CELANESE FIBERS COMPANY

CELRIVER PLANT

Rock Hill, South Carolina

Task II

Methylene Chloride Survey Report

of the Contact

July 18, 1978

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CENTER FOR OCCUPATIONAL AND ENVIRONMENTAL SAFETY AND HEALTH

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Introduction and Purpose

The potential exposures to methylene chloride during its use at the Celriver Plant located in Rock Hill, South Carolina were surveyed on July 18, 1978. The purpose of that survey was to determine background levels of methylene chloride and other chemicals that may exist in the working environment during that chemical's use in the production of triacetate fibers and to determine if a more detailed industrial hygiene survey is necessary. The justification and degree of detail necessary for the in-depth industrial hygiene survey will be based on the feasibility of performing an epidemiologic study. If the worker population at this facility is adequate to support a retrospective mortality study, extensive personal and area sampling will be conducted over several days to characterize exposures to the target chemical as well as concurrent contaminants. Should a retrospective mortality study not be possible in any of the plants visited for methylene chloride, a cross-sectional type exposure survey will be conducted which will require a revisit to several of the methylene chloride facilities to collect a limited number of samples to quantify worker exposures to methylene chloride.

The sampling protocol to be used in the detailed survey will be decided by the Project Officer at NIOSH.

The study of methylene chloride was conducted under contract to NIOSH as one of the agents identified for the Industrial Hygiene Assessment of Selected Chlorinated Hydrocarbons (Contract No. 210-76-0158).

The Celriver Plant has a mailing address of:

Celanese Fibers Company
Celriver Plant
Cherry Road Station
Rock Hill, South Carolina 29730 Telephone: 803/366-4121.

The SRI International survey team consisted of Mr. Mas Koketsu, Senior Industrial Hygienist; Mr. Frank Stern, NIOSH Epidemiologist/Systems Analyst, also participated in the survey. The principal Celanese Corporation contact was E. M. Dixon, M.D., Corporate Medical Director, New York City. The principal contact at the Celriver Plant was B. E. Seward, Industrial Relations Manager. Celanese personnel assisting in the survey of the methylene chloride areas included H. Newton Williams, C. S. Laubly, L.R. Birkner, and R. C. Chapman. A complete list of the Celanese personnel and attendees of the opening conference can be found in the Appendix to this report.

Present Operations: Existing Controls and Monitoring, Process Description

The SRI survey of the Celriver Plant consisted of a walk-through of the production areas where methylene chloride is used or is found to be present.

Triacetate polymer flake is prepared for extrusion by converting the solid into a liquid and conditioning this mixture. The flake is dissolved in a solvent consisting of methylene chloride and methanol in a batch mixer. Roughly three pounds of solvent is added for each pound of flake, together with conditioners and titanium dioxide if a dull "dope" is desired. "Dope" is the term used to describe the liquid medium of fiber forming polymer suitable for extruding. The flake is added to the batch mixer through a weigh hopper, together with the other dry ingredients, and the methylene chloride-methanol solution is delivered via a closed piping system. This solution is slowly mixed until the solids are completely dissolved in the mixer which has a capacity of approximately 500 gallons.

Following the mixing, the dope is processed through a series of three filtration steps. The A-stage filter removes the coarser particles, while

the B-stage and C-stage filters provide depth filtration. This is essential to ensure that the liquid is absolutely free of material which would clog the extrusion heads.

During the mixing and filtration processes, the solution is in an enclosed plumbing system and there are no exposures. However, the filter presses require periodic stripping and replacement of the filter elements. Approximately 10-12 filter presses are stripped each week, taking about 45 minutes for each filter press. A local exhaust system has been installed to assist in removing the solvent vapors during these operations. The filter elements are permitted to partially dry before being processed to recover the solvent and polymer.

Following filtration, the triacetate dope is pumped to the extrusion area, preheated, filtered through a candle filter, and forced through the extrusion head referred to as a spinerette or jet. The extruded fibers travel down through a drying cabinet where heated air aids in removing the solvent and dries the fibers. The dried fibers are brought together and form Arnel®, the triacetate yarn which is spun onto a carrier package known as a bobbin. Individual cabinets are grouped together in a long series of cabinets referred to as a metier.

Air from the drying cabinets together with the solvent vapors from the drying filament is passed through a charcoal recovery system to reclaim the solvent.

The principle control for the solvent vapors is the cabinets which constantly pull air from the work area into openings and as this air rises up the height of the cabinet, the vapors are pulled along and into the collection duct of the vapor recovery system. There is a

slight negative pressure inside the cabinets preventing the solvent-laden air from escaping into the work area. However, the fiber filaments continue to release vapors while being wrapped or spun onto the bobbin and throughout other operations which the fiber undergoes.

These other operations include: twisting of the fibers (mechanically performed); coning, which transfers the fiber from a supply bobbin to a cone for use in the textile industry; and beaming, which is the transfer of filament from several bobbins onto a large spool known as a weaving or section beam. These latter operations are conducted in the Textile Department of the plant.

The production of triacetate fibers is a 24-hour per day, seven-day per week continuous operation with no shut-down except for equipment failure. Personnel working in the production areas do not require any personal protective equipment under usual operating conditions. However, the pressmen, when disassembling the filter presses wear protective gloves and the twisting operators in the twisting area of the Textile Department are required to wear hearing protection while in the area.

In the preparation area where the dope is mixed and filtered, there are a total of 20 employees operating the mixers or maintaining the filters. In the extrusion areas there are approximately 260 operators in Block I, the large area which produces primarily acetate fibers, although some of the metiers are producing Arnel® yarn. In Block II there are 80 employees potentially exposed since most of the metiers are producing Arnel® fibers. Bobbin Stores, an area where full bobbins are kept until ready for further processing has approximately 100 employees, while in the Textile Department Twisting employs approximately 130; Coning has 140; and Beaming has

190 persons.

Job Description and Personnel

As mentioned above, the number of employees potentially exposed to methylene chloride would total approximately 920 persons. However, all of these persons may not be working with the triacetate fibers continuously throughout the entire work shift. The 920 employees are roughly equally divided over the four rotating shifts which operate the plant continuously. The principle product of the Celriver plant is acetate fiber with triacetate accounting for about one-third of the plant production.

The job titles and description of the personnel in the fibers production areas are as follows:

Preparation Area

Control Operators - Charge and monitor the mixing of the flake and solvent in the mixers. These operators are located in a control room away from the mixing area.

Pressmen - Prepare the filter presses for filtering the dope. Remove and replace the filter elements and also operate the recovery equipment for reclamation of the dope from the filter elements.

Extrusion Area

Jet Wiper - Operates and maintains the extrusion equipment to ensure that the dope is flowing evenly and continuously. Usually, one jet wiper is responsible for two metiers, approximately

200 individual cabinets.

Doffer - Removes and replaces bobbins on the metiers. Loads onto the transport, observes the operation of the individual cabinets.

Patrolers - Assists the Doffers, removes "shorts," bobbins which do not have a full amount of yarn. Also observes the operation of the individual cabinets.

Bobbin Stores

Bobbin Stores Operator - Loads and unloads transports, readies bobbins to be taken to the Textile Department.

Textile Department

Twisting Operators

- Creeler - Doff off full packages (bobbins) after yarn has gone through the mechanical twisting
- Lace-up Operator - Laces or threads ends of full bobbins through the twister onto empty spools.

Coning Operators - Doffs off full cones, replaces empty bobbins and laces up ends of full bobbins for transfer to cones.

Service Operator - Provides transports with full bobbins for the twisting or coning operators, takes back empty bobbins.

Conveyor Operators- Operates conveyor "train" throughout all yarn handling departments.

Beaming Operator - Removes and replaces bobbins transferring yarn onto weaving or section beams. Tie ends together to maintain continuous feeding and transfer of yarn.

In addition to the job categories mentioned above, there are plant maintenance and supervising personnel who may receive methylene chloride exposures.

Potential Exposures

The major potential exposures observed in the fiber production and handling areas are to methylene chloride, acetone, and methanol. Vapors from these solvents are present in the vicinity of processing equipment handling Arnel® as well as in the preparation and extruding areas. If it is decided that the Celriver plant be included for an in-depth industrial survey, acetone and methanol should be included as additional compounds for personal monitoring, permitting the combined exposures to be documented.

Housekeeping

The general housekeeping throughout the fiber production areas was considered very good. The equipment used in the fiber manufacturing is constantly maintained and inspected and the fiber yarn processing equipment and areas are likewise constantly maintained. No problems related to housekeeping were observed during the walk-through survey of these areas.

Description of the Facility and Operations

The Celriver Plant of the Celanese Fibers Company is located in Rock Hill, South Carolina. The construction of the plant began in January 1947 and fiber production started in August 1948. There are 1,100 acres of total property, with the fenced plant area occupying 85 acres. The principle products include cellulose acetate and triacetate flake, acetate fibers and triacetate (Arnel®) fiber which are produced in four major buildings. These are (1) Cellulose Acetate, (2) Block I Extrusion, (3) Block II Extrusion, and (4) Textile buildings. In addition, there are warehouse, acid recovery, main shop, powerhouse, filter plant, administration, and personnel buildings, plus several other buildings. Approximately two million square feet of total building area is under roof.

There are 1950 employees at this facility of which approximately 1200 are production workers, 350 in the administrative area, and 400 in the maintenance and related operations. The hourly personnel work on four rotating shifts. These workers are represented by the following union:

Amalgamated Clothing and Textile Workers Union
Local 1093-T
President: Mr. George McCraw

Health and Safety Program

The health and safety responsiblities are under the Manager of Industrial Relations at the Celriver Plant. Mr. B.E. Seward directs the efforts of the plant safety and environmental program, which has eight persons directly involved; there is also a plant safety committee, comprised of both management and hourly employees, which conducts departmental inspections and assists in resolving problems relating to safety.

The OSHA Incident Rate for the year 1977 was 1.18 and for the current year through June, the Incident Rate was 1.72. The Incident Rate is computed by multiplying the number of injuries or illneses logged in the OSHA 200 form by 200,000 and dividing by the total number of employee hours worked per year.

The Calriver Plant has recently received an award from the National Safety Council for placing first among plants in the Textile Section. This award was based upon the low accident frequency and severity rates experienced by the plant during the past year.

Until early this year, the medical program was headed by a part-time physician, Dr. William H. Williams, who spent two hours per day, five days per week in the plant. Dr. Williams died and until a new physician can be recruited, the medical needs of the plant are handled by the Ebenezer Medical Clinic located at 1317 Ebenezer Road, Rock Hill, South Carolina. They conduct pre-employment physicals and periodic physical examinations, as well as handling injury cases.

In addition to the physicians at Ebenezer Medical Clinic, there is a full-time nurse assigned to each of the four work shifts. A brigade of approximately 100 employees is equipped and available to handle fires and other emergencies. There are about 85 personnel throughout the plant who are trained to provide immediate first-aid care in the event of an accident.

Medical monitoring of employees has not been instituted at this facility. The only periodic testing currently offered is audiometric examinations. of those employees working in areas designated as high noise exposure areas. Staff personnel are given annual physical examinations, but the hourly employees are not included in this program.

Personal protective equipment in general is not required in most

areas of the plant. However, for jobs which require the use of special equipment, these are provided and may include clothing, safety glasses or chemical goggles, safety shoes, respirators, aprons, gloves, hearing protection, etc.

Industrial hygiene needs are provided by corporate industrial hygienists and also from the headquarters of the Celanese Fibers Company located in Charlotte, North Carolina. An Environmental Technician is present at the Celriver Plant and collects air samples to monitor the work environment concentrations which are analyzed by the laboratory at the plant. He is also responsible for collection of waste water and other environmental samples.

Description of Survey Methods and Results

A Century Systems Organic Vapor Analyzer (OVA) was used as the environmental sampling instrument. MDA Accuhaler® 808 sampling pumps, equipped with two charcoal collection tubes in series were used as the primary means to characterize airborne levels of methylene chloride, and also to determine the presence of acetone vapors in the work areas surveyed.

The Century Systems OVA Model 128 is equipped with a gas chromatograph with a flame ionization detector which was used to identify and quantify airborne levels of methylene chloride. The instrument did not respond properly at the onset and required field maintenance which negated the calibration and upon return to Menlo Park a new calibration was performed. The calibration curve for the instrument is attached.

Measurements of methylene chloride vapor were made at each of the locations for the area samplers. Readings on the GC ranged from 42 to 170 on the meter which corresponds to 458 ppm to 1853 ppm. These are instantaneous "grab sample" readings which do not correlate well with the long term area samples (see Table II).

Area monitoring pumps, the MDA Accuhalers®, were placed on or around equipment in the various work areas. The samplers were allowed to collect solvent vapors for approximately six hours, although some of the samplers ceased operating after a period of time. However, those collected sufficient sample that the methylene chloride and acetone present were recovered and their amount determined. Samplers were placed in the preparation area, the extrusion areas, bobbin storage, and in the twisting area. Charcoal tubes supplied by SKC, Inc. (Lot 106) were used as the collection media. Two tubes, a large SKC tube containing 600 milligrams of charcoal, and a standard SKC tube containing 150 milligrams of charcoal, were used in series. The large tube was used as the primary section. The standard tube was connected to the larger tube with a short piece of rubber tubing and was used as the back-up section. The pumps were calibrated to sample at a nominal rate of 50 cc/min. Air is drawn through the charcoal tubes and the solvent vapors are adsorbed on the charcoal. The analysis of the samples of methylene chloride was accomplished by SRI's Analytical, Physical, and Inorganic Chemistry Group following NIOSH P & CAM Methods S329, 127.

Relative humidity and temperature measurements were taken in all the areas using a hand-operated sling psychrometer. Relative humidity ranged between 39% to 56% and temperatures ranged from 77°F to 92°F (25°C to 33°C).

Tables I and II provide the sampling results and the readings obtained from the use of the Century Systems OVA. These are area or "grab samples" and do not properly reflect the levels or concentrations to which workers in the areas would be exposed for extended periods of time. For that determination personal samples would provide an accurate assessment of the employees' time-weighted average exposure. During the sampling, Celanese industrial hygienists conducted side-by-side sampling of our area samplers and also collected some personal samples on the workers. These data were not made available to SRI.

Celanese Corporation has also had an evaluation of the worker exposure levels performed by personnel from Dow Chemical Company who conducted an epidemiological study of methylene chloride workers. Preliminary data provided by Dow to Celanese was available and is presented in Table III.

Summary and Recommendations

Approximately 920 employees from a total plant population of 1950 work within areas where there is a potential for exposure to methylene chloride. These persons are not exposed all of the time, since the production of Arnel®, the triacetate fiber, is concurrent with the production of acetate fibers. Triacetate fiber production may be as high as one-third of the total production of fibers from the Celriver Plant. The survey by SRI was conducted to determine the levels of methylene chloride present in the work areas where the triacetate fiber is prepared, extruded, and packaged.

Preliminary determination of ambient airborne methylene chloride levels using charcoal collection tubes indicate that there is from 49 ppm to a high of 685 ppm in the areas sampled. Acetone which is present in the manufacture of acetate fibers is also present in concentrations from less than 3 ppm to 609 ppm in the same areas.

It is recommended that the Celriver Plant of Celanese Fiber Company be considered by NIOSH as a possible site for a detailed industrial hygiene survey of methylene chloride in support of a cross-sectional type epidemiological/industrial hygiene evaluation. This recommendation is based upon the following reasons:

1. The methylene chloride concentrations as determined by area sampling exceeded the OSHA standard of 500 ppm in two instances and were close to the standard in several other samples. All but one sample exceeded the present ACGIH recommendation of 200 ppm and the 75 ppm recommendation presented by NIOSH in their Criteria Document of Methylene Chloride.
2. There is a large number of persons who are potentially exposed to methylene chloride and would present a good sample population for an epidemiological study.
3. The fiber manufacturing operations are continuous and therefore exposure levels would be relatively constant.

However, as mentioned previously, Dow Chemical Company has performed a similar study of employees exposed to methylene chloride, and Celanese has stated that the results of this study will be made available to NIOSH.

Should NIOSH decide to have SRI perform a Task III (detailed I.H. survey) at this facility, it is recommended that acetone and methanol levels be fully quantified along with personal breathing zone time-weighted average samples for methylene chloride.

TABLE I

CHARCOAL TUBE-AREA MONITORING RESULTS
CELRIVER PLANT, ROCK HILL, SO. CAROLINA
WALK-THROUGH SURVEY CONDUCTED JULY 18, 1978

Sample Number	Sample Location	Time (Min)	Volume (liters)	Acetone ppm	Methylene Chloride ppm
1	Block II Extrusion Spinning Area Btwn Metiers 60-61	378	13	93	495
2	Block II Extrusion Spinning Area Btwn Metiers 64-65	373	14.5	221	543
3	Block II Extrusion Area - Front of Metier 57	365	2.7**	123	394
4	Block II Catwalk Jet Area Between Metiers 58-59	355	19.3	142	381
5	Block II Catwalk Jet Area Between Metiers 60-61	353	16.8	144	409
6	Filter Press Area Block II at Press C107	375	14.6	*	285
7	Bobbin Storage Area - Column K26	328	4.1**	183	343
8	Block I Extrusion Spinning Area Btwn Metiers 39-41	324	3.9**	609	685
9	Textile Department Twisting - Btwn D23 - D24	308	12.9	484	49
10			Blank	*	*

*Below detectable level.

**Sampling pump did not perform throughout entire sampling period.

NOTE: The front and back charcoal tubes were analyzed separately. No methylene chloride or acetone was detected in any of the backup tubes. Detection limit of 0.1 mg.

TABLE II

ORGANIC VAPOR ANALYZER (OVA)
METHYLENE CHLORIDE ENVIRONMENTAL SAMPLING RESULTS
CELRIVER PLANT, ROCK HILL, SO. CAROLINA
WALK-THROUGH SURVEY CONDUCTED JULY 18, 1978

Sample Location	Total Hydrocarbon Meter Reading	Methylene Chloride* Meter Reading	ppm
Near Sampler #1	420-480	50	550
Near Sampler #2	540-560	70	760
Near Sampler #3	540-580	72	785
Near Sampler #4	500-510	74	806
Near Sampler #5	520-550	78	850
Near Sampler #6	320-360	42	458
Near Sampler #7	500-520	70	760
Near Sampler #8	1000+	170	1853
Near Sampler #9	420-440	110	1200

*see calibration curve - Appendix

NOTE: Total Hydrocarbon readings included indication of acetone, methanol and methylene chloride, while methylene chloride readings were obtained using the GC column which separated the vapors with the methylene chloride peak coming off at approximately 1 min. 15 sec.

TABLE III

PRELIMINARY EXPOSURE DATA - DOW STUDY*

METHYLENE CHLORIDE AVERAGE EXPOSURES

Location	Approx. Total Employees Excluding Engineering	Concentration** ppm
Extrusion I	260	200
Extrusion II	80	400
Preparation	20	300
Bobbin Stores	100	150
Twisting	130	70
Coning	140	40
Beaming	190	60

*Provided by Celanese Celriver Plant

**Approximate eight-hour time weighted average concentration.

APPENDIX

TABLE IV

METHYLENE CHLORIDE SURVEY ATTENDEES
CELRIVER PLANT, ROCK HILL, SO. CAROLINA
WALK-THROUGH SURVEY CONDUCTED JULY 18, 1978

Celanese Corporation Personnel

B. E. Seward	Celriver Plant, Industrial Relations
R. M. Summers	Celriver Plant, Production Manager
R. W. Godwin	Celriver Plant, Director of Manufacturing
E. M. Dixon, M.D.	Corporate Medical Director
J. C. Pullen	Environmental Manager, Celanese Fibers Co
L. R. Birkner	Industrial Hygienist, Celanese Corp.
R. C. Chapman	Celriver Plant, Environmental Specialist
W. M. Washington	Celriver Plant, Senior Project Engineer
C. S. Laubly	Manager Industrial Hygiene, Celanese Corp.
Edward W. Ewald	Celriver Plant, Technical Manager
H. Newton Williams	Celriver Plant, Extrusion Superintendent

SRI Personnel

Mas Koketsu	Senior Industrial Hygienist

NIOSH Personnel

Frank Stern	Epidemiologist/Systems Analyst

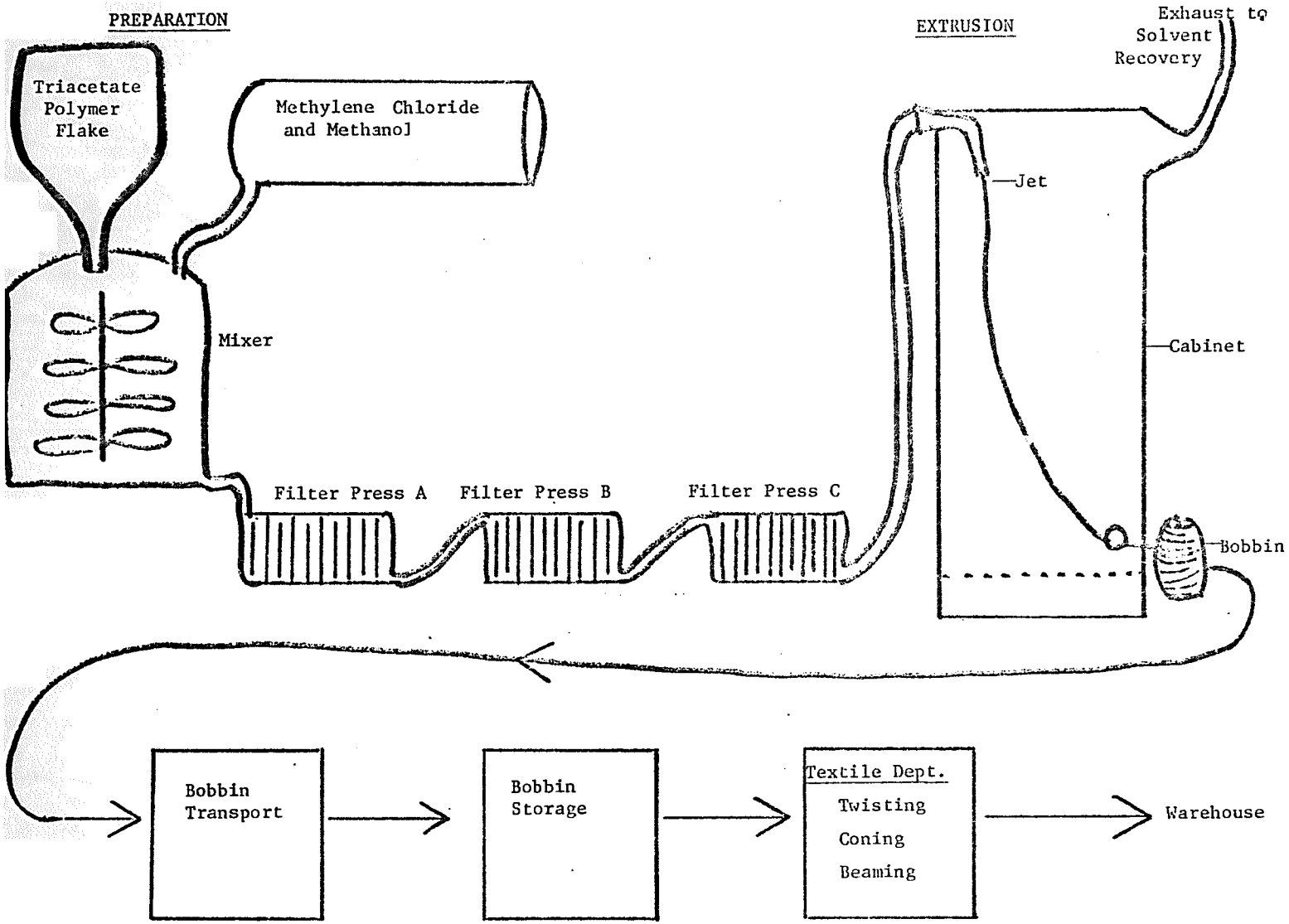
PREPARATION
Triacetate Polymer Flake
Methylene Chloride and Methanol
Mixer
Filter Press A
Filter Press B
Filter Press C
EXTRUSION
Exhaust to Solvent Recovery
Jet
Cabinet
Bobbin
Bobbin Transport
Bobbin Storage
Textile Dept.
Twisting
Coning
Beaming
Warehouse

FIGURE 1

FIGURE 2

Century OVA-128 Calibration - Methylene Chloride

July 21, 1978 M. Koketsu/S. Claxton