasses with side shields, goggles or face shields may afford more complete eye and face protection.

7. Department 285: Reclaim (Tocco Unit and Salt Bath)

a. Tocco Unit

In the reclaim work area, rubber is removed from metal parts which have failed to meet finished product specifications. A dielectric heating unit (Tocco Unit) is used to heat the rubber metal

interface which permits removal of the rubber from the metal part. This heating process results in the evolution of smoke and vapors from the rubber both during the heating of the part and from the removed rubber until it has cooled.

To prevent contamination of this work area the reclaim process should be provided with exhaust ventilation (1) at the point of heating; (2) at the work station where the rubber is removed from the part; and (3) over the bin where the removed rubber cools.

At the time of the initial visit to this work area rubber was being removed from both large and small parts. Emissions at the point of heating were being fairly well controlled, but the work area where rubber was removed from the metal parts was poorly controlled. No ventilation was provided over the bins where removed, smoking rubber was deposited. As a result, the entire work area became choked with smoke.

At the time of the follow-up visit the reclaim process was found to have been equipped with improved ventilation. The exhaust hoods have been extended to include the rubber removal working areas and a canopy hood with side curtains had been positioned over the reclaimed rubber bins. Overall, control of emissions had been improved; however, many of the changes were of a temporary nature and should not be expected to yield prolonged service.

A major fire hazard was also present with the system as observed in March, 1975. Emissions from the heating process deposit in the exhaust ducts and occasionally ignite. A short while before our visit in March, a fire had occurred in the exhaust ducts which rendered the system inoperable for a time.

It is this investigators recommendation that consideration be given to the complete redesign of ventilation control for this process. New ventilation structures should be designed so that they can be periodically cleaned. Effluent vapors and particulate should be removed from the air stream before discharge to the atmosphere.

b. Salt Bath

A molten salt bath containing sodium and potassium hydroxide with sodium nitrate additive is utilized to remove rubber from parts racks used in other departments of the plant. The racks are lowered into the bath with a hoist. After several minutes the racks are hoisted from the bath and lowered into an adjacent compartment where they are quenched with a water spray.

During the initial visit the operator of the salt bath was observed to wear a face shield and gloves but no other special protective equipment. Irritating fumes or vapors were noted to be emitted

from the quenching operation. Ventilation for the salt bath and quench was observed to be minimal.

At the time of the follow-up visit the salt bath operator was asked to wear sampling equipment to measure his exposure to sodium and potassium hydroxide.

C. Evaluation Methods

1. Measurement of Airborne Workroom Contaminants

a. Department 231: Richardson System and Banbury

Employees working in the Richardson System (RS) and Banbury areas are exposed to a wide variety of airborne particulate materials. Many process ingredients are manually handled in dry or granular form.

Due to the "batch" nature of the work operations and varying rubber formulations being prepared, the relative composition of the airborne particulate was assumed to be highly dynamic. On this basis, it was concluded that attempts to characterize an employee's exposure to any given contaminant during a specific time interval would be of little value to the evaluation. Practically speaking, specific analytical procedures were not available for the overwhelming majority of substances used in these work areas.

In this case it was decided that breathing zone concentrations of total airborne particulate would serve as a qualitative indication of relative exposure. From the results of this sampling and (1) an examination of the potential toxicity of the substances handled and processed in these work areas; (2) an analysis of work practices and controls; and (3) results of privately conducted health related interviews with exposed employees, it was felt that a meaningful assessment of hazard to employee health could be made.

Breathing zone samples were obtained through the use of personal air sampling equipment. Airborne particulates were collected on pre-weighed cellulose ester (0.8 µm pore size) filters held in closed face (pin removed) plastic cassettes. Filter cassettes were positioned near the breathing zones of monitored employees. Workroom air was drawn through the filters at a flow rate of 1.5 liters per minute by battery powered, MSA Model G personal sampling pumps. Filter cassettes were changed at approximately two hour intervals. Total particulate collected on the filters was determined gravimetrically at the NIOSH analytical laboratories in Cincinnati, Ohio.

b. Department 273A: Paint Mixing, Paing Spraying and Vapor Degreasing

Employee exposures in these work areas were evaluated by (1) measuring airborne concentrations of solvent vapors; (2) examining the toxic properties of the solvents in use; (3) analyzing work practices and process controls; and (4) interviewing exposed employees.

Breathing zone samples of airborne solvent vapors were obtained using personal sampling equipment. Sipin, battery powered personal sampling pumps were utilized to draw air through air sampling tubes containing activated charcoal at flow rates of approximately 0.1 liter per minute. Sampling tubes were positioned in the breathing zones of workers and were changed approximately every two hours.

Bulk samples of paint and solvent were obtained to assist analysis of air samples. Air samples were analyzed by the gas chromatographic method described by White, et al.[1] Analyses were performed at the NIOSH analytical laboratory in Salt Lake City, Utah.

c. Department 285: Salt Bath Cleaning

The salt bath operator's exposure to caustic fumes (sodium and potassium hydroxide) was measured using personal sampling equipment. Air contaminants were collected on cellulose ester (0.8 µm pore size) filters held in open face plastic cassettes. The filters were positioned in the breathing zone of the operator.

Filters were analyzed by atomic absorption spectrophotometry in the NIOSH laboratores in Cincinnati, Ohio.

Work practices and controls were examined and the salt bath operator was privately interviewed.

2. Interviews with Exposed Employees

Each employee who was asked to wear personal sampling equipment was interviewed by a NIOSH industrial hygienist using a standard questionnaire. The results of this interviewing will be presented in the discussion of evaluation results. Conclusions drawn from employee interviews have been reviewed by NIOSH physicians as part of the clearance procedure for this health hazard evaluation determination report.

D. Evaluation Criteria

The three primary sources of criteria used to access workroom concentrations of air contaminants in this evaluation are: (1) NIOSH criteria for recommended standards for occupational exposure to substances (Criteria Documents); (2) recommended and proposed threshold limit values (TLV's) and their supporting documentation as set forth by the American Conference of Governmental Industrial Hygienists (ACGIH)(1975); and (3) occupational health standards as promulgated by the U.S. Department of Labor (Federal Register, June 27, 1974, Title 29, Chapter XVII, Subpart G, Table G-1.

In the following tabulation of criteria, the most appropriate value (in the opinion of this investigator) is presented with its reference and other information footnoted.

Substance	Permissible Exposure 8-hour Time-Weighted-Average Basis
(1)Butyl acetate (n-butyl acetate)	150 ppm(a)
(2)Butyl cellosolve (2-butoxy ethanol)	50 ppm (Skin)(b)
(3)Carbon black	3.5 mg/M3(c)
(4)Carbon monoxide	35 ppm
(5)Cellosolve acetate (2-ethoxyethyl acetate)	100 ppm (Skin)
(6)Diisobutyl ketone	25 ppm
(7)Isobutyl acetate	150 ppm
(8)Methyl butyl ketone (2-hexanone)	25 ppm (Skin)
(9)Methyl ethyl ketone (2-butanone)	200 ppm
(10)Potassium hydroxide	C(d) 2 mg/M3
(11)Sodium hydroxide	C 2 mg/M3
(12)Stoddard solvent	100 ppm
(13)1,1,1-Trichloroethane (methyl chloroform)	350 ppm

(b)Skin = absorption of the substance through the skin, mucous membranes, or eye either from airborne concentrations, or more particularly, by direct contact with the substance may potentially contribute to the overall exposure.
(c)mg/M3 - milligrams of substance per cubic meter of air.
(d)C = ceiling value; indicates that no excursions above the stated concentration should be permitted at any time due to the fast acting toxic effects of the substance at higher concentrations.

(1)Reference: Federal occupational health standard (1974) and ACGIH TLV (1975).

(2)Reference: Federal occupational health standard (1974) and ACGIH TLV (1975).

(3)Reference: Federal occupational health standard (1974) and ACGIH TLV (1975).

(4)Reference: NIOSH Criteria Document (1972). The federal occupational health standard (1974) and ACGIH TLV (1975) for carbon monoxide are presently 50 ppm for 8-hour time-weighted-average exposure. NIOSH additionally recommends that no exposure should occur to concentrations in excess of 200 ppm.

(5)Reference: ACGIH TLV (1975). The federal occupational health standard for cellosolve acetate is presently 200 ppm for 8-hour time-weighted-average exposure.

(6)Reference: ACGIH TLV (1975). The fereral occupational health standard for diisobutyl ketone is presently 50 ppm for 8-hour time-weighted-average exposure.

(7)Reference: Federal occupational health standard (1974) and ACGIH TLV (1975).

(8)Reference: ACGIH TLV (Proposed change 1975). The ACGIH has proposed a new TLV for methyl butyl ketone based on recently discovered information that it can cause toxic changes in the nervous system in man. The proposed TLV also carries the "skin" notation recognizing the potential cutaneous absorption hazard. The federal occupational health standard for methyl butyl ketone is presently 100 ppm for 8-hour time-weighted-average exposure.

(9)Reference: Federal occupational health standard (1974) and ACGIH TLV (1975).

(10)Reference: ACGIH TLV (1975). No federal occupational health standard presently exists for this substance.

(11)Reference: ACGIH TLV (1975). The federal occupational health standard for sodium hydroxide is presently 2 mg/M3 for 8-hour time-weighted-average exposure but not a ceiling value.

(12)Reference: ACGIH TLV (Proposed change 1975). The federal occupational health standard for stoddard solvent is presently 500 ppm for 8-hour time-weihted-average exposures.

(13)Reference: Federal occupational health standard (1974) and ACGIH TLV (1975).

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In addition to the above criteria for discreet substances, toxicological information regarding a variety of proprietary compounds and families of compounds used in the Richardson System and Banbury work areas was considered. A summary of the important features of this materials evaluation is presented in the next section of this report.

E. Evaluation Results and Discussion

1. Department 231: Richardson System and Banbury

The results of breathing zone personal air sampling conducted in this department are shown in Table I attached at the end of this report. As can be seen from the data, measured exposures varied over a wide range. Observation of employees during the period of personal sampling indicated that relative exposure was strongly dependent on individual employee work practices with regard to the handling of powdered raw materials.

Area samplers set up near the conveyor of Banbury No. 2 indicated a total airborne particulate concentration of approximately 14 mg/M3 during the time period 0830 to 1015 on the day personal sampling was conducted. A second set of area samples positioned near the transportation aisle in the room with Banbury No. 3 indicated a total airborne particulate concentration of approximately 2.6 mg/M3 during the time period 0815 to 1020 on the same day.

The nine men sampled on March 5, 1975 ranged in age from 47 to 60 years with an average age of 53.3 years. Their work experience with Goodyear ranged from 10 to 33 years with an average of 26 years. The average length of service in the department was 16.6 years with a range of 6 to 28 years. When asked directed questions regarding their smoking habits and occurrence of specific symptoms, the men responded as shown in the tabulation below.

		Reported Symptom					
Employee	Smoker	Eye Irritation	Sinus and Nasal Symptoms	Throat Irritation	Phlegm	Headaches	Rashes or Slow Healing Sores
1	No	Freq.	Freq.				Freq.
2	Past	Freq.	Freq.	Occas.	Freq.		Occas.
3	No		Occas.				
4	Present	Freq.			Freq.		
5	No		Freq.		Freq.		Freq.
6	No				Freq.		
7	Present		Freq.		Freq.	Freq.	Freq.
8	Present	Freq.	Freq.		Freq.		
9	Present	Occas.	Freq.				

Freq. = frequent occurrence of symptom
Occas. = occasional occurrence of symptom

In response to this investigator's request for information regarding substances used in Department 231, the company provided a list of 113 substances accompanied by an indication of their relative usage. Annual usage of the substances varies over a wide range from under 500 pounds to in excess of 1,000,000 pounds.

From the air sampling data in Table I, it can be seen that exposures to airborne particulate in this department are highly variable and that very heavy concentrations are encountered in some work operations.

The symptomatology reported by the employees appears compatible with exposure to significant quantities of airborne particulate. Sinus and nasal symptoms and also phlegm are conditions which can result from inhalation of significant quantities of airborne particulate. Of course, other influences such as colds, etc. can also bring on these symptoms but the employees did not relate the occurrence of these symptoms to colds but rather to the use and handling of particular substances in association with their work. Similarly, the occurrence of rashes, slow healing sores and eye irritation were also related by the employees to use and handling of materials in this department.

A search for toxicological information regarding substances used in this department was only partially successful. For many of the substances no information could be found in the literature regarding their potential toxicity. However, many substances utilized in Department 231 do have recognized toxic effects. These materials were found to display a wide range of relative toxicity from substances like titanium dioxide and iron oxide to carbon black to lead and other more toxic materials. Among the materials for which toxicity information could be found were several with the potential to produce acute eye, skin and respiratory tract irritation. Others were noted to be capable of producing chronic and in some cases serious effects on health if proper precautions are not observed.

In general, the work practices and controls observed in Department 231 were not sufficiently well developed to adequately control employee exposures to the toxic materials used and handled in the department. The symptomatology reported by employees is at least some indication of the possible acute effects of these materials. Little can be concluded regarding the potential chronic health effects these men may experience except to note that they do handle a variety of potentially toxic materials with minimal protection from engineering controls and personal protective equipment.

It is the recommendation of this investigator that the industrial hygiene staff of the Goodyear Tire and Rubber Company carefully examine this work department. Immediate consideration should be given to providing improved protective clothing which would minimize repeated and prolonged skin contact with materials handled. Many of the operations involve hand dumping of dry ingredients which could be better controlled by enclosing

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The symptomatology reported by the employees appears compatible with exposure to significant quantities of airborne particulate. Sinus and nasal symptoms and also phlegm are conditions which can result from inhalation of significant quantities of airborne particulate. Of course, other influences such as colds, etc. can also bring on these symptoms but the employees did not relate the occurrence of these symptoms to colds but rather to the use and handling of particular substances in association with their work. Similarly, the occurrence of rashes, slow healing sores and eye irritation were also related by the employees to use and handling of materials in this department.

A search for toxicological information regarding substances used in this department was only partially successful. For many of the substances no information could be found in the literature regarding their potential toxicity. However, many substances utilized in Department 231 do have recognized toxic effects. These materials were found to display a wide range of relative toxicity from substances like titanium dioxide and iron oxide to carbon black to lead and other more toxic materials. Among the materials for which toxicity information could be found were several with the potential to produce acute eye, skin and respiratory tract irritation. Others were noted to be capable of producing chronic and in some cases serious effects on health if proper precautions are not observed.

In general, the work practices and controls observed in Department 231 were not sufficiently well developed to adequately control employee exposures to the toxic materials used and handled in the department. The symptomatology reported by employees is at least some indication of the possible acute effects of these materials. Little can be concluded regarding the potential chronic health effects these men may experience except to note that they do handle a variety of potentially toxic materials with minimal protection from engineering controls and personal protective equipment.

It is the recommendation of this investigator that the industrial hygiene staff of the Goodyear Tire and Rubber Company carefully examine this work department. Immediate consideration should be given to providing improved protective clothing which would minimize repeated and prolonged skin contact with materials handled. Many of the operations involve hand dumping of dry ingredients which could be better controlled by enclosing

and provision of local exhaust ventilation. As with all operations of this type, employee appreciation and understanding of the hazard is of utmost importance. Observation of the work practices of several employees strongly suggested that they did not understand the potential hazard.

As a means of interim control of employee exposures to airborne particulate, a program of respiratory protection should be established with provision of air-purifying dust respirators to employees engaged in dusty jobs. Employees should be instructed in the use, limitations and maintenance of such respiratory protective devices.

Until better permanent control of exposures can be implemented, it can only be concluded that employees in this department are potentially at risk to the development of acute and chronic adverse health effects. This conclusion is supported by (1) measured air concentrations of particulate which, in general, can be permitted only for non-toxic materials; (2) reported symptomatology from employees; and (3) observation of work practices and controls inappropriate to the materials being handled.

2. Department 273A: Paint Mixing, Paint Spraying and Vapor Degreasing

a. Paint Mixing

Air sampling was conducted in the paint mixing room during both the initial visit to the area and during the follow-up visit. The results of this sampling are shown in Table II attached at the end of this report. As can be seen from the concentrations measured, worker exposure was not excessive on either of the days sampled. However, interviews with employees and comments from labor and management representatives indicated that activity in the paint mixing room was relatively low during both visits. In addition, it was learned that solvent concentrations could be significantly higher during periods of peak production.

Although airborne concentrations of solvent vapor were not significant on the dates sampled, several inadequacies in work parctices and engineering control were noted. Employees were basically asymptomatic at the time of each visit except for skin irritant effects resulting from direct contact with solvents. In the opinion of this investigator, these adverse effects on the skin could be prevented by use of appropriate impervious protective clothing. Under no circumstances should repeated and prolonged contact of mixing or washing solvents be permitted with bare hands and forearms. Non-impervious clothing which becomes wet with paint or solvent should be removed promptly and not reworn until properly cleaned.

Only minimal ventilation control is provided in the paint mixing room. (Refer to Figure 1.) For the purposes of reducing employee exposures during full production and to minimize the chance for fire or explosion,

improved exhaust ventilation should be strongly considered. Pouring of solvents, stirring of open buckets of paint, and washing of mixing buckets and paint mixing tools should all be conducted under or inside an appropriate hood.

b. Spray Painting

Exposures of employees working in spray painting operations of Department 273A were evaluated on March 4, 1975. The results of personal air sampling for solvent vapors are shown in Table III attached at the end of this report. As can be seen from the concentrations measured, worker exposure to solvent vapor was found to be very low on the day sampled.

The eight persons sampled inside the spray painting area were privately interviewed. Four employees were male and four female. The average age for the males in the group was 29.5 years (range 27 to 32) and the average age for females was 47 years (range 32 to 54). Their work history with Goodyear averaged 8.3 years (range 4 to 11) for males and 19 years (range 9 to 27) for females. The average length of service in the spray painting operation averaged 0.7 years (range 0.1 to 1) for males and 1.8 years (range 1 to 2) for females. When asked directed questions regarding their smoking habits and occurrence of specific symptoms, the employees responded as shown in the tabulation below.

			Reported Symptom				
Employee	Sex	Smoker	Eye Irritation	Sinus and Nasal Symptoms	Throat Irritation	Headaches	Rashes or Slow Healing Sores
1	M	Present	Freq.	Freq.	Freq.	Freq.*	
2	F	No	Freq.		Freq.	Freq.	Freq.
3	F	No	Occas.	Occas.	Freq.		
4	M	Present	Freq.				
5	F	No			Occas.		
6	F	No	Freq.		Freq.		
7	M	No	Occas.	Freq.		Occas.	
8	M	Present	Occas.				

Freq. = frequent occurrence of symptom
Occas. = occasional occurrence of symptom
*Related symptom to smoking

As can be seen from the responses, many of these employees appear to experience irritative symptoms on a regular basis. Several of the employees did comment that they felt paint particulate overspray was responsible for eye, nasal and throat irritation. Observation of work practices and personal protective equipment in use would tend to support this relationship.

Although employee exposures to airborne solvent vapors in this work area were found to be low, attention should be given to the provision of better personal protective equipment to prevent eye and skin contact with paint overspray and skin contact with paint and solvent sludge during cleanup operations. Under no circumstances should bare hands be used to remove sludge from the waterfall booths. Also use of combustible materials (i.e. paper) inside the booths should be discontinued.

c. Vapor Degreasing

On March 6, 1975 during the follow-up visit, air samples were gathered to determine exposure to 1,1,1-trichlorethane associated with the degreasing of parts racks used in the spray painting operation. One sample was collected in the breathing zone of the degreaser operator and another was collected in the work area where part racks are hand brushed and scraped. The samples were collected between 0755 and 1043 in the morning.

The breathing zone concentration for the degreaser operator was found to be 460 ppm and the work area sample showed a concentration of 330 ppm. The 8-hour time-weighted-average occupational health standard for 1,1,1-trichloroethane is 350 ppm. Although the degreaser operator's exposure was greater than 350 ppm for the period sampled, he did not work in the degreasing room for the remainder of the day and thus his 8-hour time-weighted-average exposure was not in excess of 350 ppm.

This small amount of sampling does indicate that the practice of removing racks wet with degreasing solvent from the tank and hand scraping without local exhaust ventilation results in significant intermittent exposure. The degreaser operator did say that he had been asymptomatic since the installation of improved ventilation on the degreasing tank.

To prevent the degreaser operator from being overexposed during periods when he must work most of an 8-hour shift in the degreasing room and to minimize routine intermittent exposure, the following recommendations are made:

1. Increase the residence time of the dirty racks in the degreaser so that a maximum amount of caked-on material will fall off without hand scraping.
2. Allow the racks to thoroughly drain before removing for hand scraping and brushing.

3. Install a slotted exhaust hood adjacent to the degreasing tank to capture vapors emitted by the hand scraping and brushing operation.

An alternate solution would be the use of an approved air-purifying organic vapor respirator during scraping operations. As with the use of any respiratory protection device, a program of training and maintenance would be necessary.

3. Department 285: Salt Bath

The exposure of the salt bath operator to caustic potassium hydroxide and sodium hydroxide was measured on March 5, 1975. Breathing zone air samples were collected during the period 0858 to 1420. Due to the nature of the sampling and analytical procedures employed, information on short term peak concentrations could not be obtained. The average exposure of the salt bath operator to potassium hydroxide and sodium hydroxide during the period sampled was 0.09 mg/M3 and 0.1 mg/M3 respectively. These values are much below the maximum exposure limits recommended by the ACGIH.

It should be noted that the work load for the salt bath operator on the day of the survey was relatively light. During periods of increased activity, exposures may increase. It is important that the exhaust ventilation system for the bath and quench be maintained in good working order. The salt bath operator should be equipped with protective clothing in addition to the face shield he was observed to wear. An apron and long heat resistant gloves would seem appropriate to protect against accidental caustic burns.

V. REFERENCES

1. White, W.D., D.B. Taylor, P.A. Mauer and R.E. Kupel. A Convenient Optimized Method for the Analysis of Selected Solvent Vapors in the Industrial Atmosphere. Am. Ind. Hyg. Assoc. J., vol. 31, March-April, 1970.

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TABLE I: Results of Breathing Zone Airborne Particulate Sampling in Department 231 (Samples Collected March 5, 1975)

LOCATION / JOB	SAMPLING INTERVAL	PARTICULATE CONC. mg/M3*	TIME-WEIGHTED CONC. mg/M3**
No. 1 Banbury			
Operator	0816-1040	5.1	
	1128-1315	5.6	5.7
	1315-1438	7.0	
Rubber Cutter	0817-1040	6.1	
	1129-1310	8.4	5.7
	1310-1437	1.8	
No. 2 Banbury			
Operator	0809-1037	5.2	
	1128-1310	2.7	4.3
	1310-1434	4.5	
Compound Service	0811-0916	5000***	
	0916-1036	11	
	1129-1313	360	150
	1314-1435	29	
No. 3 Banbury			
Operator	0820-1038	2.8	
	1128-1308	3.5	3.5
	1308-1435	4.7	
Compound Service	0822-1309	5.3	
	1128-1308	6.8	6.3
	1308-1435	7.4	
No. 9 Banbury			
Operator	0805-1035	3.6	
	1126-1306	5.5	4.2
	1306-1430	3.7	
Compound Service	0803-1034	11	
	1126-1303	8.2	8.8
	1305-1427	5.6	
Richardson System			
Operator	0813-1032	23	
	1127-1303	21	18
	1303-1436	7.1	
Blender			
Operator****	0800-1020	9.0	9.0

*mg/M3 = milligrams of total airborne particulate per cubic meter of air
**Time-weighted concentration based on period sampled
***Result uninterpretable: Cassette heavily contaminated
****Sample collected March 6, 1975

TABLE II: Results of Breathing Zone and Work Area Solvent Vapor Sampling in Department 273 A (Paint Mixing), (Samples collected July 26, 1974 and March 4, 1975)

JOB/WORK AREA	SAMPLING INTERVAL	SOLVENT VAPOR CONCENTRATION (PPM)* A	B	C	D	E	F	G	H
Samples Collected 7/26/74									
Paint Technician	1321-1435	ND	ND	2.4	ND	ND	36	ND	1.0
Paint Technician	1322-1435	"	"	0.8	"	"	24	"	2.0
Samples Collected 3/4/75									
Paint Technician	0827-1118	"	0.4	0.3	"	"	ND	4.0	ND
	0945-0959	"	ND	ND	"	"	180	4.0	"
	1138-1215	"	"	"	"	"	ND	ND	"
Work Area Samples Collected in Paint Mixing Room	0832-1034	"	"	0.6	"	"	"	"	"
	0835-1036	"	6.2	ND	"	"	"	"	"
	1035-1219	"	ND	"	"	"	"	2.0	"
	1036-1226	"	"	"	"	"	"	ND	"
	1215-1435	"	"	1.1	"	"	"	4.0	"
	1224-1443	"	0.9	0.2	0.1	"	"	1.0	"
	1226-1446	"	ND	ND	ND	"	"	ND	"

*Parts of vapor per million parts of contaminated air

A = Butyl Acetate; ND means less than 0.1 ppm
B = Butyl Cellosolve; ND means less than 0.2 ppm
C = Cellosolve Acetate; ND means less than 0.2 ppm
D = Diisobutyl Ketone; ND means less than 0.2 ppm
E = Methyl Butyl Ketone; ND means less than 0.1 ppm
F = Methyl Ethyl Ketone; ND means less than 0.1 ppm
G = Stoddard Solvent; ND means less than 1.0 ppm
H = Isobutyl Acetate; ND means less than 0.2 ppm

Note: All of the above samples were also analyzed for xylene, but none was detected in any sample. The detection limit for xylene is approximately 0.2 ppm.

TABLE III: Results of Breathing Zone Solvent Vapor Sampling in Department 273A (Spray Painting and Inspection), (Samples collected March 4, 1975)

JOB	SAMPLING INTERVAL	SOLVENT VAPOR CONCENTRATION (PPM)* A	B	C	D	E	F	G
Painter	0849-1040	ND	ND	1.1	0.4	ND	ND	2.0
	1040-1254	"	"	1.5	0.5	"	"	4.0
	1254-1340	"	"	ND	ND	"	"	3.0
	1340-1442	"	"	"	"	"	"	5.0
Painter	0902-1029	"	1.4	0.4	"	"	"	2.0
	1103-1235	"	ND	ND	"	"	"	3.0
	1235-1443	"	"	0.4	1.0	"	"	11
Painter	0854-1020	"	"	ND	ND	"	"	2.0
	1040-1106	"	"	0.3	"	"	"	2.0
	1127-1311	"	"	0.3	"	"	"	2.0
	1311-1444	"	"	0.7	"	"	"	2.0
Painter	0906-1105	1.6	"	2.0	0.4	15	6.4	7.0
	1105-1256	ND	0.8	1.6	ND	ND	ND	8.0
	1256-1444	"	1.6	0.7	"	"	"	5.0
Relief Painter	0858-1050	"	0.2	1.1	0.8	"	"	4.0
	1050-1259	"	ND	0.7	ND	"	"	3.0
	1259-1445	"	"	ND	"	"	8.6	5.0
Relief Painter	0857-1035	"	"	"	"	"	ND	1.0
	1036-1244	"	"	0.6	0.3	"	"	6.0
	1244-1444	"	1.2	0.6	0.3	"	"	6.0
Ransburg Oper.	0852-1025	"	ND	0.5	ND	"	"	2.0
	1026-1055	"	"	1.9	0.6	"	"	5.0
	1132-1305	"	"	1.9	0.6	"	"	5.0
	1307-1446	"	"	1.8	0.4	"	"	8.0
Ransburg Helper	1100-1259	0.5	"	1.9	0.6	"	5.9	3.0
	1259-1444	ND	"	1.3	0.4	"	ND	8.0
Inspector	0737-1051	"	"	ND	ND	"	"	ND

*Parts of vapor per million parts of contaminated air

A = Butyl Acetate; ND means less than 0.1 ppm
B = Butyl Cellosolve; ND means less than 0.2 ppm
C = Cellosolve Acetate; ND means less than 0.2 ppm
D = Diisobutyl Ketone; ND means less than 0.2 ppm
E = Methyl Butyl Ketone; ND means less than 0.1 ppm
F = Methyl Ethyl Ketone; ND means less than 0.1 ppm
G - Stoddard Solvent; ND means less than 1.0 ppm

Note: All of the above samples were also analyzed for Xylene, but none was detected in any sample. The detection limit for xylene is approximately 0.2 ppm.