Note: This is a reference cited in *AP 42, Compilation of Air Pollutant Emission Factors, Volume I Stationary Point and Area Sources.* AP42 is located on the EPA web site at www.epa.gov/ttn/chief/ap42/

The file name refers to the reference number, the AP42 chapter and section. The file name "ref02_c01s02.pdf" would mean the reference is from AP42 chapter 1 section 2. The reference may be from a previous version of the section and no longer cited. The primary source should always be checked.

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Report of the Phase II Plant Visit to Celanese's Celriver Acetate Plant In Rock Hill, South Carolina, Regarding the Development of New Source Performance Standards For the Synthetic Fibers Industry

I. Place and Date

Celanese Fibers Company
Celriver Plant
Rock Hill, South Carolina

May 28, 1980/Revised Version

II. Attendees

Name	Affiliation
George Rodenhausen	Celanese, New York Office
Gene Jaynes	Celriver Plant Industrial Relations Manager
J.J. McDermott, Jr.	Celriver Plant Manager
Greg Benjock	Celriver Environmental Superintendent
J.D. Bennett	Celriver Technical Manager
R.C. Law	Celriver Solvent Recovery and Preparation Area Supervisor
James C. Pullen	Celanese-Charlotte
J.M. Davis	Celriver Development Superintendent
R. Russell Rhinehart	Celriver Technical Supervisor
Dennis Crumpler	EPA/CPB
K.W. Grimley	EPA/EMB
Robert Zerbonia	PES, Inc.
Roy Manley	PES, Inc.
Gregory Lathan	PES, Inc.

III. Discussion

Prior to the plant tour, a meeting was held between Celanese personnel and the EPA/PES Project Team. Representatives of Celanese opened the meeting by supplying PES with copies of the Celriver cellulose acetate overall materials flow diagram including separate flow-sheet diagrams of the preparation department, extrusion department, and the solvent recovery system. These materials are contained in Appendix A. Russell Rhinehart requested that the PES/EPA project team treat this material as confidential.

Dennis Crumpler detailed EPA procedures on the handling of sensitive information and Robert Zerbonia discussed the confidentially agreement between PES and Celanese including a short discussion of the trip report and the procedure for removing confidential information from the report. Mr. Zerbonia outlined the objectives for the day along with a short history of NSPS project. He indicated that PES was especially interested in their solvent recovery and spinning process.

Russell Rhinehart reviewed the handout material and provided descriptions of the overall materials flow: polymer preparation, polymer extrusion (spinning operations), and the solvent recovery system. After the presentation, a tour of the plant was conducted. The following information on the process was derived from the presentation and the subsequent plant tour.

Process

Two types of yarn are produced at Celanese, Acetate (trade name for cellulose acetate) and cellulose triacetate. Different solvents are used in the production of each yarn type; Acetate uses acetone and triacetate uses a mixture of methylene chloride and methanol. When the different types of additives and delusterants used in the preparation of triacetate and acetate fibers are considered, then it is noted that Celanese makes a variety of fiber types.

Polymer, solvent, and other additives are mixed in a tank by mechanical agitation. The heat produced by mixing aids in the mixing and dissolving of certain products. From the mixing tank the dope is sent to successive surge or holding tanks for storage of the dope before it is pumped to filters. Filter presses are not hooded but use normal room air ventilation to remove residual solvent which is released from the presses. After the removal from the presses, the filtering media or material is steamed in ovens. This mixture of steam and solvent is sent to solvent recovery. All waste is redissolved and sent back to the original filter presses, and then returned to the original storage tanks. After filtering the dope, it is sent to the extrusion process. Room air is brought through the air conditioning system and is eventually sent to the extrusion area.

Portions of dope are drawn from the main header and sent to the spinning machines which are called metiers. Each metier consists of a group of spinning cabinets; in each cabinet dope is taken off the branch header and filtered through a final filter prior to extrusion. The dope is then metered through a pump and into a spinneret head. Room air is pulled in at the top, bottom, or center of the spinning cell. The quench air flows concurrently with the direction of the emerging filaments if it enters at the top of the cabinet, countercurrently if it enters the bottom of the cabinet, and in both directions if it enters the middle of the cabinet.

Room air surrounding the spinning cabinets contains solvent that has evaporated from the yarn after leaving the cabinets. Each metier is equipped with a duct for exhausting vapor-laden air. These lines manifold into a large duct on the roof of the building, which transports the air to the solvent recovery system.

Filaments emerging from the spinning cell are brought together and taken up on a bobbin or pirn. The fiber is subsequently removed from the bobbins (pirns) and wrapped on beams or cones for shipment.

Ventilation and Solvent Recovery

As the filament yarn fibers emerge from the spinning cell or cabinet, they contain significant residual solvents. By the time of shipment the residual solvent content is down to an insignificant amount. Therefore the difference in residual solvent content is emitted into the extrusion (spinning) room or the twisting/beaming/coning rooms (textile area). The extrusion room air is diluted in order to meet/maintain the OSHA worker exposure concentration limits on the solvents.

In order to balance the need for optimum solvent recovery with the need for protection of workers from solvent exposure, Celanese has developed a sophisticated system of in-plant air management. This system involves the re-use of plant air from the three basic process areas of the fiber plant. Room air from the dope preparation area (dissolving, mixing, filtering) and room air from the twisting/coning/beaming areas, both of which contain low levels of solvent, are vented (transported) to the extrusion room at a predetermined flow rate. The extrusion room air is then used to supply the process or evaporation air for the spinning cell solvent evaporation. This process air, which contains a high concentration of solvent, is vented together with a fixed amount of extrusion room air, which contains a low level of solvent to the solvent recovery system. To properly accomplish the air management, the plant maintains a negative room pressure. The plant monitors this negative pressure and considers maintaining the negative room pressure an important operating parameter with regard to operation of the solvent recovery system.

The solvents recovered at the Celriver plant include methylene chloride, acetone, and methanol. A common capture and recovery system is used to collect all the solvents up to the point of the distillation columns (a mixed solvent system). The solvent-laden air from the spinning cells, together with a portion of the spinning or extrusion room air, is vented to the carbon adsorption system. The inlet solvent concentration of the gases at the carbon adsorption system is relatively constant at about 46 percent of the LEL.

The carbon beds are regenerated on a time cycle basis which is adjusted through analysis of exit stack conditions. Gas chromatographs sequentially monitor all the carbon beds for concentrations of all three solvents. In each recovery unit there are three carbon beds receiving vapor laden air while one is steaming or regenerating. The average exit gas concentration from the carbon bed exhausts is 20 ppm, total solvent.

There are separate distillation columns for each solvent fraction. The wastewater remaining after distillation contains a small amount of solvent (0.002 percent) and is sent to the waste treatment plant.

The carbon used in the adsorption beds is removed and washed (cleaned) yearly. About 10 percent of the carbon is lost due to fines removal during cleaning. Total carbon use involves about a 50 percent makeup every 3 years.

Emissions

Celanese personnel reported that fugitive solvent emissions are the major loss to the atmosphere. Celanese reported to the State of South Carolina emissions of 206 tons/year from the solvent recovery stacks and emissions (solvent) of 2,482 tons/year from other sources. These losses occur from building doors and windows, and sewers. Some is lost to the fiber product.

Post-Tour Meeting

After concluding the plant tour, a follow-up meeting was held to answer any additional questions regarding the Celanese plant or the NSPS project in general. The first question concerned the air management system practiced by Celanese. The system was described by Mr. Rhinehart.

It was then asked if Celanese has made any efforts in the past to increase the solvent capture and recovery efficiency. It was reported that Celanese has tried a number of measures. In the early 1960's enclosures with sliding doors were installed at the spinning machines. These proved unsuccessful from an economic and labor aspect. There was considerable time or labor-loss due to the physical handling of the enclosures (opening/closing when working on machines). The company also tried air curtains; these were ineffective in reducing solvent exposure to the operators. Economics played a major determining role in evaluating these methods. In addition, physical space at existing facilities also must be considered. Equipment and personnel must move down the machine aisles; this has been a large constraint at existing plants. Another aspect that must be considered is the fact that enclosure of the spinning machines results in high concentrations of solvent within the enclosure. When operators or plant personnel opened these doors, this resulted in exposure to high concentrations of solvent. The OSHA standards, in the opinion of the Celanese personnel, inhibit the real use of enclosures.

Celanese personnel reported that other attempts have been made in this area. Efforts were directed at enclosing the bobbins; these also proved unsuccessful. A study was conducted to consider storage of the bobbins during the time period when solvent is evaporating. Celanese reported that the time required for the residual solvent to reach the lower levels was too great to allow use of this technique.

Celanese reported that the big unknown which affects the entire fibers industry is petroleum prices. Celanese products are not directly petroleum dependent, but since the entire fiber market is interrelated, there is significant indirect petroleum dependence.

Additional marketing information will be included in the Celanese response to the EPA 114 letter from Mr. Don Goodwin. This response is scheduled for early July.

PROCESS DIAGRAMS

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Figure 1. OVERALL MATERIALS FLOW

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Figure 2. PREPARATION DEPARTMENT

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Figure 3. EXTRUSION DEPARTMENT

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Figure 4. RECOVERY DEPARTMENT

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APPENDIX A

Plant Survey Agenda

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Celanese Fibers Company
Prepared Industry Profile for Acetate Filament Market

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