AP42 Section: 6.9

Background Chapter 4

Reference: 63

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March 1994

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United States
Environmental Protection
Agency

Office of Air Quality
Planning and Standards
Research Triangle Park NC 27711

EPA-450/3-82-011b
March 1984

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Synthetic Fiber Production Facilities— Background Information for Promulgated Standards

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Synthetic Fiber Production Facilities— Background Information for Promulgated Standards

Emission Standards and Engineering Division

U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Air and Radiation
Office of Air Quality Planning and Standards
Research Triangle Park, North Carolina 27711

March 1984

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ENVIRONMENTAL PROTECTION AGENCY

Background Information
Final Environmental Impact Statement
Synthetic Fiber Production Facilities

Prepared by:

Jack R Farmer 3/12/84

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1. The promulgated standards of performance will limit emissions of volatile organic compounds (VOC) from new and reconstructed synthetic fiber production facilities. Section 111 of the Clean Air Act (42 U.S.C. 7411), as amended, directs the Administrator to establish standards of performance for any category of new stationary source of air pollution that ". . . causes or contributes significantly to air pollution which may reasonably be anticipated to endanger public health or welfare." EPA Regions I, II, III, and IV are particularly affected, since most synthetic fiber production facilities are located in these regions.

2. Copies of this document have been sent to the following Federal Departments: Office of Management and Budget; Labor, Health and Human Services, Defense, Transportation, Agriculture, Commerce, Interior, and Energy; the National Science Foundation; the Council on Environmental Quality; members of the State and Territorial Air Pollution Program Administrators; the Association of Local Air Pollution Control Officials; EPA Regional Administrators; and other interested parties.

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1.0 SUMMARY

On November 23, 1982, the Environmental Protection Agency (EPA) proposed standards of performance for synthetic fiber production facilities (47 FR 52932) under authority of Section 111 of Clean Air Act. Public comments were requested on the proposal in the Federal Register. There were 6 commenters composed mainly of industry and industry association representatives. Also commenting was one State environmental agency. The comments that were submitted, along with responses to these comments, are summarized in this document.

1.1 SUMMARY OF CHANGES SINCE PROPOSAL

There have been no changes, other than editorial or typographical, made to the regulation since proposal.

1.2 SUMMARY OF IMPACTS OF PROMULGATED ACTION

1.2.1 Alternatives to Promulgated Action

The regulatory alternatives are discussed in Chapter 6 of the proposal BID. These regulatory alternatives reflect the different levels of the emission control from which one is selected that represents the best demonstrated technology, considering costs, nonair quality health, and environmental and economic impacts on the synthetic fibers industry. These alternatives remain the same and are described in Chapter 6 of the proposal BID.

1.2.2 Environmental Impacts of Promulgated Action

The environmental impacts of the promulgated standards are described in Chapter 7 of the proposal BID, and are essentially unchanged.

The analysis of environmental impacts in the BID Volume I, with the changes noted in BID Volume II, now becomes the final Environmental Impact Statement for the promulgated standards.

1.2.3 Energy and Economic Impacts of Promulgated Action

The energy impacts of the promulgated action are described in Chapter 7 of the proposal BID, and remain unchanged since proposal.

Economic impacts are described in Chapter 8 and 9. The values for cost-effectiveness of the standards at facilities projected in 1987 have been adjusted for accuracy, but still indicate the standards will achieve emission reductions at reasonable cost.

1.2.4 Irreversible and Irretrievable Commitment of Resources

These impacts are discussed in Chapter 7 of the proposal BID, and remain unchanged since proposal.

1.2.5 Environmental and Energy Impacts of Delayed Standards

Table 1-1 in the proposal BID provides a summary of the impacts associated with the proposed standards. Delay in implementation of the standards could result in additional VOC emissions, as described in Chapter 7 of the proposal BID.

1.2.6 Corrections and Clarifications

Comments received from the public following proposal included notation of several minor typographical and mathematical errors in the proposal BID and preamble. These are discussed in detail in Chapter 2 of this document and docket item II-B-2. None of the errors will result in changes in the environmental or economic impacts of the standards.

2.0 SUMMARY OF PUBLIC COMMENTS

The list of commenters and their affiliations is shown in Table 2-1. Six comment letters were received. A summary of the comments and EPA's responses to them are presented in this chapter under the following headings:

1. Selection of Source Category
2. Selection of Best Demonstrated Technology
3. Selection of Format of the Standards
4. Environmental Impacts
5. Costs and Economic Impacts
6. General

2.1 SELECTION OF SOURCE CATEGORY

2.1.1 Comment (IV-D-1, IV-D-2, IV-D-3, IV-D-4, IV-D-6):

Five commenters said that the proposed NSPS is not needed because there will be no capacity additions in the solvent-spun synthetic fibers industry in the next 5 years.

Response:

EPA does not agree with the commenters that there will be no capacity additions in the next 5 years (see responses to Comments 2.5.1, 2.5.2, 2.5.8, 2.5.9, 2.5.14). Even if the commenters' projections are correct, however, EPA believes the NSPS would still be warranted. If growth is projected to occur, whether within 5 years or beyond 5 years, the issue is whether best control technology should be a factor in that growth. The 5-year period has no special significance in the decisions as to whether or not an NSPS is warranted. The 5-year period is often a reasonable indicator of growth. However, such factors as cyclic growth, the current economic downturn, etc., can result in situations where projected growth in the next 5 years is not indicative necessarily of long-term trends. Since an NSPS is intended to achieve long-term benefits, it is important to look beyond 5 years. Even if growth is not certain, however, it is still not unreasonable to promulgate the NSPS. EPA has been developing it for over 3 years, and most of

Table 2-1. LIST OF PERSONS SUBMITTING COMMENTS ON THE PROPOSED STANDARDS

Docket Entry Number[a]	Commenter and Affiliation
IV-D-1	James C. Pullen Manager, Environmental Activities Celanese Fibers Company Charlotte, North Carolina 32414
IV-D-2	Charles W. Jones, President Man-made Fiber Produces Association, Inc. Washington, D.C. 20036
IV-D-3	(transmittal letter) Robert R. Romano, Ph.D Manager, Air Programs Chemical Manufacturers Association Washington, D.C. 20037
	(body of comment) Geraldine V. Cox, Ph.D Vice President and Technical Director Chemical Manufacturers Association Washington, D.C. 20037
IV-D-4	(transmittal letter) Robert L. Stoots, Jr. Coordinator Agency Relations Tennessee Eastman Company Kingsport, Tennessee 37662
	(body of comment) James C. Edwards Manager, Clean Environment Program Tennessee Eastman Company Kingsport, Tennessee 37662
IV-D-5	Daniel J. Goodwin Manager, Division of Air Pollution Control Illinois Environmental Protection Agency Springfield, Illinois 62706
IV-D-6	David T. Modi Attorney, Environment Division E.I. duPont de Nemours and Company Wilmington, Delaware 19898

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[a] The docket number for this project is A-80-7. Dockets are on file at EPA Headquarters in Washington, D.C., and at the Office of Air Quality Planning and Standards in Durham, N.C.

the Agency resources for this project have already been spent. Since no extra effort is required, and since early promulgation of these standards would enhance the ability of facility owners to plan for whatever future growth will be necessary, establishment of the standards at this time is reasonable. Consequently, EPA believes the NSPS will be beneficial in limiting VOC emissions from new or reconstructed synthetic fiber production facilities when they are built, regardless of whether it is within 5 years or beyond.

2.1.2 Comment (IV-D-2):

One commenter claimed that the proposed regulation is unnecessary because no new or significantly modified facilities that produce acrylic, modacrylic, and cellulose acetate fibers will be built or required in the next 5 years. This commenter referred to past communications for support of this position, but did not cite the pertinent supporting portions. He also claims the background information document (BID) for the proposed standard contains significant errors of an economic and technical nature, but no specific errors were noted. He summarizes by requesting that EPA "---discontinue this needless activity."

Response:

As stated in the response to Comment 2.1.1, EPA believes that the NSPS will be beneficial in limiting VOC emissions from affected facilities when they are built, regardless of whether it is within 5 years or beyond, and that there will be significant growth in this industry in the future. The communications that have been provided by others have been carefully considered, and it is EPA's conclusion that none affects EPA's assessment of the benefits of the standards. The communications referred to in the above comment overall do not show, in EPA's opinion, that the standards are "needless." The commenter has provided no specific support for his comment. Absent this information, EPA must conclude that it has made a reasoned judgment based on the best information available, and that there is not sufficient justification for discontinuing development of the standard; the preponderance of information available shows that the standards will result in emission reductions at reasonable cost from a category of sources that contributes significantly to ozone pollution.

2.1.3 Comment (IV-D-6):

One commenter questioned the significance of VOC emissions from synthetic fiber plants by pointing out the small percentage of VOC emissions contributed by the synthetic fiber industry to total VOC emissions from all sources. He estimated that the fiber industry baseline emissions are about 0.2 percent of emissions from all sources and that the emission reduction achieved by the standard would amount to 0.05 percent, or less, of total VOC emissions.

Response:

EPA agrees that VOC emissions from the synthetic fibers industry are a small percentage of total VOC emissions; however, most VOC emissions come from a large number of relatively small sources (when compared, for example, with sources of particulate matter or sulfur dioxide, which can be much larger). There are no relatively large individual sources of VOC emissions; rather, emissions from all these industries combined create the ozone danger Congress intended standards of performance to address. Since these emissions can be reduced only by controlling each type of contributor, most of these individual contributors must be viewed as significant, even though emissions from each may seem small when compared to the total. More specifically for this industry, EPA considers synthetic fiber plants to be significant sources regardless of the percentage of VOC emissions they contribute to the total. For example, a typical dry spinning acrylic plant controlled to baseline levels would emit about 1,900 megagrams of VOC per year. The NSPS would reduce those emissions by about 1,100 megagrams per year. Section 302(j) of the Clean Air Act defines a major stationary source as one that emits 100 tons (91 megagrams) or more of an air pollutant. For these reasons, EPA believes that there is no reason to alter its conclusion, established by rulemaking at 40 CFR 60.16, that the synthetic fiber production industry is a significant contributor of VOC emissions and should be listed for regulation by an NSPS.

2.2 SELECTION OF BEST DEMONSTRATED TECHNOLOGY

2.2.1 Comment (IV-D-3, IV-D-4):

Two commenters said that it is not appropriate to transfer enclosure technology used in some acrylic fiber production to filter tow production because of fundamental differences in the types of solvents, raw materials used, curing rates, and resulting emission rates. The two commenters provided conflicting views, however, concerning the weight and resulting curing rates of acrylic fibers as compared to filter tow. Commenter IV-D-3 indicated that filter tow fibers are lighter and thus would have a faster curing rate while commenter IV-D-4 indicated the opposite would be true.

Response:

Neither commenter explained why the difference in emission rates they believe to exist between acrylic and filter tow fiber spinning would cause the use of enclosures for filter tow to be inappropriate. Commenter IV-D-3 did provide a comparison between the variables causing different emission rates for modacrylic and filter tow fiber production but did not explain how these variables would affect the effectiveness of enclosures. All the variables discussed by the commenters were carefully considered by EPA during development of the proposed NSPS, as indicated in Chapter 4 and Appendix C of the proposal BID. Unfortunately, most of the data regarding solvents, raw materials, fiber size, and curing rates are claimed to be confidential by the companies from which they were obtained and, therefore, could not be discussed in detail either in the BID or in this document. After consideration of these variables, however, EPA concluded that properly designed and operated enclosures are the most effective means of capturing VOC emissions from all spinning facilities (with the exception, perhaps, of acetate filament yarn - see 47 FR 52937, the preamble to the proposed NSPS).

A thorough investigation revealed no design, operational, or safety problems associated with enclosures. In addition, in correspondence to and meetings with EPA personnel during development of the proposed NSPS, representatives of commenter IV-D-4 made the following statements: "The design and installation of an enclosure system does not pose any formidable problems." (Attachment 1 to docket item II-E-92), and ". . . technically, enclosures could be designed to effectively capture VOC emissions from the spin cell area and provide worker access." (Page 2 of docket item II-D-68).

One representative noted that his company has studied the possibility of recovering fugitive acetone emissions from their filter tow process. He noted that enclosures are the most viable capture system to pursue but that it is not now economically attractive. He estimated that an enclosure system would have an approximate 5-year return on investment (docket item II-D-68).

Finally, enclosures are being successfully used on a filter tow spinning facility in Japan, confirming EPA's position that they are appropriate as control technology on new and reconstructed filter tow facilities that would be subject to the NSPS.

2.2.2 Comment (IV-D-3, IV-D-4):

Two commenters claimed that enclosures do not meet the requirements for best demonstrated technology for the cigarette filter tow industry because they have not been demonstrated for domestic facilities. Commenter IV-D-3 also stated that enclosure technology has not been demonstrated for many acrylic fiber production areas and is not representative of technology employed by this category.

Response:

The commenters' use of the term "best demonstrated technology" is a reference to Section 111(a)(1)(C) of the Clean Air Act, which specifies that a standard of performance ". . . reflects the degree of emission reduction achievable through the application of the best system of continuous emission reduction which (taking into consideration the cost of achieving such emission reduction, and any nonair quality health and environmental impact and energy requirements) the Administrator determines has been adequately demonstrated for that category of sources." EPA normally refers to this system of continuous emission reduction as "best demonstrated technology" or BDT.

The commenters have interpreted the Section 111 requirement that the system be adequately demonstrated as meaning that it be in actual use at each type of existing facility in the category of sources being regulated and that it be achieving the level of the NSPS for which it is the basis. EPA interprets the requirement more broadly. Control technology can be considered BDT if it can be shown to be the best system demonstrated for the category of sources, not necessarily on the category of sources. This means that a system used in an entirely different industry using a different process from the one being regulated can be BDT if its performance would not be affected by the differences in the sources. Similarly, a system used in some segments of the industry being regulated, or in some parts of the process, but not others, can be considered BDT for all segments or all parts of the process if investigation of the relevant variables reveals no reason that it cannot be designed, installed, and operated so that it achieves the same emission control under all the conditions in which it would be applied.

This interpretation of the term "demonstrated" has been upheld in the courts. As stated by the D.C. Circuit in Portland Cement Association v. Ruckelshaus, 486 F.2d 375, 391 (1973):

> "We begin by rejecting the suggestion of the cement manufacuturers that the Act's requirement that emission limitations be 'adequately demonstrated' necessarily implies that any cement plant now in existence be able to meet the proposed standards. Section 111 looks toward what may fairly be projected for the regulated future, rather than the State of the art at present, since it is addressed to standards for new plants - old stationary source pollution being controlled through other regulatory authority."

EPA believes that enclosure technology as a means of capturing VOC emissions from sources in synthetic fiber processing facilities meets these criteria (as explained in the response to comment 2.2.1) and therefore represents BDT for the industry.

2.2.3 Comment (IV-D-3, IV-D-4):

Two commenters stated that the 90 percent capture efficiency for enclosures that is part of the basis for the NSPS is not supported by adequate documentation or data. They also contended that since enclosures must be opened frequently to allow worker access to equipment, the 90 percent capture efficiency is not supportable. Commenter IV-D-3 estimated that enclosures could capture no more than 86 percent of VOC emissions. He apparently based this efficiency on an estimate that enclosures would be open, rendering the system ineffective, for 8 to 19 percent of the time and that overall out-of-service time for the enclosures would be about 14 percent.

Response:

As indicated in the preamble to the proposed NSPS (47 FR 52936), the 90 percent capture efficiency used by EPA to calculate achievable emission reductions was based on solvent use and emission data collected for fiber production facilities of several companies. Emission tests were conducted and solvent mass balance data collected at acrylic fiber plants that use enclosures (docket items II-A-19, II-A-20, II-B-99).

Although these data indicated that the tested plants were achieving about 95 percent capture with their enclosures, EPA selected 90 percent to account for the more frequent opening of enclosures to allow worker access that is necessary at filter tow facilities (estimated at 14 percent based on information provided to EPA by commenter IV-D-4 (docket item II-D-68)).

In order to respond to commenter IV-D-3's concern that the opening of enclosures for as much as 19 percent of the time would further reduce the capture efficiency of the enclosures to 86 percent, EPA recalculated the efficiency. (For the detailed calculation, see Appendix A.) The calculation indicates that under these worst-case conditions, the lowest capture efficiency would be over 91 percent, not the 86 percent claimed by the commenter. Therefore, EPA continues to believe that enclosures on fiber processing facilities can consistently achieve greater than 90 percent capture.

2.2.4 Comment (IV-D-3):

One commenter criticized EPA for not having a standardized method for measuring capture efficiency and referred to a memorandum written by EPA's contractor that indicated the lack of a test method to measure capture efficiency created a problem in determining emission rates. The commenter also cited a memorandum written by EPA's Office of General Counsel regarding capture efficiency as it relates to the NSPS for rubber tire manufacturing. The memo discussed the need to specify an acceptable method for measuring capture efficiency since it was an integral part of the rubber tire standard.

Response

Although an acceptable test method for directly measuring capture efficiency of enclosures at synthetic fiber plants would have been helpful during development of the proposed NSPS, it was not essential and is not needed to show compliance with the standard. EPA was able to determine capture efficiencies of enclosures through use of solvent mass balances, emissions data, and other industry-provided information (see response to comment 2.2.3) to determine the level of VOC emission control reflected in the standard.

The standard itself does not require determination of capture efficiency. Rather, it requires a calculation involving plant records of solvent flow and/or polymer flow into and out of the affected facility. While the OGC opinion may be appropriate for the rubber tire NSPS, it is not relevant to the synthetic fibers NSPS because it requires a different means of demonstrating compliance that does not involve determination of capture efficiency.

2.2.5 Comment (IV-D-3, IV-D-4):

Commenter IV-D-3 asserted that capture efficiency of an enclosure is decreased by the efficiency of the ultimate control device (e.g., carbon beds). He noted that if a carbon bed is estimated to be 92 percent efficient, then the total capture efficiency of the enclosure could be no more than 80 percent (0.86 x 0.92 = 0.79). Commenter IV-D-4 said, ". . . because vapors captured by the enclosure must be routed subsequently to other control devices (e.g., carbon beds), a 90 percent enclosure efficiency is not supportable or realistic."

Response:

Both commenters are apparently referring to overall control efficiency rather than capture efficiency. Capture efficiency is the amount of a substance collected or captured by the enclosure compared to the amount released by the source enclosed. Thus, any downstream treatment by a control device has no bearing on capture efficiency. It should also be noted that in the BID the only application for which a carbon bed was specified to be 92 percent efficient at synthetic fiber production facilities is one treating filter tow dryer emissions which have unusually high relative humidity. All other carbon beds operated in the synthetic fibers industry can achieve over 95 percent efficiency, as discussed in the BID and preamble.

2.2.6 Comment (IV-D-3, IV-D-4):

Two commenters claimed that the use of enclosure technology on filter tow facilities would create a safety hazard because acetone concentrations within the enclosures could build up to explosive levels within 30 seconds. They acknowledged that a foreign producer uses enclosures in filter tow facilities but believed that the fundamental differences (spinning line speeds) in the foreign and domestic operations make transfer of this technology to domestic operations inappropriate. They expressed concern that the manual activation of safety systems used by the foreign producer would not be fast enough to rely on to prevent an explosion within the 30 seconds it would take for a potential explosion to occur.

Response:

The safety of enclosures on filter tow facilities was a subject of several meetings and communications between EPA and commenter IV-D-4 during development of the proposed NSPS (docket items II-B-76, II-B-92, II-E-87, II-E-89, II-E-91, II-E-92, II-E-94, and others). All the points regarding safety raised in their comment on the proposed NSPS were considered by EPA prior to proposal. As discussed in Chapter 4 of the proposal BID, EPA is aware that domestic producers would not rely solely on manual activation of safety features to avoid explosions within enclosures. The system envisioned by EPA would be designed such that the exhaust fans would be interlocked mechanically, electrically, or otherwise with the spin cell extrusion pumps. Should the exhaust fans fail, fiber would no longer be produced, additional solvent would not be released into the enclosure, and the enclosure doors would open automatically. This would allow dilution and diffusion of the solvent vapor into the room air.

EPA does believe that manually opening the enclosure doors is a reasonable and dependable backup or failsafe method of preventing the buildup of explosive vapor concentration. It should be noted that workers currently must observe the machines constantly to respond immediately to spinning machine malfunctions and "roll breaks," or "feed wheel wraps." (These terms, used by two different fiber producers, both refer to the malfunction in which fiber exiting the spin cell is wrapped around the godet roll. The wrap will become larger as more fiber is wound, and will cause more serious problems if not cut and removed quickly.) Thus, workers are always available to open the enclosure doors should the automatic opening system fail to operate when needed.

EPA believes that due to the automatic safety features that would be designed into an enclosure system, the occurrence of an exhaust fan shutdown with the simultaneous continued release of solvent into a closed enclosure is very unlikely. Should such a situation occur, however, EPA agrees with the commenters that workers would need enough time to respond to avoid an explosion. The commenters suggest that the workers may have no more than 30 seconds to manually open the enclosure doors but do not provide any supporting data.

To evaluate this claim, EPA calculated the amount of time required for solvent concentrations to reach the lower explosive limit (LEL) within an enclosure under worst case conditions. Data collected prior to proposal of the NSPS (primarily from commeter IV-D-4) were used to make the calculations.

Two situations were evaluated: one is a pilot enclosure system designed by commenter IV-D-4 and the other is a system for a hypothetical 50 million pound per year plant. For both situations, it is assumed that fiber spinning continues after the exhaust fan stops suddenly and the enclosure doors remain closed. EPA's calculations indicate that it would take 2.4 minutes to reach the LEL at the pilot system and 5.1 minutes to reach the LEL at the hypothetical plant. There would be an adequate amount of time in either situation for a worker tending the machines to manually open the enclosure doors if the automatic door opener fails. (See Appendix B for the detailed calculations).

Thus, EPA believes that the enclosure systems that represent BDT for the proposed NSPS do not pose any risk of explosion that cannot be alleviated by proper design and operation.

2.2.7 Comment (IV-D-3, IV-D-4):

One Commenter (IV-D-4) claimed that the use of enclosures on spinning machines would negate current fire protection measures. He claimed that "enclosure systems connected to a control device would have unlimited oxygen supply and ready ignition sources." Another commenter (IV-D-3) noted that the spinning cabinets in use at domestic filter tow plants are isolated from each other, and cabinet fires are prevented from flashing over to other cabinets. He claimed the tow line enclosure would provide a connection between all the cabinets along a spinning line, so that a fire in one cabinet along a spinning line could ignite all the cabinets. This commenter also noted the danger of an "unlimited supply of oxygen," where enclosures are used.

Response:

The comments that an enclosure system would create an unlimited oxygen supply, ready ignition sources, and a convenient route for fire to spread from one to several or all the spinning cabinets on a line reflect an incorrect appraisal of a properly designed and fail-safe enclosure system.

Before responding, it is first important to make clear that fire can potentially propogate in two ways in a situation such as this. In one, the flame would propogate along the surface of the fiber, the potential for which would be the same with and without enclosures. In the other, the flame would propogate through the vapor space, a phenomenon described here as flashover.

The commenters in this case appear to be referring to flashover. This can only occur when there is a limited supply of oxygen, which causes vapor concentrations to be in the "explosive range." When there is too little oxygen, the vapor exceeds the upper explosive limit (UEL). When there is an excess of oxygen, the vapor concentration is below the lower explosive limit (LEL). In neither case is fire or explosion of the vapor possible.

The comments about an unlimited oxygen supply apparently refer to the continuous flow of air drawn into the enclosure by its exhaust system. The volume of air drawn into the enclosure, however, is established by the design of the enclosure and exhaust system so that the solvent vapor concentration is maintained well below the LEL during normal spinning operation. In other words, the vapor in the enclosure could neither ignite nor support a flame, and, as a consequence, a fire in one cabinet could not spread via the enclosure to other cabinets. The reference to an unlimited oxygen supply being a hazard or safety concern is, therefore, inappropriate.

The only upset condition germane to the discussion of oxygen supply or the flashover of fire from one to other spinning cabinets is the malfunction of the enclosure's primary exhaust system concurrent with continued spinning. In this situation, the air (oxygen) supply is no longer continuous nor unlimited but is fixed by the volume of the enclosure.

If no other safety features alleviate the malfunction, the solvent vapor concentration might approach explosive limits. (see the response to Comment 2.2.6 and Appendix B for a determination of the time required). However, the enclosure should be designed and equipped with secondary exhaust systems, alarms, automatically opening doors, and line shutdown interlocks with the spinning pumps. In addition to these mechanical features, operators are always standing by to correct this and other malfunctions. At worst, then, the malfunction would cause the safety mechanisms to create conditions identical to current operating conditions without an enclosure, i.e., the spun yarn and solvent would be exposed to the spinning room atmosphere.

With respect to the commenter's claim concerning an increased number of ignition sources, no further information was provided. No system designs considered to reflect BDT would affect the type or number of ignition sources already available. Note, however, that with the enclosure doors closed, worker access is prevented, and the solvent vapor is physically separated from the workers, from sparks or flames caused by tool malfunctions, and from any other ignition sources.

EPA concludes that enclosures can be designed and installed to create an effective solvent vapor capture system while maintaining operating conditions that pose no greater risk for fires or explosions than current operating conditions without enclosures.

2.2.8 Comment (IV-D-1):

One commenter requested that enclosures for crimpers at filter tow facilities should be considered an emission control option to be used only if necessary to meet the NSPS. He discussed difficult operating and maintenance problems that would be caused by crimper enclosures. He also indicated that the amount of residual solvent remaining on the tow by the time it reaches the crimper is miniscule.

Response:

EPA recognizes that the installation of enclosures on crimpers at existing plants would present unreasonably difficult operating and maintenance problems. However, EPA believes enclosures could be appropriately designed and operated for new facilities subject to the NSPS so as to present no particularly difficult operational problems.

Information provided in Table 6-8 of the BID, which reflects data received from several manufacturers, indicates that residual solvent at the crimper would not be "miniscule" but would amount to a significant percentage of total VOC emissions from the entire facility. However, if it is miniscule, control equipment would not be needed. It should be noted that the NSPS is an emission limit, not an equipment standard, and does not itself require enclosures for crimpers.

2.2.9 Comment (II-D-3, II-D-4):

Two commenters claimed that the use of enclosures would create worker exposure problems whenever worker access is necessary because the enclosures would concentrate acetone vapor to levels higher than permitted by OSHA and internal guidelines. The commenters further claimed that because of "rapid production rates and need for immediate worker access," it would not be possible to purge the enclosure prior to opening the access doors.

Response:

The commenters are correct in stating that the solvent vapor would be more concentrated with enclosures than without. However, testing at a plant that uses enclosures (docket item II-B-99) revealed that when a door is opened for worker access, substantial flow of air into the enclosure causes considerable dilution. Secondly, the tested plant uses a spinning solvent that is far more toxic than acetone (the TLV is 10 ppm vs. 1,000 ppm for acetone) and has effectively dealt with the personnel exposure problem through the use of work practices, as described below. It is therefore apparent that plants using acetone in spinning should as well be able to effectively control their solvent vapor so as to avoid personnel exposure problems.

One Japanese manufacturer has installed enclosures at filter tow spinning facilities not only for solvent recovery but also to limit worker exposure to acetone. In that country, the exposure limit is 200 ppm, compared to the OSHA limit in the U.S. of 1,000 ppm. The enclosures are always under negative pressure created by the exhaust fan. Tests showed (docket item II-B-99) that when an enclosure door is opened there is a large inflow of room air past the worker and into the enclosure, flushing the immediate area. Thus, there is is no need for a special system purge prior to opening an access door, and there would be no resulting production delay.

Where many doors are opened at once, as in the case of a "roll break," the concentrated vapor within the enclosure is immediately diluted and diffused into room air. This is the procedure followed by the Japanese acetate filter tow manufacturer, who also reports no problems with worker exposure. This is all the more significant in light of the lower personnel exposure limit. Therefore, EPA believes that worker exposure to acetone vapors can be effectively controlled to safe levels.

2.2.10 Comment (IV-D-1, IV-D-3, IV-D-4):

Three commenters said that although air management can be an effective tool to control solvent concentration pockets and reduce worker exposures, its use as an air emissions control technique is limited. Therefore, it should be considered only an optional and not mandatory method to be used if the affected facility cannot otherwise achieve the NSPS. Commenters IV-D-1 and IV-D-3 said that the costs and energy impacts of treating the large volumes of air in such a system should be evaluated. Commenters IV-D-3 and IV-D-4 said that air management has not been successfully demonstrated for domestic fiber production areas.

Response:

The air management control option to which the commenters refer was used by EPA as the basis for the VOC emission level achievable at cellulose acetate filament yarn processing facilities. Although they claimed the use of air management is "limited," the commenters did not identify or explain its limitations as a control technique. The standards do not require that air management be used, but this option is the best system that EPA found for controlling emissions at filament yarn processing facilities. It is currently being used at a filament yarn plant operated by commenter IV-D-1. Thus, it has been demonstrated for the type of facility for which EPA selected it as BDT. The increased costs and energy impacts associated with treating the large air volumes associated with this system were analyzed by EPA (see Chapters 7 and 8 of the BID) and were found to be reasonable.

2.3 SELECTION OF FORMAT OF THE STANDARDS

2.3.1 Comment (IV-D-1, IV-D-3, IV-D-4):

Two commenters suggested that the format of the standards should be changed to kg VOC per Mg fiber extruded (the proposed format was kg VOC per Mg solvent used). Commenter IV-D-1 suggested that the standards should be expressed in both formats. All the commenters said that many plants already keep records of solvent loss compared to the amount of fiber extruded. Commenters IV-D-3 and IV-D-4 also indicated that the proposed format would require unjustified expensive monitoring of multiple process streams and burdensome recordkeeping because the costs would be several times higher than the $5,000 estimated by EPA. They further claimed that the proposed format would allow VOC emissions to increase with increased solvent usage, and commenter IV-D-3 said that the proposed format would encourage such an increase.

Response:

The format for the proposed standards was selected by EPA to provide maximum flexibility to owners and operators of affected facilities in determining compliance. After a careful review of the commenters' points, EPA concludes that the format should not be changed. Even though the format is expressed in units of VOC emissions per unit solvent used, the procedures for demonstrating compliance in 40 CFR 60.603 allow the option of determining VOC emissions per unit of fiber extruded using existing plant records, as recommended by the commenters. To convert the result to units of the standards as expressed in 40 CFR 60.602, a simple multiplication of the solvent-to-polymer ratio for the affected facility is all that is required. Thus, the regulation accomplishes what the commenters suggested while allowing owners and operators to choose the procedure that is best suited to the situation. It also reflects the use of BDT at each facility, whereas an emissions per unit fiber format would not. A format of that type would have to be based on an assumed solvent-to-polymer ratio, which varies from plant to plant as discussed below.

EPA disagrees with the commenters' statement that the format of the standards would encourage increased use of solvent and higher VOC emissions. The commenter is apparently assuming that a company would change its solvent-to-polymer ratio to reduce the ratio of VOC emissions to solvent used. Information provided to EPA by all of the fiber producers indicates that a company very carefully selects a solvent to polymer ratio for process reasons, and that it usually has a small variability tolerance. To adjust the ratio in order to achieve apparent VOC emission reductions would likely adversely affect fiber quality. EPA believes that the marginal changes in apparent VOC emission reductions following a ratio adjustment would not justify such radical process changes.

EPA does not believe that the costs of solvent flow meters and associated recordkeeping are unreasonably expensive. Information (docket item II-B-38) submitted by several vendors of flowmetering equipment shows that totalizing flow meters with an accuracy of ± 1 percent over the operating range typically cost no more than $5,000 each. Some equipment of the type required costs as little as $2,000 per meter, including peripheral equipment. To be certain that the cost of metering equipment was not understated, new information was gathered after receiving the comment (docket item number IV-D-7 and IV-D-8).

This new information confirms that the totalizing flow meters cost less than $5,000 per unit. The number of units required at an affected facility depends on the facility's choice of format for reporting, the particular layout of pipes and tanks, and the process itself. However, EPA estimates that no more than 12 meters would be needed at a new facility to comply with the monitoring requirements (assuming the owner or operator chooses to meter all solvent flows rather than use the plant records procedure described above). At a maximum cost of $5,000 each, the total cost for the meters would be $60,000. Recording costs would be very small since only monthly totals would be recorded.

Therefore, the maximum cost for monitoring would be about 1 percent of the capital cost for the VOC emission control equipment, which in turn would be about 8 percent or less of the capital cost for new facilities. EPA considers these monitoring costs to be reasonable in light of the usefulness of accurate monitoring to assure the emission reductions intended under the standards.

2.4 ENVIRONMENTAL IMPACT

2.4.1 Comment (IV-D-6):

One commenter questioned the accuracy of the baseline emission rate and resulting emission reduction values for Model Plant 2 (dry-spun acrylic facility). He claims the only domestic dry-spun acrylic manufacturing facilities in the United States currently emit at lower rates than estimated for baseline (32 vs. 45 kg/1000 kg fiber) by controlling emissions from spin cell exits. As a result, emission reductions and solvent recovery credits are overstated, he claims.

Response:

The issue raised by the commenter is whether EPA should have assumed that a new dry-spun acrylic plant would install the same VOC emission control equipment currently used at existing plants. DuPont is currently the only domestic producer of dry-spun acrylic fibers. However, another company could enter the market in the future using a process different from DuPont's. The main reason that DuPont captures the dimethylformamide solvent (DMF) emitted at the spin cell exits is to protect worker health. DMF is highly toxic, with a threshold limit value (TLV) of 10 ppm. DuPont's capture and recovery of DMF results in a lower emission rate than would occur at a plant using a less toxic solvent that could be removed from a work area through room ventilation and exhausted to the atmosphere. Therefore, EPA believes it is appropriate to evaluate the impacts of the NSPS against the baseline assumptions that were presented in the BID.

To respond to the commenter's concerns, however, EPA calculated the emission reduction that would occur if new dry-spun acrylic facilities were identical to the DuPont plants. The VOC emission reduction at acrylic plants that is attributable to the NSPS would be about 1,500 Mg rather than about 2,000 Mg estimated in Table 8-14 of the BID. Even if the lower emission reduction were accurate, the cost per megagram of emission reduction would be as much as $266/megagram, instead of the $200/megagram projected by EPA. These costs are considered reasonable.

2.4.2 Comment (IV-D-6):

The commenter claims that in Table 6-6 of the BID, the Alternative III emission rate for Model Plant 2 should be 20 kg instead of 18 kg. This error, combined with the overstatement of the baseline emission rate (discussed in comment 2.4.1) results in an overestimated emission reduction potential.

Response:

The commenter does not indicate the basis for the 20 kg emission rate; however, confidential information provided earlier by this commenter (docket item II-D-94) was apparently the basis of this claim. Examination of solvent use and emission figures for two plants in the document reveal only minor variance from the EPA-developed values given in the BID, even when compared item for item within the totals. Further, emission value variation between the two plants described in the confidential document was slightly greater than the variation between the values for the plants and the EPA values. Therefore, EPA believes that stated emission values in the BID reflect the conditions expected at facilities operating under Alternative III controls.

2.4.3 Comment (IV-D-6):

One commenter noted an apparent mathematical error on the model plant representing Alternative III for dry-spun acrylics (page 6-23, Table 6-6). The make-up rate for Regulatory Alternative III should be 43 kg he claims, not 42 as shown, since the constituents are 18 kg (emissions), 20 kg (nongaseous losses) and 5 kg (residual in the fiber) for a total of 43 kg.

Response:

The correct value for total make up at the model plant is 42 kg per 1,000 kg fiber as presented in the BID. The apparent error noted by the commenter results from rounding up of the make-up rate constituent values to whole numbers for presentation in the BID. The value of 43 kg is the total of the rounded values.

2.4.4 Comment (IV-D-6):

The commenter stated that the EPA emission reduction estimate projected for 1987 is not accurate because there will be no new facilities subject to the NSPS through 1985.

Response:

EPA's growth projections are discussed in Section 2.5 of this document. EPA continues to believe that growth will occur and that significant emission reductions will result from the NSPS. The projected 1987 emission reductions are estimates and may be more or less than the actual reductions that will occur.

2.4.5 Commenter (IV-D-6):

One commenter noted that emissions for model plants (47 FR 52938, 3rd column, 1st paragraph) and 1987 projected facilities were not computed with the same capacity utilization; emissions for the former were computed based on 95 percent utilization, while the 1987 projected acrylic dry-spun affected facilities were based on 81 percent utilization. He thus claimed that EPA was "looking for the figure that is largest."

Response:

The 95 percent utilization rate was assumed for model plants to reflect normal operating conditions under a full market demand situation. EPA would be remiss if this condition were not evaluated, since it will be experienced by some or all new plants at least some of the time. On the other hand, there are other periods when plants are not fully utilized. A correct overall, long-term perspective on an annual basis must consider both. Therefore, a utilization rate of 81 percent was assumed as an annual average for new plants for a typical year. EPA was not "looking for the figure that is largest," but was trying to estimate emissions and costs under high production as well as nominal conditions. Using 95 percent instead of 81 percent to estimate emissions for individual plants did not affect EPA's decisions regarding the significance of the sources. Either utilization rate would cause emissions of more than 1,000 tons per year from an individual plant operating under baseline conditions.

2.4.6 Comment (IV-D-3):

One commenter felt that Regulatory Alternative II for acrylic/modacrylic production facilities (Model Plants 1 and 3) failed to include emission reduction requirements for polymer solutioning, or cutting and baling areas. This commenter claimed that "solvent losses from these areas will typically account for approximately 33 percent recovery of total solvent lost."

Response:

The commenter is correct in saying that EPA did not include emission reduction requirements for these areas. Model Plants 1 and 3 were developed to characterize wet-spun acrylic and dry-spun modacrylics, respectively. These model plants were reviewed on several occasions by industry representatives, and appropriate revisions were made to subsequent drafts; the parameters given in the BID reflect the most accurate information available to EPA.

Emission values for each 1,000 kg of acrylic fiber, as listed on pages 6-16 and 6-28 of the BID show that filtering/dissolving ("solutioning") amount to only 1 kg of the 40 kg emissions, and that total solvent lost (which equals makeup) equals 70 kg. Likewise, the emission value shown for the cutting/baling area is 1 kg of the 40 kg emission losses or 70 kg total losses. Emission values for each 1,000 kg of modacrylic fiber show that emissions from solutioning amount to 5 kg of the 140 kg emissions or 155 kg total solvent loss. Industry reports that the solvent residual in the fiber after drying is very low (as low as 0.5 percent by weight). Thus, it is not possible that substantial amounts of solvent, relative to total solvent loss, could be released after the drying stage; the negligible solvent released in the cutting and baling area is not sufficiently concentrated to permit economic recovery. None of these emission values approaches 33 percent of total solvent loss or total solvent emissions.

EPA did not include emission reduction requirements for these areas because the emissions are small relative to either total emissions or total solvent loss, and it would not be technically or economically feasible to attempt recovery. However, should there be a new process development that causes more solvent to be emitted at these points, they would probably need to be controlled to achieve compliance with the NSPS.

2.5 COSTS AND ECONOMIC IMPACTS

2.5.1 Comment Summary (IV-D-6, IV-D-3, IV-D-4):

One commenter (IV-D-6) claimed that the 1982 and 1987 production forecasts for acrylics as given in Table 7-1 are overstated. He further stated that current capacity will be adequate through 1987. Two commenters (IV-D-3, IV-D-4) claimed that the in-house regression equations used by EPA to project growth in the industry are oversimplified, and do not yield results consistent with traditional and historically proven industry forecasting authorities (Stanford Research Institute, Textile Industries, and the Chemical Economics Handbook). Citing a current domestic production capacity utilization rate of 74 percent (Textile Organon, July, 1982), commenter IV-D-3 stated that reliable industry forecasts predict that no new production capacity will be needed during the next five years.

Response:

EPA made its 1983-87 growth projections for acrylic and modacrylic fibers and cellulose acetate and triacetate fibers using both published sources referenced by the commenters and in-house regression analyses. Published projections definitely were not ignored. In fact, the projections sections of the Synthetic Fibers Production Facilities BID (pp. 9-36 to 9-44, 9-60 to 9-69) discuss nearly all of the sources suggested by the commenters. EPA found that many of the projections reviewed did not cover the time period (1983-1987) and/or variable of interest. Where appropriate, EPA did use the published projections as well as its regression results in performing its analysis.

EPA also found that there was quite a difference in the growth rates forecast by the published projections. EPA addressed these variations by selecting a projection range bracketed by a high and low production projection for all three solvent spun synthetic fiber commodities projected in Chapter 9. These commodities were: acrylics and modacrylics, acetate textiles, and acetate filter tow. For two of these commodities, acrylics/modacrylics and acetate textiles, the low growth projection embraced the contention of some of the commenters that there would be no new plant construction in the projection period (BID, p. 7-2).

Table 2-2 provides a summary of the projections considered. Both Textile Industries and Textile Organon have published projections for domestic consumption of acrylic and modacrylic fibers, but neither source specifically addresses production. Projections have appeared in Chemical and Engineering News but the bases and sources of these projections are not specified, and the period of "long-term" 1 percent growth is not

Table 2-2. SUMMARY OF GROWTH PROJECTIONS CONSIDERED

Fiber products projected	Source*/ date	Period of projection	Projected annual growth rate (%)
Acrylic fiber production	DRI Winter 1979	1978-90 1982-85	2.3 5.6
Acrylic fiber demand	C&EN 12/1/80	"long-term"	≤ 1.0
Acrylic fiber -domestic mill consumption	Textile Industries 2/79	1982-87	1.6
Acrylic fiber -domestic consumption	Textile Organon 1/81	1979-85	2.7
Acrylic fiber production	Regression analysis, 1982	1981-87	2.8 ('81) to 2.4 ('87)
Acetate textile fibers	CEH 11/76	1975-81	-3.5
Cigarette filtration tow		1975-81	4.8
Acetate and rayon domestic fiber consumption	Textile Industries 2/79	1977-87	-2.0
Acetate textile fiber production	Regression analysis,	1981-87	1.0 ('81) to 0.9 ('87)
Cigarette filter tow production	Regression analysis, 1982	1981-87	4.7 ('81) to 3.6 ('87) or 7.2

*Full references contained in Chapter 9 of BID dated. Data Resources, Inc. (DRI), in its publication Chemical Review (Winter, 1979), provides production projections through 1987 based on data through 1978. DRI's compound growth projection of 2.3 percent from 1978-1990 compares favorably with EPA's linear regression. The Textile Industries projection was ultimately used by EPA for the lower bound projection of acetate fiber production.

Published growth projections for cellulose acetate and triacetate textile fibers in Textile Industries do not separate acetate from rayon fibers and rayon production greatly exceeds acetate fiber production. Thus, rayon dominates the classification and the projection. The acetate textile projections available from the Chemical Economics Handbook (CEH) were based on 1975 data. Newer projections are now available from CEH, but these projections still cover only the first part of the projection period. Currently, CEH projects very modest growth in total acetate and triacetate fiber production through 1984. Acetate textile fiber production is projected to decline, but increases in cigarette filtration tow production are expected to slightly outweigh this decline. The growth projections EPA ultimately used, in conjunction with current capacity utilization, resulted in forecasts of no new acetate textile fiber plants under either the low or high growth estimates and two to four new cigarette filtration tow plants under the low and high growth estimates, respectively.

The regression estimates employed by EPA to supplement published projections have been constructed in accordance with accepted methodology. The regression methodology employed is discussed in Chapter 9 of the BID, and, for the purposes of projecting emission potential, is as complete and sophisticated as is possible given data and resource availability.

2.5.2 Comment (IV-D-1):

One commenter contended that, while the demand for domestically produced cigarette filter tow is likely to grow over the projection period, additional production of that commodity could be met by shifting acetate textile fiber capacity to filter tow production. This would be feasible because the commenter projects a decline in acetate textile fiber demand and production.

Response:

While EPA does not project any new acetate textile fiber plants, its examination of recent production levels (1975-1979) indicated a stabilization in production of the product after dramatic production declines in the 1970-1975 period. By 1980, most of the excess capacity in the acetate textile fiber sector had been eliminated. (Capacity utilization in 1980 was over ninety-two percent.) Moreover, the time trend in production over the 1975-1979 period showed a slight increase (one percent per year). As a result, EPA concluded that during the projection period, excess acetate textile fiber capacity would not be available to augment the current cigarette filter tow capacity. Consequently, any substantial increase in the demand for production of cigarette filter tow would necessitate new plant construction.

2.5.3 Comment (IV-D-6):

One commenter claimed that the credit for recovered solvent was overstated because the full market price was used in calculating the credits. The commenter explained that a fiber producer who also is a manufacturer of the solvent in question will not get the credit for full savings, but only for the actual costs of manufacturing and transportation.

Response:

The decision to use the market prices of solvents to calculate recovery credits was based on generally accepted economic principles. In a competitive setting, market prices represent the opportunity cost of resources. Internal accounting valuations often reflect sunk costs or market structure phenomena which, while real enough to the firm, do not best reflect the value of a good to the economy as a whole. The economic concept of opportunity cost as reflected in market prices should be the basis for an economic analysis of a standard. To argue, as these commenters have, that the internal opportunity cost of their solvent production equipment is zero is in conflict with the premium (as embodied in price) that the external market appears to place on that equipment.

2.5.4 Comment (IV-D-1, IV-D-3, IV-D-4):

The commenters noted that capital costs for model plants did not include costs for utilities and polymer manufacturing. They indicated that if present domestic acetate fiber plants run at full capacity, there would likewise be no excess polymer capacity available to supply a new filament or cigarette tow spinning facility. Commenter IV-D-1 cited the high cost of polymer manufacturing equipment (stainless steel, etc.) and utilities such as coal-fired steam boilers, which when added to the cost of a new spinning facility, would drive the product cost beyond the competitive range with substitute fibers or imports. Another commenter (IV-D-4) said the actual cost to a manufacturer for increased fiber production should include the cost of new polymer manufacturing capacity.

Response:

The commenters are correct that the model plants for cellulose acetate fiber production do not include polymer manufacturing capacity (e.g., acetate flake capacity), and the capital costs of polymer production facilities are not included in new plant costs. This does not mean that polymer costs are ignored. In the analysis, market prices are used to estimate polymer costs to new plants. In a competitive setting, market price represents the economic opportunity cost of any resource. In particular, market price covers all the costs of production, including payments on principal and interest, and therefore embodies the capital costs associated with the production of the polymer. Estimating future polymer prices therefore involves more than just forecasting the cost of future plants. If the polymer industry is operating near capacity (as is claimed), then the current market price used in the analysis may actually reflect a price premium corresponding to the additional cost of bringing new capacity on line.

2.5.5 Comment (IV-D-3, IV-D-4):

Two commenters claimed that the baseline capital cost for a new filter tow plant should be $104 million instead of $67.1 million shown in the proposal BID. Commenter IV-D-4 said that, as the builder of the last filter tow plant in the world, his company is uniquely qualified to provide cost data to EPA and had provided actual cost information documenting a $104 million estimate.

Response:

We agree with commenter IV-D-4 that his company is well qualified to estimate capital cost for new filter tow plants. The information supporting the $104 million estimate was carefully considered by EPA as was other information provided by his company and other companies. In response to an earlier similar claim, EPA explained in a letter to commenter IV-D-4 (docket item II-C-138), how the $67.1 million was derived and why it was considered to be the best estimate after evaluating all available information. The commenters have not provided any additional cost data to support their comment. Therefore, EPA believes the capital cost estimates for new filter tow plants should not be changed.

2.5.6 Comment (IV-D-3):

One commenter said that, based on a survey of actual costs, the additional capital cost required to achieve Alternative II control at acrylic/modacrylic production facilities (Model Plant 1) is understated. Where the Agency estimated the Alternative II incremental capital cost at $3.8 million, the commenter estimated it to be $6.3 million.

For Model Plant 4, the commenter disputed the incremental capital cost estimates contained in the BID associated with the increased control from Alternative II to Alternative III. Specifically, the BID estimates an incremental capital cost of $1.2 million; the commenter estimates these same costs at about $7.4 million, and claims EPA has understated these costs by 516 percent.

Response:

Because some of the text and a related table provided by this commenter made confusing and inappropriate comparisons, EPA contacted this commenter and asked for clarification. However, the commenter did not believe any revisions were necessary.

The commenter's claim concerning incremental capital costs for Model Plant 1, Alternative II were not supported by any information or data. For Model Plant 4, the commenter has inappropriately compared incremental costs to arrive at the 516 percent value above. He correctly shows the BID-reported incremental capital costs between Alternative II and Alternative III at $1.2 million. He claims this value should be $7.4 million, but the table of costs provided by the commenter shows that $7.4 million is his estimate of the additional cost required above baseline to meet Alternative III control. The commenter has thus incorrectly compared a baseline to Alternative III incremental cost ($7.4 million) with the EPA Alternative II to III incremental cost ($1.2 million).

Further it should be noted that the commenter has reported 1981-based costs, and is comparing these costs directly with 1980-based costs. Application of an inflation factor of about 10 percent for that period would significantly narrow the difference between the BID values and the commenter's stated values. The commenter's 1981 value of $7.4 million, if reduced by about 10 percent for inflation, would be $6.7 million for comparable 1980 dollars. EPA reports (BID Table 8-3) the incremental cost of control above baseline to Alternative III at $4.2 million. The appropriate comparison is therefore $4.2 with $6.7 million, a difference of 37 percent, not 516 percent.

EPA has received capital cost information from six plants that manufacture acrylic and/or modacrylic fibers. The reported costs for relevant process areas and items of control equipment at the various plants did not cluster about a single value, but rather showed a range of values. EPA recognizes that there are legitimate reasons for the variations, such as non-process related options, materials and quality of construction, and variations in the processes themselves. The values presented in the BID will therefore not necessarily reflect any given plant's costs exactly; EPA believes that the BID-presented costs are reasonably valid representations of costs at new or reconstructed facilities.

2.5.7 Comment (IV-D-3, IV-D-4):

Two commenters claimed that because the baseline capital cost for a new filter tow plant was underestimated by EPA, a re-evaluation of the cost-effectiveness using $104 million as the baseline capital cost would show the standards to be unduly burdensome. Commenter IV-D-3 also suggested that the same would be true for acrylic/modacrylic fiber facilities.

Response:

The baseline capital cost referred to by the commenters is the amount needed to build a new facility in the absence of the NSPS. It is used as a "baseline" against which to compare the costs associated with control equipment to achieve the NSPS. Thus, it does not affect the cost-effectiveness of the NSPS. Cost-effectiveness is a comparison of the increase in annualized costs (beyond baseline) to achieve the NSPS to the increase in the amount of emission reduction (beyond baseline). Thus, while the amount of baseline capital cost may affect a company's decision to build a new plant, with or without an NSPS in effect, it does not affect the cost-effectiveness of the NSPS. A higher baseline facility cost does result in air pollution control costs becoming a smaller percentage of the total cost of producing a product.

2.5.8 Comment (IV-D-3, IV-D-4):

Two commenters said that filter tow producers could not afford to build a new filter tow production facility because the high capital cost of a new plant would require a price increase of 50 percent if EPA's capital cost estimate for a baseline plant of $67.1 million is used, or 75 percent if the commenters' estimate of $104 million is used. The commenters claimed that there would be no new plants built, therefore, particularly since current prices of domestically produced filter tow are under serious pressure from foreign competition.

Commenter IV-D-3 suggested that substitutes for filter tow might be used by cigarette manufacturers if the price of filter tow increased significantly. He also recommended that EPA recalculate the growth forecast for filter tow by incorporating the 40 percent export market, considering the effect of price increases on the export market, and considering the excess capacity currently available. He also took issue with the EPA position that the demand for cigarettes is highly inelastic. The commenter felt that this assertion was disputed by recent significant decreases in cigarette consumption in both the United Kingdom and West Germany after the imposition of excise taxes. In addition, the commenter cited the American Tobacco Institute estimation of a 3 to 8 percent decline in 1983 domestic consumption of cigarettes following the imposition of an $0.08 per pack excise tax.

Response:

Acetate filter tow manufacturers have a legitimate concern about the international competitiveness of new facilities. Foreign exports make up about 40 percent of their market. It should be noted, however, that the high implicit prices for filter tow from new facilities originates almost exclusively from the cost of the facility, not from the cost of air pollution control. To the extent that foreign producers share the conditions that have resulted in such an increase in the baseline cost of cigarette filter tow from a new facility, the export market for domestic tow producers will probably remain strong.

Interaction between domestic and international makers of cigarette filter tow also depends on differing demand trends across markets. In particular, market penetration of filtered cigarettes is lower abroad than in the United States and will probably continue to increase outside the United States. Increased consumption of filtered cigarettes will result in increased demand for filtration tow. Thus the world market for tow will probably continue to grow.

Since available data and resources did not permit detailed analysis of the demand and supply relationship discussed above, estimates of the net effect of potential positive or negative influences on the competitiveness of domestic tow producers in the international market could not be made. EPA therefore selected the neutral assumption that domestic manufacturers would maintain their market share.

EPA's position that price increases for cigarette filter tow will have little effect on the export market derives in part from an assumption that the price elasticity of export demand is similar to the price elasticity of domestic demand. The estimate of the price elasticity of domestic demand for cigarette filter tow was derived from the price elasticity for cigarettes themselves. Cigarette demand is generally found to be highly price inelastic (see Source 90, BID). The demand for cigarette filter tow is estimated to be even more inelastic because it is only a small part of a cigarette cost. Accordingly, an increase in cigarette filter tow price is not expected to have a major impact on secular growth in acetate filter tow consumption.

The EPA analysis does not ignore the possibility of substitution in cigarette filter production, but it does judge such substitution to be of limited potential. It is believed that cigarette manufacturers experiment with alternate materials principally for longrun purposes, especially for incorporation in new brands. Since filter design affects the taste and therefore the desirability of a cigarette, manufacturers are extremely hesitant to substitute filter materials in existing brands (p. 9-91 of BID).

It is recognized that the U.S. position in the world filter tow market is not what it once was. However, the bulk of the decline in U.S. market share occurred some years ago. Throughout the 1970's the United States was responsible for 54 percent of world filter tow production. According to the most recently available data, the U.S. share appears to have been sufficiently stable over the last decade to justify an assumption of continued maintenance of its world market share.

2.5.9 Comment (IV-D-3, IV-D-4, IV-D-6):

One commenter (IV-D-6) said that EPA's capital cost estimate of $70 million for a baseline acrylic/modacrylic plant was too low. Commenters IV-D-3 and IV-D-4 said that the cost estimate for the cigarette filter tow plant was too low. All the commenters concluded that the underestimated capital costs resulted in implicit price estimates for the fibers that were too low. They suggested that higher capital cost estimates would result in correspondingly higher implicit fiber prices that would remove any incentive to build new plants.

Response:

EPA does not believe that larger new plant capital costs would dramatically change the results of the implicit price analysis. This is because so much of the product cost is related to the cost of operating inputs, and not to capital equipment (pp. 9-72 and 9-85 of the BID). In order to test this contention, EPA ran the implicit price model with the capital cost values suggested by the commenters. It was found that the implicit price of acrylics increased only four to nine cents over the baseline price of $2.45/kg; the implicit price of cigarette filter tow increased fourteen cents over the baseline analysis price of $3.47.

2.5.10 Comment (IV-D-3):

While granting that it may be possible to design adequate safety controls and monitors for enclosure systems at filter tow facilities, one commenter stated that the Agency has failed to adequately account for the incremental cost of such safety equipment systems. He referenced the December 8, 1981, memorandum titled, "Discussion of Potential Safety (Explosion) Problem Associated with the Use of Enclosures (Synthetic Fibers NSPS, ESED Project 80/15), (docket item II-B-86) and noted in his comment that equipment costs associated with the prevention of excessive risks were, "substantially greater than the total direct cost of $3.2 million estimated by EPA for the Alternative II control system stated in the BID, Page 8-10." He quoted the memorandum to read, "the equipment costs associated with the prevention of excessive risk are ...5 percent of the total capital cost for a new spinning process."

Response:

The equipment cost referred to in the December 8, 1981, memorandum was estimated to "amount to less than 5 percent of the total capital costs for a new spinning process." The wording was incorrect. It should have read "amount to less than 5 percent of the total control equipment capital costs above the baseline level for a new spinning process", not the total cost of a baseline plant. The commenter, in applying the 5 percent to the total capital cost for a new spinning process EPA baseline plant, arrived at a safety equipment cost of $3.4 million (.05 x $67.1 = 3.4).

Based on this, the commenter concluded that the $3.4 million safety equipment cost represented a "substantially greater" cost than the total direct cost of $3.2 million estimated by the EPA for the Alternative III entire control system, as stated in the BID, Page 8-10. The incremental capital costs above the baseline level for an acetate filter tow manufacturing plant (EPA model plant 4) are estimated to be $3.0 million, which represents 4.5 percent of the total capital cost associated with a baseline plant (Table 8-3 of BID). Consequently, the safety equipment costs are $0.15 million (0.05 x 3.0 = 0.15) and not $3.4 million, as was previously interpreted from the cited memorandum.

2.5.11 Comment (IV-D-3):

One commenter noted that the capital investment required to achieve emission reductions at polymer solutioning and cutting/baling areas in acrylic or modacrylic fiber plants would be $8.8 million. He noted that EPA had failed to include emission reduction requirements for these areas.

Response:

As shown in the response to comment number 2.4.6, the standards are not based on control of emissions from these areas because they are relatively small compared to total solvent emissions, and more difficult or expensive to capture relative to other emission points in the same plants. Because these emissions were not considered to be controllable, no capital or other costs were associated with these emission points.

2.5.12 Comment (IV-D-3):

One commenter indicated that Agency-generated operating costs associated with the regulatory alternatives are underestimated. This was supported, in the commenter's opinion, by the Agency not including the following two factors in its cost estimates:

(1) the additional cost of the water required to strip the solvent from the scrubber system and to maintain the solvent level in the fiber at or within product or process specifications, and

(2) the cost of the additional horsepower required to operate the large scrubber system.

Response:

Although not specifically delineated, the incremental costs for the items mentioned were included in the Regulatory Alternative II and III costs of increased control in Tables 8-4 through 8-8 in the BID. Docket items II-B-32, II-I-3, II-B-41, II-D-66, II-D-68, and II-D-22 provide complete information on the development of control costs for the factors noted by the commenter.

2.5.13 Comment (IV-D-6):

One commenter claimed that the operating conditions for scrubber #2 at a dry-spun acrylic fiber plant were incorrect. This scrubber is used to control and recover solvent emissions from the steaming/drying portion of the process, and requires 2,000 kg/h of demineralized water to achieve 98 percent scrubber efficiency, according to Table 6-6 in the BID. However, the commenter claims that engineering calculations performed for a similar scrubber indicate 3.5 times as much water would be required to achieve 98 percent efficiency.

Response:

The amount of water estimated for the scrubber was based on information from several manufacturing plants relevant to gas flow, scrubbing liquid flow, scrubbing efficiency, and other parameters. As well, manufacturers of scrubbing equipment were contacted for their assistance in determining correct parameters, and appropriate information was given to a firm that generates computer-aided scrubber parameters to obtain its estimate. All the above were considered in determining the model plant parameters the commenter questions. Assuming the commenter is correct, however, the increase in water usage would have a minimal effect on costs for utilities (an increase of about $2,900, or less than 1 percent of the $319,200 utilities cost in Table 8-5).

2.5.14 Comment (IV-D-6):

One commenter emphasized that a large portion of the current acrylic fiber production was and is being exported (29 percent in 1979, 25 percent in 1980, 28 percent in 1981). He claims that should the domestic demand increase to the point where total demand approaches total capacity, the industry would not consider new capacity, but instead simply reduce the export percentage to accommodate the domestic demand. This is asserted because, he claims, the domestic market is "more attractive." Thus, the commenter concludes, there is no need for new capacity, even though total production may soon approach existing capacity.

Response:

EPA performed an analysis using historic data on domestic and export acrylic shipments to determine whether the export market was a residual market as the commenter contended. This analysis is described in docket item II-B-84. It shows that the data suggested that domestic shipments and export shipments tend to move in the same direction, increasing and decreasing together. In addition, there is no correlation between the changes in the annual observations of the variables contained in the two time series. These facts suggest that the export market is not simply a residual market for the acrylic producers, that will be curtailed when domestic consumption of acrylics increases.

2.6 GENERAL

2.6.1 Comment(IV-D-6):

This commenter noted that Table 1-1 in the proposal BID expressed the expected Alternative II and III emission reductions as being a "moderate" impact, while an earlier draft of the BID (July 1981) expresses a larger reduction but characterized this as being a "small" impact. "There is an obvious inconsistency here in the assessment process," this commenter claims.

Response:

The first draft (July 1981) was in error; an 8,500 Mg per year emission reduction is not a small impact.

2.6.2 Comment (IV-D-6):

One commenter pointed out what he felt to be an inconsistency between the Regulatory Alternative II 1987 projected emission reduction shown on page 6-12 and 7-2 (31 percent to 44 percent) and the Alternative II emission reduction (31 percent to 47 percent) stated on page 52936, 3rd column, last paragraph of the Federal Register notice. These reductions are expressed for dry-spun acrylic and cellulose acetate filter tow production facilities, respectively.

Response:

The 31 percent to 44 percent range noted refers specifically to reductions achieved at the two type plants projected to be constructed by 1987, acrylic/modacrylic and cellulose acetate filter tow. Emission reductions for Alternative II shown in table 6-2 are for all the model plants developed, and not only for the projected facilities. The correct emission reduction range associated with all the model plants developed for Alternative II is 31 percent to 55 percent. This percentage reduction range as shown on Table 6-2 is consistent with table 6-3, "Summary of Control Options and Regulatory Alternatives."

The emission reduction range noted by the commenter on page 52936 of the Federal Register notice should reflect the emission reductions achievable through the use of enclosures when applied to certain process stages of the model plant types that can utilize enclosures (that is, all but Model Plant 5, for acetate filament.) The correct range at these plants as derived from Table 6-2, Table 7-1, or as noted the table on page 52938 of the Federal Register proposal notice is 31-44 percent. Thus, the range shown on page 52936, 31-47 percent, is indeed in error.

2.6.3 Comment (IV-D-6):

In reference to Chapter 8.0, Cost Analysis, one commenter claimed that the annual cost figures for two acrylic/modacrylic fiber plants (baseline, Alternative II, and Alternative III) presented in Table 8-14, Projected 1987 Cost Effectiveness of Regulatory Alternatives," page 8-21, do not correspond to the Model Plant estimates in Table 8-11, "Regulatory Alternative II Cost Effectiveness Compared to Baseline Costs," page 8-17, and Table 8-12, "Regulatory Alternative III Cost Effectiveness Compared to Baseline Costs," page 8-18.

Response:

The appropriate projected 1987 Model Plant annual cost figures for the baseline, Alternative II, and Alternative III estimates found in Table 8-14, were not derived directly from Table 8-11 and Table 8-12. For each selected model plant, the value for "Total Annual Expenses" from Tables 9-34 and 9-36, less polymer costs and adjusted for 81 percent capacity utilization, was multiplied by the projected number of new affected facilities for the years 1982 through 1987, to reflect the associated growth scenario.

Thus, the values in Table 8-14 reflect expected 1987 utilization rates and resultant costs; the values in Tables 8-11 and 8-12 reflect the model plants and their associated costs, all of which were based on 95 percent capacity utilization. (See Response 2.4.5.)

Because of rounding of solvent recovery credits, cost-effectiveness estimates for Alternative II and Alternative III and the totals associated with the high growth scenario have been slightly affected. These minor modifications are reflected in the revised Table 8-14 and associated text. (See Appendix C.)

2.6.4 Comment (IV-D-6):

One commenter noted that the summary paragraph on capital and annual costs (47 FR 52939) was not found in the BID, and that it was difficult to trace the development of the various figures.

Response:

Several reported values on Tables 8-14 involve compounded rounding. Direct comparison of this table in the BID to the specific values in the Federal Register notice is not possible. The values in each are, however, correct and comparable when rounding is accounted for. Appendix C includes for convenience a revised Table 8-14 and the accompanying text. Because of the difficulty this commenter had in tracing some of the figures in the Federal Register notice, the derivations and corrected values are provided below:

Capital costs of installed control equipment for Regulatory Alternatives II and III are $18.0 and $27.8 million respectively. From Table 8-3, these values are derived by adding twice the Model Plant 2 capital costs and four times the Model Plant 4 capital costs, for each alternative.

The capital costs of implementing Alternative II at individual projected plants is shown on BID Table 8-3 as $3.0 million; for Alternative III the costs range from $4.2 to $5.5 million.

"Annualized costs" for operating control equipment at all projected plants should instead read "annual operating costs," and are derived from BID Table 8-3 by adding twice the annual operating costs for Model Plant 2 and four times the annual operating costs for model plant 4. The corrected values thus determined are $3.8 million for Alternative II and $5.4 million for Alternative III.

The values for "additional solvent recovered" read for Alternatives II and III respectively, $3.8 million and 6.2 million (in the FR notice); the correct values should be $3.89 million and $6.20 million. These values are also found on the revised BID Table 8-14, in Appendix C. In the Federal Register notice, the "Net Annualized Costs" of $1.2 million to the industry for either alternative, and individual plant costs of as much as $0.2 million are found on the revised and original Table 8-14.

The phrase "Net Annualized Costs" as used in the table and the Federal Register notice means "increase in net annualized costs above baseline."

2.6.5 Comment (IV-D-3, IV-D-4):

Two commenters agreed with EPA's decision to exempt modified facilities from the NSPS.

Response:

No response necessary.

2.6.6 Comment (IV-D-2):

The commenter supports EPA's decision to delay development of an NSPS for viscose rayon.

Response:

No response necessary.

2.6.7 Comment(IV-D-3):

One commenter requested that information provided during development of the NSPS by three fiber producers be incorporated into the docket. This information from Celanese Corporation, E.I. duPont de Nemours and Company, and Eastman Kodak Company, is dated 7/3/80, 9/22/81, 11/30/81, 12/2/81, 12/3/81, 12/23/81, and 4/23/82, according to the commenter.

Response:

These comments were included in the rulemaking docket prior to proposal of the NSPS and were carefully considered by EPA in developing the proposed NSPS. The issues they raise are fully discussed in the BID, the preamble to the proposed standards, and the comment summaries and responses in this document. (See docket entries II-D-52, II-B-89, II-D-70, II-D-71, II-E-93, II-D-76, and II-D-97.)

2.6.8 Comment (IV-D-6):

One commenter noted an apparent inconsistency in values given for recovered solvent (BID Tables 8-4, 8-5, 8-6, 8-7, 8-8) and the supposed origin of these values in the model plant parameters given in Chapter 6. He notes that if the emission rates and indicated reductions as shown for the model plants are multiplied by the expected production rates, then the resulting emission figures do not agree with the recovered solvent figures on the Chapter 8 tables.

Response:

The commenter has erroneously compared rounded values with values calculated from more precise basic data. Tables 8-4 through 8-8 show recovered solvent amounts, and these precise values are used for computing the economic value of the solvent, as reported in Chapter 8. The derivation of these amounts is shown in docket item II-B-90. In other places in Chapter 8, however, these values were rounded for simplicity from thousands of kilograms to gigagrams, then the rounded values used in subsequent calculations (see Tables 8-11, 8-12, 8-13, and 8-14). The latter (rounded) values were used for descriptive purposes, not exact evaluations. Where economic impacts were considered, however, the more precise values were used (Tables 8-4 through 8-8).

Also, it should be noted that the emission values given for the various model plants in Chapter 6 have themselves been rounded to whole numbers. Any minor variation in these values, when multiplied by large production amounts, would result in apparent real differences. Emission reductions thus computed may not be as precise as the emission reductions shown on Tables 8-4 through 8-8 and on docket item II-B-90.

Thus, it can be seen that the variations are not errors of fact but rather the result of compounded rounding errors. No changes to the figures are considered necessary.

2.6.9 Comment (IV-B-5, IV-B-6):

A number of editorial comments were made by two commenters, and these are summarized in docket item IV-B-2.

Response:

None of the editorial comments or changes affect the standards, and no further response is necessary.

APPENDIX A

CALCULATION OF ENCLOSURE CAPTURE EFFICIENCY

Although not required by the standards, EPA has assumed in developing model plants for the industry that enclosures would achieve at least 90 percent capture efficiency. This efficiency was in part based on solvent mass balance data collected at plants where enclosures are now in use. In addition, both concentration and flow values at the enclosures were measured at one of the plants. These measurements and the information obtained from several fiber producers are the basis for EPA's calculation of enclosure capture efficiency, as described below.

EPA's test data indicate that while all enclosure doors are closed, the continuous exhaust creates negative pressure within the enclosure; consequently, vapor leakage from the enclosures does not occur. In fact, there is significant inflow of room air into the enclosures through all available openings, cracks, sheet metal joints, etc. Thus, while operating normally and with doors closed, the enclosure would exhibit complete capture and exhaust of any VOC released within the enclosure. For this reason, 100 percent capture during periods of normal operation was assumed for the time periods when the doors are closed.

During a portion of production time, one door is open, and capture efficiency is then dependent on face velocity into the enclosure through the opening, whether negative pressure still exists within the enclosure, and the degree of turbulence at the edges of the door opening. Testing performed on enclosures revealed that when one or two doors are opened, there is significant flow of room air into the enclosure. This flow is great enough to prevent diffusion of vapor into the room. (docket items II-A-15 and II-B-99) The only VOC losses at the door would be very low amounts due to turbulence. Room air concentration measurements made 4-5 feet from an opened door did not show any increase beyond background levels, although the VOC concentration within the enclosure was significantly greater than background levels. As well, measured exhaust flows from the entire spin cell enclosure were greater than the air flow into the enclosure via one or two open doors. Therefore, the remainder still comes in via the aforementioned cracks, leaks, and other openings. Since negative pressure is maintained even with one or two doors open, then it is seen that capture is still essentially complete. For the purposes of calculating overall efficiency, 99 percent will be assumed.

About half the time enclosures would need to be open, access to the entire line is necessary to repair "roll breaks" (tow line breaks). Because of this, all doors would be opened initially, then closed one by one as fiber from each spin cell is rethreaded and adjusted. (docket item II-B-76) [During this period, all doors would not necessarily be left open for the entire repair operation. All the doors would be opened initially, then closed one by one as repairs are made, until only one door remains open as the last spin cell is tended. It is then seen that the average area of opening (number of doors open) is half the entire possible area (all doors open), during the time access of any kind is required. This concept will not directly be used in computations, but is made to further support later developed values.]

Following the opening of all the enclosure doors, the concentration within the enclosures, initially at about 5,200 ppm or 20 percent LEL as reported by industry personnel (II-C-125 and II-E-86), would quickly be reduced due to diffusion and dillution, and approach room air VOC concentrations. The equilibrium concentration reached within the enclosure will be at least as great as the room air concentration. OSHA limits the room air concentration of acetone to 1000 ppm, and industry personnel report typical room air concentrations at about 800 ppm.

While the doors are opened and spinning repairs made, the enclosure exhausts will continue to operate. A finite amount of solvent VOC is captured as long as the exhausts continue to operate, regardless of the position of any of the enclosure doors. The exhausted VOC concentration will of course be lower than under normal operation, but will be at least as great as the room air concentration, shown above as about 800 ppm. The important point is that the enclosure exhibits some degree of capture, even with all doors opened. The amount of capture can be expressed as the ratio of vapor concentration with the doors closed to the vapor concentration with the doors opened. This ratio provides an indication of the efficiency of the entire enclosure.

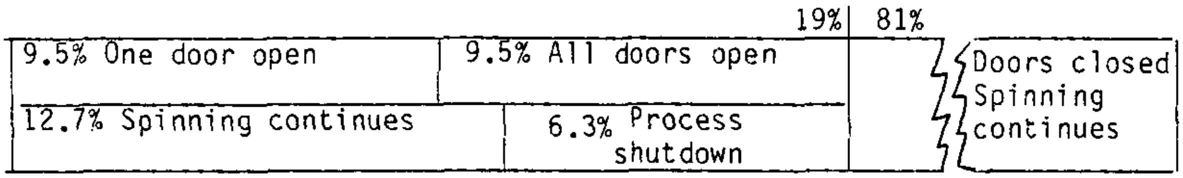
$$\frac{\text{Concentration of captured vapor with doors opened}}{\text{Concentration of captured vapor with doors closed}} \times 100$$

$$= \frac{800\text{ ppm}}{5200\text{ ppm}} \times 100 = 15\%$$

Capture efficiency was also based on information provided by the industry concerning the amount of time a hypothetical enclosure would be opened for required worker access: "...worker access to the individual spin cells is required approximately 14 percent of total production time." He noted that... during the time when worker access is necessary the enclosures would be less effective in capturing VOC emissions. During approximately half of the time access is required, it would be necessary to open at least one of the enclosure doors. The remaining time would require all of the enclosure doors to be open. [He] further estimated that approximately two-thirds of the time worker access is required, the spinning operation continues. The remaining one-third of the time requires a process shutdown.

One industry representative (IV-D-3) has indicated that during as much as 19 percent of total production time, access to the spinning machines is required. (This is significant, since one or more doors to a hypothetical enclosure would be opened during this period, and enclosure capture efficiency would conceivably be reduced.) Combining this information with the information in the preceeding paragraph, it is estimated that all doors would be opened (at least initially) during 9.5 percent (about one-half) of the total required access time, and one or two doors would be opened during the other 9.5 percent of the time. In addition, of the time access is required (19 percent), spinning continues for about 12.7 percent (two-thirds) of the time, and the process is shut down for the remaining 6.5 percent (one third). Information is not now available to reveal how these simultaneous events overlap (that is, for example, whether the process shutdown occur with one door open or with all doors open, on average). For the purpose of computing capture efficiency, the two extreme cases will be considered; actual capture efficiency would fall between the two extremes.

A. The first situation would yield the highest capture efficiency:



81% of the time doors are closed and spinning continues ....100% capture
9.5% of the time one door is open and spinning continues.... 99% capture
3.2% of the time all doors are open and spinning continues.. 15% capture
6.3% of the time process is shut down...................... -

These values could be used at this point to calculate overall capture efficiency, except for a further consideration. Since the process is shut down for a portion of the total time, it is not appropriate to consider capture or lack of capture during this period. Thus, the period of shutdown should be eliminated from consideration, or factored out in some appropriate manner. The spinning process continues for about 93.7 percent of total time (100 - 6.3); this should be considered as the available time, during which capture efficiency may be considered:

93.7 percent of total time = 100 percent available time

$$\frac{100\%}{93.7\%} = 1.067$$

This is the factor by which all other reported vaues should be multiplied to provide corrected values.

Thus, correcting for process shutdown:

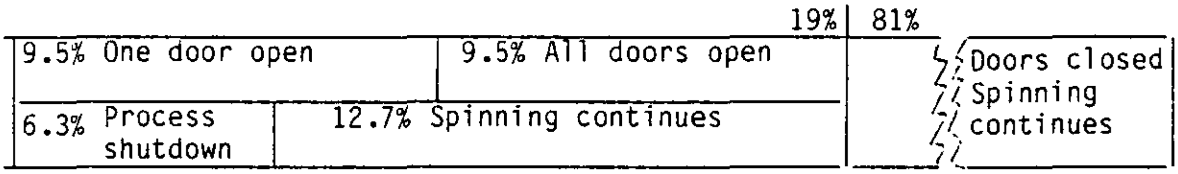
1.067 x 81.0 percent x = 86.4 percent available time
1.067 x 9.5 percent x = 10.1 percent available time
1.067 x 3.2 percent x = 3.4 percent available time

These values are then multiplied by the appropriate capture efficiency to determine overall capture:

86.4 percent available time x 100 percent capture = 8640
10.1 percent available time x 99 percent capture = 1010
3.4 percent available time x 15 percent capture = 51
9701

9701 ÷ 100 = 97%
overall capture efficiency

B. The second case and most conservative value is determined as follows:



81% of the time doors are closed and spinning continues.....100% capture
9.5% of the time all doors are open and spinning continues.. 15% capture
3.2% of the time one door is open and spinning continues.. 99% capture
6.3% of the time the process is shutdown.................. —

Determine the factor for the period of process shutdown:

93.7 percent of total time = 100 percent of available time

$\frac{100\%}{93.7} = 1.067$

Again, correcting for process shutdown:

1.067 x 81.0 percent total time = 86.4% available time
1.067 x 9.5 percent total time = 10.1% available time
1.067 x 3.2 percent total time = 3.4% available time

The corrected values are again multiplied by the appropriate capture efficiency to determine overall efficiency:

86.4 percent available time x 100 percent capture = 8640
10.1 percent available time x 15 percent capture = 151
3.4 percent available time x 99 percent capture = 337
9128

9128 ÷ 100 = 91.3%

This value represents the worst case, most conservative conditions. For the purposes of model plant parameters and calcuations relative to solvent recovery, this value is rounded down, again conservatively, to 90 %.

APPENDIX B

SAFETY CONCERNS WITH THE USE OF ENCLOSURES

In developing control options for the standards, EPA has envisioned enclosures that would capture solvent vapor evolved from the spun fiber, and vapor pumped or pulled along with the fiber as it leaves the spin cell. In the absence of enclosures, this vapor would be diluted with room air and exhausted to the atmosphere. By limiting dilution air and controlling the vapor concentration, the enclosures would actually permit the solvent vapor within the enclosure to be concentrated sufficiently to make the solvent economically recoverable using carbon adsorption or scrubbing, but not so concentrated as to present a hazardous condition.

The amount of solvent released into an enclosure is dependent on two sets of parameters: those related to the fiber and its spinning step, and those related to the design and operation of the enclosure. Fiber-related parameters include extrusion rate, fiber denier (size) and shape, type of solvent, the size of the opening at the base of the spin cell through which the extruded fiber exits, and the pressure maintained within the spin cell. The enclosure-related parameters are air temperature and the relative pressures in the spin cell and the enclosure.

To insure high quality, a fiber manufacturer would attempt to keep all of these parameters constant for a given product; under steady-state conditions the amount of solvent released into an enclosure would be constant. For this reason, it should be possible to design the exhaust rate of the enclosure such that the solvent vapor concentration can be maintained at any desired level. One company has claimed that the exhaust flow rate for a new 50 million pound per year facility would be about 12,000 cfm, and the concentration would be about 5200 ppm or 20 percent of the LEL for acetone. (II-D-71, II-D-81, II-E-86). The obvious conclusion is that during normal operation, explosive conditions would not exist nor could the solvent vapor in the enclosure support a flame.

The discussion reduces to the safety of the enclosure only during upset conditions (for example, when an enclosure exhaust fan fails). Based on information provided by the industry, the following conditions occuring simultaneously could possibly create unsafe situations: (1) the enclosure's primary and backup exhaust systems fail, (2) the evolution of solvent vapors into the enclosure continues, and (3) the enclosure doors remain closed at least until the lower explosive limit is reached. EPA believes preventive measures can be included in the design of the exhausts, enclosures, spinning equipment, and safety mechanisms such that explosive conditions would be avoided. Obviously, there could be many variations of this system, but as a minimum the following are significant design considerations:

- The primary exhaust system would be connected to a warning (horn, light, etc.) system.
- A backup exhaust system would also be connected to the primary system for automatic emergency activation.
- The primary and/or backup exhaust systems would be interlocked such that failure of one or both would cause the spinning machine to shut down, and the enclosures doors to open.
- The enclosure doors would be spring-loaded or otherwise set to be opened, and pneumatically or mechanically held shut under normal operation.
- Employees that constantly tend the machines would recognize a malfunction (fan failure) and could open the enclosure doors manually if the automatic system failed. Estimates show they would have a minimum of 2 1/2 minutes before flammable conditions developed. (see page B-5)
- Once the doors are opened, any vapor present would quickly diffuse into the room, preventing any further buildup toward the LEL, i.e., the concentration in the area of the enclosure would quickly approach that of the spinning room.

Regardless of the exact design, the general approach is feasible, and in fact, representatives of two domestic companies have noted that their firms either operate such systems or have agreed that such designs are feasible. In summary, the design of the enclosure, exhaust fans, spinning pumps, and safety interlocks would prevent the vapor concentration within the enclosures from reaching an explosive or flammable level.

Nevertheless, some industry officials have questioned the use of enclosures, and have claimed that the enclosures would provide "ready ignition sources", an "unlimited oxygen supply", and would "negate current fire protection measures."

With respect to "ready ignition sources," (see docket items IV-D-3 and IV-D-4) no further information was provided by the commenters to identify these sources. No changes are being considered that would affect the number or type of ignition sources already existing. The enclosures do not increase the risk associated with additional ignition sources. In fact, since the enclosure vapor is not flammable, if there is a source of ignition, then the flame could not be transmitted to other spin cells through the enclosure.

The existing ignition sources are: (1) the fiber itself, (2) cabinet fires, and (3) static electricity. Although these sources do currently exist, the presence of enclosures would not affect the level of risk from these ignition sources, based on the discussion of fail safe mechanisms. Note that with doors closed, worker access is prevented, and possible ignition sources such as nonapproved tools are separated from the vapor.

The commenter's claim of unlimited oxygen supply may be a reference to the continuous flow of air into the enclosures that is generated by the exhaust fans. There appears to be a concern that in the event of a fire within an enclosure,* air would be continuously provided and would thus promote a still larger fire. Although the exhaust fans continuously draw room air into the enclosures, it is difficult to recognize how this situation would somehow provide an unlimited oxygen supply. The only entrances for air are via the small opening for spun fiber at the base of the spin cabinet, the cracks between doors and other places, or through designed vents. Because these are restrictive openings, they would not provide an "unlimited" supply of oxygen, but as discussed earlier, the continuous flow of air (oxygen) prevents the vapor concentration from approaching explosive or flammable levels. If the exhaust

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*Such a fire is assumed to be possible only for the sake of discussion.

were to fail, the failsafe mechanisms would, by opening the enclosure doors, preclude the development of explosive conditions and duplicate currently existing conditions.

Determination of Minimum Time to Achieve LEL

To insure that the worst-case conditions are examined, however, a situation in which the above design features nevertheless fail will be considered. The most important factor then becomes how long it will take for an explosive concentration to develop within the enclosure, and the length of time it will take for a nearby operator to recognize the condition and manually open the enclosure doors.

To determine the explosion risk under abnormal conditions, EPA has collected relevant information from a number of plants, and has calculated the minimum time to reach the LEL, given the data received from the industry. Because the information describes both real and hypothetical cases, two separate calculations were made.

A. Determination of Time to LEL Based on Pilot System

To determine minimum time to reach the LEL, it is necessary to determine: (1) the mass of vapor released during a given period (2) the size of the particular enclosure (3) the LEL concentration (4) the density of the solvent vapor (5) initial concentration within the enclosure:

1) An industry representative reported in earlier communications that the dope extrusion rate at a pilot enclosure was 5.2 lbs/min (2.36 Kg/min). He also reported that 5 percent of the weight of the extruded dope would evaporate as solvent between the spin cell exit and the crimper (the area enclosed). Thus, 0.05 x 2.36 lbs/ min = 0.118 kg/min = evolution rate of solvent.
2) It was also reported in the same communication that the enclosure volume was 200 ft^3. (5.66 m^3).
3) The LEL for acetone, used at this facility, is about 2.6 percent by volume (minor variations would result from temperature, changes and levels of O_2 and other gasses.) This also may be expressed as 26,000 ppm.

4) The density of the solvent (acetone) vapor at 80 °F is about 0.067 kg/ft^3. (2.37 kg/m^3).

5) The steady-state concentration is 20 percent LEL = 5200 ppm

Using the above, minimum time to LEL can be determined for the enclosure, assuming the exhaust fan stops suddenly and completely and that all enclosure doors remain closed.

Calculate weight of acetone within the enclosure initially:
5.66m^3 x 5200 ppm x 2.37 kg/m^3 = 0.070 kg

Calculate weight of acetone within the enclosure at the LEL:
5.66m^3 x 26,000 ppm x 2.37 kg/m^3 = 0.349 kg

The difference is the additional acetone required to achieve LEL:
0.349 kg - 0.070 kg = 0.279 kg

We know the rate of evolution is 0.118 kg/min, therefore it will take 0.279 ÷ 0.118 = 2.4 minutes to achieve the lower explosive limit within this enclosure.

B. Determination of Time to LEL Based on Hypothetical Facility

One company has provided information on enclosures at a hypothetical 50 million pound/year plant (22.7 gigagrams). This company has suggested that although their pilot enclosure has operated at about 8-10 percent LEL, the optimum concentration would be about 20 percent LEL. As well, such enclosures would exhaust enclosure air and solvent vapor at about 12,000 cfm (339.8m^3).

1) These two parameters determine the mass of solvent that would be released into the enclosure, since mass x flow rate = concentration. The vapor at 20 percent LEL (5200 ppm) exhausted from the enclosure would contain the following mass:

exhaust rate x concentration x density (80°F) = mass exhausted

$$\frac{339.\text{m}^3}{\text{min}} \times \frac{5{,}2000 \text{ parts acetone}}{1000{,}000 \text{ parts air}} \times 2.37\ \frac{\text{kg}}{\text{m}^3} = \frac{4.19 \text{ kg}}{\text{min}}$$

2) It is also necessary to determine the volume of a hypothetical enclosure as a preliminary step to determining time required to achieve LEL. Information provided earlier by one company noted that a pilot system that could extrude 2.36 kg of dope/minute was enclosed, and the volume of this enclosure was about 5.66m^3. A plant that produces 50 million

pounds per year would extrude 200 million pounds (90.7 gigagrams) of dope, assuming a typical 3:1 solvent-polymer ratio. We can further assume about 95 percent utilization of such a plant, or 8400 hours/year operation. The extrusion rates can then be expressed as follows:

90.7 gigagrams/yr = 10,780 Kg/hr = 180 Kg/min

We can assume that the pilot enclosure volume and extrusion rate would be scaled up to the 22.7 gigagram million pound/year plant thusly:

$$\frac{\text{extrusion rate at large plant}}{\text{extrusion rate at pilot plant}} = \frac{\text{enclosure volume at large plant}}{\text{enclosure volume at pilot plant}}$$

$$\frac{180\ \text{kg/min}}{2.36\ \text{kg/min}} = \frac{x\ \text{m}^3}{5.66\ \text{m}^3}$$

$x = 432\ \text{m}^3$ = total enclosure volume for a 22.7 gigagram/year plant

3) Now the time to achieve the lower explosive limit can be determined for the full size plant, given a sudden and complete loss of exhaust and also given that all enclosure doors remain closed.

The initial concentration within was already set at 20 percent of the LEL; the resulting mass is then determined:

$5200\ \text{ppm} \times 424.5\text{m}^3 = 2.36\text{m}^3$ pure acetone vapor

At the lower explosive limit of 26,000 ppm, the enclosure would contain:

$26{,}000\ \text{ppm} \times 424.5\text{m}^3 = 11.1\text{m}^3$ pure acetone vapor

Thus, the difference is the additional vapor required to reach the LEL:

$$11.1\text{m}^3 - 2.2\text{m}^3 = 8.9\text{m}^3$$

The density of acetone at 80°F is:

$$2.37\text{kg/m}^3$$

Therefore, the weight of additional acetone would be:

$$2.37\text{kg/m}^3 \times 8.9\text{m}^3 = 21.1\ \text{kg}$$

We have already determined that the evolution rate of acetone into this enclosure is 4.18 kg/min. Therefore, the time to reach LEL = 21.1 kg ÷ 4.18 kg/min = 5.1 minutes, or about 5 min. 6 sec.

Summary

The times calculated above, 2.4 minutes and 5.1 minutes, both show that there is adequate response time for nearby operating personnel to open the enclosure doors, shut down the spinning machine, or otherwise respond to the malfunctions.

One domestic manufacturer of acetate filter tow has begun a pilot system to study the use of enclosures. They claim that because the system is fairly new, conclusions should not be made with regard to long-term use or benefits. However, they do report that thus far no explosive situations have developed during the operation of this system.

One Japanese manufacturer of acetate filter tow that uses enclosures as envisioned by EPA was questioned concerning the safety of their enclosures. Their response is self-explanatory:

"Electric power of the exhaust fan comes from the same power line of spinning machines. If power were to fail, extrusion of acetate dope in the spinning machines would stop at the same time when the exhaust fan is down. Therefore there would not be the development of explosive conditions in the enclosures with no further generation of acetone vapor.

If only an exhaust fan were to fail, alarm bell and light in the control room tell an emergency in the exhaust fan and a room attendant inform promptly operators in the spinning area of the exhaust fan emergency. Then operators rush to open all the enclosure doors. To make doors wide open, there will be no development of explosive condition.

There have never been any operational and safety problems such as fires or explosions resulting from a build up of the solvent vapor within the enclosures since we ran for more than two years with the use of enclosures." [Now almost four years; this correspondence was received in April 1982.]

APPENDIX C

REVISED TEXT AND TABLE FROM BID CHAPTER EIGHT

The following pages are revised versions of pages 8-19 through 8-21 of the October 1982 Draft Background Information Document for Synthetic Fiber Production Facilities.

(BID page 8-19)

plants 1 through 5 are presented in Tables 8-11, 8-12, and 8-13. All costs, production levels, emission reductions, etc., are based on model plant parameters described in Chapters 6 and 8.

Under Alternative II, model plant 1 shows a zero cost effectiveness when compared to baseline, Alternative I; the costs of controls for emission reduction are offset by the value of the recovered solvent. Model plant 3 shows a net gain of $182/Mg under Alternative II; the additional solvent that could be recovered beyond baseline would result in decreased annualized costs. Model plants 2, 4, and 5 show positive cost effectiveness of $166, $166, and $588 per Mg VOC reduction, respectively, when compared to Alternative I.

Under Alternative III, model plants 1 and 3 show a net gain or annual savings of $350 and $193 per Mg of emission reduction, respectively, when compared to the baseline. Model plant 2 would experience a zero cost effectiveness under this alternative. However, model plants 4 and 5 would incur positive increases in annual costs of $120 and $442 per Mg of emission reduction, respectively, above the baseline case.

Compared to Alternative II, the application of Alternative III to the model plants would result in decreased annualized costs of control and thus in decreasing cost per Mg of emission reduction, as presented in Table 8-13.

8.4.2 Projected 1987 Cost Effectiveness

The projected capacity shortfalls as presented in Tables 9-20 and 9-33 of Chapter 9 lead to the following conclusions concerning likely capacity additions by synthetic fiber producers by 1987:

(1) The projected capacity shortfall arising from the high growth projection for acrylic and modacrylic fibers would support additional plant capacity. For this analysis, it is assumed that capacity is constructed in increments of model plant capacity, and that plants of model plant 2 type would be built. Two plants, each with 45.36 Gg capacity, would be constructed by 1987 since there would be significant capacity shortfall if only one were constructed. These two plants would each operate at 81 percent capacity utilization in 1987. (Table 9-11 in this BID indicates that this capacity utilization rate is well within the range of historical values.)

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(2) The projected capacity shortfall arising from the low growth projection for acrylic and modacrylic fibers would not support additional capacity. This shortfall would likely be met by debottlenecking current production processes.

(3) The projected capacity shortfall arising from the high growth projection for cigarette filtration tow would support additional capacity by 1987. Again, it is assumed that capacity is constructed in increments of model plant capacity. Four plants, each with 22.7 Gg capacity, would be constructed. These four plants would each operate at 95 percent capacity utilization. A capacity shortfall of 4.3 Gg would still exist, but this shortfall would not support an additional plant.

(4) The projected capacity shortfall arising from the low growth projection for cigarette filtration tow would also support additional plant capacity by 1987 (capacity that would be constructed in increments of model plant capacity). Two plants, each with 22.7 Gg capacity, would be constructed. These two plants would each operate at 95 percent capacity utilization. Excess capacity of 1.7 Gg would exist.

(5) The projected capacity shortfalls arising from either the high or low growth projections for cellulose acetate textile yarn would not support additional capacity by 1987.

Based on the above conclusions, comparisons of annualized costs per megagram of emission reduction were made for those plants that are most likely to be built in the next 5 years. All three regulatory alternatives were examined. Compared to the baseline, Alternatives II and III result in emission reductions of as much as 5.5 and 8.5 Gg/year, respectively, by 1987. Annualized costs per megagram of emission reduction for typical plants would be as much as $412 and $200 respectively, for Alternatives II and III.

Because the Alternative III increased costs of control over Alternative II are ofsett by increased solvent recovery, Thus, there is net cost per megagram of emission reduction to the industry in implementing Alternative III over Alternative II. Table 8-14 presents the projected 1987 cost effectiveness of the regulatory alternatives.

Table 8-14. PROJECTED 1987 COST EFFECTIVENESS OF REGULATORY ALTERNATIVES

	Acrylic/Modacrylic		Cellulose Acetate Filter Tow		Totals	
Growth Scenario 1982-1987	high	low	high	low	high	low
Number of Affected Facilities[a] 1987	2	0	4	2	6	2
Alternative II Solvent Recovery Credit[b] (10^6\$)	1.06	0.0	2.33	1.41	3.39	1.41
Alternative III Solvent Recovery Credit[b] (10^6\$)	2.18	0.0	4.02	2.01	6.20	2.01
Baseline Annual Cost[c] (10^6\$/yr)	108.0	0.0	128.0	64.0	236.0	64.0
Alternative II Net Annual Cost[c] (10^6\$/yr)	108.4	0.0	128.8	64.4	237.2	64.4
Alternative III Net Annual Cost[c] (10^6\$/yr)	108.4	0.0	128.8	64.4	237.2	64.4
Alternative II Increase in Net Annual Cost Over Baseline (10^6\$/yr)	0.4	0.0	0.8	0.4	1.2	0.4
Alternative III Increase in Net Annual Cost Over Baseline (10^6\$/yr)	0.4	0.0	0.3	0.4	1.2	0.4
Alternative II Emission Reduction[d] (Mg)	972	---	4560	2280	5532	2280
Alternative III Emission Reduction[d] (Mg)	2000	---	6480	3240	3480	3240
Alternative II Cost Effectiveness (\$/Mg)	412	---	175	175	217	175
Alternative III Cost Effectiveness (\$/Mg)	200	---	123	123	142	123

[a] All values projected assume 81 percent capacity utilization for acrylic/modacrylic facilities and 95 percent for acetate filter tow facilities.

[b] Amount of solvent recovered multiplied by solvent cost, \$1.09/kg DMF and \$0.62/kg acetone.

[c] These values include solvent recovery credits, but do not include polymer costs. See also Tables 9-34 and 9-37.

[d] Emission reduction is from Tables 3-4 through 3-8, Line 10 "Recovered Solvent."

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15. SUPPLEMENTARY NOTES

16. ABSTRACT

Standards of performance to control emissions of volatile organic compounds (VOC) from new and reconstructed synthetic fiber production facilities are being promulgated under the authority of Section 111 of the Clean Air Act. This document contains a detailed summary of the public comments on the proposed standards (47 FR 52932), responses to these comments, and a summary of changes to the proposed standards.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
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