PLACE VISITED:	Goodyear Tire and Rubber Co. Cast Film Division St. Marys, Ohio
DATE OF VISIT:	February 9-10, 1976
PERSONS MAKING VISIT:	Paul Johnson Robert Rinsky Peter Infante Mark Jones Ronald Young
PERSONS CONTACTED:	Clifford Johnson, M.D. Corporate Medical Director Jack Holiday, Plant Manager Richard Ballinger, Safety Direc Sam Sekel, Assistant Personnel Harold Chrismer, General Foreman, Cast Film Division William Irons, Chemical Engineer
PURPOSE OF VISIT:	To determine if a suitable population exists for an environmental-epidemiological study of workers exposed to benzene.

INTRODUCTION

The Industry-Wide Studies Branch of the National Institute for Occupational Safety and Health has initiated an epidemiologic evaluation of mortality patterns among employees utilizing benzene. On February 9-10, 1976, a team of industrial hygienists and epidemiologists conducted a walk-through survey of the pliofilm operation of the Goodyear Tire and Rubber Company. The major purpose of that survey was to determine if a suitable population of workers exposed to benzene existed at this facility.

PLANT DESCRIPTION AND HISTORY

The Cast Films Division manufactures clear plastic films (polyvinyl chloride and rubber hydrochloride) by the solvent casting method. Of interest to this survey were the operations associated with Pliofilm (rubber hydrochloride). Pliofilm operations started in St. Marys in 1939 with two production units. In 1941, two more units were installed, and in 1947 two additional units were installed. Two units were "narrow" (48" recovered width) and the other four were "wide" (app. 60" recovered width). Full operation netted approximately 16,000 lbs./day. These six units ran until 1966. In 1967, production was cut-back to four units, and in 1970 a further reduction to three units was made. Subsequently, in 1974, operation was limited to one unit. By 1975, production had increased to two units and at the time of our visit, three units were operating.

The Pliofilm Department works three shifts (11-7, 7-3, 3-11), five or six days per week. When two units are operating, the following operating personnel are required:

SHIFT	# OF WORKERS
1st Shift	10
2nd Shift	10
3rd Shift	9
	29

In addition, three maintanance personnel and six supervisors are required. The ten operating personnel are divided as follows:

3 Casting Unit Operators
2 Casting Unit Helpers
1 Reactor Operator
2 Neutralizer Operators
1 1st Man Operator
1 Banbury - Quencher Operator

Department code number 146A refers to pliofilm production and 146B refers to the sleding department where pliofilm is cut, wrapped and shipped.

PROCESS DESCRIPTION

A schematic diagram of the process is shown in Figure 1. Natural rubber is uncrated and dumped in a Banbury mixer for approximately 22 minutes. The rubber from the Banbury passes through a mill and is conveyed to agitated mixing tanks where benzene is added. During this three hour mixing process, the rubber is dessolved in the benzene. This liquid is then piped to blending tanks where further mixing takes place. These tanks also serve as a hold tank for the reactor. As the process continues, the solution is introduced to the reactor, where hydrochloric gas (HCL) is added. Also, measured amounts of benzene are added to reduce the percent solids from 20% to 9% or less. From the reactor tanks the rubber hydrochloride is dropped into neutralizing tanks. Film scraps, soda ash, plasticizers and additional benzene are added. The mixing is a 6 to 7 hour process, and is adjusted to 10% rubber hydrochlorid Next the mixture is passed through a plate and frame filter press. The

benzene in the filter cake is separated by a Quencher Unit. Residue from the separation is descarded, while the benzene is pumped to a still for further processing.

After filtration, the rubber hydrochloride is piped to a central storage area until needed. From storage the rubber hydrochloride solution passes through a small plate and frame filter press and then to the casting units. Here the solution is spread on a conveyor, the solvent evaporated, and the finished film taken up on rolls. Temperatures during the drying process reach and many times exceed 170°F. This unit is enclosed and entered only for maintenance or to rethread the film take-up system. A hinged door is located in front of the dam. The door is opened periodically to make necessary adjustments for film thickness. The final rolls of film from these units are stocked in bulk rolls and or cut for size and packed for shipping.

The casting unit is swept with air to maintain benzene concentrations below the lower explosive limit. The exhaust air from the casting unit is passed through a wet scrubber before being channeled into one of 2 absorber units. The absorber units contain activated charcoal which absorbs the benzene. When the charcoal bed is saturated the contaminated air stream is diverted to a second absorber unit while the first unit is being desorbed by the use of a steam sparger. The benzene vapor and stream is then condensed and piped to the decanter, where the benzene is drawn off and sent to a receiving tank. Finally, the benzene is purified and returned to underground storage.

MEDICAL

The Goodyear Tire and Rubber Co. has a corporate medical director, Dr. Johnson, is located in Akron, Ohio. A local general practitioner, Dr. Harbord, is retained as a consultant to the plant and performs all physical examinations. Also present during each shift is a registered nurse.

Pre-employment physicals are required of all persons which include chest x-rays, blood cell counts, hemoglobin, platelet, and routine urinalysis. Medical controls consist of monthly white blood count and hemoglobin determination of all employees with benzene exposure. These records are kept indefinitely. Over the years, occasional decreases in white blood cell counts (<4,000) have been observed. In these cases, the employee is removed from benzene exposure.

POTENTIAL HAZARDS

The major health hazards observed during this survey were as follows:

1. Respiratory exposure to benzene vapors.
2. Potential noise exposure.

INDUSTRIAL HYGIENE AND SAFETY PROGRAMS

Industrial Health and Safety programs are supervised by Mr. Ballinger. Also under his supervision is a preventive maintenance program to replace leaky valves, pipes, seals, and packings as leaks are detected. Industrial hygiene surveys and monitoring are conducted on a regular basis. Personal protection programs presently in force include safety glasses in selected areas, and respirators where benzene exposures may occur.

VENTILATION SYSTEMS

During the Pliofilm operation, exhaust ventilation ducts are provided at each unit. The system consists of hoods and vents with the air flow provided by centrifugal fans. Improved ventilation systems which discharge into large roof collectors have been installed in potential high exposure areas.

ENVIRONMENTAL MONITORING

Sampling and analytical methods for analysis of benzene in air employs absorption on charcoal, followed by desorption and gas chromatographic measurement. To obtain this data 20 breathing zone samples were collected on charcoal tubes by a Dupont pump using a flow rate of 100 cc/minute. Samples were collected for approximately 4 hours. After collection the charcoal tubes were sent to Salt Lake City, Utah for analysis. The results obtained can be found in Table I. It should be noted that appropriate respiratory protection was worn, at least part time, by the Neutralizer Operator and 1st man Operator.

RECOMMENDATIONS

Exposure to benzene should be controlled so that no worker will be exposed to benzene in excess of 1 ppm as determined by an air sample collected at one liter/minute for two hours.

CONCLUSION

A suitable population exists at this facility to conduct an epidemiologic evaluation of mortality patterns.

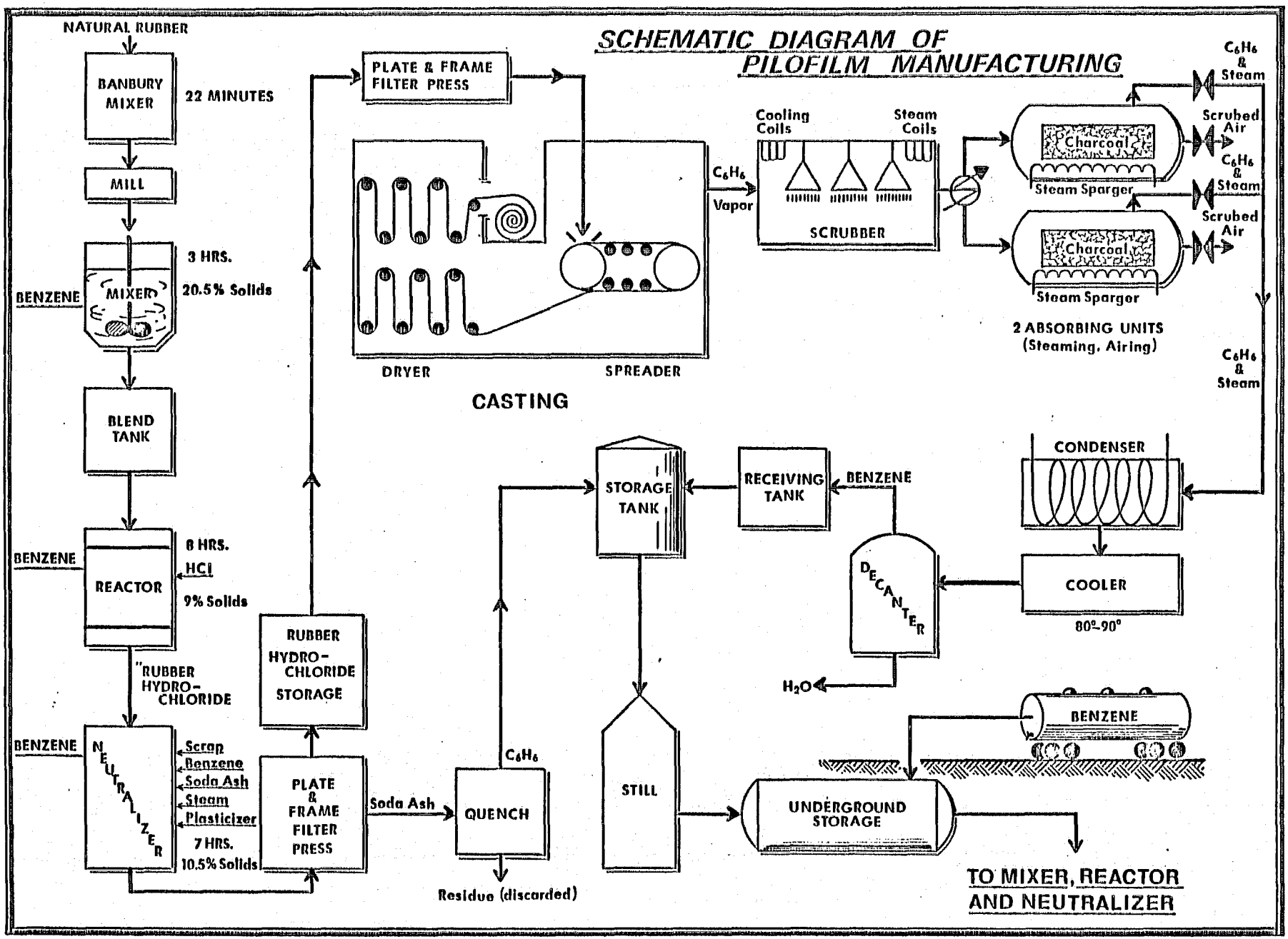
SCHEMATIC DIAGRAM OF PILOFILM MANUFACTURING
NATURAL RUBBER
BANBURY MIXER
22 MINUTES
MILL
3 HRS.
BENZENE
MIXER
20.5% Solids
BLEND TANK
BENZENE
REACTOR
8 HRS.
HCl
9% Solids
"RUBBER HYDRO-CHLORIDE
BENZENE
NEUTRALIZER
Scrap Benzene
Soda Ash
Steam
Plasticizer
7 HRS.
10.5% Solids
RUBBER HYDRO-CHLORIDE STORAGE
PLATE & FRAME FILTER PRESS
Soda Ash
QUENCH
Residue (discarded)
C6H6
PLATE & FRAME FILTER PRESS
DRYER
SPREADER
CASTING
C6H6 Vapor
Cooling Coils
Steam Coils
SCRUBBER
Charcoal
Steam Sparger
Charcoal
Steam Sparger
2 ABSORBING UNITS (Steaming, Airing)
C6H6 & Steam
Scrubed Air
C6H6 & Steam
Scrubed Air
C6H6 & Steam
CONDENSER
COOLER
80°-90°
DECANTER
H2O
BENZENE
RECEIVING TANK
BENZENE
STORAGE TANK
STILL
BENZENE
UNDERGROUND STORAGE
TO MIXER, REACTOR AND NEUTRALIZER

Table I

EIGHT-HOUR TIME-WEIGHTED AVERAGE BENZENE EXPOSURES

Occupational Title	Number of Individual Samples	Range, ppm	Avg. 8-hr. TWA, ppm
Banbury-Quencher Operator	2	5.86 - 11.04	8.45
Reactor Operator	2	4.88 - 13.11	8.99
Neutralizer Operator	4	6.87 - 47.80	24.91
Casting Unit Operator	6	3.78 - 9.61	7.18
Casting Unit Helper	4	6.50 - 12.61	8.20
1st Man Operator	2	16.68 - 18.40	17.54

(Retyped from faint original)

March 22, 1972

Mr. R.E Hanning
Manager - Cast Films

Subject: Air Sampling for Concentration of Benzol

At 8:30 P.M. on March 17, 1972, air samplings were taken in C & D Spreader room, scrubber room and control during shutdown. Instrument used was a Universal Tester from MSA, testing for concentration of Benzol.

Following are the results:

Test #1 - Removing Dam from C & D Spreader	Less than	5 ppm
Test #2 - Cement Storage Room Area		25 ppm
Test #3 - D Unit Cement Press	over	200 ppm
Test #4 - Pouring Press Flushings into Buckets on D Unit		25 ppm
Test #5 - Inside D Unit Drier		0 ppm
Test #6 - In D Unit Drier Door Opening		0 ppm
Test #7 - C Unit Cement Press		98 ppm (avg. 3 readings)
Test #8 - D Unit Scrubber		1.5 ppm (avg. 3 readings)
Test #9 - Rinsing D Unit Scrubber		10 ppm
Test #10 - Opening Door of C Unit Scrubber		5 ppm
Test #11 - Visual Check of Storage Tank While Emptying During Stock Change	over	200 ppm
Test #12 - Inventory Check of Tank		100 ppm
Test #13 - Cleaning Dam in Aisle	Less than	5 ppm

Followed [redacted] during shutdown. Saintignon was not wearing USBM approved respirator.

The amount by which threshold limits may be exceeded for short periods of time whithout injury to health depends upon a number of factors; such as, the nature of the contaminant; whether very high concentrations, even for short periods, produce acute poisoning; whether the effects are cumulative; the frequency with which high concentrations occur; and the duration of such periods. All factors must be taken into consideration in arriving at a decision as to whether a hazardous condition exists.

Manager,-Safety

Bruce C Bubp
gs

(RETYPED FROM FAINT DUPLICATE)

DIVISION OF SAFETY AND HYGIENE

May 4, 1948

James R. Fluker, Superintendent
Division of Safety and Hygiene
Columbus, Ohio

In re: The Goodyear Tire & Rubber Co.,
Akron 16, Ohio

On April 27, 1948, a visit was made to the above-named company for an industrial hygiene survey requested by J. T. Kidney, Safety Director, in a letter dated April 20, 1948.

Contact was made with J. T. Kidney; Dr. Hatch, Medical Director; R. W. Pickes, Safety Supervisor; W. T. Van Orman, Research Engineer; Henry W. Ernst, in charge of Pliofilm Research; W. H. Nichol, in charge of Plastic Research; D. C. Butts, Superintendent of Research; H. J. Osterhof, Director of Research; A. M. Clifford, Assistant Director of Research; T. W. Fisher, Foreman of Air Foam; D. M. Cornell, in charge of Safety of Plant C; Jack Craeger, Superintendent of Chemical Storage; Walter Schroeder, Assistant Superintendent of Chemical Storage; T. A. Pringle, Supervisor in charge of Asbestos Operations, Newt W. Nollan, Division Foreman of Paint Department in Plant A; and Edward Myers, Assistant Foreman of Paint Department in Plant A; and Edward Myers, Assistant Foreman of Paint Department in Plant A.

This company manufactures tires, deep freeze units, metal caskets, life rafts, balloons, pliofilm, air foam mattresses and cushions and numerous other types of rubber goods.

The first building to be surveyed was that of the Research Department wherein all research problems are analyzed. At the time of visit, the chief hazard was that of exposure to benzol fumes. A pilot plant is constructed in one area of this research building and on the date of visit it was not in operation due to a mechanical breakdown. This research building is extremely modern and those in charge of all operations are highly trained in research activities. They are well aware of the toxicity of the benzol. It was deemed advisable to plan a return to this plant when benzol was being used and take spot check tests to determine the concentrations in various areas. Only one man has complained of benzol poisoning and he is not engaged in research operations at the present time.

In a meeting with various heads of the departments, it was suggested that they obtain instruments which would give them checks on their operations at various intervals so that they would have constant information of top concentration of any type of toxic material that they might be handling. One must realize that in a research department, conditions change daily and the amount of material handled is in a lesser quantity than would be used under production schedules. The writer was informed that benzol was carried to various operations in open containers. He believes that the movement of benzol should either be through enclosed systems, or transported in containers having a tight lid. We have always been under the impression that a concentration of 50 parts per million of benzol was considered safe. However, various authorities seem to agree that 35 parts per million should now be classified as a safe concentration. As soon as conditions are corrected so that a benzol run may be started, the writer will make a return visit to this research department.

In Department 146-A, on the third floor, pliofilm is manufactured. Large amounts of benzol are used in this department. Various type machines such as dryers, spreaders, mixers, etc., are all exhausted. There are, however, a few areas of the plant and a few conditions wherein an employee might be subjected to an extremely high concentration of benzol. The benzol test taken at the front end of the dryer showed 120 parts per million. The employees working on this dryer are well aware of the toxicity of benzol and have been instructed to, and do, wear respirators when they are required to enter the front end of this dryer. The door which leads into the dryer is marked, indicating that respirators must be donned before entrance. This dryer is #C.

A spreader, also #C, contains an effective exhaust system but a test showed 120 parts per million under the dam. Again, employees use respirators whenever they enter this spreader. On one of these spreaders, at the back end, there was a door which shows no warning as to the necessity of wearing a respirator. The writer obtained a concentration of over 1,000 parts per million just inside this door. The head of the Department stated that no one worked inside the back of this spreader. But, nevertheless, there was a door there leading into the mechanical workings. It is quite possible that a maintenance man, or some other employee, might enter this room. In so doing, he would subject himself to an extremely dangerous concentration of benzol fumes which might even prove fatal. I am therefore recommending that warning signs be posed on this door and that entrance be obtained only with a written order from the superintendent.

In Building #32, on the fourth floor, in Department 146-A, there was located storage cases. These storage cases contain benzol. In a test taken at the top of a tank, the test showed 500 parts per million of benzol. The information obtainable seemed to indicate that one or more employees would spend approximately one hour per day at these tanks. If this be the case, the men are exposed to a definite benzol hazard. There are no exhaust systems outside of this tank at the openings. I believe that this is a solvent recovery system. I recommend that a special exhaust system be built around the tops of these openings so that no employee would be exposed to high benzol fumes.

(MATERIAL NOT RELATED TO BENZENE HAS BEEN REMOVED.)

The company is installing a new pliofilm unit in this plant; and while it is far from complete, one can see that adequate exhaust systems will be used to eliminate high concentrations. I believe that before this pliofilm unit is placed in operation, adequate checks should be made to determine the concentrations of the benzol fumes.

In the chemical storage, Department 245A, numerous chemicals are stored, such as benzol carbondisulfide, etc. The chemical storage is equipped with explosion-proof lights. The tanks are all grounded and there is a sprinkler system throughout. I recommend that the motor which is a spark producer be removed from this storage unit and a non-explosive motor substituted. I am wondering why Goodyear does not see fit to use color marking for the various pipes. One may think that this is not necessary but we have found in many instances that men have disconnected the wrong pipe, thereby causing injury, property damage and, in some instances, death. I do not believe that it is asking too much to paint these pipes containing toxic materials, with the proper designated color.