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# REPORT OF THE PLANT VISIT TO BADISCHE CORPORATION'S SYNTHETIC FIBERS PLANT IN WILLIAMSBURG, VIRGINIA

## PURPOSE

The purpose of the plant visit was to gather background information (i.e., emission data, design data, and operating data) on the acrylic fiber spinning processes and associated air pollution control equipment for Phase I development of new source performance standards (NSPS) for the synthetic fibers industry.

## PLACE AND DATE

Badische Corporation
Post Office Drawer D
Williamsburg, Virginia 23185

November 28, 1979/Revised Version

## ATTENDEES

| Name | Affiliation |
|---|---|
| Donald Duguid | Badische Corporation |
| Joe A. Mann | Badische Corporation |
| Michael O. Johnson | Badische Corporation |
| Richard L. Charter | Badische Corporation |
| David L. Shifflett | State Air Pollution Control Board |
| Dennis W. Crumpler | U.S. EPA/CPB |
| Greg P. Lathan | PES |
| Robert Zerbonia | PES |

## DISCUSSION

Prior to the plant tour, a meeting was held with the Badische Corporation personnel, a representative of the State Air Pollution Control Board, and the EPA/PES project team. Dennis Crumpler provided

an overall description of the Phase I scope and objectives in development of NSPS for the synthetic fibers industry.

Some discussion then followed on the type of information which Badische Corporation may be required to provide in order for EPA/PES to carry out its Phase I responsibilities under the amended Clean Air Act. Of particular concern to Badische Corporation personnel were the measures taken to ensure confidentiality of any industrial process trade secrets which might be released to EPA/PES. Dennis Crumpler and Robert Zerbonia then detailed the procedures taken by their respective organizations in the treatment and handling of confidential information.

Mr. Joe Mann then provided a brief outline and history of the acrylic spinning process presently being used at the Williamsburg plant. This process is unique to Badische Corporation. Mr. Johnson noted that because of appreciable differences in overall acrylic spinning process schemes (no two domestic acrylic fiber manufacturing processes are alike) establishment of NSPS (or BDTC or RACT), applicable to the acrylics industry in general, may not be possible.

It was suggested that the Textile Economics Bureau would be a reliable source of production capacities and indicator of market trends for the overall synthetic fibers industry.

Messrs. Johnson and Charter next described the air pollution emission sources which have been identified and registered with the State of Virginia. Acrylonitrile was identified as the major atmospheric pollutant from the spinning operations at the Williamsburg plant. At this point a tour of the B-fiber plant was conducted by Messrs. Johnson and Charter.

## PROCESS DESCRIPTION

At the Badische Corporation's Williamsburg plant, acrylonitrile and other monomers are polymerized to produce polyacrylonitrile homopolymer and copolymers. Polymerization is followed by a vacuum removal step which facilitates recovery of unreacted monomer and thereby reduces acrylonitrile emissions which occur during the spinning operations.

In the spinning process, polymer solution is extruded into a coagulation bath containing a dilute zinc chloride/water solution which functions as a non-solvent. Coagulated polyacrylonitrile is then washed extensively with water in a counter current bath to remove zinc chloride and other residuals, including monomer. A substantial portion of the unreacted monomer returns with the wash water to be recovered during solvent purification. Monomer loss during spinning and washing, however, is reported to be the major source of process emissions to the atmosphere.

Washing is followed by stretching, drying, crimping, and cutting and baling of the fibers. Selected products are also dyed on line continuously.

At Williamsburg, the acrylic manufacturing facility is comprised of two separate plants with basically similar processing steps. The Z fiber plant produces polyacrylonitrile homopolymer. The flow sequence for this plant is shown in Figure 1. The B fiber plant copolymerizes acrylonitrile (AN) and other monomers to produce products with characteristics suited to various end uses. The process flow sheet is shown in Figure 2.

## EMISSION AND CONTROL TECHNOLOGY

The major source of emissions to the atmosphere during acrylic fiber production at the Badische Williamsburg plant is volatilization of residual unreacted monomer during the spinning and washing operations. Unreacted monomer is carried over from the polymerization reactor; a portion of this monomer is removed by vacuum stripping of the polymer prior to storage. It is estimated that this vacuum flash step following polymerization releases up to 80 percent of the unreacted AN for recovery.

Plant personnel stated that the remaining monomer, which is sent to spinning, is released from the polymer in the spinning and washing stages. The majority of the unreacted AN, however, is absorbed in the

Figure 1. Block Diagram of Plant Spinning Operations

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Figure 2. Block Diagram of Plant Spinning Operations

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dilute solvent used in the spinning and washing steps; the remaining residual monomer is volatilzed and is emitted to the atmosphere. The plant personnel stated that testing has shown that no residual monomer remains in the fiber product. It can therefore be concluded that all residual monomer is released in the spinning, washing, and drying stages. Plant personnel were of the opinion that all monomer release occurred during spinning and washing of the fibers and that the stretching and drying steps accounted for only insignificant amounts of monomer release.

There are no direct or add-on emission control systems for reduction of AN emissions applied to the Badische plant spinning facilities. Recovery of a portion of the unreacted AN present in the spinning solution by processing wet-spinning and fiber washing solutions serves as an indirect control method.

In the spinning area of the plant the spinning bath and fiber handling equipment were partially enclosed in order to increase the air flow rate (e.g., venturi effect) across the polymer and to decrease AN levels in the spinning room. Room air is being drawn off from above the enclosure and the collected gases are routed to an outlet stack. The partially enclosed spinning area served as a means to maintain AN levels below the OSHA limits.

## FINAL DISCUSSION

Messrs. Johnson and Charter agreed to provide EPA/PES with the most recent update of the State emission registration forms as well as copies of the information provided to Pullman-Kellogg in their investigation of AN. Badische Corporation will also provide the test results, which are the basis of the emission estimates, and the calculations used in the estimates. Badische personnel also agreed to furnish the results of any test conducted to determine the quantity of AN in the fiber dryer exhaust air streams.

APPENDIX A

Plant Survey Agenda

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