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REPORT OF THE INITIAL PLANT VISIT TO AMERICAN CYANAMID COMPANY CONCERNING PHASE II DEVELOPMENT OF NEW SOURCE PERFORMANCE STANDARDS FOR THE SYNTHETIC FIBERS INDUSTRY

I. Place and Date

American Cyanamid Company
Santa Rosa Plant
Fibers Division
Milton, Florida 32570

April 11, 1980/Revised Version

II. Attendees

Name	Affiliation
K.N. Sharitz	American Cyanamid
Dr. J.B. Halladay	American Cyanamid
Robert White	American Cyanamid
G.J. Kenngott	American Cyanamid
Robert Zerbonia	PES
Roy Manley	PES
Greg Lathan	PES

III. Discussion

Robert Zerbonia opened the meeting between representatives of American Cyanamid and Pacific Environmental Services (PES) with a discussion of New Source Performance Standard Development for the Synthetic Fibers Industry including Phase I and Phase II objectives. He explained that PES would confine their interests to polymer mixing, dope preparation, spinning and subsequent texturizing operations through shipment, but not polymer preparation, boilers, or other support equipment.

Dr. Halladay indicated that the PES agenda for discussion seemed to be directed toward wet and dry spinning processes which employed organic solvents for spinning. The solvent used for acrylic fiber production at American Cyanamid is sodium thiocyanate (NaSCN), which is a salt solution. Dr. Halladay stated that due to the recognition of air and industrial hygiene problems over the last 15 years, American Cyanamid finds themselves with a spinning process that does not pollute. Research and development work for Cyanamid's acrylic fiber manufacturing process was initiated in the early 1940's at the Research and Development Center of American

Cyanamid. Presently there are no other patents or licenses governing this process in the United States, other than the American Cyanamid process ownership.

Dr. Halladay suggested that costing information required in the survey sent to Cyanamid by PES does not seem to pertain to the American Cyanamid process since American Cyanamid emits no volatile organic compounds nor has any air emission control systems from that portion of the process of interest. Robert Zerbonia stated that this information was vital to establish a baseline model plant for a non-organic solvent process to use in the economic study of Phase II development.

IV. Process Description

Neale Sharitz provided the following process description for acrylic fiber manufacture.

Raw material is received by rail car and stored. It is sent to the reactor area where the AN is reacted to produce the polymer, polyacrylonitrile (PAN). After the polymer is produced, the remaining monomers are stripped from the slurry and recycled. The PAN is fed to a polymer purification system where it is washed to remove any remaining free monomers or catalyst residuals. Pure PAN remains as a nonbiogradable plastic. The purified polymer is subsequently put through a dissolving operation using a solution with NaSCN which results in a single-phase system of three components.

The resulting solution is blended and stored. It is then put through a primary filtration operation to remove any suspended solids. It is subsequently sent to a deaeration area to remove all air. Various additives are later incorporated into the solution to give the end fiber certain desirable qualities.

At the spinning stage, dope is extruded into an aqueous NaSCN solution. Filament molecules at the face of the spinnerets are disoriented and are aligned through a stretching operation. This stage also imparts strength to the fiber. A washing step is then employed to remove all traces of solvent from the fiber. The water which is utilized in extrusion, prestretching, and washing steps is routed to a solvent recovery system after it leaves the spin bath.

After the washing step, the tow is stretched on large rolls to impart strength followed by drying to collapse the fiber. A subsequent relaxing operation is employed which allows disorientation of the fiber molecules to leave open sites for dyeing. In the following finishing and tempering stage, a lubricant and antistatic agent are added. A crimp is added to the fibers to give them cohesion. The dryed product is boxed for storage.

The solvent recovery system at American Cyanamid employes multiple effect evaporators to remove the water from the NaSCN solution (exiting the washing stage) and concentrate the NaSCN solution. Cyanamid recovers 99.6 percent of all NaSCN used in their dissolving, spinning, and washing operations. Of the solvent which enters the recovery system, half of the loss is due to handling operations, while the other 0.2 percent is lost in the recovery operation. A concentrated NaSCN solution is produced after evaporating the water remaining in the recovery unit and is returned to the dissolving step. The wastewater from the recovery system is routed to a biological treatment/system. It is then disposed of by spray irrigation or discharged to surface waters. Certain wastewater streams may be routed to an alternative physical/chemical treatment system with ultimate disposal by deep well injection.

After a discussion of the manufacturing process, PES personnel asked several questions. Robert Zerbonia asked if the polymer was steam stripped to remove any of the residual monomer. Representatives of American Cyanamid indicated that there was a steam stripping operation and there was no detectable monomer present after the washing step. Mr. Zerbonia also asked if American Cyanamid had any worker exposure problems. Cyanamid representatives claimed to have none whatsoever in the areas of interest to PES. The usual strict AN precautions were taken in the polymerization area, but since there is less than 1 ppm of residual monomer at the spinning and processing stage, worker exposure here is very low, if detectable at all. In addition, representatives of Cyanamid indicated that the spin bath is cold, which further inhibits volatilization.

When asked if any of the NaSCN broke down or degraded into other components, representatives of American Cyanamid claimed that attempts have been made in the past to measure degradation; but, if it did occur in the extrusion, spinning and subsequent washing operations, it was not detectable. Any degradation which does occur would probably take place in the solvent recovery system where elevated temperatures are reached. American Cyanamid claims that NaSCN is a stable compound.

Robert Zerbonia asked Cyanamid representatives about the market stability of acrylic fibers. Mr. Kenngott noted that some Dupont acrylic plants in Europe had recently shut down. He also stated that there appears to be excess capacity in the US as well as worldwide. American Cyanamid's relative position to other major acrylic fiber producers was discussed. Dr. Halladay indicated that some fibers have market place advantages that may offset their higher costs of production (polyester, for example, has permanent press characteristics). Mr. Kenngott added that the estimated growth rate of acrylic fibers is probably lower than that of other fibers. Both Dr. Halladay and Mr. Kenngott estimated the acrylic fiber growth rate to be somewhere between 4 and 7 percent per year.

Although 90 percent of American Cyanamid's acrylic fiber went into the production of carpet in 1969, presently almost all (95 percent) of Cyanamid's acrylic fiber production is directed into the non-carpet markets such as apparel and home furnishings. Roy Manley suggested that with only 4 to 7 percent growth per year, plus the existing excess capacity in the market, there appeared to be little likelihood that demand would exceed supply in the next 5 to 7 years. Mr. Kenngott agreed and pointed out that any increases in demand would most likely be met by debottlenecking existing equipment.

Roy Manley suggested that the cost data (to be provided by American Cyanamid) could be for hypothetical new construction rather than actual cost data. Robert White and Neil Sharitz indicated that the data for hypothetical new construction would be easier to provide for two reasons: a) the actual data would be very sensitive information, and b) these costs were incurred over a 22-year period. Therefore, these costs would be less informative and much more difficult to obtain.

Cyanamid representatives indicated that the last expansion in capacity occurred in 1967 (the solvent recovery system was completed in 1968) and that they had no plans for expansion in the next 5 to 10 years, except for debottlenecking.

The PES project team was taken on a plant tour, beginning in the dissolving operation, through all subsequent processing steps to final packaging.

V. Action to be Taken

An agreement was reached on the additional cost information to be provided by American Cyanamid. This information will consist of three parts:

1. The cost data on the dissolving through washing stages, (attached - Table I).

2. The cost data for the recovery system.

3. Any emission values or tests performed at the dryer.[1]

Note: Data will be hypothetical 100 m. lb./yr. fiber operation.

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[1] Analytical data destroyed from 1972-74 emission survey. One (1) conditioner/dryer exhaust gas sample analyzed 5/80 indicated <2 ppm organic material. (Analysis by gas chromotography using flame ionization detector.)

TABLE I

COSTING 100 M LB./YR. FACILITY 1980 DOLLARS

	POLYMER - FIBER DISSOLVING THRU WASHING	SOLVENT RECOVERY EQUIPMENT
INSTALLED COST EQUIPMENT	$21 - 24M	$6 - 8M
MAINTENANCE - 5%	1.1M	0.3M
OPERATING LABOR (DIRECT & O.T.)	1.0M	.13M
INDIRECT COSTS - 10%	2.2 M	.6M
LIFE EXPECTANCY	20 YRS.	20 YRS.
OPERATING LABOR (PERSONS PER SHIFT)	SUPERV. 1 OPERATOR 9 10	SUPERV. OPERATOR 2 2

NOTES:
1) NO UTILITIES OR OFF-SITE INCLUDED.
2) PROCESS BUILDING NOT INCLUDED. TWO-STORY 150'W x 400'L
3) 100M LB./YR. ON 8400 HR. BASE=11,904 LB./HR., ASSUME 100% POLYMER TO FIBER YIELD.

UTILITIES

	UNIT COST 1980
COOLING TOWER WATER	$.04/K GAL.
PROCESS WATER	.03/K GAL.
D.I. WATER	.30/K GAL.
ELECTRICAL	.04/K KWH
REFRIGERATION	4.0/M BTU
STEAM (220 SAT.)	4.0/M BTU

USING THE ABOVE COSTS-ANNUAL OPERATING COSTS FOR UTILITIES WOULD BE:

DISSOLVING THRU TOW WASH	$2,500 K/YR.
SOLVENT RECOVERY	$2,200 K/YR.

APPENDIX A

Plant Survey Agenda

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