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Report of the Phase II Plant Visit to Celanese's Celco Acetate Fiber Plant in Narrows, Virginia, Regarding the Development of New Source Performance Standards for the Synthetic Fibers Industry

I. PURPOSE

The purpose of the plant visit was to obtain process, operating, and emissions data regarding the cellulose acetate fibers segment of the synthetic fibers industry. The information obtained will serve as background data in the formulation of an emission point source testing program for use in the development of "new source performance standards" (NSPS) for the synthetic fibers industry.

II. PLACE AND DATE

Celanese Fibers Company
Celco Acetate Fiber Plant
Narrows, Virginia

August 11, 1980/Revised Version

III. ATTENDEES

Name	Affiliation
Howard Irwin	Environmental/Energy Superintendent, Celanese
James C. Pullen	Manager, Environmental Activities, Celanese, Charlotte
Pete Sauvigne	Solvent Recovery Department, Celanese
Winton Kelly	EPA: Emission Measurement Branch (EMB)
Roy Manley	Pacific Environmental Services, Inc.
Richard Berard	Pacific Environmental Services, Inc.
Michael Hartman	TRW
Robert Jongleux	TRW

IV. DISCUSSION

Prior to the scheduled plant tour, a meeting was held with the above-listed Celanese personnel, and the EPA/PES/TRW project team. Howard Irwin, Celanese Environmental/Energy Superintendent, initiated the meeting by informing the project team of a major plant shutdown caused by a series of system failures, which resulted in the loss of almost all electrical power and all steam generating capacity. Therefore, due to the possibility of explosive fumes in the interior plant facilities, the plant tour was confined to exterior facilities only. James C. Pullen, Celanese Manager of Environmental Activities, presented a brief historical overview of the fiber types produced by the plant. Originally built for the production of acetate filament in 1939, the plant was later expanded to include staple operations during the 1940's. During the 1950's and 1960's, cigarette filtration tow operations were added by conversion of the staple spinning machines and baling facilities. Since then, a number of spinning machines have been added to the plant specifically to make cigarette tow, the last having been installed in 1976.

Celanese representatives then presented a cursory description of the production process. Initially, cellulose acetate resin, which is produced in-house, is mixed semi-continuously with acetone and a delusterant (titanium dioxide) to make a white, viscous solution which is called dope. The resulting batches are blended, and filtered using plate-and-frame presses. The dope is then pumped to the spinning machines (metiers) and then through metering pumps and spinnerettes into individual drying cabinets in the metiers. Evaporation of the solvent from the dope leaves individual filaments which are gathered together into a tow line as they leave the cabinets. The room air surrounding the spinning cabinets contains solvent that has evaporated from the filaments after leaving the cabinets.

Each cabinet has its own air flow control orifice, which functions to maintain the solvent concentration within the cabinet to a target below 75 percent of the Lower Explosive Limit (LEL) of acetone. (The LEL is defined to be 2.6 percent acetone by volume.) Acetone vapor laden air from the cabinets is withdrawn and ducted to a solvent recovery system which consists of activated carbon adsorption beds, steam desorption and distillation of the resulting acetone-water mixture.

General post-spinning operations include crimping, drying, and baling. The tow band fiber is conveyed from the spinning machine to a crimper. The crimper "crimps" the fibers, giving them cohesion. Each tow line has its own stuffer-box crimping system. Water is sprayed onto the rollers, which force the tow band into the stuffer-box. At this stage, acetone is measurable in the water, but since there is an absence of heat at the crimper, there is no significant evolution of vapors. After passing through the crimper the tow band is piddled onto the dryer apron. From the dryers the tow is conveyed to the baling operation, and is packaged into pound bales.

The dryers were characterized as being a system which uses low pressure steam followed by hot air. The cigarette tow dryers exhaust directly to a particular solvent recovery unit manifolding first to an air conditioning unit with cooling and heating elements. Pete Sauvigne, of Celanese's Solvent Recovery Department, characterized the air conditioning unit as performing two functions. First, cooling the VLA to remove the acetone and finishing oils; secondly, reheating the air to an appropriate adsorption temperature, readying it for recovery via carbon adsorption beds.

Solvent Recovery System.

At this time, Celanese representatives provided a presentation of the Celco facilities solvent recovery system with the aid of a blueprint diagram of the exterior plant along with two schematic process flows. The two solvent recovery processes associated with filament extrusion operations and tow extrusion operations are housed in separate facilities. Two VLA ducts and a room air crossover duct, each at least three feet in diameter connect the two facilities.

Heated room air is drawn into the filament spinning machines as quench air. Some of the room air is moved directly via the room air crossover duct from the filament extrusion building to the cigarette tow extrusion building. Solvent vapor laden air from the spinning machines is ducted to recovery units located next to the building. The recovery process differs in the production of the two types of fiber, textile filament and cigarette tow, only in that the VLA is cooled before adsorption in the filament recovery system by means of a wet (spray) cooler; while in the recovery system tow, the VLA is cooled using dry coil heat exchangers. The solvent recovery facility is common inasmuch as all adsorbers are interconnected via the two previously mentioned crossover ducts.

A typical recovery unit consists of VLA precoolers, fans, aftercoolers, and four adsorber beds. One solvent recovery unit out of a total of 10 is the exception to this and has only three adsorber beds. The inefficiency demonstrated by another one of the units is primarily due to finishing oils which accumulate on the carbon. A four-to-six inch loss of the 30-inch charcoal bed is attributable to this occurrence. It was indicated that only the cigarette tow dryers are manifolded to this unit.

Pete Sauvigne then presented an overview of a typical adsorber unit, including a bed analyzer "curve cycle." Typically, vapor-laden air from the extrusion process enters one of four carbon beds at the top of the bed (four beds to one unit). To desorb acetone, steam is introduced via a steam sparger into the bottom of the carbon bed. The vapor stream exiting the condensor is then routed to a standard distillation recovery process. It was reported that nine distillation stills are on the site, but that only the larger, more efficient ones are in use. Any vents from the distillation accumulators are tied back to the VLA system. A graphic representation of a bed analyzer curve cycle depicted a U-shaped curve with acetone in parts per million (ppm) on the y axis and time the X coordinate. The units are operated on a time rather than concentration cycle. The initial cycle steams, followed by three adsorption cycles; a hot bed and a cool bed (if applicable). During the final cycle saturation is achieved. It is the final cycle which is analyzed for breakthrough conditions. Celanese performs a continuous temperature profile on each adsorber. Low pressure steam from the turbines is used for the desorbing cycle at approximately 25 psi.

Celanese representatives next presented the plant in-house solvent recovery efficiency reports; tabulated computer print-outs depicting acetone losses from various (production) plant locations compiled on a daily, weekly, and monthly basis. The computer-based system has been in operation since 1978.

V. Plant Tour

Exterior. Due to the unanticipated plant shutdown, which precluded a thorough tour, only a cursory examination of the plant exterior was conducted. Filament operations and cigarette tow operations are housed in separate buildings. It was indicated that the first floor of each building contained the dope preparation and filtration operations; the second floor, the spinning machines. Solvent recovery units are found both inside and outside building structures.

VI. Final Discussion

Upon completion of the plant tour, a brief discussion was conducted among representatives of the project team and Celanese. Final data for the sample testing was agreed upon including access to testing points, test facilities, cost considerations, and sample run time intervals, along with projected test period dates. It was agreed that PES would use Celanese's sample data for testing purposes. In addition, in response to James Pullen's inquiry, it was stated that PES required data only for cigarette filtration tow operations. Celanese indicated they were undergoing major changes in their filament process and therefore in-house data for this process would not be representative.

VII. Action To Be Taken

1) TRW (in conjunction with EPA) agreed to provide Celanese with a detailed description of the materials and projected costs associated with the emission point source test plan.

2) TRW (in conjunction with EPA) agreed to provide Celanese with proposed test dates as soon as these dates could be finalized.

3) PES will oversee the progress toward the actual testing and will prepare to collect process and in-house test data during the emission testing.

APPENDIX A

Plant Survey Agenda

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Material Claimed Confidential
By Company And Therefore
Deleted From Inclusion
In The Public Record