Final Summary of Regulatory Subgroup P-MACT teleconferences on 7/10/97 and 7/14/97

I. Purpose

The purposes of the meeting included: (1) The EPA providing a description of the Presumptive MACT process; (2) summarizing the EPA efforts that are underway to collect information to support the PMACT determination; (3) discussing the scope of the source category in terms of industry segments with HAP emissions; (4) defining preliminary subcategories and affected sources, and (5) identifying regulatory requirements and well controlled affected sources.

II. Date and Place

July 10 and 14, 1997
Research Triangle Institute
BankSouth Building
Durham, NC

III. Participants

See the lists of participants at the end of this memorandum. The telephone conference was started July 10 and could not be completed because of service problems with the call-in line. The telephone conference was completed in a second session on July 14. Participants are listed separately for July 10 and July 14.

IV. Meeting Summary

Paul Almodóvar of the U.S. Environmental Protection Agency (EPA) chaired the meeting and opened with a review of previous activities, including the initial PMACT meeting of May 29, and noted that the next PMACT meeting of all stakeholders is planned for the week of August 18. Mr. Almodóvar stressed the EPA need for state participation in the project.

The attached Regulatory Subgroup briefing document was distributed to participants before the meeting. After Mr. Almodóvar's introduction and review, Steve York of the Research Triangle Institute conducted the PMACT briefing, following the attached document. For topics that were discussed by the group, the following paragraphs present summaries of information provided, issues raised, and consesus reached. The page number presented parenthetically with each topic refers to the corresponding page in the briefing document.

Presumptive MACT is...(Page 3 of 17)

Mr. York noted that rather than trying to develop an estimate of what the proposed MACT would be based on a review of the limited amount of currently available information, the current goals of the PMACT process by October 1997 include the following:

- Understand industry processes that are HAP emission sources
- Identify typical emissions points
- Identify/involve representatives for each industry segment
- Determine scope
- Locate major sources
- Identify existing controls
- Identify issues/develop plan for resolving

In response to a question from Steve Maynard concerning whether EPA is only interested in Title V sources, Mr. York and Mr. Almodóvar responded yes. Mr. Almodóvar later clarified this response, noting that we are also looking for information on synthetic minor sources that have taken measures to limit HAP emissions. Such measures could serve as the basis for the MACT floor. Mr. Almodóvar also stated that EPA will have to make a finding that HAP emissions from area sources do not present a threat to human health and the environment. Michael Landis offered that some plants limit hours of operation or take similar measures to limit emissions to be synthetic minor sources.

Steps in the Presumptive MACT Process (page 4 of 17)

Mr. York stated that the next PMACT Round Table meeting of stakeholders is tentatively scheduled for the week of August 18. The purpose of this meeting will be for ATMI to present MACT survey results and for EPA to present a summary of the information being developed in the Regulatory Subgroup meeting on emission sources, existing regulatory requirements, and control options. (Subsequent to the Regulatory Subgroup meeting, it has been determined that ATMI will provide the ATMI survey results to EPA prior to the Round Table meeting, so that this information can be incorporated into EPA's summary.)

Preliminary Subcategories (page 9 of 17)

Mr. York observed that the preliminary subcategories are broad subcategories based essentially on how the industry has characterized itself through the American Textile Manufacturers Institute (ATMI) and the Carpet and Rug Institute (CRI). Polymeric coating of supporting substrates is broken out as a subcategory because there is a NSPS covering this source category and a CTG that has been adopted into many State regulations. The "other industry groups" are industry segments that ATMI has indicated might not be well represented through the ATMI MACT survey. The information in parentheses is our current perception of these industry segments.

Mr. York stated that in the case of hosiery, on the basis of the information from the one large plant, it is unlikely that this industry segment would be covered by the MACT standard. Phil Davis offered that there are very low emissions from sock mills. The consensus of the participants was that hosiery manufacturing is a small source of HAP emissions and should not be covered by the MACT standard.

Regarding narrow fabrics production, Steve Maynard noted that there is one facility that was Title V for HAP and VOC because of emissions from the coating of narrow fabrics, however, the emissions are controlled by a fume incinerator and the facility is now a synthetic minor. Jimmy Johnston will look into one narrow fabrics production facility that may have high HAP emissions.

Michael Landis stated that there is one facility that manufactures tire cord and fabrics in his region. Both polyester and nylon fabrics are coated at the facility. The polyester fabric has more coating. The biggest emission source is the curing oven, which is like a tenter frame. The facility is a minor or synthetic minor source of HAP emissions.

Known Emission Sources and Control Options: Basic Textile Manufacture - Slashing (Page 10 of 17)

Steve York submitted that methanol from the PVA sizing typically applied to synthetic yarns is probably the primary source of HAP emissions from slashing. Michael Landis stated that the methanol is a contaminant and that the methanol content of PVA has been reduced for cost reasons (facilities applying the PVA pay for the methanol emissions). The reductions in methanol have come in the last 2 years.

John Burke offered that one manufacturer of PVA has reduced the methanol content to below 1 percent. Mr. Burke also noted that in vertically integrated mills with sizing and desizing operations at the same facility, the PVA is sometimes recycled back to the sizing process. The recycled PVA does not contain methanol, therefore, emissions are reduced. There are not many vertically integrated mills with both sizing and desizing.

Kim Melvin reported on one Title V HAP facility that has cut methanol emissions significantly. The facility uses a sizing called TC5M rather than PVA. TC5M contains only 0.033 percent methanol. TC5M is probably a different sizing product, rather than PVA with reduced methanol content.

None of the participants knew of a slasher with a control device.

Known Emission Sources and Control Options: Basic Textile Manufacture - Preparation and Dyeing (Page 11 of 17)

Steve York stated that of the preparation processes listed, solvent scouring is the only one that we know would involve the use of HAP compounds and that there is apparently very little solvent scouring done. Solvent scouring would only be used in a case where a very clean substrate is needed for dyeing. Michael Landis responded that he knows of no facility using solvent scouring; all scouring is done with surfactants. Mr. Landis also commented that scouring removes knitting oil (mineral oils), which is a source of visible emissions from subsequent drying and curing operations. Steve Maynard reported knowing of one flame scrubber used to control oil smoke to meet opacity standards (20% or 40%, depending on the date of installation of the source). With thorough preparation of the fabric, there are no visible emission problems. Michael Landis also reported that several facilities have internal afterburners on dryers and tenter frames to control smoke.

Regarding dyeing, Steve York submitted that according to limited information available to us, disperse dyeing of synthetics appears to be the most likely source of HAP emissions. The HAP emissions would come from the dye carriers. Michael Landis reported that he is not aware of any significant emissions from dyeing. The type of dye will depend on the substrate: a dyestuff is chosen that will penetrate the substrate being dyed. Mr. Landis also commented that there are not many emissions from mixing and application.

Kim Melvin stated that one facility reports 5% methanol in dyeing with emissions of 1 TPY from each of 2 dyeing ranges. Another facility reports 5TPY of 1,2,4 trichlorobenzene emissions from dyeing. Steve Maynard offered that one facility uses naphthalene/biphenyl as dye carriers in pressurized dye becks. Small emissions are reported from the tenter frame used for drying.

Michael Landis stated that most facilities are converting to pressure dye becks rather than using atmospheric dye machines. The use of pressure dye becks greatly reduces emissions. Paul Almodovar asked if there are technical reasons for using atmospheric rather than pressure dye machines. Mr. Landis responded that some delicate fabrics may need to be dyed at atmospheric pressure; this is a question to pose to the industry.

None of the meeting participants knew of the use of any HAP emission control equipment for dye mix or dyeing processes.

Aarti Sharma asked if anyone knows if spin finishes contain any HAP. John Burke replied that spin finishes are applied to synthetics. Most spin finish is removed in wet processes so it will not adversely affect dyeing. There is probably a small amount of spin finish emitted from tenter frames in heat setting. One company drives off spin finishes in a heat setting process and uses a condenser to recover the finishes. Mr. Burke did not know if there are any HAP in spin finishes.

Known Emission Sources and Control Options: Basic Textile Manufacture - Printing (Page 12 of 17)

Steve York opened the discussion of printing by saying that we believe that most print paste used now is aqueous based. Steve Maynard submitted that one facility in western North Carolina (Cranston Print Works) uses print paste that contains VOC and HAP. The facility is a major source of VOC emissions. The facility cannot switch to aqueous-based print pastes for technical reasons; the dyes they use are not water soluble and the VOC is needed for viscosity control. The plant uses no emission controls.

Mike Landis reported that Fieldcrest Cannon prints sheets, but was not certain what type of print pastes are used; possibly soybean based. The plant would be a good one to visit to see a lot of different processes.

Paul Almodóvar summarized the discussion of printing by saying that reformulation of print paste is a control option. No participants knew of the use of any emission control equipment.

Known Emission Sources and Control Options: Basic Textile Manufacture - Finishing (Page 12 of 17)

Steve York opened the discussion of finishing, noting that from available data, formaldehyde emissions from the breakdown of the cross-linking resin used in permanent press finishes seem to be the main HAP of concern. Mr. York asked if any of the participants knew of other finishing operations with potentially significant HAP emissions. John Burke concurred that formaldehyde emissions from resin finishes are probably the major concern. Kim Melvin submitted that one facility applying a Scotch Guard® finish reports ethylene glycol emissions of around 3 TPY.

Regarding the use of emission controls on drying/curing tenter frames, John Burke knew of one incinerator in operation that controls VOC emissions and uses heat recovery as the source of heat for the tenter frame. Ken Babb reported seeing incinerators in use, but not at Title V facilities. Michael Landis offered that one facility uses a carbon bed to recover 1,1,1 trichloroethane emitted from a finishing process. The carbon bed achieves around 99% recovery. However, the facility is planning to and may already have switched to a finish without 1,1,1 trichloroethane.

Kim Melvin reported that data submitted by a plant in the Asheville region indicate that emissions from a tenter frame are out of compliance with opacity requirements. The State is requiring a Method 5 stack test for particulates. The plant is also planning to perform a Method 25A test on the control device inlet and outlet to determine the control device efficiency in controlling VOC. The control device is a JHK fume oxidizer that operates at 450 to 550 °F. The fume incinerator was installed to control opacity and is only operated for runs where opacity is a problem. Testing is scheduled for August.

In summary, Steve York stated that most emission control equipment used on tenter frames seems to be for opacity control.

Known Emission Sources and Control Options: Carpet and Rug - Heat Setting (Page 14 of 17)

Steve York opened the discussion by saying that the only known emissions from heat setting are caprolactam emissions from the Suessen heat setting method, and caprolactam has been removed from the HAP list. Jimmy Johnston reported that work over the past few years has confirmed the presence of caprolactam in emissions from Suessen heat setting from the decomposition of nylon. It is likely that the temperature and pressure of operation of the Suessen machines are the driving forces of the caprolactam emissions. Mr. Johnston has some emission test data available for Suessen heat setting machines and will mail this to Mr. York. Michael Landis may also have some test data in the Mooresville regional office. (A check of the test data in the Mooresville office indicates that it is only for particulates.)

Known Emission Sources and Control Options: Carpet and Rug - Dyeing (Page 14 of 17)

Jimmy Johnston reported that 27 carpet mills in Georgia submitted Title V permit applications; only 5 of the mills are major for HAP emissions. One of the five plants reported biphenyl emissions from dyeing and another plant reported glycol ether emissions. The dryer or tenter frame should be where most of the emissions occur.

Aarti Sharma asked if there are any differences between fabric and carpet dyeing that would affect emissions of HAP compounds used as carriers. No one knew of any. John Burke noted that regarding dye carriers such as 1,2,4 trichlorobenzene, naphthlene, zylene, biphenyls, etc., a study conducted by Brent Smith of North Carolina State University College of Textiles for the State of North Carolina found that less than 5% and in some cases less than 1% ends up in the dye bath wastewater. Most of the dye carriers are emitted from the tenter frame; some are emitted from the dye bath.

Known Emission Sources and Control Options: Carpet and Rug - Back Coating (Page 14 of 17)

The briefing document lists the emission source from back coating as methanol used as a latex thickener. Michael Landis questioned whether latex would contain methanol; his experience is that there might be formaldehyde and ammonia in latex thickener. Jimmy Johnston responded that at least 3 plants that are major report methanol emissions from thickener; however, many latex thickeners do not contain methanol. Mr. Johnston did not know what is being substituted, but does know that it is non-HAP. (In a subsequent telephone call from Marzieh Shahbazaz to Steve York, Ms. Shahbazaz reported that according to a source in the carpet and rug industry, backing contains methanol and/or ethanol. Because of concern with the MACT standard, the industry is shifting to 2 different latex backings. One has no methanol, but contains from 5 to 6% ethanol, resulting in an increase in VOC emissions. The second has 0.5% methanol, resulting in decreased HAP and VOC emissions.)

Aarti Sharma noted that CRI claims there are no formaldehyde emissions from carpet and rug manufacture and inquired about the source of formaldehyde emissions. Michael Landis responded that he would look it up. (No information was found in a subsequent visit to the Mooresville office.)

Known Emission Sources and Control Options: Polymeric Coating of Substrates (Page 16 of 17)

Steve York asked if anyone is aware of any emission control devices being used on this source. Michael Landis responded that thread bonding is subject to the polymeric coating NSPS, subpart VVV. He knows of one facility that has thread bonding operations. In one process at the facility, nylon thread is bonded by being passed through a bath of nylon dissolved in methanol. The facility is a major source for HAP emissions (methanol) and uses a thermal oxidizer that achieves a destruction efficiency of 98% or better to control the methanol emissions. In the second process at the facility, polyester thread is bonded by passing the threads through a bath of polyester and methylene chloride. Methylene chloride emissions are not controlled. No other participants had information on sources in this subcategory.

V. Action Items

- Jimmy Johnston will look for information on one narrow fabrics production facility that may have high HAP emissions. Mr. Johnston will also mail emission test data for Suessen heat setting to Steve York.
- Steve York will contact Brent Smith regarding a study of air emissions from the dye bath.
- Michael Landis will look for information regarding the source of formaldehyde emissions from carpet and rug back coating.
- Any participant that would like to add additional information for this meeting summary is encouraged to do so.

Participants (July 10)

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Regulatory Subgroup

PRESUMPTIVE MACT FOR FABRIC PRINTING, COATING, AND DYEING

EMISSION STANDARDS DIVISION
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
U.S. ENVIRONMENTAL PROTECTION AGENCY
RESEARCH TRIANGLE PARK, N.C.

July 10, 1997

PURPOSE

- Describe the Presumptive MACT process
- Summarize information needs and EPA efforts underway to collect information
- Discuss scope of source category
- Define preliminary subcategories and affected sources
- Identify well controlled affected sources

PRESUMPTIVE MACT IS...

- An estimate of what the proposed MACT would be based on a review of currently available information
- Assistance provided to State and local agencies to make case-by-case MACT determinations
- Not a regulation - offered only for guidance and information
- The starting point for the MACT standards development process

STEPS IN THE PRESUMPTIVE MACT PROCESS

1. Initial scoping meeting with State and local agencies

2. State and local agencies assist in gathering information to determine preliminary presumptive MACT

3. Meeting to discuss data and preliminary presumptive MACT with Round Table Group (industry, environmental groups, State and local agencies, EPA)

4. Presumptive MACT meeting with State and local agencies to:

   ! Obtain input on best method to develop the standard:
     Traditional EPA rulemaking process
     Adopt-A-MACT
     Share-A-MACT
     Propose presumptive MACT as the standard
     Other
   ! Identify questions to be addressed in developing MACT
   ! Determine strategy for meeting with industry and environmental groups
   ! Determine preliminary presumptive MACT

5. Round Table Meeting with industry, trade organizations, and environmental groups

6. Finalize presumptive MACT and select method for standards development

INFORMATION NEEDS

- Industry profile including:
  - Plants and plant locations
  - Types of processes
  - Number of production lines
  - Plant capacity and actual production

- Process descriptions including:
  - Unit operations
  - Steps in process where HAPs are used
  - HAP and non-HAP emission points
  - Pollutants emitted

- Applicable control technologies and pollution prevention measures, e.g., measures to reduce organic chemical usage
  - Description of control technology or pollution prevention measure
  - Control efficiencies/emission reductions
  - Control costs

- Current industry practices relative to air pollution control

SOURCES OF INFORMATION

- Literature
  - TRI data base
  - Existing State regulations
  - EPA documents
  - Reference texts
  - Trade journals

- Trade Associations
  - ATMI
  - CRI
  - ETAD
  - AYSA
  - NAHM
  - IFAI

- Site visits

- Regional, State, and local regulators

- Vendors of the following products:
  - Coating/finishing/dyeing/printing chemicals
  - Organic solvents
  - Process equipment
  - Emission control equipment

EMISSION POINTS *

- ! Storage tanks and containers
- ! Mixing tanks (mix kitchens)
- ! Application area
- ! Flash off area
- ! Drying/curing ovens
- ! Machine and equipment cleaning
- ! Equipment leaks
- ! Wastewater treatment systems

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* Identified from EPA documents.

ORGANIC AND INORGANIC HAPS OF CONCERN *

CAS No.	Pollutant
75-07-0	Acetaldehyde
92-52-4	Biphenyl
7782-50-5	Chlorine
84-74-2	Dibutyl phthalate
111-42-2	Diethanolamine
107-21-1	Ethylene glycol
50-00-0	Formaldehyde
N/A	Glycol ethers
7647-01-0	Hydrochloric acid
67-56-1	Methanol
71-55-6	Methyl chloroform
78-93-3	Methyl ethyl ketone
108-10-1	Methyl isobutyl ketone
75-09-2	Methylene chloride
101-68-8	4,4'-Methylenediphenyl diisocyanate
91-20-3	Naphthalene
108-95-2	Phenol
127-18-4	Tetrachloroethylene
108-88-3	Toluene
120-82-1	1,2,4-Trichlorobenzene
79-01-6	Trichloroethylene
1330-20-7	Xylenes (mixed isomers)

* Reported as releases in the TRI database for facilities in SIC 22 and 3069.

PRELIMINARY SUBCATEGORIES

- Basic textile manufacturing (SIC Major Group 22- Textile Mill Products, with the exception of SIC Industry Group No. 227 Carpets and Rugs and SIC Industry No. 2295 Coated Fabrics, Not Rubberized).

- Carpets and rugs (SIC Industry Group No. 227).

- Polymeric coating of supporting substrates (SIC Industry Nos. 2295 Coated Fabrics, Not Rubberized and 3069 Fabricated Rubber Products, NEC).

- Other industry groups?
  - Hosiery (According to Tommy Thompson of Sarah Lee Hosiery, the largest hosiery plant in the US has potential process air toxic emissions of 1.5 TPY, most of which are acetic acid and ammonia)
  - Narrow fabrics (From basic textiles short course at NCSU College of Textiles, same processes as broadwoven fabrics)
  - Tire cord and fabrics (Biggest HAP emission source polymeric coating of supporting substrate)

KNOWN EMISSION SOURCES AND CONTROL OPTIONS

! Basic Textile Manufacture

- Slashing: Description: Slashing or sizing is the application of a chemical sizing solution to warp yarns prior to weaving to protect against snagging or abrasion that could occur during weaving.

Equipment and chemicals: Sizing is done on a large range called a slasher using pad/dry techniques. Yarns are dried over hot cans or in an oven. The three main types of size currently used are natural products (starch), fully synthetic products (e.g., PVA), and semisynthetic blends (e.g., modified starches and carboxymethyl cellulose or CMC). In addition to these, additional auxiliary chemicals are often added (lubricants, etc.).

Emission sources: The primary source of HAP emissions from slashing is methanol from PVA size, typically applied to synthetics. Other HAP sources can be toxic additives. Most methanol emissions are believed to occur from the size application and yarn drying after size application.

P2: Incoming raw material QC can reduce HAP emissions, e.g., avoiding addition of toxic organics such as biocides. Other QC measures include preparing correct quantities of size, proper selection of size mix, scheduling runs, eliminating unnecessary additives, avoiding leaks and spills, etc.

Control options: Reduced methanol content in PVA size or use of air emission control equipment. Not much information on possible substitutions (since size mixes achieve specific results) or control equipment. In fact synthetic sizes are recommended for use, because natural materials cause water pollution (BOD/COD) problems.

KNOWN EMISSION SOURCES AND CONTROL OPTIONS (CONT.)

- **Preparation and Dyeing:**

Description: Preparation includes any of several steps that may be taken to clean or prepare the fabric prior to dyeing; such as, desizing (woven only), scouring, heat setting (synthetics and blends), bleaching, and mercerization (optional). Textiles are dyed using continuous and batch processes and dyeing may take place at any of several stages in the manufacturing process (i.e., stock, tow, yarn, fabric, garment).

Equipment and chemicals: Different types of equipment used. Heat setting - semi-contact oven or tenter frame, no chemicals applied. Desizing, scouring, bleaching - various types of washers and steamers; chemicals vary from a simple warm water wash or use of surfactants, chelates, alkai, and oxidizing agents to solvent scouring (very uncommon). Mercerizing - mercerizer, chemicals used are NaOH and surfactants. Dyeing - various types of dyeing machines are used, for example, jet dye machines for fabrics; various dye classes are used (e.g, disperse for synthetics and direct for cellulosics). Drying - ovens, tenter frames.

Emission sources: HAP emissions will generally be from dryer stacks (from tenter frames) and curing ovens used for drying and heat setting operations. The pollutants will vary widely according to the type of substrate, the end product, and desired properties of end product. Possible HAP sources are: scours - perchloroethylene, xylene, toluene; dye carriers - biphenyl and dibutylphthalate residue; and other spot removal and machine cleaning solvents.

P2: Not much information on solvent scouring, or when such aggressive cleaning may be needed. However, at this stage incoming griege goods with other contaminants can be rejected. Other potential impurities (such as pentachlorophenol on wool, metals on cotton, and toxic spin finishes on synthetics) can result in air emissions, in subsequent wet finishing operations (test incoming goods for contaminants). Limited information available on dyes that use toxic carriers or whether substitutions are possible. QC measures include chemical dosing systems and automated mix kitchens to optimize dye use, low bath-ratio dyeing systems, and dyebath reuse. These measures have been designed to deal with water pollution problems, but also can reduce air emissions through reduced chemical use/substitution.

KNOWN EMISSION SOURCES AND CONTROL OPTIONS (CONT.)

Control options: Some facilities use fabric filters/demisters, venturi scrubbers, or ESPs typically employed to control particulate emissions (mists/opacity) from tenter frames, since most States have opacity standards. A small minority may use incinerators/afterburners. States do not appear to have special requirements for preparation and dyeing operations other than opacity limits.

Printing: Description: Color and patterns, usually in the form of a paste, are applied to fabrics using a variety of techniques of which rotary screen printing is the most common, with pigments being the most common dye class used. Fabric is treated with steam, heat, or chemicals to fix the color. (Dyeing is preferred for solid patterns or simple patterns).

Equipment and chemicals: Printing range (variations in equipment and techniques). Chemicals used are pigments (most common) or dyestuffs, and auxiliaries (such as softeners, thickeners, cross-linking agents, etc.).

Emission sources: Pollutants depend on printing technique and chemicals used. Possible HAP sources are solvent-based print pastes - however these have almost completely been replaced by polymeric thickeners (a small organic solvent percentage - 2% - may be needed to produce the correct rheology). A few printers still use oil-water emulsion systems as thickeners and some specialty print shops still use solvent-based printing inks. Urea-formaldehyde crosslinking agents can also be used. HAP emissions would be during application, drying and curing operations. Another source of organic solvents is cleaning operations (machine cleaning and screen cleaning). Examples of HAPs used in cleaning include xylene and ethylbenzene.

P2: GMPs (color shop practices and print paste handling) and possible substitutions for cleaning operations. Use of polymer print pastes (not varsol based, e.g., synthetic polymers similar to those used for warp sizes) and other nonvolatile alternatives. Various P2 options and emerging technologies for reducing water pollution and chemicals are used, such as ink jet printing and heat transfer printing.

Control options: Limitation of HAP in print pastes; use of air emission control equipment is unknown. Some States have VOC content limits based on the CTG for vinyl coating, which refers to any printing or decorative topcoat applied over vinyl coated fabric or vinyl sheets. The CTG recommended limitation is 0.45 kg VOC/ liter of coating (minus water).

KNOWN EMISSION SOURCES AND CONTROL OPTIONS (CONT.)

Finishing: Description: Finishing encompasses any of several mechanical (e.g., texturizing, napping) and chemical processes (e.g., optical finishes, softners, urea-formaldehyde resins for crease resistance) performed on fiber, yarn, or fabric to improve its appearance, texture, or performance.

Equipment and chemicals: Various. Chemical finishing can be on a continuous finishing range (pad and tenter frame). Fabric is passed through an oven after treatment to drive off water and activate/cure finishing chemicals. No chemicals are used in mechanical finishing.

Emission sources: The HAP sources will be specific chemical finishes that may be released during application and during drying and curing operations. HAPS of concern include ethylene oxide - breakdown of wetting agent; formaldehyde - breakdown of cross-linking resin (used for permanent press finishes) if N-methylol linkers are used; glycol ethers - softeners; hexane - softeners, wax water repellant; hydrocarbons (not necessarily HAPs) - softeners, wax water repellant, spin finish residues; knitting/winding lubricants; methanol - cross-linking reaction product, wetter; methyl methacrylate - hand-builder impurity. Other HAP sources include spot removers and machine cleaning solvents.

P2: Many chemical and mechanical alternatives are available for every finishing operation - but the specific nature and applicability of these is unclear. Some mechanical finishes and design alternatives can avoid chemical processing. Evaluate all nonchemical alternatives. For example for softness - enzyme softening of cotton, mechanical alternatives. Proper use and application of N-methylol cross-linkers can minimize formaldehyde releases. Some cross-linkers that eliminate formaldehyde are available, but much more expensive. Mechanical finishing (compacting) can also eliminate use of the cross-linker. Acrylic hand-builders and stiffeners can replace formaldehyde-based hand-builders. Low add-on finishing - sprays, foams, kiss rolls, ultra high extraction with vacuum. Humidity sensors in drying (optimize dryer performance in terms of energy use, dye migration, and air pollution).

Control options: Some facilities use fabric filters/demisters, venturi scrubbers, or ESPs to control particulate emissions (mists/opacity) from tenter frames, since most States have opacity standards. A small minority may use incinerators/afterburners. States do not appear to have special requirements for finishing operations other than opacity limits.

KNOWN EMISSION SOURCES AND CONTROL OPTIONS (CONT.)

! **Carpet and Rug**

- **Heat setting:**

Description: Carpet manufacture involves various mechanical processes, as well as heat setting and dyeing. Heat setting is a process for stabilization of carpet yarns by exposure to heat. Not all yarn is heat set (just cut pile).

Equipment and chemicals: There are 3 heat setting methods classified by type of equipment used; superba, autoclave, and suessen.

Emission sources: According to the Carpet and Rug Institute (CRI), there are HAP emissions only from the suessen heat setting method. The only substance thought to be emitted (CRI) is caprolactam, which has been removed from the HAP list. According to CRI, there are no formaldehyde emissions.

P2: Unknown.

Control options: Unknown.

- **Dyeing:** Description: The dyeing process imparts color to the carpet. Finishing is done after tufting, weaving, and dyeing and includes various mechanical (shearing, brushing) and chemical (application of soil retardant and antistatic chemicals) processes. Carpets can also be printed using processes similar to those for paper and fabric.

Equipment and chemicals: Dye beck (large vat for piece dyeing), dyes and chemicals. Also, continuous dyeing equipment.

Emission sources: Unknown. Possibly similar to those from fabric dyeing and finishing?

P2: Unknown.

Control options: Unknown.

KNOWN EMISSION SOURCES AND CONTROL OPTIONS (CONT.)

- **Back coating:**

  Description: (Considered part of finishing processes?) The typical components of the carpet are the face yarn, below which are the primary backing and the secondary backing, separated by a layer of adhesive (CaCO3/Latex). Secondary backings are reinforcing fabrics laminated to the back of carpets, usually with a latex adhesive, to enhance dimensional stability, strength, stretch resistance, etc. The back coating helps adhere carpet components to one another and is done subsequent to the tufting process. Secondary backings are typically woven jute and polypropylene. The primary backing (usually polypropylene) is different from secondary backing, and is a component of tufted carpet consisting of woven and nonwoven fabric into which pile yarn tufts are inserted.

  Equipment and chemicals: Latex, a compound consisting of natural or synthetic rubber (typically, SBR), used to coat the back of carpets and rugs. Carpet latex laminating compounds and foams contain large amounts of fillers - a common one is powdered calcium carbonate.

  Emission sources: Methanol emissions can result from its use as a latex thickener.

  P2: Methanol content in thickener is being reduced or eliminated by suppliers.

  Control options: Reduction of methanol content in thickener.

KNOWN EMISSION SOURCES AND CONTROL OPTIONS (CONT.)

! **Polymeric Coating of Substrates**

- **Coating operations:**

Description: A specialized chemical finishing technique designed to produce fabric to meet high performance requirements - for end products such as tents, tire cord, roofing, soft baggage, marine fabric, etc. The distinction between coating and laminating is that coated fabrics are true composites (e.g., a plastic film on the textile), whereas laminating involves tacking together two or more pre-formed layers. A distinction between coating and slashing is that although slashing does involve putting a coating of size on the yarn, the coating is not permanent.

Equipment and chemicals: Coating range using one of several different types of applicators such as calenders, knife coating, or roller coating. Different types of chemicals are applied depending on end use such as vinyl, urethane, teflon, flame resistants (e.g., DMDHEU), etc. In conventional systems, latex or other synthetic polymers, in an organic solvent medium, are applied to the fabric, and the solvent evaporates, leaving behind the coating.

Emission sources: Solvent-based coating systems are expected to be the largest sources of HAP emissions including MEK and toluene. Emissions will be during application and drying/flashoff operations and also during mix preparation.

P2: HAP content in coatings. Water-based systems in place of solvent-based systems, where possible. Powder coating technology (emerging technology).

Control options: Many States have specified VOC content in coatings; typically based on CTG [0.35 kg VOC/liter of coating (minus water)]. Coaters also have the option to use control equipment such as thermal incinerators, condensers, and carbon adsorption systems to reduce emissions by 81% (90% capture and 90% efficient control device), although the former method is probably more common. The best controlled facilities are believed to be those subject to NSPS (reduction of VOC emissions by 90% or total enclosure vented to 95% efficient control device).

SUMMARY OF APPLICABLE REGULATIONS & BEST CONTROLS/POLLUTION PREVENTION