Allied
Fibers & Plastics

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April 15, 1982

Mr. Jack R. Farmer, Chief
Chemicals and Petroleum Branch
Emission Standards and Engineering Division
United States Environmental Protection Agency
Research Triangle Park, N.C. 27711

Dear Mr. Farmer:

Please find attached comments which have been prepared regarding the background information which EPA has developed in support of a new source performance standard regulation for control of VOC emissions from the polymers and resins industry. These comments are directed to that portion of the background document which deals with polyester manufacturing.

On March 4, 1982, Allied representatives met with Mr. Edwin Vincent of your staff and others from EPA and Energy and Environmental Analysis, Inc., EPA's contractor for this project. This submittal includes data presented by Allied at that meeting as well as additional information in response to questions raised by Mr. Vincent and his colleagues.

We appreciate the opportunity to meet with your staff and to provide these written comments. If any additional information or clarification is required, please contact me.

Sincerely,

R.K. Smith

R.K. Smith, Supervisor
Environmental & Industrial Hygiene

RKS/bgm

cc: Mr. Edwin Vincent, EPA

Attachment

The United States Environmental Protection Agency (EPA) is currently developing a new source performance standard regulation for control of volatile organic compound emissions from the polymers and resins industry.

Material representing the technical portion of the background information document for this regulation (Chapters 3, 4, 5 & 6), has been distributed for review. Following a review of this material, Allied Fibers and Plastics Company of Allied Corporation offers the following comments regarding that portion which deals with polyester manufacturing.

Description of Present System:

Allied's Moncure plant utilizes the TPA process in two continuous polymer trains of approximately the same capacity. Molten polymer is directly transferred to the spinning process where spinning and drawing is done in one continuous operation. The product is a heavy denier, high tenacity polyester fiber used for tires, seat belts, and other industrial applications. This type of polyester comprises approximately 8% of the total market.

Figure 1 shows a process diagram for the existing facility. Esterification reactors 101, 104, and 107 are pressure vessels venting to a condenser to recover glycol vapors. Pre-polycondensation reactors 114 and 117 are evacuated with vacuum pumps and glycol spray condenser are used to recover condensible vapors. In polycondensation reactors 201, 301, and 401, vacuum is maintained by steam jet ejectors and barometric condensers.

Figure 2 shows additional detail for the vacuum systems on reactors 201, 301, and 401. Water from the condensers is circulated to two atmospheric cooling towers .A continuous blowdown from the cooling water system is fed to a distillation column where glycol and solids are removed and concentrated for recovery.

Emissions from the process occur primarily from the cooling tower and are difficult to measure by standard techniques. The emission estimates shown are based on a material balance and an estimate of cooling tower drift factors. The methods used were very conservative and probably overstate emission losses. An average glycol concentration of 7% is maintained in the cooling water, and emissions are directly related to this glycol concentration.

The high tenacity polyester fiber produced requires polymer I.V. (intrinsic viscosity) of nominally 0.95. Polymer viscosity is a function of vacuum conditions in the reactor. Polymer leaving reactor 201, with a vacuum of about 2 torr, has an I.V. of approximately 0.54. In order to build the necessary viscosity in reactors 301 and 401, vacuums as low as 0.25 torr are required. Since the performance of the direct spinning process is sensitive to changes in I.V., the vacuum system must be precise and capable of quickly adjusting to process changes.

Discussion of Control Alternatives:

Allied has reviewed the control methods proposed by EPA as regulatory alternatives. Other technologies which had the potential for reducing emissions were also evaluated.

Spray Condensers:

EPA's baseline regulatory alternative is the use of a glycol spray condenser prior to the steam jet ejector system on the polycondensation reactors. This alternative also has substantial emissions from the cooling towers.

After reviewing this alternative, Allied believes it is not technically feasible for reactors producing a high I.V. product, due to vacuum constraints. The pressure drop across the scrubber would not allow for vacuums as low as 0.25 torr on reactors 301 and 401 in Allied's process, for example. We have evaluated the alternative assuming its use on reactor 201 only, as shown in Figure 3.

While this sytem would reduce the quantity of condensibles going into the cooling water, emissions would still be a function of glycol concentration in the cooling water. This concentration would be dependent on the method for removing glycol from the cooling water. Allied's present system of feeding a cooling tower blowdown stream to a distillation column could not be practically operated at glycol concentrations much below the current level. While the emission estimates for this alternative (based on EPA's emission factor) and the present system (based on Allied's estimate) are different, actual emissions in both cases are entirely dependent on glycol concentrations in the cooling water and should be quite comparable for plants with similar cooling water blowdown systems. Lower cooling water circulation rates would reduce emissions due to cooling tower draft by about 20%.

Spray Condensers with Vacuum Pumps:

EPA's other regulatory alternative is the use of vacuum pumps in place of the steam jet ejectors and barometric condensers. This alternative would eliminate the contaminated cooling water circulation.

Allied believes this alternative is also not technically feasible for reactors producing a high I.V. product, due to vacuum constraints. Vacuum pumps currently available could not provide vacuums to 0.25 torr at these process conditions. We have evaluated the alternatives assuming its use on reactor 201 only. This system is similar to that shown in Figure 3 except vacuum pumps replace the steam jets on reactor 201.

This system would further reduce the quantity of condensibles going into the cooling water. For reasons cited in the discussion of the spray condenser alternatives, however, actual emissions from the cooling tower would be a function of the glycol concentration in the cooling water and comparable to Allied's present system.

Refrigeration System:

Another alternative evaluated by Allied was replacing the atmospheric cooling towers with a shell and tube heat exchanger using chilled water. This system is shown in Figure 4.

While this alternative offers substantial emission reductions, it has significant drawbacks. Installation and operating costs for this system are very high, and its reliability is poor when compared to the present system. The waste water discharge from this alternative would represent a 50% increase in flow to the plant's waste water treatment system.

Ethylene Glycol Jets System:

Allied has also evaluated an alternative which involves glycol motive jets to provide vacuum for the polycondensation reactors as shown in Figure 5. Virgin ethylene glycol would be vaporized and distributed to a series of jet ejectors and this glycol and process vapors would be condensed in barometric intercondensers. The glycol would be cooled and recirculated to the barometric intercondensers.

While this alternative has considerable promise and would significantly reduce emissions, it has not been demonstrated under these process conditions. There are serious feasibility questions, particularly whether glycol will be stable at these temperatures or would cause pluggage problems in the jets.

Comparison of Alternatives:

Table 1 presents the alternative in summary form. "New plant capital cost" is based on providing the vacuum system for a new facility of comparable size to Allied's Moncure plant. "Modification (dechoke) capital cost" is based on providing the vacuum system for a 20% increase in capacity for a plant of comparable size. "Operating costs" include all costs associated with the operation of the vacuum system. "Technical feasibility" and "Reliability" for the alternatives are compared to the present system which is considered 100% feasible and reliable.

The environmental impact of the alternatives is compared within the framework of assumptions already discussed.

Conclusions and comments:

1. The primary source of emissions from polyester plants is drift losses from atmospheric cooling towers. These emissions cannot be measured by standard techniques and must be estimated based on material balances and estimates of cooling tower drift factors. Emissions are directly related to the average glycol concentration in the cooling water which is dependent on the method for removing glycol from the cooling water. The emissions from Allied's present system are comparable to EPA's baseline regulatory alternative.

2. The control options proposed by EPA as regulatory alternatives are not technically feasible for the high I.V. (.95) Pet Process. Vacuum requirements preclude the use of spray condensers and vacuum pumps and make steam jet ejectors and barometric condensers the only proven and economical alternative. The use of spray condensers or vacuum pumps on part of the process (Allied's reactor 201) results in no significant reduction in emissions.

3. Modifications or dechokes for existing plants should be exempt from the proposed standard. Particularly for the regulatory alternatives proposed by EPA, the costs for modifying an existing plant cannot be justified in terms of the anticipated emission reductions.

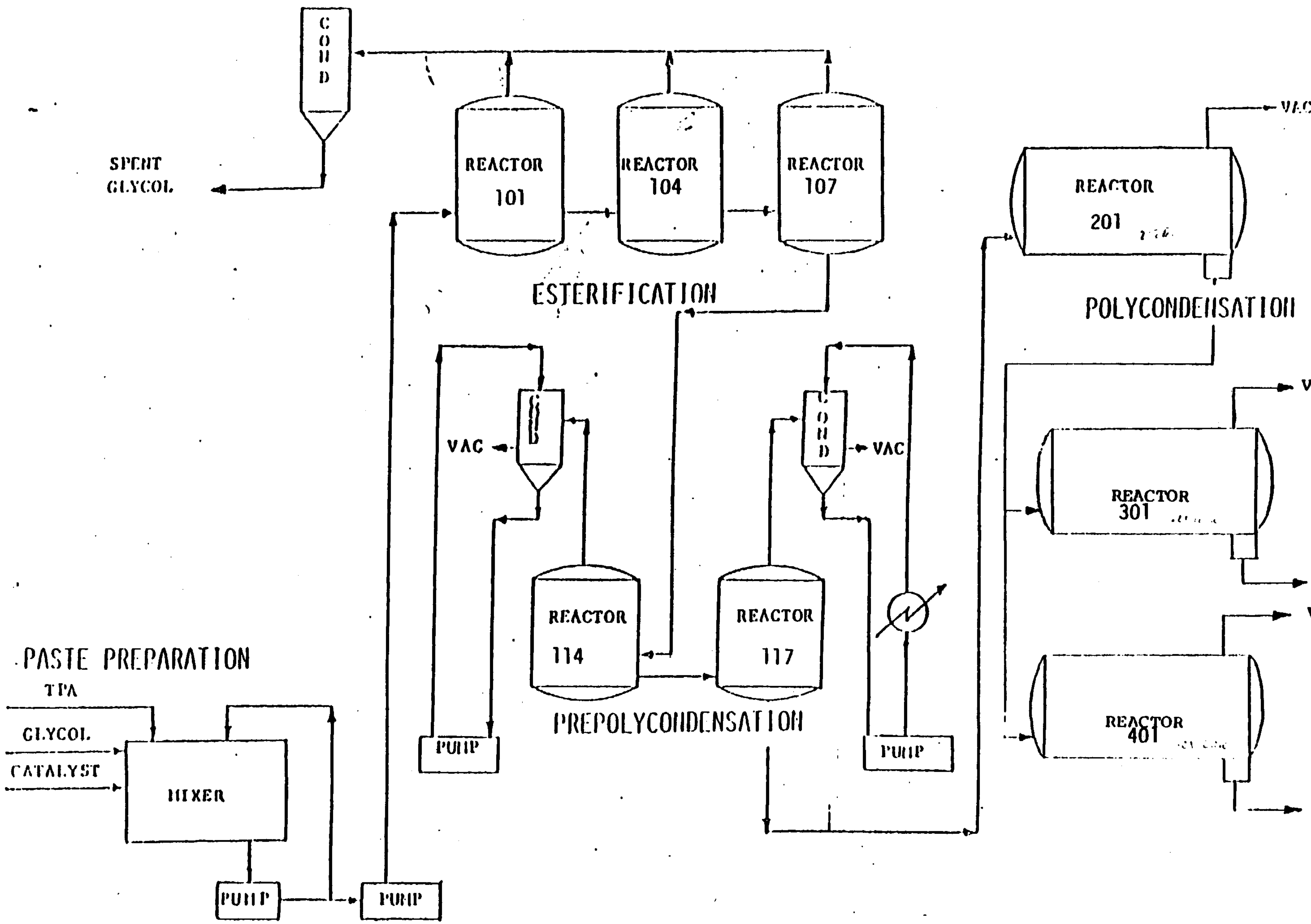
COND
SPENT GLYCOL
REACTOR 101
REACTOR 104
REACTOR 107
ESTERIFICATION
REACTOR 201
POLYCONDENSATION
VAC
VAC
REACTOR 114
REACTOR 117
PREPOLYCONDENSATION
PUMP
PUMP
REACTOR 301
REACTOR 401
PASTE PREPARATION
TPA
GLYCOL
CATALYST
MIXER
PUMP
PUMP

Figure 1

TABLE 1

COMPARISON OF SYSTEMS

FACTORS	PRESENT SYSTEM	SPRAY CONDENSER	SPRAY CONDENSER & VACUUM PUMP	REFRIGERATION SYSTEM	ETHYLENE GLYCOL JETS
New plant capital cost	$8.9MM	$7.5MM	$7.5MM	$14.7MM	$7.1MM
Modification (dechoke) capital cost	$ 0.05MM	$ 1.2MM	$ 1.3MM	$ 7.6MM	$ 4.7MM
Annual operating cost	$900M	$593M	$558M	$1900M	$330M
Technical feasibility	100%	85%	80%	90%	70%
Reliability	100%	90%	80%	75%	95%
Environmental impact:					
Air emissions (lb/1000 lb PET)					
Glycol	9.5	4.0	4.0	negligible	0.001
Oligomers	0.25	0.25	0.25		
Other organics	.27	2.7	2.7		
Waste water discharge: (lb/1000 lb PET)					
Flow				23 gpm	6.6 gpm
Glycol				4.6	1.4
Other organic				0.65	0.16
Antimony				1 ppm	1 ppm

DOCKET NO.

Category II-D

The following information is located in the confidential files of the Director, Emission Standards and Engineering Division, Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina. This information is confidential, pending final determination by the Administrator, and is not available for public inspection.

Figure 2. Flow diagram of the present system.

Figure 3. Flow diagram of a spray condenser before steam ejector system.

Figure 4. Flow diagram of a refrigeration system in place of atmospheric cooling tower.

Figure 5. Flow diagram of an ethylene glycol jet system to provide vacuum on polymerizers.