SYNTHETIC FIBERS

AP-42 Section 5.19
Reference Number
39

CELANESE
FIBERS COMPANY

July 3, 1980

JCP-80-118

Mr. Robert A. Zerbonia
Pacific Environmental Services, Inc.
1905 Chapel Hill Road
Durham, North Carolina 27707

Dear Mr. Zerbonia:

Enclosed are the completed questionnaires on the dry spinning and solvent recovery processes of the Celanese Fibers Company plants at Rock Hill, South Carolina and Narrows, Virginia. Note that there are two sets of the forms; one being complete and marked confidential, the other having all confidential information deleted. It is our understanding that the confidential information will not be subject to Freedom of Information Act inquiries and release.

If you have any questions about the data submitted, please give me a call on (704)554-3013.

Very truly yours,

J. C. Pullen
Manager, Environmental Activities

/gh

Enclosures

cc: Mr. G. F. Benjock - Rock Hill
Dr. A. E. Champ - Charlotte (w/o att.)
Mr. D. W. Crumpler - U. S. EPA (w/o att.)
Mr. J. S. Higgins - Narrows (w/o att.)
Mr. H. W. Irwin - Narrows
Mr. L. H. Knox - Charlotte (w/o att.)
Mr. J. J. McDermott - Rock Hill (w/o att.)
Mr. G. A. Rodenhausen - New York
Mr. M. D. Sellers - Charlotte (w/o att.)

ENCLOSURE I

PLANT SURVEY

A NSPS is being developed for the synthetic fiber industry wet and dry spinning processes which emit significant amounts of volatile organic compounds (VOCs). Specifically, the Phase II investigation of the synthetic fibers industry will concentrate on the following three basic stages of wet and dry spun fiber production:

1) Preparation of the spinning solution or dope (i.e., polymer dissolving, blending, and filtering).

2) Spinning of the fiber (i.e., the actual formation of the fiber filaments from the polymer).

3) Texturizing of the formed fibers (e.g., lubrication, washing, drying, stretching, heat-setting, and crimping).

During NSPS development, an evaluation of VOC emission rates will be necessary to determine the efficiency of control techniques under consideration for reduction of VOCs. Therefore EPA proposes that information on synthetic fiber spinning processes from specified synthetic fiber manufacturing plants be collected. The objectives/purposes of the information gathering program are to:

1) Provide specific, basic emission data on VOC emissions from the wet and dry spinning processes,

2) Identify candidates for the best systems of control,

3) Provide information to depict model plants that best represent the industry.

4) Identify and evaluate potential formats for any standard developed (i.e., mass units relating lbs of VOC emission to overall production or solvent recovery performance efficiency requirements).

The completed questionnaire will augment information gathered in Phase I of the NSPS development, literature searches, material balance calculations, and further information supplied by the industry. This information will provide a basis for evaluating the performance of emission control techniques applicable to the industry and estimating the ultimate VOC emissions emitted to the atmosphere. The emission data will be used to determine the levels of achievable control (e.g., the hooding, enclosure, ventilation, and equipment requirements needed to achieve the degree of capture effectiveness) and cost data associated with particular regulatory alternatives.

Since Manufacturing processes, raw materials, and solvents vary between the spinning of different fiber types, please complete a questionnaire for each fiber type produced.

Celanese - Narrows
(Filament)

1. What fiber type do you produce?

Cellulose Acetate Yarn

2. What spinning method?

Wet _____

Dry __X__

3. What polymer is used?

Cellulose Acetate

4. What solvent is used?

Acetone

5. If wet, what is composition of spinning bath?
If dry, what is composition of quench gas?

Air

6. What is polymer to solvent ratio. (lb solvent/lb dope)

Confidential

7. Do you manufacture only one fiber type per process line, or do you produce fibers with different characteristics on the same line?

Only cellulose acetate with different deniers and dpf and bright and dull luster.

8. What are design and actual production rates? How much does production vary over time — day, week, month?

Confidential

9. How is the raw material feed rate and production rate measured? What is the accuracy of the measurements?

Raw material feed rates measured by monthly accounting inventories. Accuracy of these measurements is within 5%.

10. See Figure 1 (Dry spin) or Figure 2 (wet spin). Please note on this diagram the processes used or excluded in your plant. Add any notations or sketches as appropriate. Note those points in the process where solvent or fiber testing is now performed.

11. See Figure 1 (Dry Spin) or 2 (Wet Spin). Please note the amount of polymer introduced at PY. Note the amount of product shipment at PS. How do you account for any differences between these? (secondary product formation, still bottoms, heels, waste, etc.)

Essentially all waste is redissolved. Recycle waste yarn (confidential).

12. Is fiber waste recycled? How? Which products?

All waste redissolved

13. (Wet Spinning) Is the water from the spinning bath processed for recovery of dissolved solvent and/or unreacted monomer?

N/A

14. (Wet Spinning) What process is used to effect this recovery? What is the efficiency of this process? (Of the solvent or monomer dissolved in the water, how much is recovered, and/or how much is released in waste water or vented?)

N/A

15. Do you perform dope testing after blending and prior to spinning to determine solvent concentration? If so, please describe this test.

Yes - a weigh, dry and reweigh test

16. Is the solvent/polymer mixing batch or continuous?

Semi-continuous (intermittent addition of polymer)

17. (See Figure 1 (Dry Spin) or Figure 2 (Wet Spin) Note at the left (Point MS) the amount of solvent makeup used. Also note the period in which this amount is used. (Pounds per hour, pounds per day, etc.)

Confidential

18. Is the polymer dope filtered prior to spinning? If so, is the filtering process open, enclosed, or vented? Where do the vents lead?

Enclosed (plate and frame presses)

19. Is the filter media reused? If so, is it processed, treated, or washed for reuse?

No

20. What is the approximate solvent loss as vapor at the filtering stage?

Unknown. Room air recovered

21. See Figure 3 (Wet spinning) or Figure 4 (Dry spinning). Is the fiber open to room air as it passes from one process to another following spinning? Does any solvent evaporate from the fiber at these points? Approximately how much? Are there any hoods or vents to capture this solvent?

Fiber open to room after extrusion (Point I). Residual solvent on fiber (confidential). The solvent is carried by air circulation back to solvent recovery through the spinning column. See Figure 4.

22. Are tests for solvent residuals made at any point in the fiber process (solvent remaining in/on the fiber)? If so, note on Figure 3 (Wet spin) or Figure 4 (Dry spin) the point(s) these samples are taken, with a brief indication of how this sample would be taken.

At Point I, Figure 4. At the first or metering roll, yarn is collected in a hollow disc or wheel, sealed, weighed, dried and reweighed.

23. **Please briefly describe the fiber test method used for measuring solvent residual.**

Weigh, dry and reweigh, correcting for regained water.

24. **What records are maintained, if any, with reference to the fiber tests? On what time basis are these records updated (continuous, hourly, shift, daily, etc.)?**

Data taken daily, plotted on graph weekly.

25. **Does residual solvent in any way affect fiber properties? For example, does a specific solvent residual content remain in the fiber end product to produce desired characteristics?**

Yes. Affects processing characteristics and can affect dyeability of fiber.

26. **(Wet Spinning) Is the spinning bath enclosed or covered? Are the vapors vented to a solvent recovery system? If not, where are any vapors released?**

N/A

27. **Please provide a brief description of the solvent recovery systems utilized in connection with the fiber production facility. Please include design specifications and drawings if possible.**

A common solvent recovery facility serves both filament and tow product lines. (Confidential details)

28. Please provide the design and operating paramenters for each scrubber:
    a) pressure drop
    b) inlet liquid and gas pressure
    c) liquid and gas flow rate and temperature
    d) composition of scrubbing liquid
    e) inlet and outlet solvent concentration

We have no scrubbers used for solvent recovery as shown in the flowsheet. There are five vessels called "scrubbers" which inject water into the solvent-laden air to cool it to a good adsorption temperature. No solvent is removed in these "scrubbers."

29. When was the solvent recovery equipment installed? What guarantees were given by the manufacturer?

The equipment was installed in various phases between 1940-1977. No performance guarantees.

30. What problems have been encountered with the recovery system?

Still corrosion, 3-17% carbon replacement rate/yr. High energy consumption/lb. recovered solvent.

31. What are the maintenance practices and schedules associated with the recovery system?

Carbon is washed and adsorbers inspected every three years.

32. What major modifications have been made to the recovery system in the past?

None

33. Are there any plans to upgrade the existing solvent recovery system?

The instrument control system will be upgraded to improve efficiency.

34. If your firm were to build a new fiber spinning and processing line with associated solvent recovery systems, what solvent recovery efficiency would you desire and expect? By solvent recovery efficiency we refer to the amount of solvent recovered for reuse divided by the total amount of solvent introduced into the pre-spinning process (dissolving, blending).

Confidential

35. What measures would you incorporate into any new fiber spinning and processing line to maximize solvent capture and recovery efficiency.

Same as existing lines. Windowless buildings and air-lock doors with vapor barrier in ceilings.

36. When was the last time capacity of the spinning lines was increased? Did this increased capacity tie in to existing solvent recovery equipment, or was new recovery equipment added?

Confidential

37. Note the variations in percent solvent recovery that will occur under each of the following circumstances: (Qualitative response is adequate, i.e., greater, lesser, or same recovery)

Denier change	An increase reduces recovery
Raw materials change	Unknown
Dyeability change	Unknown
Production rate	An increase reduces recovery
Process line operating speed	An increase reduces recovery
Process upset	Reduces recovery
Season	Hot weather reduces recovery
Other	

38. What is the approximate efficiency of the recovery system (after vapors are captured)? This is the efficiency within the area outlined on Figure 1, not the entire plant makeup percent.

Confidential

39. What records are kept, if any on the efficiency of the solvent recovery system? (Efficiency of equipment associated with solvent recovery, i.e., carbon beds, distillation, columns, condensers, scrubbers, etc.)

Weekly acetone loss report
Recovery efficiency
Production, stack and still losses

40. Are there any continuous monitors recording the efficiency of the recovery equipment?

Stack gas analyzers

41. If carbon beds are used, do you operate on a fixed-time to change, or a breakthrough concentration basis?

Fixed time to change

42. Please provide the design and operating parameters for the carbon adsorption system:
a) type and amount of carbon (confidential)
b) working capacity of carbon (degree of carbon regeneration)(confidential)
c) superficial velocity in bed (confidential)
d) VOC inlet concentration (confidential)
e) inlet gas flow rate and temperature (confidential)
f) cycle time (confidential)
g) regeneration cycle
   1) method of regeneration Steam
   2) length of cycle (confidential)
   3) pressure and temperature of regeneration medium 25-50 psi, 310° F
   4) condenser water outlet temperature Varies approx. 90° F
   5) method of solvent recovery Distillation
   6) How many pounds of steam are required to recover one pound of solvent? Confidential
   7) How is the condensed steam utilized or disposed?

   Sent to chemical sewer and wastewater treatment plant

43. Please indicate on Figure 5 and 6 any vents emitting solvent vapor (vapor not otherwise recovered). What is the approximate concentration at these points? Vapor or air flow rate? Temperature?

None. All acetone vents tied into the inlet to solvent recovery.

44. Are there any other solvent emission points not mentioned previously? What is the approximate composition at these points (percent solvent, water vapor, monomer, etc.)?

Room air with low concentration is lost through windows, cracks, doors, etc.

45. If incineration of waste solvent is practical, please provide the following:
a) VOC inlet concentration
b) inlet gas flow rate and temperature
c) solvent type
d) residence time — N/A
e) preheat temperture
f) firebox or flame temperature
g) supplemental fuel rate
h) amount of excess air
i) burner types
j) What type of heat recovery system is employed? What efficiencies are achieved?

46. What levels of solvent concentration are permitted in work areas?

1,000 ppm TWA

47. Is the room air recirculated or vented to atmosphere? If recirculated, approximately what percent makeup air is introduced?

Recirculated through HVAC systems. All air pulled through spinning machine to adsorbers and recovery.

48. How are rooms ventilated? What is the approximate flow rate out of the work area? Are records maintained on air flow or solvent concentration in the work area?

(Confidential) leaves through spinning machines
(Confidential) sent to tow building
All make-up air from outside
Records are maintained on solvent concentrations

49. See Figure 1 (Dry Spin) or 2 (Wet Spin). If solvent makeup (MS) equals total solvent loss (TSL) how do you account for the loss? Where do you feel most of this loss occurs?

MS = TSL

50. What are the applicable state and local regulations? Are stricter ones expected?

Same as OSHA, i.e., 1,000 ppm TWA

51. Are there any solid waste disposal problems?

No

52. Are there any water pollution control problems?

No

53. Are there any OSHA-related problems?

Confidential

54. Does the plant have any plans for expansion or modification?

Confidential

55. Cost data:

a. Solvent recovery equipment (includes condensers, columns, carbon beds, fan, stack, ductwork, etc.)

For new 1980 estimates to install 75,000 CFM acetone recovery unit

i. Purchase cost, year purchased (control device only)

$4.9 million in 1980

ii. Installed cost (state if this is a retrofit or grass roots installation)
$10.5 million grass roots. Includes electrical substation, cooling tower, control building, extended utility piping and ducting to a remote location.

(a) Recovery devices - give the materials of construction of the major components

$8.2 million - Type 316 SS internals and CS shell

(b) Ductwork

$1.2 million - Galvanized steel

(c) Stacks or vents

$0.4 million - Galvanized steel

(d) Exhaust fans

$0.3 million - Aluminum and mild steel

iii. Annual operating cost (include utilities, maintenance, and labor)
Confidential

iv. Expected life of the recovery equipment

20+ years

v. Depreciation method

Straight line

vi. Value of any product or by-product recovered by the emission control equipment

Confidential

b. Equipment or processes necessitated by installation of the emission control equipment (e.g., water treatment or solid waste disposal)?

Landfill
Wastewater treatment
Normal plant utilities

c. Process equipment: N/A

i. Installed cost (give reference year)

ii. Expected life

iii. Depreciation method

iv. Annual operating cost

56. Please discuss the growth patterns of the (polyster, acrylic, acetate, etc.) industry over the last decade.

a) Identify those product lines which have experienced real growth.
b) Please estimate the annual average percentage increase.
c) Indicate any significant downward trends.
d) Please discuss any expansion of production capacity required by this growth.
e) Does your company have any plans for expansion, modernization, or major modifications during the next five years? ________?

1) Which product lines would be involved?
2) Estimate as to capital costs required would be helpful.

Confidential

57. Please explain how imports and exports have affected your product prices and sales volume over the last five years.

a) Are these trends expected to continue?

Confidential

(CONFIDENTIAL)

FILAMENT
(Millions of Dollars)

58. What are the annual costs associated with the equipment and processes previously described:

	Polymer Prep.*	Solu/Poly Mix,* Blend, Filter	Spinning, Processing*	Solvent Recovery* Equipment Including Ductwork
Installed cost Building Structural Equipment	______	______	______	______
Maintenance				
Labor	______	______	______	______
Materials	______	______	______	______
Operating Labor Cost (direct payroll plus benefits	______	______	______	______
Indirect costs Depreciation Administrative (est.)	______	______	______	______
Year Major Items Began Operating	______	______	______	______
Life in years	______	______	______	______
Expected remaining Life in years	______	______	______	______
Utilities - unit cost	Quantity used in each operation			
electric	______	______	______	______
water	______	______	______	______
gas	______	______	______	______
oil	______	______	______	______
Operating Labor	Indicate the number of people, itemized according to operating and supervisory labor in each operation.			
	______	______	______	______

* If appropriate, combine one or more process phases.

Celanese - Narrows
(Filament)

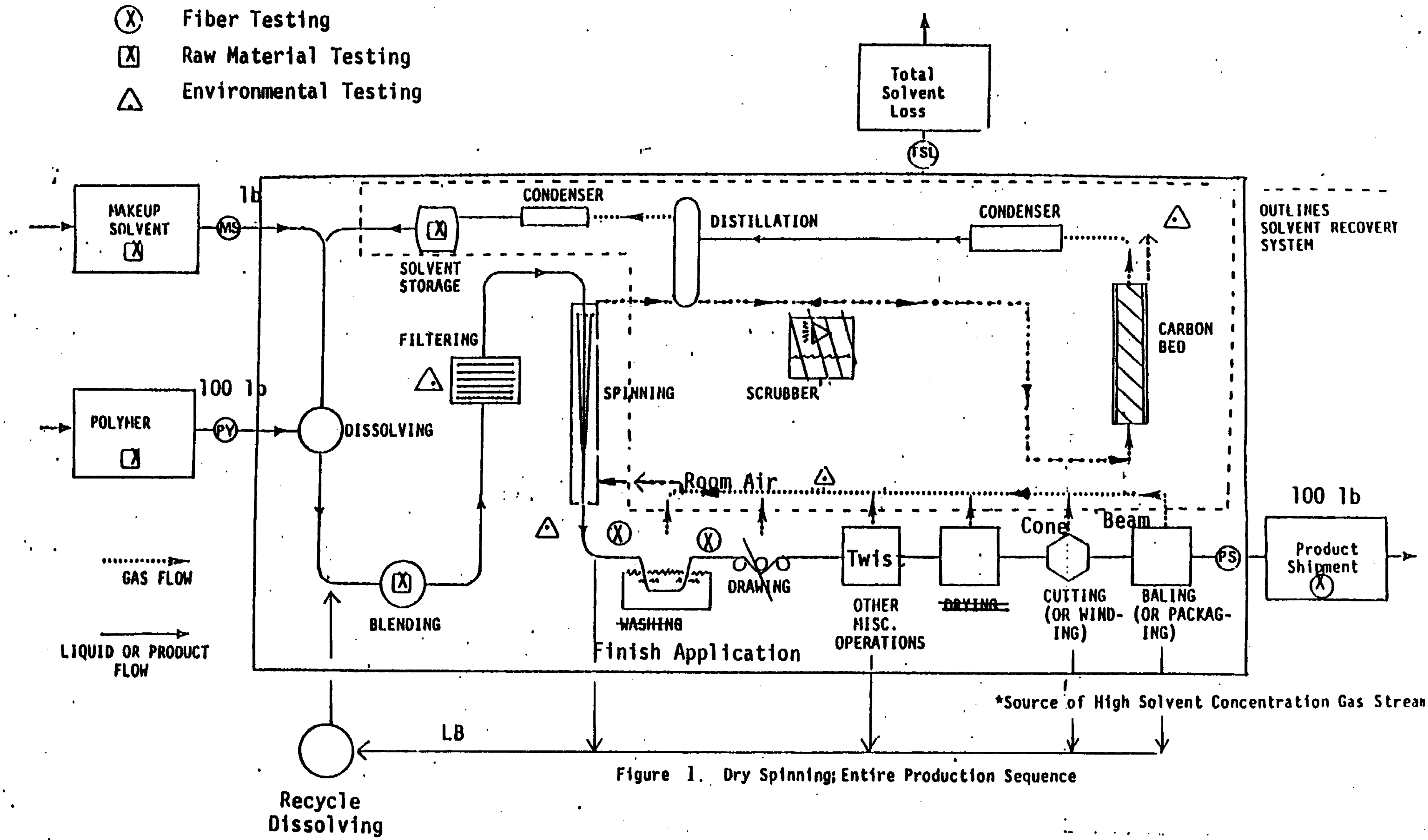

Figure 1. Dry Spinning; Entire Production Sequence

FILAMENT

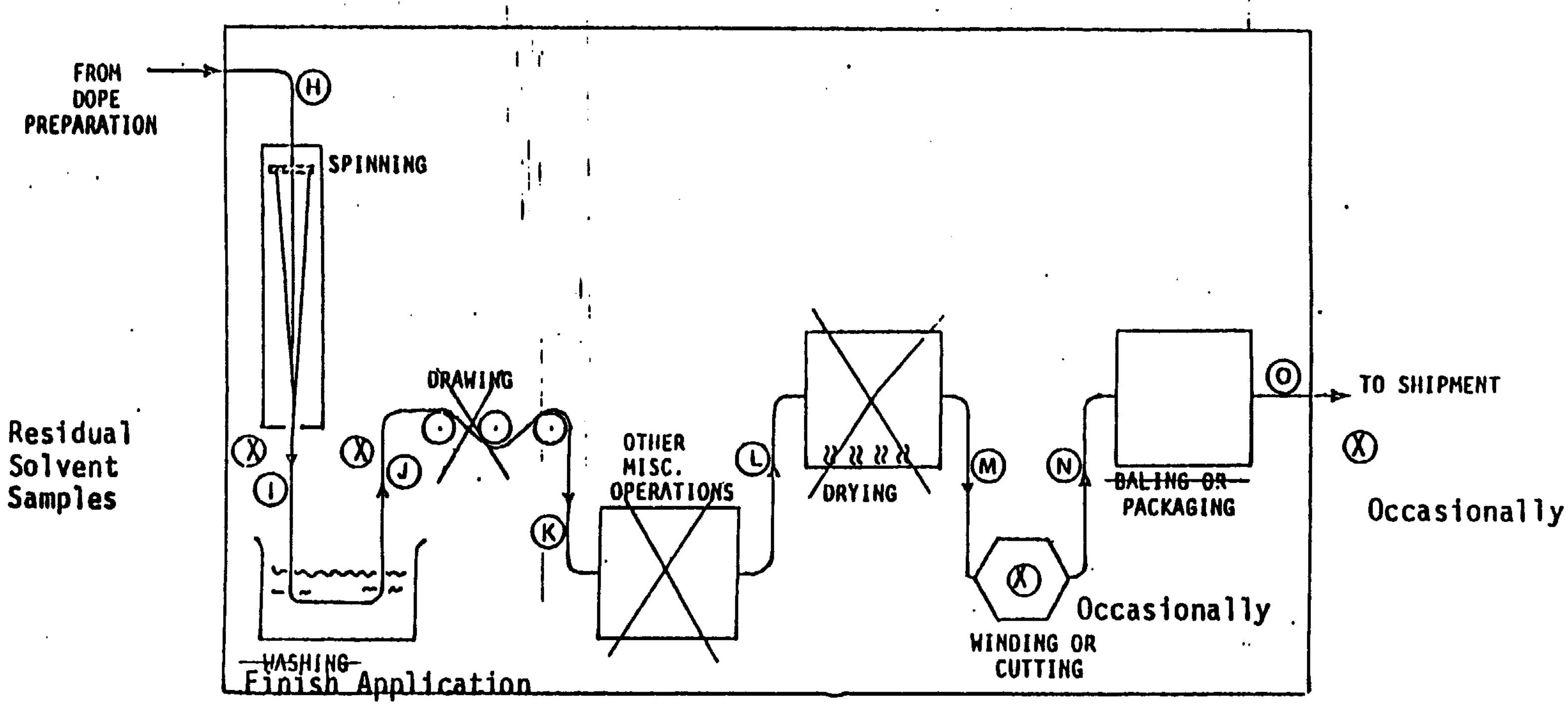

Figure 1 Second Production Stage; Spinning, Processing, Packaging
(Dry Spinning)

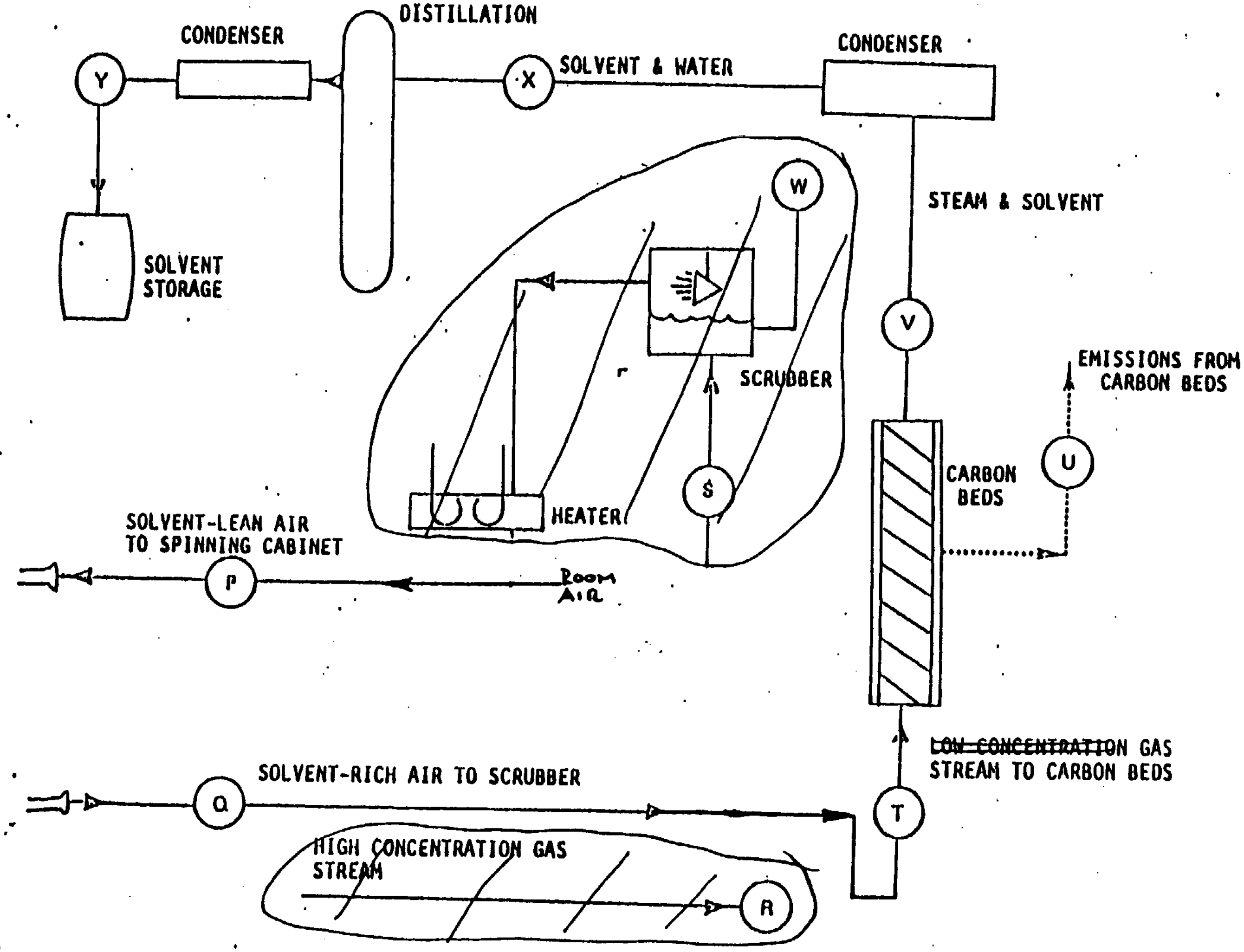

Figure 5. Solvent Recovery and Emissions for Dry Spinning

No reference.

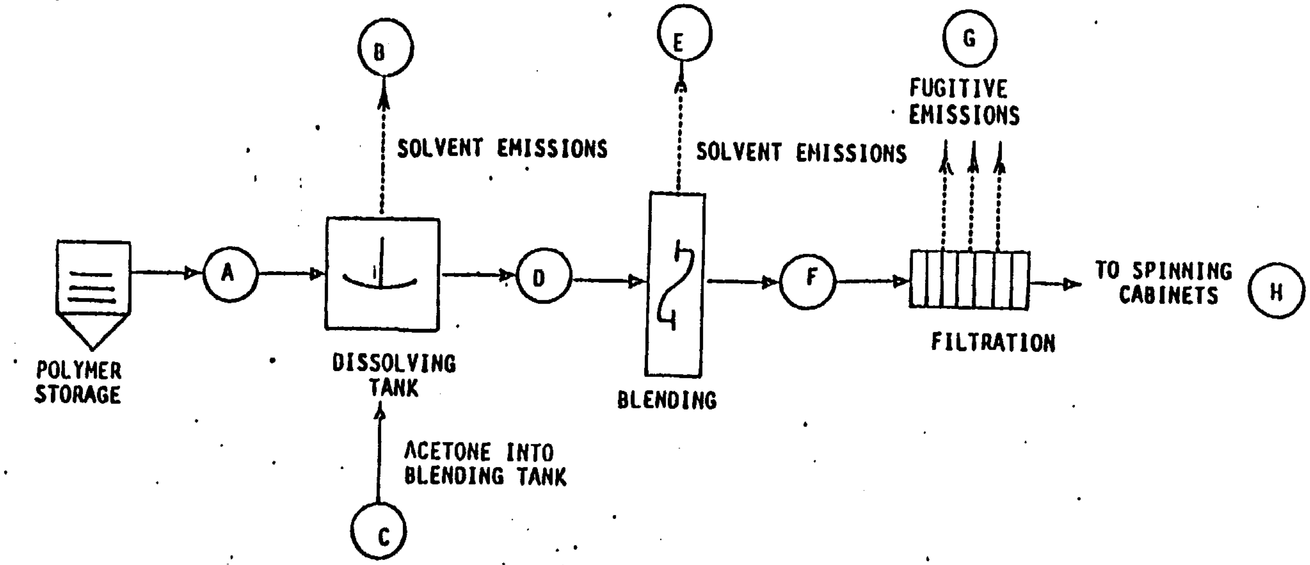

Figure 6. First Production Stage; Dissolving, Blending and Filtering

No reference.

ENCLOSURE I

PLANT SURVEY

A NSPS is being developed for the synthetic fiber industry wet and dry spinning processes which emit significant amounts of volatile organic compounds (VOCs). Specifically, the Phase II investigation of the synthetic fibers industry will concentrate on the following three basic stages of wet and dry spun fiber production:

1) Preparation of the spinning solution or dope (i.e., polymer dissolving, blending, and filtering).

2) Spinning of the fiber (i.e., the actual formation of the fiber filaments from the polymer).

3) Texturizing of the formed fibers (e.g., lubrication, washing, drying, stretching, heat-setting, and crimping).

During NSPS development, an evaluation of VOC emission rates will be necessary to determine the efficiency of control techniques under consideration for reduction of VOCs. Therefore EPA proposes that information on synthetic fiber spinning processes from specified synthetic fiber manufacturing plants be collected. The objectives/purposes of the information gathering program are to:

1) Provide specific, basic emission data on VOC emissions from the wet and dry spinning processes,

2) Identify candidates for the best systems of control,

3) Provide information to depict model plants that best represent the industry.

4) Identify and evaluate potential formats for any standard developed (i.e., mass units relating lbs of VOC emission to overall production or solvent recovery performance efficiency requirements).

The completed questionnaire will augment information gathered in Phase I of the NSPS development, literature searches, material balance calculations, and further information supplied by the industry. This information will provide a basis for evaluating the performance of emission control techniques applicable to the industry and estimating the ultimate VOC emissions emitted to the atmosphere. The emission data will be used to determine the levels of achievable control (e.g., the hooding, enclosure, ventilation, and equipment requirements needed to achieve the degree of capture effectiveness) and cost data associated with particular regulatory alternatives.

Since Manufacturing processes, raw materials, and solvents vary between the spinning of different fiber types, please complete a questionnaire for each fiber type produced.

1. What fiber type do you produce?

   A. Cellulose acetate yarn

   B. Cellulose triacetate yarn

2. What spinning method?
   Wet _____
   Dry _X_

3. What polymer is used?

   Cellulose acetate

   Cellulose triacetate

4. What solvent is used?

   Acetone (cellulose acetate)

   Methylene chloride }
   Methanol } (cellulose triacetate)

5. If wet, what is composition of spinning bath?
   If dry, what is composition of quench gas?

   dry; quench median is air

6. What is polymer to solvent ratio. (lb solvent/lb dope)

CONFIDENTIAL

7. Do you manufacture only one fiber type per process line, or do you produce fibers with different characteristics on the same line?

Can produce multiple product variants on same line . . . ie: bright and dull luster, low, medium, and high denier, cellulose acetate or cellulose triacetate.

8. What are design and actual production rates? How much does production vary over time — day, week, month?

CONFIDENTIAL

9. How is the raw material feed rate and production rate measured? What is the accuracy of the measurements?

Raw material feed rates measured by monthly accounting inventories. Accuracy of these measurements is within 5%.

10. See Figure 1 (Dry spin) or Figure 2 (wet spin). Please note on this diagram the processes used or excluded in your plant. Add any notations or sketches as appropriate. Note those points in the process where solvent or fiber testing is now performed.

11. See Figure 1 (Dry Spin) or 2 (Wet Spin). Please note the amount of polymer introduced at PY. Note the amount of product shipment at PS. How do you account for any differences between these? (secondary product formation, still bottoms, heels, waste, etc.)

Recycled waste yarn (confidential).

12. Is fiber waste recycled? How? Which products?

yes

resolutioning

all products

13. (Wet Spinning) Is the water from the spinning bath processed for recovery of dissolved solvent and/or unreacted monomer?

N/A

14. (Wet Spinning) What process is used to effect this recovery? What is the efficiency of this process? (Of the solvent or monomer dissolved in the water, how much is recovered, and/or how much is released in waste water or vented?)

N/A

15. Do you perform dope testing after blending and prior to spinning to determine solvent concentration? If so, please describe this test.

Yes . . . we use a weigh, dry, and reweigh test

16. Is the solvent/polymer mixing batch or continuous?

Batch

17. (See Figure 1 (Dry Spin) or Figure 2 (Wet Spin) Note at the left (Point MS) the amount of solvent makeup used. Also note the period in which this amount is used. (Pounds per hour, pounds per day, etc.)

CONFIDENTIAL

18. Is the polymer dope filtered prior to spinning? If so, is the filtering process open, enclosed, or vented? Where do the vents lead?

Multi-stage filtration--filtration process normally closed (plate & frame presses).

Except when press media is changed.

Room vents scavange solvent and return same to extrusion room.

19. Is the filter media reused? If so, is it processed, treated, or washed for reuse?

Filter media is not reused.

20. What is the approximate solvent loss as vapor at the filtering stage?

Unknown

21. See Figure 3 (Wet spinning) or Figure 4 (Dry spinning). Is the fiber open to room air as it passes from one process to another following spinning? Does any solvent evaporate from the fiber at these points? Approximately how much? Are there any hoods or vents to capture this solvent?

a. Yes
b. Yes (from extrusion dept. to twisting to coning or beaming)
c. Confidential
d. No

22. Are tests for solvent residuals made at any point in the fiber process (solvent remaining in/on the fiber)? If so, note on Figure 3 (Wet spin) or Figure 4 (Dry spin) the point(s) these samples are taken, with a brief indication of how this sample would be taken.

a. Yes
b. See Figure 4
c. Yarn is collected in a hollow wheel, sealed, weighed, dried, and reweighed

23. Please briefly describe the fiber test method used for measuring solvent residual.

Rewind predetermined length (weight) of yarn-accurately weighed. (xxxx grn.), boil off solvent and water, correct for water regain, reweigh and express Δ as % residual solvent.

24. What records are maintained, if any, with reference to the fiber tests? On what time basis are these records updated (continuous, hourly, shift, daily, etc.)?

Shift, weekly, and trend charts, physical tests-denier; % residual solvent; physical properties; color; uniformity.

25. Does residual solvent in any way affect fiber properties? For example, does a specific solvent residual content remain in the fiber end product to produce desired characteristics?

Yes. Effects product dyeability and physical properties.

26. (Wet Spinning) Is the spinning bath enclosed or covered? Are the vapors vented to a solvent recovery system? If not, where are any vapors released?

N/A

27. Please provide a brief description of the solvent recovery systems utilized in connection with the fiber production facility. Please include design specifications and drawings if possible.

Solvent recovery includes a batch carbon bed adsorption system steam desorption followed by multiple stages of distillation. Exhaust air from adsorbers contains 15-25 ppm (vol.) total solvent loss. Solvent recovery system is (confidential) efficient on a plant-wide basis.

28. Please provide the design and operating paramenters for each scrubber:
   a) pressure drop
   b) inlet liquid and gas pressure
   c) liquid and gas flow rate and temperature
   d) composition of scrubbing liquid
   e) inlet and outlet solvent concentration

   No scrubbers used for solvent recovery (see question #42).

29. When was the solvent recovery equipment installed? What guarantees were given by the manufacturer?

   1948

   No performance guarantees - only mechanical warranty.

30. What problems have been encountered with the recovery system?

   1. 5-10% replacement rate of carbon
   2. Relatively high energy consumption per pound of recovered solvent
   3. Relatively high rate of stress cracking in $MeCl_2$ solvent recovery adsorber valves and canopies.

31. What are the maintenance practices and schedules associated with the recovery system?

   Annual preventive maintenance program on vapor laden air valves, carbon beds, adsorbers, and distillation train equipment.

32. What major modifications have been made to the recovery system in the past?

   Replaced VLA turbines and materials of construction; carbon selection trials, distillation improvements, and air management changes.

33. Are there any plans to upgrade the existing solvent recovery system?

No

34. If your firm were to build a new fiber spinning and processing line with associated solvent recovery systems, what solvent recovery efficiency would you desire and expect? By solvent recovery efficiency we refer to the amount of solvent recovered for reuse divided by the total amount of solvent introduced into the pre-spinning process (dissolving, blending).

CONFIDENTIAL

35. What measures would you incorporate into any new fiber spinning and processing line to maximize solvent capture and recovery efficiency.

Very careful design of HVAC and solvent vapor laden air handling systems, and a careful design of room negative pressure controls.

36. When was the last time capacity of the spinning lines was increased? Did this increased capacity tie in to existing solvent recovery equipment, or was new recovery equipment added?

CONFIDENTIAL

37. Note the variations in percent solvent recovery that will occur under each of the following circumstances: (Qualitative response is adequate, i.e., greater, lesser, or same recovery)

Denier change	Reverse linear response
Raw materials change	Unknown
Dyeability change	Unknown
Production rate	Reverse linear
Process line operating speed	Reverse linear
Process upset	Poorer recovery
Season	Warm weather - poorer recovery
Other	

38. What is the approximate efficiency of the recovery system (after vapors are captured)? This is the efficiency within the area outlined on Figure 1, not the entire plant makeup percent.

CONFIDENTIAL

39. What records are kept, if any on the efficiency of the solvent recovery system? (Efficiency of equipment associated with solvent recovery, i.e., carbon beds, distillation, columns, condensers, scrubbers, etc.)

Production efficiency records
Stack emission records
Product volume & mixture records
Distillation/adsorber steam use records
Total VLA processing records

40. Are there any continuous monitors recording the efficiency of the recovery equipment?

Yes - gas chromatographic traces of stack losses

41. If carbon beds are used, do you operate on a fixed-time to change, or a breakthrough concentration basis?

Prescheduled cycles that were developed through technical optimization trials

42. Please provide the design and operating parameters for the carbon adsorption system:
    a) type and amount of carbon (confidential)
    b) working capacity of carbon (degree of carbon regeneration)(confidential)
    c) superficial velocity in bed (confidential)
    d) VOC inlet concentration (confidential)
    e) inlet gas flow rate and temperature (confidential)
    f) cycle time (confidential)
    g) regeneration cycle
        1) method of regeneration low press steaming
        2) length of cycle (confidential)
        3) pressure and temperature of regeneration medium Sat. 15 Psi steam
        4) condenser water outlet temperature 90 F. (variable)
        5) method of solvent recovery distillation and decantation
        6) How many pounds of steam are required to recover one pound of solvent? Confidential
        7) How is the condensed steam utilized or disposed?

           Sent to chemical sewer and processed by Wastewater Treatment Plant.

43. Please indicate on Figure 5 and 6 any vents emitting solvent vapor (vapor not otherwise recovered). What is the approximate concentration at these points? Vapor or air flow rate? Temperature?

All vents tied into solvent recovery system.

44. Are there any other solvent emission points not mentioned previously? What is the approximate composition at these points (percent solvent, water vapor, monomer, etc.)?

Room air with low concentrations versus lost through windows, doors, and cracks

45. If incineration of waste solvent is practical, please provide the following: (NOT PRACTICAL)
a) VOC inlet concentration
b) inlet gas flow rate and temperature
c) solvent type
d) residence time
e) preheat temperture
f) firebox or flame temperature
g) supplemental fuel rate
h) amount of excess air
i) burner types
j) What type of heat recovery system is employed? What efficiencies are achieved?

46. What levels of solvent concentration are permitted in work areas?

500 ppm $MeCl_2$ TWA

1,000 ppm Acetone TWA

200 ppm Methanol TWA

47. Is the room air recirculated or vented to atmosphere? If recirculated, approximately what percent makeup air is introduced?

Recirculated through HVAC system and used through extrusion machines. Makeup 15-20%

48. How are rooms ventilated? What is the approximate flow rate out of the work area? Are records maintained on air flow or solvent concentration in the work area?

a. Forced draft HVAC systems
b. Confidential
c. Yes

49. See Figure 1 (Dry Spin) or 2 (Wet Spin). If solvent makeup (MS) equals total solvent loss (TSL) how do you account for the loss? Where do you feel most of this loss occurs?

MS equals TSL

50. What are the applicable state and local regulations? Are stricter ones expected?

S. C. DHEC regulations on air quality

S. C./Federal OSHA regulations

51. Are there any solid waste disposal problems?

No

52. Are there any water pollution control problems?

No

53. Are there any OSHA-related problems?

CONFIDENTIAL

54. Does the plant have any plans for expansion or modification?

CONFIDENTIAL

55. Cost data:

a. Solvent recovery equipment (includes condensers, columns, carbon beds, fan, stack, ductwork, etc.)

i. Purchase cost, year purchased (control device only)

1948

(Included as installed costs under item ii)

ii. Installed cost (state if this is a retrofit or grass roots installation)

Estimated at $4.2 million per 60,000 CFM unit (1979 dollars)
Installed in existing building near spinning machines; all utilities available

(a) Recovery devices - give the materials of construction of the major components

Approximately 75%
Adsorb shell carbon steel, internal components, 316 stainless steel

(b) Ductwork

Approximately 10%
Galvanized steel

(c) Stacks or vents

Approximately 5%

(d) Exhaust fans

Mild steel
Approximately 10%

iii. Annual operating cost (include utilities, maintenance, and labor)

CONFIDENTIAL

iv. Expected life of the recovery equipment

20 plus years

v. Depreciation method

Straight line - book

vi. Value of any product or by-product recovered by the emission control equipment

CONFIDENTIAL

b. Equipment or processes necessitated by installation of the emission control equipment (e.g., water treatment or solid waste disposal)?

Plant Utilities, landfill, and wastewater treatment facility

c. Process equipment:

i. Installed cost (give reference year)

Not available

ii. Expected life

20 plus years

iii. Depreciation method

Straight line book

iv. Annual operating cost

CONFIDENTIAL

56. Please discuss the growth patterns of the (polyster, acrylic, acetate, etc.) industry over the last decade.

a) Identify those product lines which have experienced real growth.
b) Please estimate the annual average percentage increase.
c) Indicate any significant downward trends.
d) Please discuss any expansion of production capacity required by this growth.
e) Does your company have any plans for expansion, modernization, or major modifications during the next five years? ________?

1) Which product lines would be involved?
2) Estimate as to capital costs required would be helpful.

(CONFIDENTIAL)

57. Please explain how imports and exports have affected your product prices and sales volume over the last five years.

a) Are these trends expected to continue?

(CONFIDENTIAL)

58. What are the annual costs associated with the equipment and processes previously described:

	Polymer Prep.*	Solu/Poly Mix,* Blend, Filter	Spinning, Processing*	Solvent Recovery* Equipment Including Ductwork
Installed cost Building Structural Equipment				
Maintenance Labor				
Materials				
Operating Labor Cost (direct payroll plus benefits				
Indirect costs Depreciation Administrative (est.)				
Year Major Items Began Operating				
Life in years				
Expected remaining Life in years				
Utilities - unit cost	Quantity used in each operation			
electric				
water				
gas				
oil				
Operating Labor	Indicate the number of people, itemized according to operating and supervisory labor in each operation.			

* If appropriate, combine one or more process phases.

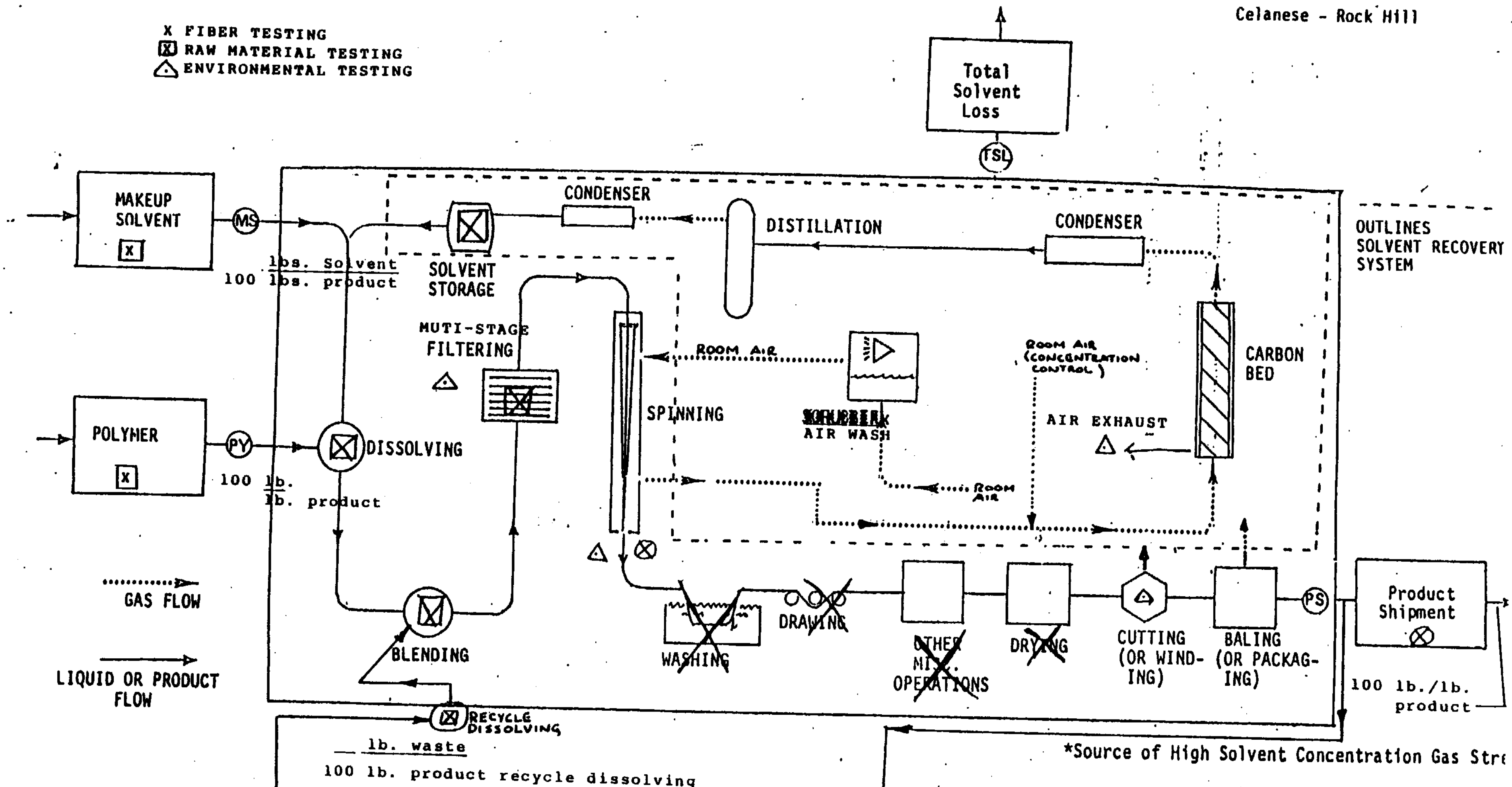

Figure 1. Dry Spinning; Entire Production Sequence

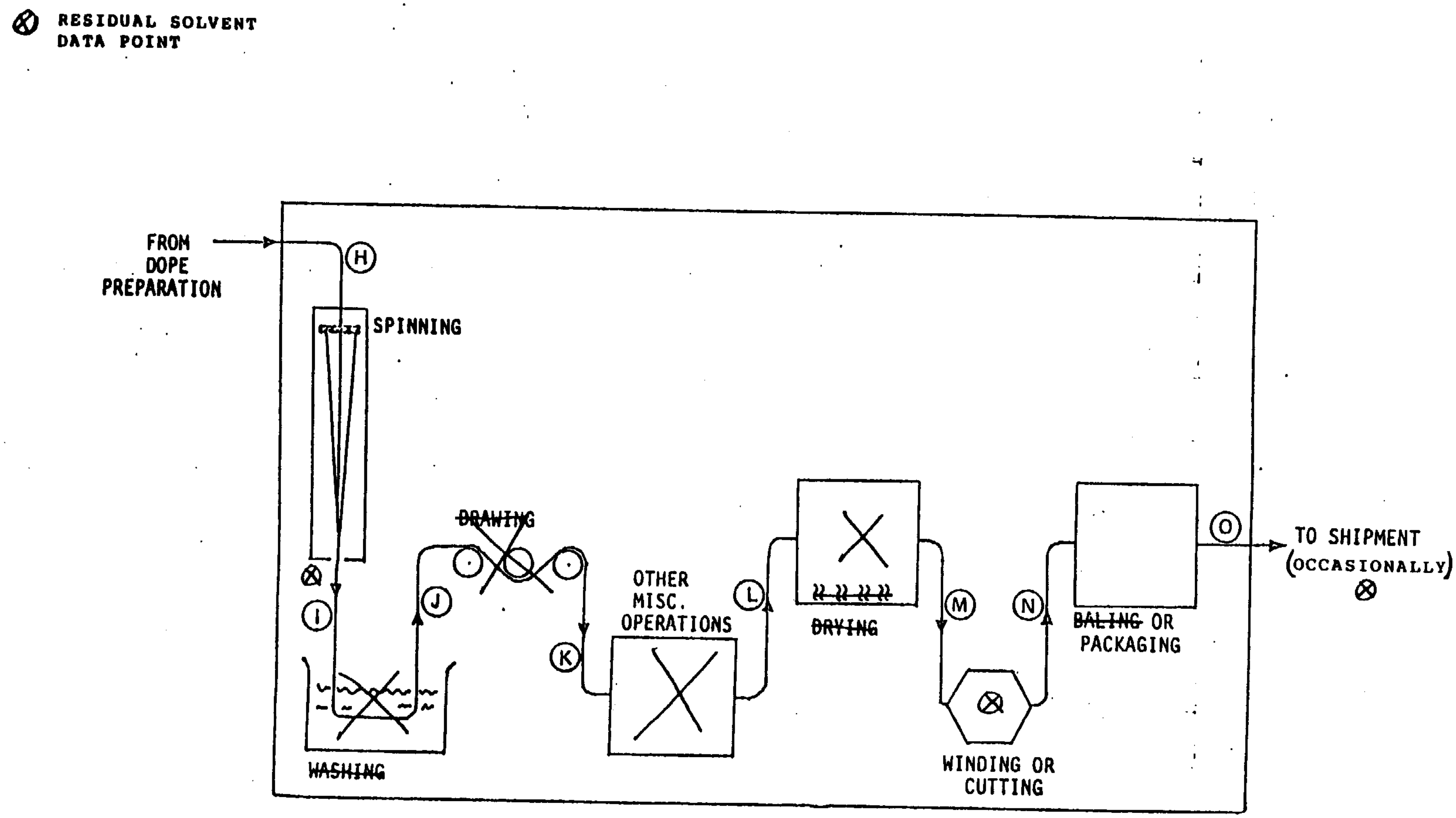

Figure 4 Second Production Stage; Spinning, Processing, Packaging (Dry Spinning)

Celanese - Rock Hill

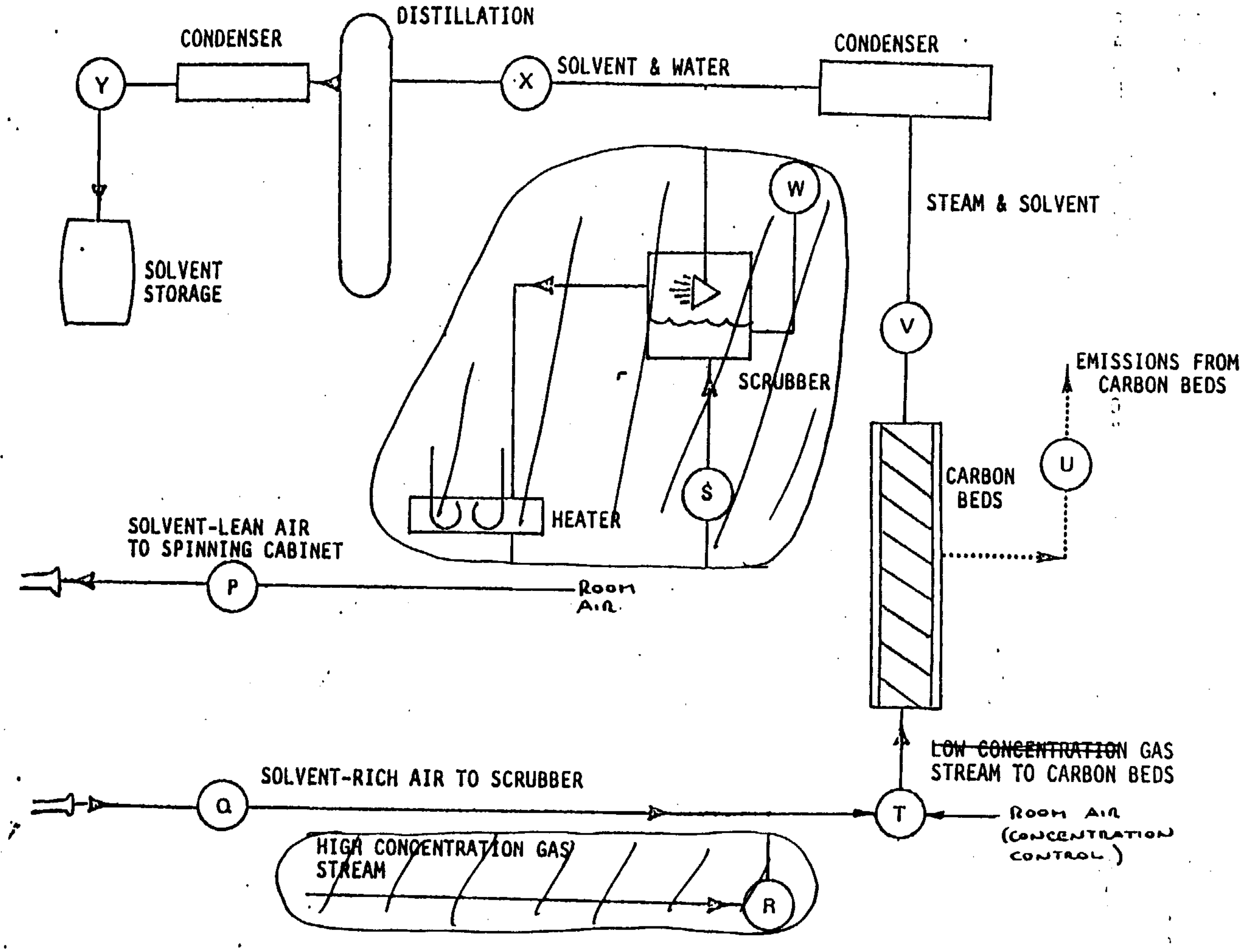

Figure 5. Solvent Recovery and Emissions for Dry Spinning

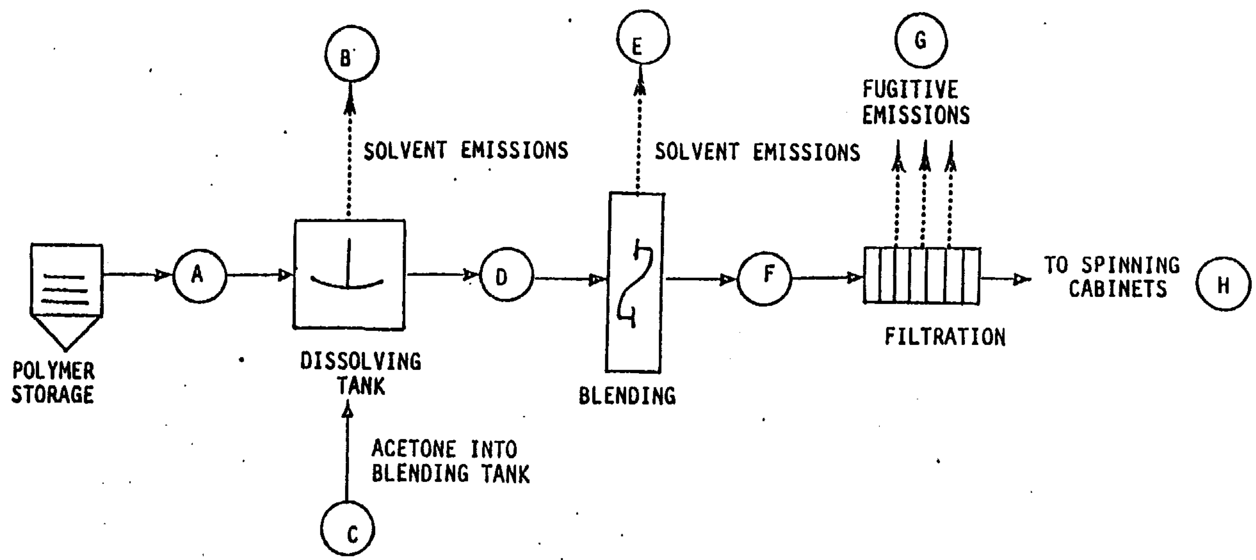

Figure 6. First Production Stage; Dissolving, Blending and Filtering

A-80-7
II-D-52

DOCKET NO. A-80-7

Category II-D

The following information is located in the confidential files of the Director, Emission Standards and Engineering Division, Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina. This information is confidential, pending final determination by the Administrator, and is not available for public inspection.

Corres: Celanese's completed questionnairs re: dry spinning, solvent recovery processes, Rock Hill, S.C., Narrows, VA plants, Dated July 3, 1980.

Confidential material consists of fully completed questionnairs for the Celanese Rock Hill, S.C. and Narrows, VA facilities.