PB80-193683

INDUSTRIAL HYGIENE REPORT

WALKTHROUGH SURVEY OF TOLUENE
AT
NATIONAL STARCH AND CHEMICAL CO.
NATIONAL STARCH AND CHEMICAL CO.
NATIONAL ADHESIVES DIV.
Plainfield, New Jersey

Survey Conducted By:

M. David Gidley, SRI International
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James Oser, NIOSH
Frank Stern, NIOSH

Date of Survey:
October 3, 4, 1978

Report Written By:
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Senior Environmental Health Scientist

Approved By:
M. David Gidley
Senior Industrial Hygienist

October 12, 1978

Under NIOSH Contract No. 210-76-0162

PURPOSE OF SURVEY:	To conduct a walkthrough survey and document past and present worker exposure to toluene in an adhesive manufacturing facility, to assess the feasibility of a retrospective cohort mortality study, and to determine if a detailed industrial hygiene survey should be conducted.
EMPLOYER REPRESENTATIVES CONTACTED:	WILLIAM POWELL Plant Manager (201) 755-4100 HENRY SUNYAK Personnel Director (201) 755-4100 MARTIN SIECKE Plant Engineering and Maintenance Superintendent (201) 755-4100 RAY BUCHAN Director of Corporate Safety (201) 685-5139 MARVIN WEINGAST Health-Safety Lab Corrdinator (201) 755-4100
EMPLOYEE REPRESENTATIVES CONTACTED:	ANTHONY TAMPONI Plant Union Representative International Printing and Graphics Local 474 (201) 755-4100
STANDARD INDUSTRIAL CLASSIFICATION OF PLANT:	2891

INTRODUCTION

This study was conducted by SRI International under Contract No. 210-76-0162 entitled "Investigation of Industries with Agents which are Newly Suspected as Occupational Health Hazards." The purpose of the study is to document past and present worker exposure to toluene and to assess the feasibility of a retrospective cohort mortality study.

During Task 1 of this effort, a literature survey was conducted on toluene and personal contacts made to identify a cohort of workers exposed to pure toluene. As a result of this effort recommendations were made to investigate toluene-based adhesive manufacturers and users. National Starch and Chemical Company was one of six selected as a manufacturer, and the results of the walkthrough survey are included in this report.

DESCRIPTION OF THE FACILITY

The National Starch and Chemical Company in Plainfield, New Jersey was visited on October 3 and 4, 1978 to conduct a preliminary industrial hygiene and epidemiologic evaluation. Names of the participants in the survey are included in the Appendix. This plant manufactures toluene-based adhesives in two areas: one devoted to polymerization, and the other the Cellu department devoted to rubber-based solution polymers. These departments cover an area three-fourths and one-and-one half acres, respectively. Several buildings were constructed between 1918 and 1963 for the PVE department and between 1955 and 1966 for the Cellu. A total of four buildings are involved in the PVE and ten in the Cellu, with a total square footage of 11,000 and 29,000 respectively. The overall plant size is approximately one-half mile long by one block wide. The remainder of the plant is devoted to starch processing, solid adhesive manufacturing, and water-base adhesive manufacture. This is a multiproduct facility with many types of adhesives being manufactured. The remaining buildings were bought in the 1920's at which time adhesives were already being produced. Polymerization began between 1930 and 1935. Use of toluene is thought by the plant management to have begun around 1955.

The employees are represented by the International Printing and Graphics Union (Local 474). The plant union representative is Anthony Tamponi.

DESCRIPTION OF THE WORK FORCE

It was reported that approximately 31 employees may be exposed to toluene in the total plant population of about 225 persons and 120 administrative persons. There are 14 people in production in the PVE area and 17 in the Cellu area. This covers three shifts with 3 or 4 people per shift. The job titles and number of workers that are potentially exposed to toluene are as follows:

For PVE and Cellu* Departments

Job Title	Job Description	Per Shift	Total Force
Operator	heating and mixing of product & watches tank	3-4	9-12
Assistant Operator	assists operator	3-4	9-12
Helper	loads tank and draws off product	3-4	9-12
			31

*Job titles are the same for both departments with department indicated on employment records.

There are a total of 156 employees in the total plant during the day shift.

DESCRIPTION OF PROCESS

National Starch produces toluene-based adhesives by two basic processes. The first is by polymerization and the second by addition of solvents to mixing kettles and the solution of rubbers in these mixes. In the polymerization method (PVE department), commercial grade toluene is used in a batch process. Toluene is pumped in from an underground tank farm through a pump manifold. Toluene is added to the kettles in metered amounts. Two kettles related to toluene-based adhesive production are located at the north end of Building 40, but these are not exclusively used for solvent polymerization. Other solvents and monomers used in addition to toluene are those compatible with vinyl solution polymerization processes. These raw materials, specific for the adhesive to be produced, are added to the kettle. Following polymerization there is a draw-off process with drums filled manually.

In the production of rubber-based solution polymers (Cellu Department), the raw materials are elastomeric bases, toluene and other hydrocarbon solvents. The basic process consists of the addition of toluene and other solvents to mixing kettles (pumped in from the tank farm), dissolving rubbers in the solvent mixture, and then final draw-off into drums. A process flow diagram of this process is presented in the Appendix.

In the Cellu department toluene is sometimes used to clean the kettles or tanks when the product is being changed from a toluene-based adhesive to another type of adhesive. The spent toluene is drummed and is reused at a later time in manufacturing toluene-based adhesives.

Thus the basic end products for this facility include solution polymers, emulsion polymers, elastomer adhesives, including neoprene and contact cements. The facility as a whole also manufactures starches and resins which do not involve the use of toluene.

DESCRIPTION OF PAST EXPOSURES

There have been no major changes in the process engineering controls or in equipment over the years. The ventilation equipment was installed at the time the buildings were constructed. The products have remained essentially the same over the years except for a general trend, since the early 1960's toward more water-based and fewer solvent-based adhesives. This reflects the adhesives industry trend toward water-based products in general. Products that are no longer made have been replaced with products with similar chemical makeup with minor changes.

Air sampling has been conducted since 1974, including 8-hour time-weighted averages. These samples are area samples, usually taken with bags using personal sampling pumps. Some charcoal samples have been taken. No personal samples for toluene have been taken. This monitoring has been done at times when the corporate industrial hygienist expected peak exposures. The levels were reported to be well below the TLV, at less than one ppm.

DESCRIPTION OF MEDICAL, INDUSTRIAL HYGIENE, AND SAFETY PROGRAMS

The plant employs an industrial hygienist at the Plainfield location. Marvin Weingast is a corporate industrial hygienist who supervises chemists or technicians at other plant locations that conduct industrial hygiene sampling. Monitoring of toluene and other solvents may be conducted depending on the type of product being produced. If high levels are suspected, then monitoring is performed according to the schedule of the products to be produced, which is known about a week in advance. There is no routine schedule for air sampling. Area samples are taken in bags using personal sampling pumps followed with gas chromatographic analysis. Color indicating tubes and vacutainers are also used.

The company's safety program is supervised by Mr. Hank Sunyak. The program consists of biweekly meetings lasting 10 to 15 minutes, in which all employees participate to discuss any safety problems or potential dangers that have been noticed. There is forklift training and training for the buggy luggers. A total of 3 people are involved in the formal safety program, and there are review meetings and inspections that are conducted. Lost time accidents for 1977 were 17. These were

primarily slips, falls, and sprains due to the slippery floors common to adhesive manufacturing. The frequency rate was 25.06 and the severity was 718.04. The plant is not aware of any medical abnormalities among the workers.

Safety glasses and safety shoes are required for all employees. Gloves are available to the employees in the foreman's office. Respirators are also available but are not required. The respirators are MSA, and a Scott Airpack is also available. Hard hats are also not required. Showers are not required, but shower and changing facilities are available. NIOSH Current Intelligent Bulletins on toxic substances are provided to supervisors.

There is no physician on site at this location, but physicians are on call. Names of these physicians are listed in the Appendix. A nurse is not regularly at the facility, but at least 1 employee for each shift has formal first aid training. Pre-employment medical exams are required for both hourly and salaried employees. Periodic physical exams are not required, but an annual chest X-ray is provided on an optional basis. The pre-employment exam includes a chest X-ray, hearing tests, which consist of whispering to the patient, a visual tests, a lung function tests, blood test (hemoglobin), and complete urine test.

INSPECTION OF THE PLANT

The manufacture of toluene-based adhesives and the use of toluene at this plant site is described above. The manufacturing facility is a batch operation. The potential for toluene exposure exists when the adhesive product is being polymerized (PVE department) or mixed and dissolved (Cellu department), during the draw-off operation, and when tanks are cleaned with toluene. As mentioned above, a total of 31 employees in these departments have direct and potentially continuous contact with toluene. The maintenance and supervisory staff are not included in this potentially exposed group. The exposure of these workers was not evaluated to the extent of determining job function dose to toluene or to the combined exposure of toluene with other solvents used throughout the plant. Other workers that may have intermittent contact are those in the south wing of Building 40 (PVE department) where emulsion polymers that do not contain toluene are made, such as wood glues. Drafting of vapors from the north wing may occur and detectable levels were observed.

The major areas of potential exposure are listed in Table 1 of the Appendix. Workers move about the area within each department, but there is little or no movement between the Cellu and PVE departments which are physically located in separate buildings some distance apart. The north end of Building 40 (PVE) has two kettled devoted to toluene-based adhesives. Helpers load the raw materials and pump the toluene and other solvents into the kettles in metered amounts on the second floor. Operators and assistant operators watch the kettles during polymerization on the first floor, which is also near the pump manifold.

The Cellu department is in Buildings 20 and 22 which have two floors and are separated by a dry material storage area. Potential exposure to toluene exists near the mixing tanks on the second floor where helpers load the tanks and toluene is pumped in metered amounts. On the first floor potential exposure exists near the tanks during the mixing and draw-off process when the product is drummed.

Engineering controls in the PVE department are primarily natural ventilation through doors and windows. The north wing--first floor near the kettles--has a cross draft between two open doors (weather permitting). One flexible exhaust duct exists for evacuating the kettles prior to entry for cleaning, which occurs two to three times a year. This flexible duct, however, is inadequate since a large hole has been burned into it. Safety procedures are used for entry into the tank including air-supplied respirator.

In the Cellu department a ventilation system exists with low point ventilation ducts next to each of six tanks. One large fan at the south end of the building exhausts the system. Make-up air is supplied at the ceiling in the center of the room. Dried and wet adhesive and resins cover the floor in most of the production areas, particularly in the PVE building. This creates a potential for increased exposure to toluene and other solvents which evaporate from the spilled adhesive. The spilled adhesive may create a safety hazard in terms of slips and falls.

Waste products are disposed of by a state-approved hauler. This includes removal of flammable and nonflammable waste drums to a state-authorized waste disposal system. Toluene and other solvents used to clean tanks and kettles are reused for subsequent batches.

DESCRIPTION OF SURVEY METHODS

A Century Total Organic Vapor Analyzer and Draeger tube for toluene were used as environmental sampling instruments to obtain direct instantaneous readings. These were used as range-finding instruments to determine approximate levels. Samples were taken at the sites indicated in Table 2 of the Appendix. Both total hydrocarbon and toluene levels were measured. One Draeger tube sample was taken near a drum filling operation, but no detectable level was found. No further Draeger samples were taken since the Century indicated levels that were too low to be readily detected by the tubes.

RESULTS AND DISCUSSION

The results of the environmental sampling are presented in Table 2. Toluene levels ranged from approximately 6-12 ppm in the PVE department. Total hydrocarbon levels were between approximately 1.6 and 4.8 ppm. Differences between the total hydrocarbon and toluene levels are probably due to drafting during sampling.

Toluene levels in the Cellu department (dissolving of rubbers) ranged from approximately 5 to 8 ppm and total hydrocarbon levels ranged from 1.6 to 3 ppm. A cleaning mix of xylene and toluene was being used with a resultant 8 ppm toluene level nearby.

These toluene levels are well below the current threshold limit value of 100 ppm. However, these samples should not be considered representative of eight-hour personnel exposures, but do show that low level exposures are occurring. The conditions, according to the plant management, were typical with the facility running at a usual capacity and product line.

Exposure to other solvents was observed. No exposures to benzene were observed, and the plant management indicated none has ever been used as far as they are aware. Thus workers at this facility are exposed to pure toluene but are probably intermittently exposed. Exposure in the past is likely to have been comparable since no major changes in ventilation, equipment, process or products have occurred. A gradual change from fewer solvent-based adhesives to more water-based adhesives since about 1960 would indicate exposures to toluene were perhaps of greater duration (i.e., per eight-hour day or per week) in the past than at present.

CONCLUSIONS

Sampling results of toluene use areas suggest low level exposure (less than 10 ppm) and the probability of low personnel exposures to toluene vapors. The plant is a typical multiproduct adhesive manufacturing facility which results in exposures to a variety of solvent mixtures. Eight-hour time-weighted averages obtained through personnel samples may result in higher exposures than detected through direct reading instruments, since peak values may contribute to the overall level and not all operations were sampled.

RECOMMENDATIONS

The above conclusions indicate low level exposure to toluene in this typical, multiproduct adhesive manufacturing facility. Thirty-one employees are potentially exposed either continuously or intermittently to toluene. The effects of operations such as tank car unloading and various mechanic and maintenance functions were not evaluated, so that job function dose could not be determined.

In light of the following, it is recommended that a more detailed industrial hygiene survey be conducted to properly characterize exposures, especially for specific job functions. This evaluation should include personnel monitoring:

1. The sampling results were low and cannot be used alone as a characterization of job function dose.

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2. The number of workers involved with toluene.

3. The possible toluene exposure during tasks such as maintenance and tank car unloading.

4. Worker exposures to the combination of airborne levels of toluene and other solvents (but not benzene), particularly in light of a possible future epidemiologic study of toluene.

Appendix A

List of Participants

Survey at

National Starch and Chemical Co.

Plainfield, New Jersey

October 3, 4, 1978

Name	Organization and Responsibility
Henry Sunyak	National Starch, Personnel
Martin Siecke	National Starch, Plant Engineering and Maintenance Superintendent
William Powell	National Starch, Plant Manager
Ray Buchan	National Starch, Director of Corporate Safety
Marvin Weingast	National Starch, Health-Safety Lab Coordinator
M. David Gidley	SRI International, Senior Industrial Hygienist
Mary A. Zerwas	SRI International, Senior Environmental Health Scientist
James Oser	National Institute for Occupational Safety and Health, Project Officer
Frank Stern	National Institute for Occupational Safety and Health, Epidemiologist

FIGURE A-1

GENERAL PROCESS FLOW

PVE DEPARTMENT

National Starch and Chemical Co.
Plainfield, New Jersey

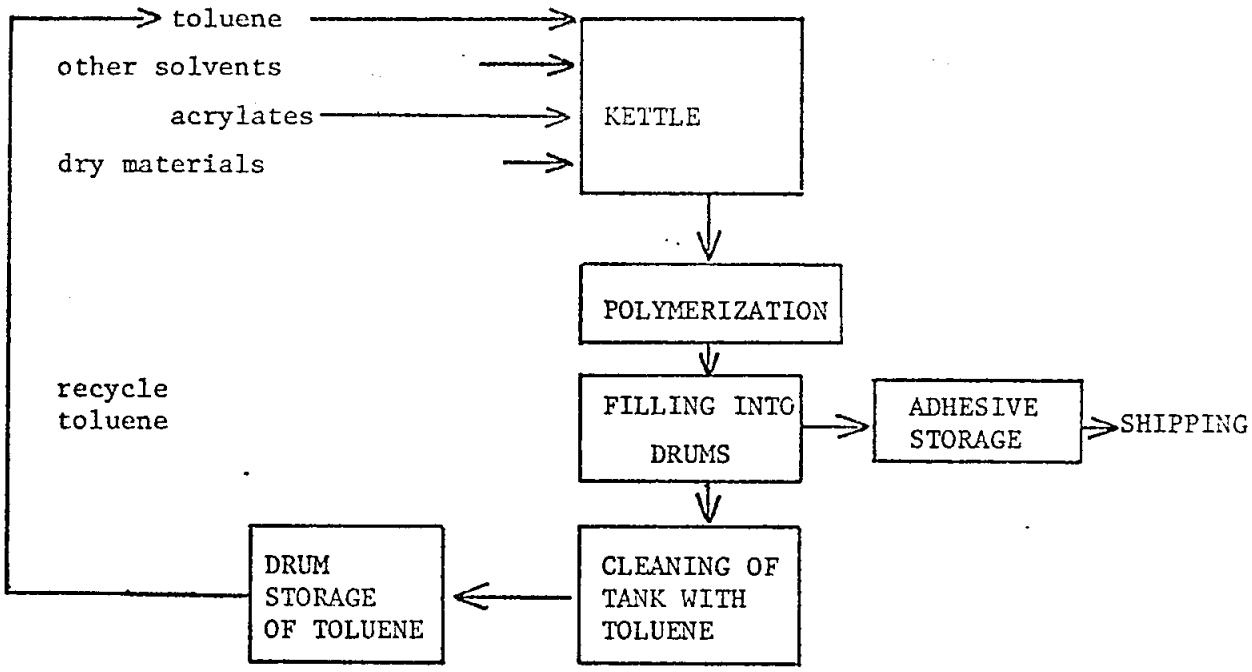
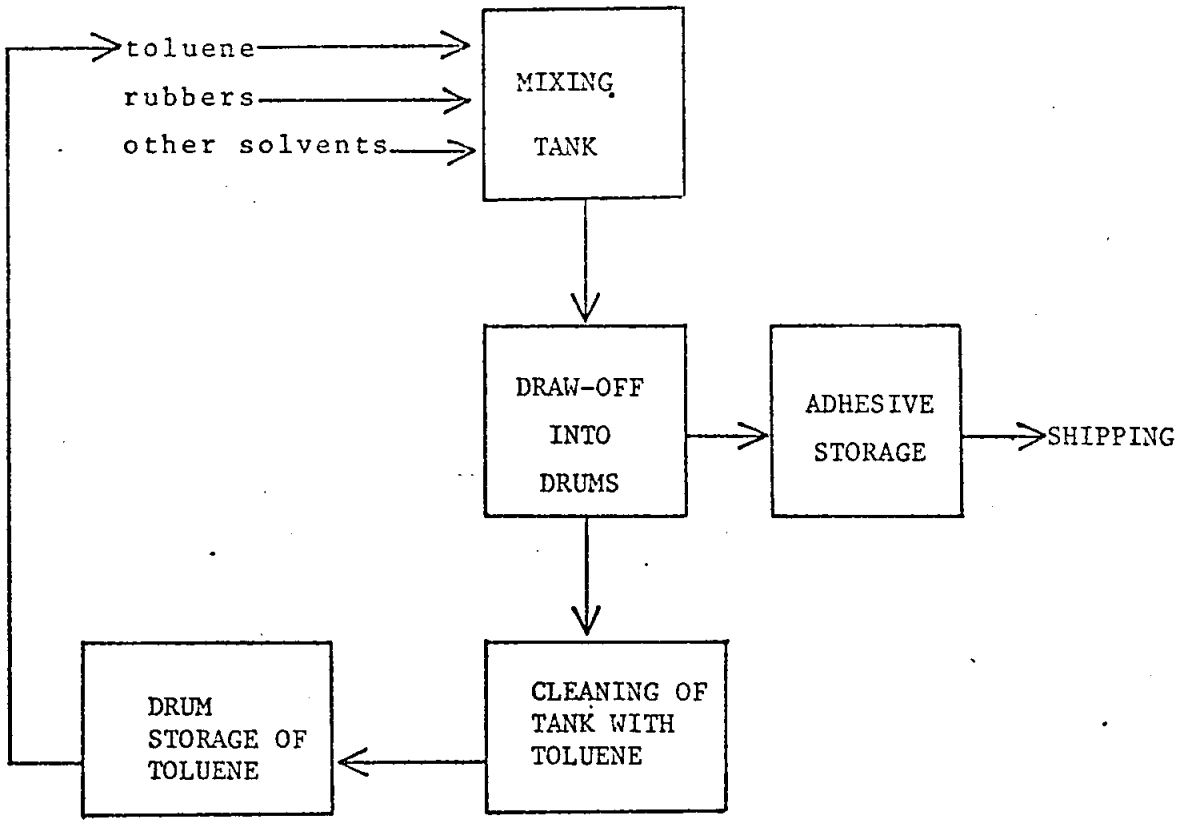


FIGURE A-2

GENERAL PROCESS FLOW

CELLU DEPARTMENT

National Starch and Chemical Co.
Plainfield, New Jersey



INTER OFFICE MEMO

National STARCH and CHEMICAL CORPORATION

TO Folder Note DATE 5/19/75

FROM R. W. Buchan

SUBJECT MEDICAL CONSULTANTS - Plainfield Plant

PHYSICALS:
(Salaried & Hourly) — Dr. Barry Schenk, Off Fridays, 1177 Park Ave., Plainfield, N. J. 07060 - 755-2726
Dr. Ellis Singer, 1177 Park Ave., Plainfield, N.J. 07060 - - 756-3324

COMPENSATION
Dr. J. F. Scalera, 101 Sampton Ave., So. Plainfield, N.J.
(Off Weds. and make appts. before 4 PM if possible) - - - 756-5207

PENSION PHYSICALS
(Hourly)
Dr. S. Piness, 915 Park Ave., Plfd. (No hours on Thurs.) - 755-6898

GENERAL MEDICAL - - Dr. Strom, 410 W. 7th St., Plfd., NJ 07060 (Off Weds.) = 756-4644
Dr. Wm. Balogh, 315 Dunellen Ave., Dunellen (Off Weds.) - 968-6066

Note: For Acrylonitrile Exposure, call: Dr. Scalera or Emergency Room, Muhlenberg Hospital

FINDERNE: Dr. Glass/Dr. P. Flicker, 286 E. Main St., Somerville, N.J.08876 - - 722-0822

BURNS OR SUTURING - Dr. Robert Null, 975 Park Ave., Plfd. - - - - - - - - - - - - 755-0360
Dr. M. L. Griswold, 1314 Park Ave., Plainfield, NJ - 756-7252
Dr. Philip Labate, 1111 Park Ave., Plainfield, N. J. - 757-1171
Dr. Ursula Steinberg, 1024 Park Ave., Plainfield, NJ - 755-0009

SKIN DISEASE or RASH — Dr. Hugh McCulloch, Jr., 977 Park Ave., Plainfield, N. J. 756-2483

BACK SPRAINS or BONES: Dr. M. Shafi, 1550 Park Ave., So. Plainfield, N. J. - 561-2122
Dr. E. S. Rachlin, 721 Park Ave., Plainfield - 753-9099
Dr. Paul Kandra, 1010 Park Ave., Plainfield - 757-5972

EYES
Dr. George Lane, 600 Park Ave., Plainfield 756-2192
Dr. Lobell, 1015 Park Ave., Plainfield 754-0304
Dr. Robert Shapiro, 900 Madison Ave., Plainfield, NJ 757-1409
Dr. Jerome Wolff, 935 Park Ave., Plainfield, N. J. 756-6361
Dr. Lucien Hirsch, 160 E. 7th St., Plainfield, N. J. 756-1234
~~Dr. Douglas W. Kramer, 1019 Park Ave., Plainfield, N. J. 756-1420~~

DENTAL CONSULTANT: Dr. Edmund Sage, 829 Park Ave., Plainfield, N. J. 755-3152

NOTE: Any Medical Cases requiring sutures — Send to MUHLENBERG HOSPITAL EMERGENCY ROOM
Telephone: 668-2000
(Then call doctor)

cc: Control Lab.
E. Eastman, Dev. Div.
Switchboard

MUHLENBERG HOSPITAL — Patient Info 668-2020

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FORM 621-LR

TABLE A-1

Potential Exposure Areas in the
Toluene-Based Adhesive Manufacturing Facility

National Starch and Chemical Company
Plainfield, New Jersey

Potential Exposure Chemicals	Location	Number of Workers Potentially Exposed
Toluene Other Solvents Monomer Chemicals	PVE Department Building 40 2nd Floor - North Wing (Loading of Kettles) Helpers	6-7
Toluene Other Solvents	PVE Department Building 40 1st Floor - South Wing (Watching Kettles) Operators/Assistant Operators	6-7
Toluene Other Solvents	PVE Department Building 40 1st Floor - South Wing (Drafting of Vapors from North Wing)	3-4
Toluene Elastomers Others Solvents	Cellu Department South End of Building Building 20 - 1st Floor Tanks #3 and #6	2-3

TABLE A-1 (CONTINUED)

	Location	Number of Workers Potentially Exposed
Toluene Other Solvents	Cellu Department Building 22 - 1st Floor Tank #13 (Helpers/Operators)	2-3
Toluene Other Solvents	Cellu Department Building 22 - 2nd Floor (Helpers)	2-3
Resins Plastics	Cellu Department Between Building 20 and 22 Dry Material Storage	∿ 4-6

TABLE A-2

RESULTS OF ENVIRONMENTAL SAMPLING

National Starch and Chemical Company
Plainfield, New Jersey

Survey Conducted October 4, 1978

Toluene

Sample Number	Sample Location	Toluene Century Reading	Toluene Approximate Concentration (ppm)
1	PVE dept. at emulsion pumping station (no toluene in use, but some drafting)	3.4	7
2	Center of PVE building at Tank 4 (filling area)	3.8	10
3	North end of PVE building valve manifold (open door at east and west)	3.0	6
4	PVE building second floor (north end) adjacent to mix tanks, all operating	3.5	7
5	PVE building second floor (north end) behind center mix tank	3	6
6	As in sample 5 - by gallon metering device - west end next to mix tank	4.4	10
7	PVE building second floor at large holding tank. Any solvent or material could be used (Tank 5)	4.9	11
8	PVE building second floor east side between mix tanks	5.3	12

TABLE A-2

(Concluded)

Sample Number	Sample Location	Toluene: Century Reading	Toluene: Approximate Concentration (ppm)
9	Cellu dept. Bldg. 20 over filling drum	4	8
10	Cellu dept. Bldg. 20 at Tank 3* (assistant operator in action)	3.4	7
11	Cellu dept. Bldg. 20 at drum filler (assistant operator from Tank #3)	3	6
12	Cellu dept. Bldg. 22 Tank 13 (filling 55 gal. drums) mixture containing toluene (helper in action)	3.4	7
13	As above, by Tank 13	3.4	7
14	As above, around Tank 13	<.6	Barely detectable
15	Cellu dept. Bldg. 22 (second floor) filler to Tank 13	2.8	5

*Toluene at Tank 3 likely coming from Tank 6. No toluene in adhesive at Tank 3.

TABLE A-3

RESULTS OF ENVIRONMENTAL SAMPLING

National Starch and Chemical Company
Plainfield, New Jersey

Survey Conducted October 4, 1978

Sample	Sample Location	Hydrocarbon Century Reading	Hydrocarbon Approximate Concentration (ppm)
16	PVE dept. at emulsion pumping station (no toluene in use, but some drafting)	1.6	2
17	Center of PVE building at Tank 4 (filling area)	3.2	3
18	PVE building second floor (north end) adjacent to mix tanks, all operating	3.0	3
19	PVE building second floor at large holding tank. Any solvent or material could be used (Tank 5)	4.8	5
20	PVE building second floor east side between mix tanks	2.8	3
21	Cellu building first floor Draeger tube	No response	
22	Cellu dept. Bldg. 20 adjacent to Tank 6 cleaning mix in tank of xylene and toluene	3	3
23	Cellu dept. Bldg. 22 (second floor) at metering console at purge barrel (containing toluene)	3.0	3

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