REPORT OF THE INITIAL PLANT VISIT TO AMERICAN ENKA COMPANY RAYON FIBER PLANT LOWLAND, TENNESSEE REGARDING THE DEVELOPMENT OF NEW SOURCE PERFORMANCE STANDARDS FOR THE MAN-MADE FIBERS INDUSTRY

I. Purpose

This trip was made to gather background information on man-made fiber operations for Phase I of new source performance standards (NSPS) development for the man-made fibers industry.

II. Place and Date

American Enka Company
Rayon Fiber Division
Lowland, Tennessee
January 22, 1980

III. Attendees

Name	Affiliation
George B. Johnson	Manager, Safety & Health, American Enka
Phil Buckner	Chief Engineer, American Enka
T. C. Benning, Jr.	Operations Manager, American Enka
Bruce Roberts	Environmental & Energy Engineer, American Enka
C. D. Cannon	Manager, Environmental Control, American Enka
Earl West	Corporate Manager, Environmental Affairs, Enka, N. C.
Roger Strelow	Leva, Hawes Law Firm (D. C.), (American Enka Representative)
Dennis W. Crumpler	Chemical Engineer, US EPA
Robert Zerbonia	PES, Inc.
Gregory P. Lathan	PES, Inc.
Roy Manley	PES, Inc.

IV. Discussion

Representatives of American Enka opened the meeting by describing the history of Enka's Lowland, Tennessee, plant beginning with the initial purchase of the land for the facility in 1946. The rayon filament plant was completed in 1948 and was operated for 26 years until it was closed in 1974. The present rayon staple facilities were put on line in in 1956 and subsequently expanded in 1964. The rayon staple facility presently is operating at 115 million lbs/yr. Nylon 6 manufacturing facilities were added in 1962 and were followed by a polyester staple facility in 1967 which presently produces approximately 100 million lbs/yr. The Lowland, Tennessee, plant employs 3400 people in their nylon, polyester and rayon producing operations.

Mr. Crumpler and Mr. Zerbonia gave a detailed description of Phase I of the New Source Performance Standards. Mr. Strelow requested a copy of the Phase I draft which had been completed 2 weeks earlier. EPA agreed to mail him a copy without the recommendations section, which are under revision.

Discussion turned towards the possibility of Enka constructing new rayon producing plants in the near future. Enka representatives clearly stated that although they were receiving profits from the manufacture of rayon staple, capital expenditures for the construction of new rayon facilities were far too high to warrant the building of new plants and any increase in demand would be met by upgrading existing facilities, to increase capacity through increased spinning speeds. They further claimed that any expansion beyond 5 years would probably be included in a new non-viscose process that is less energy, pollution and maintenance intensive; but this new process is still only in the development stage, that is, confined to laboratory production only.

Flow diagrams for rayon staple manufacture, nylon-polyester filament manufacture, and nylon-polyester staple manufacture were provided by representatives of the American Enka Company (Figures 1, 2, and 3). The manufacturing processes for these fibers were described by plant personnel and appeared to be essentially identical to the descriptions given in the Phase I survey report. A subsequent tour of the nylon and polyester filament operation and the rayon staple manufacturing process was conducted (see section on plant tour).

Representatives of American Enka were then questioned about their CS_2 recovery system. The present recovery system at Enka was designed after a similar recovery system used by a rayon manufacturing facility in Holland. Enka presently recovers approximately 14 percent of the 37 million pounds of CS_2 consumed annually in the production of viscose rayon at their Lowland, Tennessee, plant. This amounts to five million pounds. Collection is only attempted at the hot dip stage because here the concentration of CS_2 is high enough and the volume of air is small enough to make collection of the CS_2 vapors economically feasible (the rayon tow contains only 1 percent residual CS_2 after leaving the hot dip stage). The hot dip bath is a tightly closed system (with a two-inch water seal around the lid of the bath) used to remove impurities (mainly CS_2 from the rayon fiber immediately after it emerges from the spinning bath. CS_2 gas is removed through a header to a recovery system where it enters a countercurrent "scrubber" (actually a condenser) through the bottom. Cold caustic soda enters at the upper portion. The CS_2 vapors are condensed on tray-type condensers to liquid and are subsequently pressed back to virgin storage where it is kept under a layer of water to prevent evaporation. All noncondensables are vented to a flame.

An earlier CS_2 recovery system was attempted at Enka's Asheville, North Carolina, plant. Spools of rayon yarn were washed in pressurized vacuum tubs. The spools were degassed by hot H_2O; the CS_2 liberated and absorbed on mineral oil. The CS_2 was subsequently separated by distillation. This method proved to be less efficient than the cold caustic recovery system and has been discontinued.

Plant Tour - The spinning operations of nylon and polyester were visited first. American Enka's Lowland facility produces its' own polyester chips from DMT, but imports raw caprolactam to product nylon 6 chips. The melt spinning processes utilized were essentially the same as nylon 6 and polyester plants visited earlier in Phase I. Some important observations or differences in process design were:

a) Caprolactam crystals forming at the head of the nylon 6 spinnerets - indicating that the nylon 6 chips here (even though they are washed thoroughly) do contain residual amounts of unreacted monomer;

b) The unique ventilation system installed in the polyester-nylon plant. Outside air is brought into an air make-up plenum where the air is moisturized, heated and filtered to the required conditions for cooling the nylon and polyester yarn for quench air system. Outside air is also brough in at the top of the facility to provide ventilation for room air. A positive air balance is maintained at the upper floor where the air is brought in and a negative air balance on the first floor of the facility where the winding operation takes place (.005" of H_2O pressure is maintained between the two facilities). This allows the quench air to flow downward from the spinneret head to the winding area. A separate room air ventilation system is employed at various points throughout the process where the finish oil is applied to the fiber to remove the lubricant vapors. This air is exhausted to commonly used recover systems such as Brinks-type Demisters and Rotocione scrubbers; but also more advanced recovery systems are employed that use electrostatic precipitators.

c) Although Enka did have an elaborate ventilation system to remove the finish oil vapors, fuming was easily visible where the lubricant was applied.

d) Some of the nylon and polyester spinning equipment had "swing" capacity. This, however, was limited to a small portion of the overall spinning capacity.

e) There was no monomer recovery system for the collection of caprolactam vaporized at the spinneret and entrained in the quench air used at American Enka.

After visiting the nylon and polyester spinning operations, a subsequent tour of the rayon manufacturing facilities was conducted. This process was essentially identical to one visited earlier in Phase I with a few exceptions:

a) The CS_2 recovery system (discussed previously).

b) Immediately after emerging from the spin bath, the tow enters a hot dip stage where the cellulose is regenerated further and most of the bound CS_2 is released. This is essentially a wash stage where the tow is immersed into hot water and squeezed by rollers. CS_2 vapors released are vented to the recovery system.

V. Action to be Taken

1. Enka will mail EPA or PES a copy of the most recent state air pollution registration forms for emissions from their nylon, polyester, and rayon facilities.

2. A nylon 6 chip analysis or an analysis of quench air from nylon 6 quench boxes (looking for residual monomer).

3. An estimate of controlled and uncontrolled emissions from the polyester and nylon texturizing operations will be sent to EPA or PES to determine the efficiency of the various control devices applied to these operations.