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Control Techniques Guidelines for Paper, Film, and Foil Coatings

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Control Techniques Guidelines for Paper, Foil, and Film Coating

Sector Policies and Programs Division
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I. Introduction

Clean Air Act (CAA) section 172(c)(1) provides that state implementation plans (SIPs) for nonattainment areas must include “reasonably available control measures” (RACM), including “reasonably available control technology” (RACT), for sources of emissions. Section 182(b)(2)(A) provides that for certain nonattainment areas, States must revise their SIPs to include RACT for each category of volatile organic compound (VOC) sources covered by a control techniques guidelines (CTG) document issued between November 15, 1990 and the date of attainment.

The United States Environmental Protection Agency (EPA) defines RACT as “the lowest emission limitation that a particular source is capable of meeting by the application of control technology that is reasonably available considering technological and economic feasibility.” 44 FR 53761 (Sept. 17, 1979). In subsequent Federal Register notices, EPA has addressed how states can meet the RACT requirements of the Act.

CAA section 183(e) directs EPA to list for regulation those categories of products that account for at least 80 percent of the VOC emissions, on a reactivity-adjusted basis, from consumer and commercial products in areas that violate the NAAQS for ozone (i.e., ozone nonattainment areas). EPA issued the list on March 23, 1995, and has revised the list periodically. *See* 60 FR 15264 (March 23, 1995); *see also* 71 FR 28320 (May 16, 2006), 70 FR 69759 (Nov. 17, 2005); 64 FR 13422 (Mar. 18, 1999). Paper, film, and foil coatings are included on the current section 183(e) list.

This CTG is intended to provide state and local air pollution control authorities information that should assist them in determining RACT for volatile organic compounds (VOCs) from paper, film, and foil coatings. In developing this CTG, EPA, among other things, evaluated the sources of VOC emissions from the paper, film, and foil coating industry and the available control approaches for addressing these emissions, including the costs of such approaches. Based on available information and data, EPA provides recommendations for RACT for paper, film, and foil coating.

States can use the recommendations in this CTG to inform their own determination as to what constitutes RACT for VOCs for paper, film, and foil coatings in their particular nonattainment areas. There are several hazardous air pollutants (HAP) that are also VOCs. The information contained in this document is provided only as guidance. This guidance does not change, or substitute for, requirements specified in applicable sections of the CAA or EPA’s regulations; nor is it a regulation itself. This document does not impose any legally binding requirements on any entity. It provides only recommendations for state and local air pollution control agencies to consider in determining RACT. State and local pollution control agencies are free to implement other technically-sound approaches that are consistent with the CAA and EPA’s implementing regulations.

The recommendations contained in this CTG are based on data and information currently available to EPA. These general recommendations may not apply to a particular situation based

upon the circumstances of a specific source. Regardless of whether a State chooses to implement the recommendations contained herein through State rules, or to issue State rules that adopt different approaches for RACT for VOCs from paper, film, and foil coatings, States must submit their RACT rules to EPA for review and approval as part of the SIP process. EPA will evaluate the rules and determine, through notice and comment rulemaking in the SIP approval process, whether the submitted rules meet the RACT requirements of the CAA and EPA's regulations. To the extent a State adopts any of the recommendations in this guidance into its State RACT rules, interested parties can raise questions and objections about the substance of this guidance and the appropriateness of the application of this guidance to a particular situation during the development of the State rules and EPA's SIP approval process.

Section 182(b)(2) of the CAA requires that a CTG issued between November 15, 1990, and the date of attainment include the date by which States subject to 182(b) must submit SIP revisions in response to the CTG. Accordingly, EPA is providing in this CTG a one-year period for the required submittal. Pursuant to section 182(b)(2), States required to submit rules consistent with section 182(b) must submit their SIP revisions within one year of the date of issuance of the final CTG for paper, film, and foil coatings. States subject only to the RACT requirements in CAA section 172(c)(1) may take action in response to this CTG, as necessary to achieve attainment of the national primary ambient air quality standards.

II. Background and Overview

There have been three federal actions relative to some or all segments of the paper, film, and foil surface coating industry. In May 1977, EPA published a CTG for controlling VOC emissions from surface coating of paper (1977 CTG).¹ In October 1983, EPA promulgated the new source performance standards (NSPS) for surface coating of pressure sensitive tape and labels (1983 NSPS)² which is a subset of the paper, film, and foil surface coating industry. Finally, in December 2002, EPA promulgated the National Emission Standards for Hazardous Air Pollutants: Paper and Other Web Coating (2002 NESHAP).³

The 1977 CTG, 1983 NSPS, and 2002 NESHAP provide a thorough discussion of the paper, film, and foil surface coating industry, the nature of VOC emission (and in the case of the 2002 NESHAP, organic HAP emissions) from the industry, available control technologies for addressing such emissions, the costs of available control options, and other information. The 1977 CTG recommends and the 1982 NSPS establishes VOC emission limits, whereas the 2002 NESHAP establishes organic HAP emission limits and does not address non-HAP VOC.

At least 44 State and local jurisdictions have specific regulations that control VOC emissions from paper, film, and foil surface coating operations (or segments of the paper, film, and foil surface coating industry). A discussion of the applicability and control options found in the federal actions and State and local rules is presented in Section V of this document.

We developed the recommended approaches contained in this document after reviewing existing State and local VOC emission reduction approaches, the 1977 CTG, the 1983 NSPS, and the 2002 NESHAP, as well as information obtained since issuance of the 2002 NESHAP.

The remainder of this document is divided into six sections. Section III describes the scope of sources to which the control recommendations in this draft CTG could apply. Section IV describes the paper, film, and foil industry, including the types of paper, film, and foil products, coating materials (i.e., coatings and adhesives) and the coating processes, and identifies the sources of VOC emissions from these processes. Section V describes the available control approaches for addressing VOC emissions from this product category and summarizes Federal, State and local approaches for addressing such emissions. Section VI provides our recommendations for RACT for paper, film, and foil coating. Section VII discusses the cost-effectiveness of the recommended control approaches. Section VIII contains a list of references.

III. Applicability

This draft CTG provides control recommendations for reducing VOC emissions stemming from the use of coatings in paper, film, and foil surface coating operations. This section describes the scope of entities for which EPA is recommending the control options in this draft CTG. As explained above, this document is a guidance document and provides information for States to consider in determining RACT. When State and local pollution control agencies develop RACT rules, they may elect to adopt control approaches that differ from those described in this document and/or promulgate applicability criteria that differ from those recommended here.

In terms of applicability, we recommend that the control approaches discussed in section VI of this CTG apply to any paper, film, and foil surface coating operation where the actual VOC emissions associated with all aspects of the coating operation are equal to or exceed 6.8 kg/day (15 lb/day), or an equivalent level such as 3 tons per 12-month rolling period, before consideration of controls. We do not recommend these control approaches for facilities that emit below this level because of the very small VOC emission reductions that can be achieved. The recommended threshold level is equivalent to the evaporation of approximately two gallons of solvent per day. Such a level is considered to be an incidental level of solvent usage that could be expected even in facilities that use very low-solvent coatings, such as UV cure coatings. Furthermore, based on the 2002 NEI data and the 2004 ozone nonattainment designations, facilities emitting below the recommended threshold level collectively emit less than 2 percent of the total reported VOC emissions from paper, film, and foil coating facilities in ozone nonattainment areas. For these reasons, we are not extending our recommendations in this draft CTG to these low emitting facilities. For purposes of determining whether a facility meets the 6.8 kg/day (15 lb/day) threshold, aggregate emissions from all paper, film, and foil surface coating operations at a given facility are included.

In developing their RACT rules, State and local agencies should consider carefully the facts and circumstances of the affected sources in their States. As noted above, States can adopt the above recommended 6.8 kg/day (15 lb/day) actual VOC emissions or equivalent applicability criterion, or they can develop other applicability criteria that they determine are appropriate considering the facts and circumstances of the sources in their particular nonattainment areas. EPA will review the State RACT rules in the context of the SIP revision process.

Based on the 2002 National Emission Inventory (2002 NEI), we estimate that there are 716 paper, film, and foil surface coating facilities in the United States. Of these, we estimate that 474 facilities are located in current ozone nonattainment areas (based on April 2004 designations) and 251 of the facilities located in ozone nonattainment areas emit more than the 6.8 kg/day (15 lb/day) VOC applicability threshold described above. The 2002 NEI was also used as the source of statistical information concerning the paper, film, and foil surface coating industry as a whole.

According to the 2002 NEI, paper, film, and foil surface coating facilities are located throughout the United States, with the Pacific Coast and the Northeastern States having the largest numbers of facilities. Appendix B shows that these facilities are distributed across 21 States. Appendices C and D summarize the current State and/or local requirements that are applicable to paper, film and foil surface coating.

In addition to the 2002 NEI, we reviewed relevant information in the Background Information Document (BID) for the 2002 NESHAP.⁴ The BID for the 2002 NESHAP indicated that there are about 429 paper, film, and foil surface coating facilities in the United States. This information was based on the 1996 Toxic Release Inventory (TRI) database for 12 Standard Industrial Classification (SIC) codes identified for the paper and other web industry. We believe that the NEI data provides a more accurate and current prediction of the total number of paper, film, and foil surface coating facilities.

IV. Process Description and Sources of VOC Emissions

The paper, film and foil coatings product category listed under section 183(e) of the CAA includes coatings that are applied to paper, film, or foil surfaces in the manufacturing of several major product types for the following industry sectors: pressure sensitive tape and labels (including fabric coated for use in pressure sensitive tapes and labels); photographic film; industrial and decorative laminates; abrasive products (including fabric coated for use in abrasive products) and flexible packaging. The category also includes coatings applied during miscellaneous coating operations for several products including: corrugated and solid fiber boxes; die-cut paper paperboard, and cardboard; converted paper and paperboard not elsewhere classified; folding paperboard boxes, including sanitary boxes; manifold business forms and related products; plastic aseptic packaging; and carbon paper and inked ribbons.

Coating performed on or in-line with any offset lithographic, screen, letterpress, flexographic, rotogravure, or digital printing press is not part of the paper, film and foil coating category. The application of inks, coatings and adhesives on or in-line with rotogravure or flexographic printing presses used in the production of flexible packaging is addressed in the CTG for Flexible Package Printing (EPA 453/R-06-003, September 2006). The application of inks, coatings and adhesives on or in-line with publication rotogravure printing presses is addressed in the CTG for Graphic Arts: Rotogravure and Flexography (EPA 450/2-78-033). The application of inks, coatings and adhesives on or in-line with offset lithographic or letterpress printing presses is addressed in the CTG for Offset Lithographic Printing and Letterpress Printing (EPA 453/R-06-002, September 2006).

A. Process Description

The paper, film, and foil surface coating process can be described as a web coating process, which is a process that applies a continuous layer of coating material across essentially the entire width or any portion of the width of a web substrate to: (1) provide a covering, finish, or functional or protective layer to a substrate; (2) saturate a substrate for lamination; or (3) to provide adhesion between two substrates for lamination. The web coating operations and emission control techniques do not vary significantly among the sectors of the paper, film, and foil surface coating industry.

A typical coating line consists of a series of one or more unwind/feed stations; one or more coating applicators; the flash-off area (the area between two or more consecutive coating applicators or between the coating applicator and the drying oven); one or more drying ovens; and one or more rewind/cutting stations.

There are several different types of coating applicators that may be used to apply coatings. The most common types of applicators include: rotogravure, reverse roll, slot die, knife, flexography, Mayer rod, dip and squeeze, and extrusion/calendering.⁴ The type of coating applicator used may differ among coating application stations in the same coating line.

Rotogravure (web-fed gravure) coaters are used extensively by the printing industry, but they are also used for coating. The coating materials (or inks) are picked up in the recessed areas of the roll and transferred directly to the substrate. Several gravure coaters may be combined on one coating line. In gravure coating, the coatings include both solvent and waterborne systems.⁴

The *reverse roll* coater applies a constant thickness of coating to the substrate, usually by means of three rollers--a metering roller, a backing roller, and an applicator (transfer) roller. A metering roller picks up the coating solution from a trough and transfers it to an applicator roller. (Sometimes there is no metering roller and the coating is pumped directly onto an applicator roller.) The web is supported by a backing roller where the applicator roller contacts the paper. The applicator roller then transfers the coating to the substrate, as the web passes between the backing roller and the applicator roller. The applicator roller turns in a direction opposite to that of the paper, hence the name reverse roll coater. This reverse direction of the applicator roller reduces striations in the coating that can form if the applicator roller is turned in the same direction as the paper web.

The *slot die* coater is similar to an extruder but is less heavy-duty than an extruder since less viscous materials are used with a slot die coater (a discussion of extruders is provided further below). In a slot die coater, the coating is extruded through an adjustable-width orifice onto the substrate and is sometimes followed by a smoothing roller. Slot die coaters are typically used for application of hot-melt coatings and adhesives, but may also be used to apply aqueous coatings.⁴

A *knife* coater consists of a blade that scrapes off excess coating from the substrate. The tray or trough of coating is located behind the knife blade. A continuous sheet of substrate is drawn between the knife blade and the support roller. As coating is deposited on the substrate, the knife blade spreads it across the substrate to the desired thickness. The position of the knife relative to the substrate surface can be adjusted to control the thickness of the coating. Some knife coaters use high velocity air as the knife blade; these are known as air-knife coaters. Knife coaters can apply solutions of much higher viscosity than roll coaters, thus less solvent is emitted per pound of coating applied. Knife coaters handle coatings with viscosity up to 10,000 centipoise (cp), while reverse roll coaters operate best with coatings that have a viscosity ranging from 300 to 1500 cp. Knife coaters, however, usually operate at lower speeds than roll coaters and show a greater tendency to break the web.⁴

In *flexographic* coating, the area to be coated is delineated by a raised surface on a flexible plate that is usually made of rubber or other elastomeric materials. Because of the ease in plate preparation, flexography is more suited to short production runs than gravure. Coating materials applied with flexography must be very fluid to work properly and include waterborne and solvent-based systems. The solvents used must be compatible with the rubber or polymeric plates; thus aromatic solvents are not used. Flexography is performed both on wide web (<18 inches) and narrow web (<18 inches), and on sheets as well as web.⁴

The *Mayer rod* (or wire-wound rod) coater is a metering device used to control the thickness of an applied coating. Typically, the coating is applied via a roller, and the excess coating is removed by a rod covered by a spiral-wound stainless steel wire. The rod wipes the coating off the substrate except for the portion which escapes through the spaces between the wires. Larger wire diameters result in larger spaces, and therefore heavier coatings.⁴

The *dip and squeeze* coater, also called a dip coater, impregnates or saturates the substrate rather than applying a coating to the web surface. The substrate is fed and dipped into a coating-filled pan by a system of rollers. The saturated web is then passed through nip rollers that squeeze off any excess coating.⁴

The *extrusion* coater creates a web substrate or applies coating materials to a preformed web substrate by forcing it through a die. A typical extrusion coater forms a plastic film or coating of the hot-melt type by forcing a molten polymer resin through a die as the web or conveyor passes below the die. The extruded web is then cooled to restore the coating to a solid state. Nearly all extrusion coatings are made of low-density polyethylene (LDPE). They account for a large portion of the coatings used in the printing product and packaging industry, divided about evenly between cartons/cardboard and flexible materials.⁴

In *calendering*, a process similar to extrusion, material is pressed by a roller or between rollers to form a web such as vinyl sheeting. Calendering may also be used to apply a coating to a substrate, as in the manufacture of duct tape. Prior to calendering, resins, plasticizers, and pigments are blended together in a series of blenders, mixers, and mills. Plasticizers are used to improve the flexibility of the coating/material. After mixing, the mixture is conveyed to the calender. In a typical four-roll calender, the molten coating is rolled into a continuous sheet, which is then cooled.⁴

After the coating application described above, the applied coating may be heat dried or cured in one or more drying ovens. The major functions of the drying oven are to dry the coating by evaporating the solvent and/or finish the curing of a polymeric coating.

Cleaning activities also occur at paper, film, and foil surface coating facilities. Cleaning materials are used during these activities to remove coating residue or other unwanted materials from equipment related to coating operations, as well as spray gun cleaning, etc. Cleaning materials are typically mixtures of VOC-containing solvents.

B. Sources of VOC Emissions

Primarily, VOC emissions from paper, film, and foil surface coating operations result from the evaporation of volatile components of the coatings and cleaning materials.^a The majority of VOC emissions from these materials occur during coating application/flash-off, coating curing/drying, and cleaning. The coating applicator(s)/flash-off area(s) and oven(s) are the main VOC emissions sources on the coating line. The VOC contained in the coatings evaporate from the web into the coating application/flash-off area during coating application/flash-off or are evaporated from the web during the heating process in the dryers. The remaining VOC emissions are from cleaning operations. In most cases, VOC emissions from mixing, surface preparation, handling and storage of coatings and solvents, and waste/wastewater operations are small. The following discussion describes the two primary emission sources (coatings and cleaning materials).

1. Coatings

The VOC emissions from paper, film, and foil coatings occur during coating application/flash-off and drying/curing of the coatings. Some of the VOC in the coatings evaporates from the web into the coating application area during coating application. Additional VOC evaporates from the web in the flash-off area (prior to entering the dryer). The majority, usually greater than 90 percent, of the VOC in the coatings volatilizes in the drying ovens. The VOC that evaporates from the web in the drying oven(s) are vented through an exhaust stack. The amount of VOC emitted varies depending on the type of coatings being used.

Traditionally, conventional solvent-based coatings (which generally have higher VOC content), have been used in the paper, film, and foil surface coating industry. Due to increased regulation at the federal and State level, the industry has steadily moved toward alternative coating formulations that reduce the amount of air emissions per unit amount of coating solids used. The types of coatings used in the paper, film, and foil surface coating industry include solvent-borne, waterborne, hot-melt adhesives and other 100 percent solids coatings, reactive, and radiation-cure coatings.

^a In a previous notice, EPA identified specific categories, including paper, film and foil coating, the cleaning operations of which would not be covered by EPA's 2006 CTG for industrial cleaning solvents (71 FR 44522, 44540, October 5, 2006). In the notice, EPA expressed its intention to address cleaning operations associated with these categories in the CTGs for these specified categories if the Agency determines that a CTG is appropriate for the respective categories.

Solvent-borne coatings are widely used in the paper, film, and foil surface coating industry. The solvent content of the coating is highly variable in solvent-borne coatings, and depends primarily on the type of coating applicator used (e.g., reverse roll coaters require the use of coatings with lower viscosities than knife coaters, therefore could require a higher solvent content). For solvent-borne coatings, coating formulations typically range from 40 to 80 percent solvents by weight, as supplied by the manufacturer. Users may dilute solvent-borne coatings with additional solvents. The primary solvents in solvent-borne coatings include methanol, toluene, and xylene, methyl ethyl ketone, acetone, and ethanol. Knife coaters, reverse roll coaters, and gravure coaters are commonly used to apply solvent-borne coatings.

Waterborne coatings contain water as a significant part of the fluid, although some organic solvents may be used at up to 30 percent of the fluid. Most coating equipment used for solvent-borne coatings can also be used for waterborne coatings. Knife coaters and gravure coaters are particularly well suited to application of waterborne coatings. However, troughs or trays may have to be mixed more often when they contain waterborne coatings than when they contain solvent-borne coatings because waterborne coatings are more susceptible to coagulation or agglomeration of their solids.

Oven temperatures are typically higher with waterborne coatings because water has a higher boiling point and higher heat of vaporization than most organic solvents. However, energy usage may still be lower for waterborne coatings during the drying process because less dilution air is required.

Hot-melt adhesives and other 100 percent solids coatings such as wax coatings, wax laminations, extrusion coatings, extrusion laminations, and coal seal coatings typically contain no solvent. Accordingly, these coatings emit very little VOC.

In a hot-melt adhesive application, the solid coating material is heated, delivered to the coater head in a molten state, and added onto the web by a heated gravure coater, a heated roll coater, or an extrusion coater. The coated web is then chilled, restoring the coating to its solid state. Hot-melt adhesives uses less energy than waterborne or solvent-borne coating operation because there are no dryers. The use of hot-melt adhesives also minimizes fire and explosion dangers because there are no volatile hydrocarbons.

The use of hot-melt adhesives, although growing, is still limited by several factors. Because the equipment for hot-melt adhesives is quite different from solvent-borne and waterborne coatings, existing equipment would have to be replaced to implement hot-melt adhesive use. Controlling the amount of hot-melt adhesives applied to the substrate can be difficult with hot-melt coatings, resulting in poor coating quality. The hot-melt coater head is more susceptible to streaking due to plugging or dirt accumulation. Cleaning the coater head is difficult and time consuming, making changes to coat a different substrate or use a different hot-melt adhesive on the same hot-melt adhesive line more difficult, and therefore reduces the flexibility of the coater to coat many different products. Additionally, hot-melt adhesives do not have the strength or resistance to environmental stresses such as heat or cold, as do solvent-borne coatings. The hot-melt adhesives are typically darker in color and therefore, are not used on

transparent surfaces. Finally, hot-melt adhesives cannot be used on a film substrate that is sensitive to heat because the substrate could melt during the coating process.

Reactive coatings are cured via a chemical (usually polymeric) reaction that forms other compounds. The resulting compounds are generally not VOC and/or stay with the substrate as residual VOC and is not emitted whether or not the substrate is dried.⁴ Reactive coatings are frequently used in the surface coating of decorative and industrial laminates and abrasives. Reactive coatings include styrene formaldehyde, phenolic, melamine, and epoxy resins.

Radiation-cure coatings (also called prepolymer coatings) are a special type of reactive coatings. These coatings are cured by exposure to electron beam (EB) or ultraviolet (UV) radiation. Radiation-cure coatings are solventless and are almost entirely composed of resins. They are applied in a liquid state via some typical coating application methods (*e.g.*, gravure and flexography), and polymerize into a solid state upon exposure to UV or EB radiation. UV-cured coatings require the addition of a photoinitiator to catalyze the polymerization reaction; EB-cured coatings do not, because the highly excited electrons emitted by the EB source are capable of initiating the polymerization reaction.

Benefits of radiation-cured coatings extend beyond decreased solvent usage and the associated emission reductions, including VOC emissions. The instantaneous nature of the curing process eliminates the need for drying ovens on the production line, which often leads to production increases and may allow direct integration of ancillary operations (*e.g.*, cutting, slitting, folding) into the production line. Because no drying ovens are used, both energy usage and the space required for a coating line are greatly reduced. Since the coatings will not cure unless exposed to the proper type of UV or EB radiation, they will not cure on the production equipment during operation or during process downtime. As a result, it is not necessary to clean application devices at the end of each shift or during breaks and cleaning is easier than some other coatings, such as hot-melt coating.

Although industry generally perceives UV coating usage as expensive because it may be costly to switch a coating line from solvent-based coating equipment to radiation-cured systems, there are often savings with the use of radiation-cured coatings due to the above-mentioned benefits that can offset capital costs. Another industry perception is that the coatings themselves are more expensive. Although this may be true on a volume-to-volume basis, a radiation-cured coating will cover a much greater area of substrate (2 to 4 times) than an equal volume of a solvent-based coating because the radiation-cured coating is 100 percent solids and has no loss of volume due to evaporation of solvent.

There are, however, several limitations to the use of radiation-curable systems. The extent of cure penetration can be a problem if the coating is very thick or heavily pigmented, which could result in coating not being completely cured. Because low viscosity solvents are not used, application of the relatively higher viscosity radiation-cured coatings can be problematic; although this factor is less important in the application to web substrates than other substrates which use spray coating. Also, skin contact with radiation-cured coatings has the potential for irritation and/or allergic reaction. This is especially true during cleaning, since the combination

of cleaning solvents and the radiation-cured coatings increases dramatically the level of irritation to the skin.

2. Cleaning Materials

Cleaning materials are another source of VOC emitted by paper, film, and foil surface coating operations. Cleaning materials are used to remove excess coatings from coating equipment. These materials are typically mixtures of organic solvents. The cleaning material may be a solvent, or a specific mixture of individual solvents. Cleaning materials are used to wash the coating applicators and outsides of the coating machines, and to remove residues of excess coatings between color changes. Cleaning may be done manually, using shop towels for example, or using an automatic wash system.

V. Available Control Options and Regulatory Approaches

As previously mentioned, there are two main sources of VOC emissions from paper, film, and foil surface coating operations: (1) evaporation of VOC from the coatings; and (2) evaporation of VOC from the cleaning materials. This section summarizes the available control options for reducing these VOC emissions and regulatory approaches.

A. Available Controls for VOC Emissions from Coatings

Common control techniques for reducing VOC emissions from paper, film, and foil surface coatings include pollution prevention measures and the operation of emission capture and add-on control systems. Provided below is a summary of these control techniques.

1. Pollution Prevention Measures

Product substitution/reformulation is the most commonly used pollution prevention measure applicable to the paper, film, and foil surface coating industry to decrease VOC emissions from coatings. Lower VOC content coatings (such as waterborne and higher solids content coatings) or coatings with no solvents (*e.g.*, hot-melt adhesives) may be used to reduce VOC emissions by reducing or eliminating the organic solvent present in the coating. As previously discussed, these coatings include waterborne, hot-melt, reactive and radiation-cure coatings. Coating manufacturers have developed and are continuing to develop waterborne and other alternative coating formulations that replace conventional organic solvent-borne coatings. These coatings are generally available. Conversion to these coatings can lower VOC emissions greatly, and most paper, film, and foil surface coating operations are capable of converting to these coatings. However, for some products, the currently available low-VOC coatings or coatings with no solvents do not meet the performance requirements of some paper, film, and foil surface coating operations and therefore are not viable options for production of these products.

2. Emission Capture and Add-on Control Systems

When low-VOC content coatings cannot be used due to performance requirements calling for higher VOC content coatings, VOC emissions from paper, film and foil surface coating operations can be reduced by the use of capture systems in conjunction with add-on control systems that either destroy or recover the VOC in the exhaust streams.

Capture Systems

Capture systems, such as hoods and enclosures, collect solvent-laden air from process vents (*e.g.*, drying oven vents) and/or fugitive emissions (*e.g.*, application and flash-off area) containing VOC and direct the captured air to a control device. Emissions from the drying oven can be ducted directly to a control device, making the drying oven the principal element of the capture system. In addition, capture systems are used to collect fugitive emissions from solvents that evaporate from other parts of the coating line, such as the coating application and flash-off areas, and route them to a control device.

An efficient capture system maximizes the capture of emissions and minimizes the quantity of dilution air. Facilities may combine several captured VOC-laden streams and duct them to a single control device.

The most common types of capture systems used by the paper, film, and foil surface coating industry are hoods or enclosures. Hood and enclosure capturing methods include canopy hoods, floor sweeps, partial enclosure of coating stations, room enclosures, and permanent total enclosure (PTE). There are capture systems in use with efficiencies as high as 100 percent.⁵

Add-on Control Devices in Paper, Film and Foil Surface Coating

Add-on control devices reduce the amount of VOC emissions by either destruction or recovery with or without recycling of VOC emissions in the exhaust streams. Two categories of add-on control devices are typically used by the paper, film, and foil industry: combustion (thermal or catalytic oxidation) and recovery (adsorption and condensation). While many control devices can be used to reduce VOC emissions, the following summary covers those control devices known to be used with surface coating operations: oxidation, adsorption, and condensation. In addition, there are other control measures that are known to reduce VOC emissions, but are not frequently in use in the paper, film, and foil surface coating industry. These alternative control technologies are also discussed below.

Oxidation destroys VOC emissions in an exhaust stream by exposing the stream to an oxidizing atmosphere at high temperatures. Oxidizers may be of thermal or catalytic design and combust VOC-containing exhaust streams. Catalytic oxidizers are similar to thermal oxidizers but employ a catalyst to aid in the oxidation reaction. As a result, catalytic oxidizers operate at a lower combustion temperature relative to that required in thermal oxidizers. Both types of oxidizers generally utilize either regenerative or recuperative techniques to preheat inlet gas in order to decrease energy costs associated with high oxidation temperatures. They may also use primary or secondary heat recovery to reduce energy consumption. In general, oxidizers may achieve destruction efficiencies of greater than 95 percent as applied to surface coating application operations with high and constant concentrations of VOC.

Adsorption occurs when the unbalanced molecular forces on the surface of solids (the adsorbent) attract and retain gases and particulate matter that come in contact with the solid. Several materials can be used as the adsorbent, such as activated carbon, organic resin polymer, and inorganic materials. Carbon adsorbers are most commonly used in the paper, film, and foil surface coating industry. In a carbon adsorber, activated carbon is used as the adsorbent in a regenerable fixed bed. In a typical carbon adsorber, VOC-laden air is passed through a fixed bed of granular activated carbon. The VOC in the entering air stream are adsorbed onto active sites on the surface area of the carbon. Adsorber beds are typically operated in parallel to avoid interruption of VOC control. In this arrangement, when the adsorption capacity of one bed is exhausted, it can be removed from service and a second adsorber bed can be put into service, ensuring that a control device is operating at all times. The spent carbon in the first adsorber bed is then regenerated and can be put into service again.

Carbon adsorption systems can achieve control device efficiencies greater than 95 percent.⁶ In contrast to combustion, carbon adsorption does not destroy the VOC it removes from the air stream. Carbon adsorbers used in paper, film and foil surface coating are thermally regenerated, usually by passing steam through the carbon beds.⁷ The VOC are removed from the carbon (desorbed) and transferred to the steam. The VOC-containing steam is then condensed, and the VOC solvent is separated from the water. The recovered solvent can then be decanted for sale or reuse. Regeneration can also be achieved with hot air. Hot-air regeneration can be quite attractive when dealing with water soluble solvents.⁷ Carbon adsorption is most easily adaptable to coating lines that use a single solvent; if solvent mixtures are collected by adsorbers, they usually are distilled for reuse.⁸

There are two options for disposing recovered solvents that cannot be reused. The first is to sell the material back to the solvent supplier or an independent firm that specializes in reclaiming contaminated solvents. The other option is to use the recovered solvent as a fuel in coating ovens or in boilers. However, many coating ovens and boilers are gas-fired and would require burner modifications to burn solvent. Carbon adsorption is generally economically attractive only if the recovered solvent can be reused directly.⁷

Carbon adsorbers are most suitable for solvents that are immiscible with water, such as toluene and xylene, but are not recommended for water-soluble VOC, such as methyl ethyl ketone and methyl isobutyl ketone. In the case where a water-soluble VOC is present, the water vapor will be adsorbed and desorbed along with the VOC vapor, and the VOC may require subsequent purification if it is to be reused.

The presence of solid particles or polymerizable substances in the inlet air stream to a carbon adsorber may require pretreatment of the inlet air. Cooling and dehumidification may also be required as pretreatment in some cases.⁶ Adding equipment, such as a dehumidification system, increases the costs associated with the use of a carbon adsorption system.

Condensation is where organic compounds (*i.e.*, VOC) are removed from gas streams by cooling the gas to a temperature less than the dew point of the compound. The recovered VOC compounds can then be reused or sold. Highly volatile VOC require lower temperatures for

condensation. Therefore, refrigeration is often necessary to reach the low temperatures required for acceptable removal efficiencies.⁹ Removal efficiencies usually range from 50 to 90 percent.⁶

The most common types of condensers used are surface and contact condensers. In surface condensers, the coolant does not contact the gas stream. Surface condensers allow for direct recovery of VOC from the gas stream.⁹ Unlike surface condensers, contact condensers cool through direct contact of the coolant with the gas stream. The contact condenser coolant, which is a liquid at ambient or chilled temperature, is sprayed into the gas stream. In a contact condenser, the condensed VOC are contaminated with coolant and therefore cannot usually be reused or resold directly; further processing is necessary to complete the recovery process.¹⁰

Alternative control technologies, such as liquid absorbers and biofilters are used infrequently in the paper, film, and foil surface coating industry. Ultraviolet (UV) oxidation is not currently utilized by the paper, film, and foil surface coating industry. However, it has been shown to be an effective control technology for VOC emissions from coatings in other industries. The use of these types of alternative control technologies would be highly dependant on facility needs and characteristics.

B. Available Controls for Cleaning Materials

Pollution prevention is the most common emission control technique for reducing VOC emissions from cleaning materials. The pollution prevention measures applicable to the paper, film, and foil surface coating industry include product substitution/reformulation and work practice procedures. Cleaning materials with low or no VOC content or low-VOC composite vapor pressure may be used to reduce or eliminate VOC emissions from using these materials. Work practice procedures may also reduce VOC emissions during cleaning operations by reducing the amount of VOC that can evaporate due to exposure to air.

No add-on control technologies are being used specifically for reducing VOC emissions from cleaning operations associated with paper, film, and foil surface coating. However, if cleaning operations are performed within a capture system which is ducted to an add-on control system, such as a PTE routed to a thermal oxidizer, the VOC emissions from the cleaning operation would be reduced by destruction in the thermal oxidizer. Further, there are controlled cleaning operations where cleaning is automated, enclosed, and vented to a control device.

1. Product Substitution/Reformulation

Reducing the composite vapor pressure or VOC content of the cleaning material used, either by substitution or reformulation, is one pollution prevention measure that is used to reduce VOC emissions from cleaning operations. However, little information is available regarding the types of low-VOC or VOC-free cleaning materials that could be used in the paper, film, and foil surface coating industry.

2. Work Practice Procedures

Work practices are widely used in the paper, film, and foil surface coating industry as a measure of reducing VOC emissions from cleaning materials during cleaning operations. These measures include: covering cleaning material mixing tanks; storing cleaning solvents and solvent-soaked rags and wipes in closed containers; and cleaning spray guns in an enclosed system. Use of recycled solvents for cleaning is also typical in the industry.

C. Existing Federal, State, and Local Recommendations or Regulations

The following discussion is a summary of EPA actions, as well as State and local regulations that address VOC emissions from paper, film, and foil surface coating processes. Appendices B, C, and D summarize State and local provisions.

1. The 1977 CTG

The 1977 CTG recommended limiting VOC emissions from paper coating operations. The 1977 CTG recommended VOC limits apply to paper coating lines, which are defined as consisting of the application/flash-off area and the drying oven. Cleaning materials were not addressed in the 1977 CTG.

The 1977 CTG recommended RACT for paper coating was 0.35 kg/l (2.9 lb/gal) of coating, excluding water and exempt compounds, as applied. This recommended limit was based on the use of conventional solvent-borne coatings and oxidation of the dryer exhaust which achieved an overall control efficiency of 81 percent. The limit was expressed in terms of a coating VOC content to encourage the development and use of low-VOC content coatings. Equivalent solid-based limits for paper coating operations were presented in *A Guideline for Surface Coating Calculations*” (EPA-340/1-86-016).¹¹ For paper coating, the 1977 CTG-equivalent limit was 0.58 kg/l (4.8 lb/gal) of solids using a representative coating solids. These equivalent limits were calculated using an assumed VOC density of 0.88 kg/l (7.36 lb/gal). This assumed VOC density is the same as that used in calculating the limits recommended in the 1977 CTG.

2. The 1983 NSPS

In 1983, EPA promulgated new source performance standards for pressure sensitive tape and label surface coating operations (1983 NSPS), 40 CFR 60, subpart RR. The 1983 NSPS only applies to pressure sensitive tape and label surface coating lines that commenced construction, reconstruction, or modification after December 30, 1980. The 1983 NSPS defines a coating line to include the coating applicators, flash-off areas, and drying ovens between web unwind stations and web rewind stations. The 1983 NSPS requires a 90-percent reduction of VOC emissions. Alternatively, it establishes a limit of 0.20 kg VOC/kg (0.20 lb VOC/lb) solids applied, based on a VOC emission reduction of 90 percent. Any pressure sensitive tape and label surface coating operations that inputs 45 Mg/yr (50 tpy) or less VOC into the coating process are not subject to the 1983 NSPS emission limit (other requirements such as recordkeeping and reporting do apply). Cleaning materials were not addressed in the 1983 NSPS.

3. The 2002 NESHAP

In 2002, EPA promulgated the National Emission Standards for Hazardous Air Pollutants: Paper and Other Web Coating (2002 NESHAP), 40 CFR part 63, subpart JJJJ, which applies to major sources of HAP emissions (*i.e.*, stationary sources that emit or have the potential to emit 10 tpy or more of any one HAP, or 25 tpy or more of any combination of HAP). The 2002 NESHAP addresses organic HAP emissions, including VOC HAP emissions, from all web coating lines at a paper, film, and foil surface coating facility, which include coating application and any associated curing and/or drying equipment between an unwind station and a rewind or cutting station.

The 2002 NESHAP has different emission limitations for sources that commenced construction or reconstruction on or before September 13, 2000 (existing sources), and sources that commenced construction or reconstruction after September 13, 2000 (new sources). The 2002 NESHAP limits for existing sources are based on an overall HAP emission reduction of 95 percent and are expressed as follows: (1) no more than 5 percent of the organic HAP applied; (2) no more than 0.04 kg/kg (0.04 lb/lb) coatings applied; or (3) no more than 0.20 kg/kg (0.20 lb/lb) solids applied. Similarly, the limits for new sources are based on a HAP emission reduction of 98 percent and are expressed as follows: (1) no more than 2 percent of the organic HAP applied; (2) no more than 0.016 kg/kg (0.016 lb/lb) coatings applied; or (3) no more than 0.08 kg/kg (0.08 lb/lb) solids applied.

Compliance with the 2002 NESHAP can be demonstrated by any of the following methods: (1) all coatings purchased have organic HAP contents that individually meet the organic HAP emission limit; (2) all coatings applied have organic HAP contents that individually meet the organic HAP emission limit; (3) total monthly organic HAP applied does not exceed an equivalent allowable organic HAP (which is a facility-specific weighted average calculated based on HAP content of the coatings applied); (4) use one or more capture systems and control devices; or (5) use a combination of coatings and capture systems and control devices meet the organic HAP emission limit.

4. Existing State and Local VOC Requirements

In addition to the EPA actions described above, at least 44 State and local jurisdictions have regulations that affect VOC emissions from all or part of the paper, film, and foil surface coating industry. Some of these regulations are general surface coating rules; many are specific to the paper, film, and foil surface coating industry and cover the coating line. Generally, the State and local regulations allow compliance with their requirements to be demonstrated using low-VOC coating or add-on control devices in conjunction with higher-VOC coating.

Almost all of the jurisdictions that specifically address all or part of the paper, film, and foil surface coating industry have adopted the recommended VOC emission limits in the 1977 CTG. However, there are fourteen jurisdictions that have more stringent requirements than the 1977 CTG. These jurisdictions allow compliance either using compliant coatings, or by using an add-on control system. Seven jurisdictions have VOC emission limits that are more stringent than the 1977 CTG, five in California and two in Illinois. The California jurisdictions limit VOC emissions to 265 g/l (2.2 lb/gal) of coating, excluding water and exempt compounds, as applied.

The two jurisdictions in Illinois limit VOC emissions to 0.28 kg/l (2.3 lb/gal) of coating, excluding water and exempt compounds, as applied. As an alternative to the VOC emission limits, these California and Illinois jurisdictions allow facilities to install capture systems and control devices to reduce VOC emissions from these coating operations. The required overall emission reduction, including capture and control efficiency, ranges from 55 percent to 90 percent. Specifically, the San Diego County Air Pollution Control District (San Diego) and the Ventura County Air Pollution Control District (Ventura) both require an overall control efficiency of 90 percent. Finally, there are seven jurisdictions that have VOC emission limits that are the same as the 1977 CTG. However, these jurisdictions require 95 percent emission reduction as an alternative to the VOC emission limit. The 95 percent overall control efficiency is the most stringent and likely can only be met with a permanent total enclosure that achieves 100 percent capture efficiency.

Several jurisdictions in California have requirements to regulate the VOC content of cleaning materials used in the paper, film and foil surface coating industry. These regulations are aimed at reducing VOC emissions from cleaning materials by combining work practice standards with limits on the VOC content or composite vapor pressure of the solvent being used. In some cases, the jurisdictions allow the use of add-on controls as an alternative to the VOC content/vapor pressure limits. The different air pollution control authorities in California have established similar work practice standards. However, the cleaning material VOC content/vapor pressure limits vary by jurisdiction, as do the overall control efficiency required when add-on controls are used as an alternative.

There are 10 States that have cleaning material regulations that apply to paper, film, and foil surface coating operations. Of these, 9 States do not limit the VOC content/vapor pressure of cleaning materials. Instead, they have established equipment standards, work practices, and/or recordkeeping requirements. There is one State that requires work practices as well as limiting the vapor pressure of the cleaning materials. The cleaning material regulations are summarized in detail in the draft CTG.

VI. Recommended Control Options

Based on a review of the 1977 CTG, the 1983 NSPS, the 2002 NESHAP, and the current State and local requirements discussed above, we recommend emission limits and work practices for controlling the VOC emissions from coatings and cleaning materials used in paper, film and foil surface coating operations. The following discussion summarizes EPA's recommendations for controlling VOC emissions.

As previously explained in Section III of this document, we are recommending these control options for facilities whose paper, film, and foil surface coating operations that emit 6.8 kg VOC/day (15 lb VOC/day) or more before the consideration of control. In addition, coating performed on or in-line with any offset lithographic, screen, letterpress, flexographic, rotogravure, or digital printing press is not subject to the recommendations in the draft CTG. Printing, coating and laminating performed on or in-line with such presses is addressed in other CTGs.

A. Coatings

For the purposes of this draft CTG, we recommend defining coatings as materials applied onto or impregnated into a substrate for decorative, protective, or functional purposes. Such materials include, but are not limited to, solvent-borne coatings, waterborne coatings, adhesives, wax coatings, wax laminations, extrusion coatings, extrusion laminations, 100 percent solid adhesives, UV cured coatings, electron beam cured coatings, hot melt coatings, and cold seal coatings. Materials used to form unsupported substrates, such as calendaring of vinyl, blown film, cast film, extruded film, and co-extruded film, are not considered coatings.

To control VOC emissions from coatings used in paper, film and foil surface coating, we recommend an overall VOC control efficiency of 90 percent for each coating line. Alternatively, we recommend emission limits that are equivalent to 90 percent overall control. The coating line is defined as a series of coating applicators, flash-off areas, and any associated curing/drying equipment between one or more unwind/feed stations and one or more rewind/cutting stations.

We recommend an overall VOC control efficiency of 90 percent as RACT for each paper, film, and foil surface coating line, as defined above. This emission reduction is based on the San Diego and Ventura levels of control, as well as the 1983 NSPS. The San Diego and Ventura regulations require that if an add-on control is used as the compliance option, the control system must achieve 90 percent overall emission reduction.. We are not recommending the 95 percent overall emission reduction in the 2002 NESHAP and seven States regulations. A 95 percent overall emission reduction would require facilities to install and operate a PTE (i.e., achieve 100 percent capture efficiency) in conjunction with a control device that reduces emission by 95 percent. We do not believe that it is reasonable or feasible to retrofit a PTE in all cases.

As an alternative to an overall 90 percent control efficiency, we recommend VOC content-based emission limits that are equivalent to 90 percent overall control. To determine these equivalent content-based emission limits for this product category (except for pressure sensitive tape and label surface coating lines), we used the same baseline coating, 20 weight percent solids and 80 weight percent solvent (organic HAP for the NESHAP and VOC for this CTG), used to develop similar limits in the 2002 NESHAP. Using this baseline coating content, the VOC content-based emission limits equivalent to 90-percent emission reduction are 0.40 kg VOC/kg (0.40 lb VOC/lb) solids applied and 0.08 kg VOC/kg (0.08 lb VOC/lb) coating applied. We recommend these limits for paper, film and foil surface coating except for pressure sensitive tape and label surface coating lines.

As an alternative to 90 percent emission reduction, the NSPS for pressure sensitive tapes and labels provides an alternative limit of 0.20 kg VOC/kg (0.20 lb VOC/lb) solids applied. We recommend the same alternative limit of 0.20 kg VOC/kg (0.20 lb VOC/lb) solids applied and an additional equivalent limit of 0.067 kg VOC/kg (0.067 lb VOC/lb) of coating as RACT for pressure sensitive tape and label surface coating lines. See Table 1 for a summary of the recommended RACT limits for the paper, film, and foil surface coating source category.

Table 1. Summary of Recommended RACT Limits

Units	RACT Limits	
	Pressure Sensitive Tape and Label Surface Coating	Paper, Film, and Foil Surface Coating (Not including Pressure Sensitive Tape and Label)
Emission Reduction (%)	90	90
kg VOC/kg solids (lb VOC/lb solids)	0.20	0.40
kg VOC/kg coating (lb VOC/lb solids)	0.067	0.08

B. Cleaning Materials

For cleaning materials, we are recommending work practices to reduce VOC emissions. We are not recommending the application of add-on controls in conjunction with the work practices because the use of add-on controls to reduce emissions from cleaning operations at paper, film, and foil surface coating facilities would be a costly alternative because the area to be controlled is quite large and a large volume of air would be captured and directed to a control device. However, as mentioned previously, any cleaning activities that occur within a capture device would be controlled by the associated control device. Furthermore, we do not have information available regarding current VOC content or VOC composite vapor pressure usage to determine a RACT limit for cleaning materials used in paper, film, and foil surface coating operations. Therefore, we are not recommending the use of a VOC content or VOC composite vapor pressure limit for cleaning materials.

To control VOC emissions from cleaning materials used in paper, film, and foil surface coating, we recommend work practices for use in all paper, film, and foil surface coating facilities meeting the applicability threshold noted above. We recommend that each facility implement work practices include steps to ensure that VOC emissions are minimized from mixing, storage, and handling of cleaning materials, and cleaning-related waste materials. Specifically, we recommend the following: (1) store all VOC-containing cleaning materials in closed containers; (2) ensure that mixing and storage containers used for VOC-containing materials are kept closed at all times except when depositing or removing these materials; (3) minimize spills of VOC-containing cleaning materials; (4) convey VOC-containing cleaning materials from one location to another in closed containers or pipes; and (6) minimize VOC emissions from cleaning of storage, mixing, and conveying equipment.

VII. Cost Effectiveness of Recommended Control Options

We estimated the cost effectiveness of our recommendations in this draft CTG based on information collected during the development of the 2002 NESHAP. Although there is limited cost information available, we believe that the cost estimates and other related studies developed for the 2002 NESHAP are appropriate for estimating the cost impact of our recommendations in the draft CTG for the following reasons. The recommended level of control covers the same processes as the 2002 NESHAP (i.e., all coating applicators and any associated drying/curing equipment between the unwind/feed station and the rewind/cutting station). In addition, both the 2002 NESHAP emission limits and the recommended limits can be met by the same options (i.e., use of low-VOC content coatings or add-on control systems when high-VOC content coatings are used). Finally, the 2002 NESHAP cost data is the most recent available.

To develop emission and cost impacts for the 2002 NESHAP, EPA conducted a model plant analysis, in which it evaluated HAP emissions associated with different kinds of coating processes, the emission reduction capabilities of various control options, and the costs of such controls. The model plants were developed to represent a range of sizes and emissions. Table 2 presents a summary of the model plant characteristics, the approach for complying with the requirements of the 2002 NESHAP, the HAP emission reduction associated with compliance, and the associated capital and annual cost estimates. We believe that the model plant analysis performed in the development of the 2002 NESHAP is representative of current operations in the paper, film, and foil surface coating industry.

The annual costs of complying with the 2002 NESHAP were estimated using 1998 dollars related to the use of thermal oxidizers to achieve a 95 percent HAP overall control efficiency.⁴ As previously mentioned, the control option based on use of thermal oxidizers was chosen because this option was expected to be the worst-case for costs. All other control options are expected to have lower annual costs. These costs estimates were scaled to 2005 dollars and used to estimate annual costs and cost effectiveness for this draft CTG.

Based on the 2002 NEI database, we estimate that there are a total of 474 paper, film, and foil surface coating facilities located in ozone nonattainment areas (using April 2004 designations). As previously mentioned, we are recommending the control options described in this draft CTG to facilities in ozone nonattainment areas that emit 6.8 kg/day (15 lb/day) or more of VOC. Based on VOC emissions data in the 2002 NEI database, 251 of the facilities in ozone nonattainment areas emit VOC at or above this level. According to the 2002 NEI database these facilities in aggregate emit about 8,000 Megagrams of VOC per year (Mg/yr) (8,800 tons per year, tpy).

To estimate the costs associated with the add-on control recommendation in this draft CTG, we assumed that 47 percent of the facilities in the 2002 NEI database (119 facilities) are currently complying with the 2002 NESHAP. Since the 2002 NESHAP requires a 95-percent HAP emission reduction, which also achieves a 95-percent VOC emission reduction and is higher than the recommended 90-percent emission reduction, we assume that facilities already in compliance with the 2002 NESHAP would not be required to upgrade or install a thermal

oxidizer to implement the emission reduction recommended in the draft CTG and therefore would have no additional annual costs. In addition, we assumed that since the facilities represented by Model Plant 4 (see Table 2) already have an overall control efficiency of 90 percent, these facilities would not be required to upgrade the thermal oxidizer.

Using the 2002 NEI, we identified 57 of the 132 facilities that reported the use of control devices. Therefore, we removed 57 facilities from the model plant analysis. We then distributed the remaining 79 facilities across the model plants in the same ratios as those used during the development of the 2002 NESHAP and apply the annual costs (scaled to 2005 dollars) for each model plant. Using this approach, we estimate that the total annual cost associated with this draft CTG is \$26 million per year.

Although we believe that the 2002 NEI accurately represents the number of facilities and distribution of facilities within the U.S., we believe that the overall emissions per facility of 32 Mg/yr/facility (35 tpy/facility) is underestimated as compared with the model plant emissions per facility developed for the 2002 NESHAP of 168 Mg/yr/facility (184 tpy/facility). Therefore, we used the 2002 NESHAP model plant emissions to estimate the aggregate VOC emission reduction. Table 3 presents the nationwide emission estimates using the model plant approach. As shown in Table 3, we estimate that nationwide VOC emissions are 22,200 Mg/yr (24,400 tpy). Applying the 90-percent emission reduction to facilities above the emission cutoff and that are located in ozone nonattainment areas yielded an emission reduction of approximately 20,000 Mg/yr (22,000 tpy). Therefore, the cost effectiveness was estimated to be \$1,200 per Mg (\$1,300 per ton) of VOC. Table 3 presents the nationwide annual cost estimates for the paper, film, and foil surface coating industry.

VIII. References

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Table 2. Specifications for Model Plants Developed for the 2002 NESHAP⁴

Model Plant No.	Percent of Database Major Sources	Overall HAP Control Efficiency (%)	Approach for Capture and Control ^a	Average Number of Coating Lines	Average Number of Coating Stations	Coating Use (tpy)	Uncontrolled Coating Line HAP Emissions (tpy)	HAP Emission Reduction (tpy)	Total Model Plant Capital Costs (\$) ^b	Total Model Plant Annual Cost (\$/yr) ^b
1a	20	0	PTE and new control device	2	5	2,108	99	94	2,479,820	713,596
1b	3	0	PTE and new control device	12	9	7,521	1,765	1,677	6,780,733	1,923,790
1c ^{c,d}	10	0	No change							
2a	25	50	PTE and increase T.O. efficiency	5	11	8,607	276	124	531,481	174,162
2b	1	50	PTE	31	154	369,929	2,522	1,135	1,686,000	873,287
3a	11	80	PTE and increase T.O. efficiency	3	8	7,518	915	137	473,044	161,250
3b	1	80	PTE	8	15	14,516	6,890	1,034	290,000	120,638
4 ^d	24	90	No change							
5 ^d	5	95	No change							

^a PTE = permanent total enclosure; T.O. = thermal oxidizer

^b Costs developed in 1998 dollars.

^c Although a control efficiency of zero is stated, this model plant is assumed to be using compliant coatings.

^d These model plants were not included in the analysis because they are assumed to be already in operating at the CTG's recommended level of control

Table 3. Annual Cost Estimates for Paper, Film, and Foil Surface Coating Industry

Model Plant (a)	Model Plant VOC Emissions (tpy) (b)	Percent of Facilities Requiring Additional Control	Control Approach for Complying with Draft CTG	1998 Dollars	Number of Facilities Impacted by CTG (c)	Nationwide VOC HAP Emissions (tpy)	2005 Dollars		
				Model Plant Total Annual Cost (\$/yr)			Model Plant Total Annual Cost (\$/yr)	Nationwide Total Annual Cost (\$/yr)	Cost Effectiveness (\$/ton)
1a	198	20%	Install capture system and new T.O.	\$713,596	16	3,128	\$857,781	\$13,552,938	\$4,814
1b	3,530	3%	Install capture system and new T.O.	\$1,923,790	2	8,366	\$2,312,499	\$5,480,623	\$728
1c	96	10%	None	\$0	8		\$0	\$0	\$0
2a	276	25%	Install Capture system and Increase T.O. destruction efficiency	\$174,162	20	5,451	\$209,352	\$4,134,704	\$843
2b	2,522	1%	Install capture system	\$873,287	1	1,992	\$1,049,738	\$829,293	\$462
3a	366	11%	Install capture system and Increase T.O. destruction efficiency	\$161,250	9	3,181	\$193,831	\$1,684,393	\$588
3b	2,756	1%	Install capture system	\$120,638	1	2,177	\$145,013	\$114,561	\$58
4 ^d	198	24%	None	\$0	19		\$0	\$0	\$0
5 ^e	80	5%	None	\$0	4		\$0	\$0	\$0
					79	24,296		\$25,796,512	\$1,180

(a) Model plants were defined during the development of the POWC NESHAP (40 CFR 63, subpart JJJJ). (See Table 2)

(b) Model plant HAP emissions multiplied by 2:1 VOC to HAP ratio

(c) The number of facilities in the 2002 NEI located within ozone nonattainment areas and with VOC emissions greater than 15 lb/day. Distributed across model plants using the percent of facilities subject to the NESHAP. (See Reference 10).

(c) In the 2002 NESHAP, facilities in this model plant category operate with an overall control efficiency of 90 percent, therefore, no additional costs associated with an upgrade in equipment would be necessary in order to comply with the 90-percent recommended level of control in the draft CTG.

(d) In the 2002 NESHAP, facilities in this model plant category operate with an overall control efficiency of 95 percent, therefore, no additional costs associated with an upgrade in equipment would be necessary in order to comply with the 90-percent recommended level of control in the draft CTG.

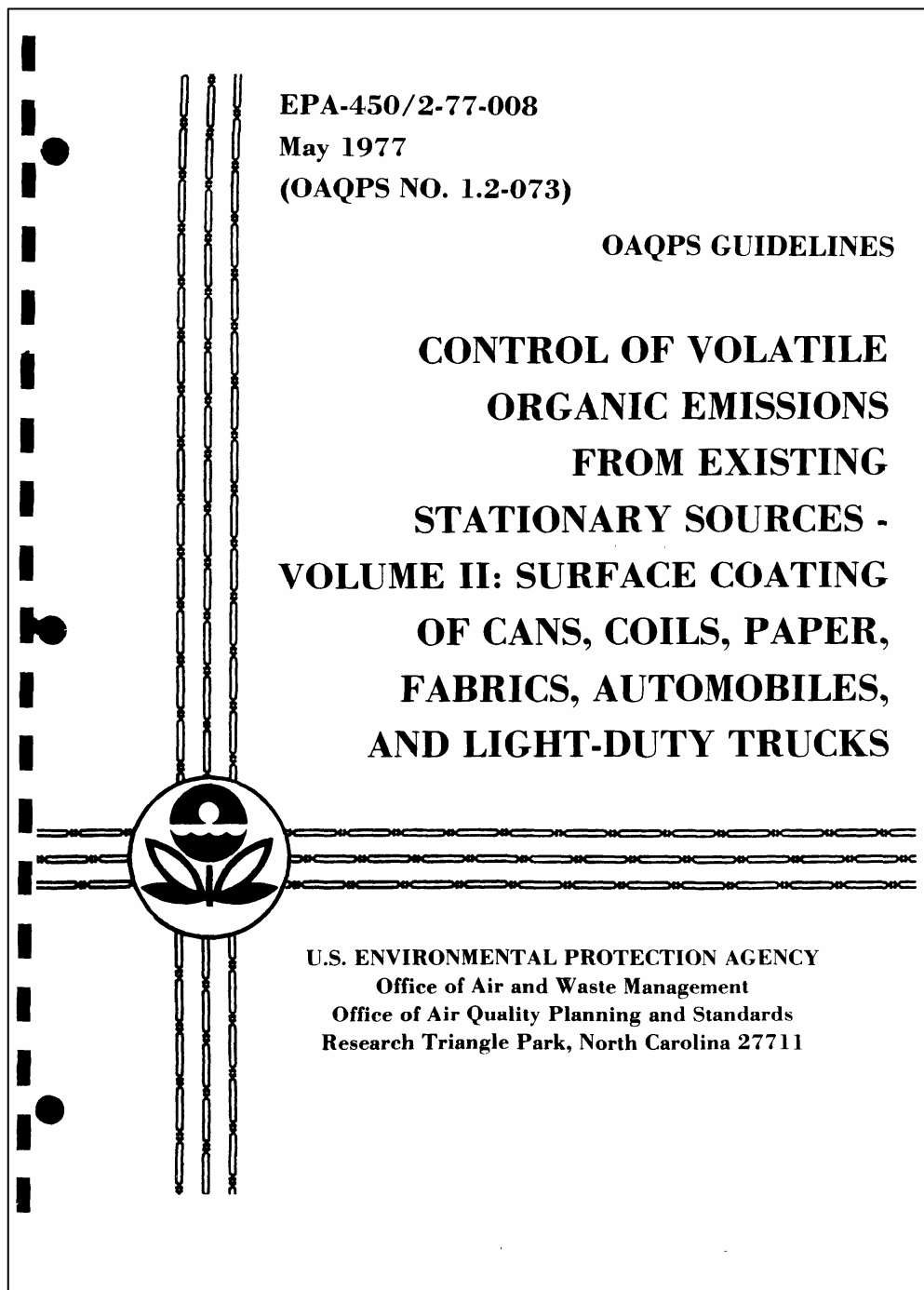
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Appendix A

**Control of Volatile Emissions from Existing Stationary Sources - Volume II:
Surface Coating of Cans, Coils, Paper, Fabrics, Automobiles, and Light-Duty
Trucks**

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**Appendix A: Control of Volatile Emissions from Existing Stationary Sources - Volume II:
Surface Coating of Cans, Coils, Paper, Fabrics, Automobiles, and Light-Duty Trucks**



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Appendix B

**Paper, Film, and Foil Surface Coating Facilities in Current
Nonattainment Areas and Associated State or Local Requirements
(Based on 2002 NEI and December 2006 Nonattainment
Designations)**

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Appendix B: Paper, Film, and Foil Surface Coating Facilities in Current Nonattainment Areas and Associated State or Local Requirements (Based on 2002 NEI and December 2006 Nonattainment Designations)

State or Local Jurisdiction	Number of Facilities in Ozone Nonattainment Areas	Product Applicability	Applicable State Emission Limit	Alternative Control Device Limits
California	38			
Bay Area AQMD	11	Paper, Fabric, and Film Applies to coating lines that emit more than 14.3 lb VOC per day	2.2 lb VOC per gallon coating (excluding water) or 1 lb VOC per gallon (excluding water) if using a control device)	Use capture and control system to meet emission limit
		Paper, Fabric, and Film Applies to coating lines that emit less than 14.3 lb VOC per day	VOC emission limit of 5 tpy or 3.5 lb VOC per gallon coating (excluding water)	Overall control efficiency of 85% or an incinerator with a control efficiency of 90%
		Cleaning Materials	VOC emission limit of 50 g VOC/l (0.42 lb/gal)	Overall control efficiency of 85% or use specified work practices
Mojave Desert AQMD	1	Organic solvents or solvent-containing materials	1,190 lb VOC per month	Overall control efficiency of 90%

Appendix B: Paper, Film, and Foil Surface Coating Facilities in Current Nonattainment Areas and Associated State or Local Requirements (Based on 2002 NEI and December 2006 Nonattainment Designations) (continued)

State or Local Jurisdiction	Number of Facilities in Ozone Nonattainment Areas	Product Applicability	Applicable State Emission Limit	Alternative Control Device Limits
San Joaquin Valley Unified APCD	3	Organic solvents or solvent containing materials that come into contact with a flame, or are baked, heat cured, or heat-polymerized in the presence of O ₂	15 lb/ day (emissions from air or heat drying for the first 12 hours must be included)	Overall control efficiency of 85%
		Organic solvents or solvent containing photochemically reactive solvent (except solvents that are baked, heat cured, or heat-polymerized)	40 lb/day (emissions from air or heat drying for the first 12 hours must be included)	Overall control efficiency of 85%
		Organic solvents or solvent containing non-photochemically reactive solvent (except solvents that are baked, heat cured or heat-polymerized)	3,000 lb/day (emissions from air or heat drying for the first 12 hours must be included)	Overall control efficiency of 85%
South Coast AQMD	23	Paper, Film, and Fabric	Coating lines and wash primer: 265 g/l (excluding water) Plastisol: 20 g/l (excluding water)	Overall control efficiency of 90%
		Cleaning Materials	VOC limits of 25 g/l (0.21 lb/gal)	Use specified work practices
Colorado	8	Paper, Fabric, Plastic-Film, and Vinyl Coating	1977 CTG Limits ^b	Use capture and control system to meet emission limit

^b 1977 CTG recommended limits: Paper Coating = 0.35 kg/l (2.9 lb/gal) coating, as applied (minus water and exempt compounds); Fabric Coating = 0.35 kg/l (2.9 lb/gal) coating, as applied (minus water and exempt compounds); Vinyl Coating = 0.45 kg/l (3.8 lb/gal) coating, as applied (minus water and exempt compounds).

Appendix B: Paper, Film, and Foil Surface Coating Facilities in Current Nonattainment Areas and Associated State or Local Requirements (Based on 2002 NEI and December 2006 Nonattainment Designations) (continued)

State or Local Jurisdiction	Number of Facilities in Ozone Nonattainment Areas	Product Applicability	Applicable State Emission Limit	Alternative Control Device Limits
Connecticut	4	Paper, Fabric, and Vinyl Coating	1977 CTG Limits ^b	Overall control efficiency of 95%
Delaware	2	Paper, Fabric, and Vinyl Coating	1977 CTG Limits ^b	Overall control efficiency of 95%
		Cleaning Materials	Composite vapor pressure no more than 45 mmHg @ 20°C; OR solvent must be at least 80% water	Use work practices to minimize emissions
Georgia	5	Paper, Fabric, and Vinyl Coating	1977 CTG Limits ^b	Overall control efficiency of 95%
Illinois	29			
Outside Chicago and Metro East Areas	Unknown ^c	Paper, Fabric, and Vinyl Coating	1977 CTG Limits ^b	Overall control efficiency of 81% (control device must get 90%)
	Unknown ^c	Paper coating Specialty High Gloss Catalyzed Coating	3.5 lb VOC per gallon coating (except water)	Overall control efficiency of 81% (control device must get 90%)
Chicago and Metro East Areas		Paper, Fabric, and Vinyl Coating	2.3 lb VOC per gallon coating (except water)	Overall control efficiency of 81% (control device must get 90%)
Indiana	9	Paper, Fabric, and Vinyl Coating	1977 CTG Limits ^b	Overall control efficiency of 67.5% (Fabric and Vinyl only)
Maine	1	Paper, Fabric, and Vinyl Coating	1977 CTG Limits ^b	Overall control efficiency of 95%
Maryland	5	Paper, Fabric, and Vinyl Coating	1977 CTG Limits ^b	Use capture and control system to meet emission limit
Michigan	11	Paper, Fabric, and Vinyl Coating	1977 CTG Limits ^b	Use capture and control system to meet emission limit
Missouri	3	Paper, Fabric, and Vinyl Coating	1977 CTG Limits ^b	Use capture and control system to meet emission limit
New Jersey	27	Paper, Fabric, and Vinyl Coating	1977 CTG Limits ^b	Control emissions by 90%

^c The number of facilities located within the Illinois jurisdictions is unknown.

Appendix B: Paper, Film, and Foil Surface Coating Facilities in Current Nonattainment Areas and Associated State or Local Requirements (Based on 2002 NEI and December 2006 Nonattainment Designations) (continued)

State or Local Jurisdiction	Number of Facilities in Ozone Nonattainment Areas	Product Applicability	Applicable State Emission Limit	Alternative Control Device Limits
New York	6	Paper, Fabric, and Vinyl Coating	1977 CTG Limits ^b	Control emissions by 80% using an incinerator
		Cleaning Materials	No numeric limit	Use work practices to minimize VOC emissions
North Carolina	23	Paper, Fabric, and Vinyl Coating - CTG limits (on a lb/gal coating basis) apply only if using a control device	1977 CTG Limits ^b	None
Pennsylvania	29	Paper and Fabric Coating	4.4 lb VOC per gallon coating solids	Use capture and control system to meet emission limit
		Vinyl Coating	7.69 lb VOC per gallon coating solids	Use capture and control system to meet emission limit
Rhode Island	1	Paper, Fabric, and Vinyl Coating	1977 CTG Limits ^b	Control emissions by 95%
		Cleaning Material	No numeric limit	Keep records of cleaning materials usage
South Carolina	4	Paper, Fabric, and Vinyl Coating	1977 CTG Limits ^b	Control emissions by 90% using an incinerator
		Cleaning Material	No numeric limit	Keep records of cleaning materials usage
Tennessee	7	Paper, Fabric, and Vinyl Coating	1977 CTG Limits ^b	Overall control efficiency of 95%
Virginia	11	Paper, Fabric, and Vinyl Coating	1977 CTG Limits ^b	Use capture and control system to meet emission limit
West Virginia	1	Paper, Fabric, and Vinyl Coating	1977 CTG Limits ^b	Overall control efficiency of 95%
		Cleaning Materials	6.8 kg/day (15 lb/day)	Use work practices to minimize emissions; Do not use VOCs for cleanup activities unless equipment is used to collect the cleaning compounds and to minimize evaporation

Appendix B: Paper, Film, and Foil Surface Coating Facilities in Current Nonattainment Areas and Associated State or Local Requirements (Based on 2002 NEI and December 2006 Nonattainment Designations) (continued)

State or Local Jurisdiction	Number of Facilities in Ozone Nonattainment Areas	Product Applicability	Applicable State Emission Limit	Alternative Control Device Limits
Wisconsin	7	Paper, Fabric, and Vinyl Coating	1977 CTG Limits ^b	Control emissions by 90% using an incinerator

Appendix C

Summary of State-Specific Regulations for Paper, Film, and Foil Surface Coating Facilities (not including California)

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Appendix C: Summary of State Regulations for Paper, Film, and Foil Surface Coating Facilities (not including California)

State/Locality	Operations Covered	VOC Numerical Limit ^a	Compliance Method	Citation
Alabama (Jefferson County)	Fabric coating	0.35 kg/l (2.9 lb/gal)	For sources located in Jefferson County: <ol style="list-style-type: none"> 1. use low solvent coating technology; or 2. a capture and control system that have an overall VOC emission reduction that meet the applicable emission limit each day; or 3. use powder coating technology; or 4. average two or more coatings on a coating line that has no add-on VOC control equipment if: <ol style="list-style-type: none"> a. The coating is the same type of operation (source category) and is subject to the same limits; and b. the coatings are on the same coating line; and c. the coatings are averaged on the basis of pounds of VOC emitted per gallon of coating solids applied to the substrate; and d. The compliance demonstration is on a 24-hour period (calendar day); and e. The VOC emissions shall be equal to or less than those emitted when all the surface coatings delivered to the application system comply with the applicable regulated VOC emission rate restriction. <p>Exemption: 55 gallons of “low-use coatings” may be exempted on an annual rolling basis Keep records of cleaning materials.</p>	Alabama DEM Air Division Chapter 335-3-6-.24 and 335-3-6-.32(6), (7), and (9)
	Paper coating	0.35 kg/l (2.9 lb/gal)		
	Vinyl coating	0.45 kg/l (3.8 lb/gal)		

**Appendix C: Summary of State Regulations for Paper, Film, and Foil Surface Coating Facilities (not including California)
(continued)**

State/Locality	Operations Covered	VOC Numerical Limit^a	Compliance Method	Citation
Alabama (except Jefferson County)	Fabric coating	0.35 kg/l (2.9 lb/gal)	For sources NOT located in Jefferson County: 1. use low solvent coating technology; or 2. 90 percent emission reduction using incineration; or 3. another equivalent control technology Exemptions: Sources with the potential to emit less than 100 ton VOC/yr and paper coating (335-3-6-.11(6) doesn't apply to any sources except sources in the State which manufacture audio or video recording tape. Keep records of cleaning material usage.	Alabama DEM Air Division Chapters 335-3-6-.01 and 335-3-6-.11(6), (7), and (9)
	Paper coating	0.35 kg/l (2.9 lb/gal)		
	Vinyl coating	0.45 kg/l (3.8 lb/gal)		
Alaska ^d				
Arizona	POWC – Incorporated by Reference, Subpart JJJJ			
Arizona/Pima	POWC – Incorporated by Reference, Subpart JJJJ			
Arizona/Pinal	POWC – Incorporated by Reference, Subpart JJJJ			

^d Alaska does not have applicable air regulations. No cleaning material regulations.

^a Numerical limits are as applied, minus water and exempt compounds, unless otherwise noted.

**Appendix C: Summary of State Regulations for Paper, Film, and Foil Surface Coating Facilities (not including California)
(continued)**

State/Locality	Operations Covered	VOC Numerical Limit ^a	Compliance Method	Citation
Arizona/Maricopa	Fabric coating	0.35 kg/l (2.9 lb/gal)	Apply all coatings containing more than 240 g VOC/L (2 lb/gal), minus exempt cmpds using: <ol style="list-style-type: none"> 1. Low pressure spray gun; or 2. An electrostatic system; or 3. hydraulic pressure atomizer (including airless and air assisted airless); or 4. non-atomizing or non-spraying application methods; or 5. alternate methods approved by regulatory authorities Use control systems meeting the following: <ol style="list-style-type: none"> 1. Prevent at least 85% of the VOC emitted, except as controlled using the alternative for very dilute streams (see 3 below) 2. Use an 87% efficient capture system; 3. Use a 90% efficient control system or for VOC input less than 100 ppm – control to less than 20 mg VOC/M³ and the control system gets 85% control Exemptions: coatings and solvents with a VOC content less than 18g VOC/L (0.15 lb VOC/gal)	Regulation III, Rule 336, section 301 through 306
	Paper coating	0.35 kg/l (2.9 lb/gal)		
	Vinyl coating	0.45 kg/l (3.8 lb/gal)		
	Cleaning Materials	35 mm Hg at 20°C	Work practices to minimize emissions	
Arkansas ^c				

^c Arkansas does not have applicable air regulations. No cleaning material regulations.

^a Numerical limits are as applied, minus water and exempt compounds, unless otherwise noted.

**Appendix C: Summary of State Regulations for Paper, Film, and Foil Surface Coating Facilities (not including California)
(continued)**

State/Locality	Operations Covered	VOC Numerical Limit^a	Compliance Method	Citation
Colorado	Fabric Coating	0.35 kg/l (2.9 lb/gal)	<ol style="list-style-type: none"> 1. Use compliant coatings; 2. Use emissions averaging; 3. Use a capture system approved by the authority or a system that meets the NSPS for Magnetic Tape 4. Use an add-on control system to meet the limit <p>Exemptions: fabric and paper coating operations with uncontrolled actual emissions (including fugitives) are less than 6.8 kg/day (15 lb/day) and 1.4 kg/hr (3 lb/hr). No cleaning materials regulations</p>	CO DPHE AQCC Regulation No. 7 5 CCR 1001-9 Section IX.E, I, J, and K
	Paper Coating	0.35 kg/l (2.9 lb/gal)		
	Plastic-Film Coating	0.35 kg/l (2.9 lb/gal)		
	Vinyl Coating	0.45 kg/l (3.8 lb/gal)		
Connecticut	Fabric coating	0.35 kg/l (2.9 lb/gal)	<ol style="list-style-type: none"> 1. Compliant coatings; 2. Daily-weighted average coating content; 3. Install capture and control system that reduces emissions by 95 percent <p>Exemptions: any coating unit with uncontrolled actual emissions from all coating units are less than 6.8 kg VOC per day (15 lb/day) combined No cleaning materials regulations.</p>	RSCA Title 22a Section 22a-174-3c,
	Paper coating	0.35 kg/l (2.9 lb/gal)		
	Vinyl coating	0.45 kg/l (3.8 lb/gal)		
Delaware	Fabric coating	0.35 kg/l (2.9 lb/gal)	<ol style="list-style-type: none"> 1. Compliant coatings; 2. Daily weighted average coating content 3. Install capture and control system that reduces emissions by 95 percent <p>Exemptions: any coating unit with uncontrolled actual emissions from all coating units are less than 15 lb VOC/day</p>	DNREC Regulation 24, Section 16, 17, and 18
	Paper coating	0.35 kg/l (2.9 lb/gal)		
	Vinyl coating	0.45 kg/l (3.8 lb/gal)		

^a Numerical limits are as applied, minus water and exempt compounds, unless otherwise noted.

**Appendix C: Summary of State Regulations for Paper, Film, and Foil Surface Coating Facilities (not including California)
(continued)**

State/Locality	Operations Covered	VOC Numerical Limit ^a	Compliance Method	Citation
	Cleaning Materials	Composite vapor pressure of 45 mm Hg at 20 °C Or Solvent must be at least 80% water, as applied	Does not apply to <i>hand-wipe cleaning operation</i> Use work practices to minimize emissions	
Florida	Fabric Coating	0.35 kg/l (2.9 lb/gal)	1. use of compliant coatings; 2. use of incineration that reduces VOC emissions by 90 percent. Exemptions: all emission units subject to the same limitation that emit less than 6.8 kg VOC per day (15 lb/day) and 1.4 kg/hr (3 lb/hr) combined No cleaning material regulations.	FAC Chapter 62-296.500, 503, and 504
	Paper Coating	0.35 kg/l (2.9 lb/gal)		
	Vinyl Coating	0.46 kg/l (3.8 lb/gal)		

^a Numerical limits are as applied, minus water and exempt compounds, unless otherwise noted.

**Appendix C: Summary of State Regulations for Paper, Film, and Foil Surface Coating Facilities (not including California)
(continued)**

State/Locality	Operations Covered	VOC Numerical Limit ^a	Compliance Method	Citation
Georgia	Fabric Coating	2.9 lb/gal OR 4.79 lb/gal coating solids (if coating content is > 2.9 lb/gal)	1. use low solvent compliant coating technology 2. use 24-hr weighted average of low solvent coating on a single coating line that meets 4.79 lb VOC/gal coating solids for fabric and paper or 7.86 lb/gal coating solids for vinyl (averaging across coating lines is not allowed) 3. use capture and control that reduces VOC emissions by 90 percent and overall VOC emissions do not exceed 4.79 lb VOC/gal coating solids for fabric and paper or 7.86 lb/gal coating solids for vinyl Exemptions: Sources located outside Cherokee, Clayton, Cobb, Coweta, DeKalb, Douglas, Fayette, Forsyth, Fulton, Gwinnett, Henry, Paulding, and Rockdale counties with potential VOC emissions are less than 100 tons per year; Sources located within Cherokee, Clayton, Cobb, Coweta, DeKalb, Douglas, Fayette, Forsyth, Fulton, Gwinnett, Henry, Paulding, or Rockdale counties with actual VOC emissions are less than 15 lb/day; total use of coatings, inks and other VOC-containing materials is less than 55 gal/yr No cleaning material regulations.	GDNR OGCA 12-9-1 391-3-1-.03(2)(w) and (x)
	Paper coating	2.9 lb/gal OR 4.79 lb/gal coating solids (if coating content is > 2.9 lb/gal)		
	Vinyl coating	3.8 lb/gal OR 7.86 lb/gal coating solids (if coating content is > 3.8 lb/gal)		
Hawaii ^f				

^f Hawaii does not have applicable air regulations. No cleaning material regulations.

^a Numerical limits are as applied, minus water and exempt compounds, unless otherwise noted.

**Appendix C: Summary of State Regulations for Paper, Film, and Foil Surface Coating Facilities (not including California)
(continued)**

State/Locality	Operations Covered	VOC Numerical Limit ^a	Compliance Method	Citation
Idaho	POWC – Incorporated by Reference, Subpart JJJJ			
Illinois (not including Chicago and Metro East areas)	Fabric Coating	0.35 kg/l (3.8 lb/gal)	<ol style="list-style-type: none"> Control emissions by an afterburner system which provides an overall 81% VOC emission from the coating line, and 90% of the nonmethane VOC (measured as total combustible carbon) which enters the afterburner. the combined actual emissions from selected coating lines (not including those constructed or modified after 7/1/79), is less than or equal to the combined allowable emissions calculated using the formula provided in the regulation. <p>Exemptions: Coating plants in which uncontrolled VOC emissions are limited by the operating permit to 22.7 Mg/yr (25 tpy); or the total coating usage does not exceed 9,463 l/yr (2,500 gal/yr); or touch-up and repair coatings used by a vinyl if the source-wide volume is less than 0.95 l (1 quart) per eight-hour period or exceeds 209 l/yr (55 gal/yr) for any rolling twelve-month period.</p> <p>No cleaning material regulations.</p>	Title 35, Subtitle B, Chapter I; Subchapter c, Part 215, Subpart F, sections 215.204(c), (e) and (f) and 215.205(b) and 215.206 (a) and (b)
	Paper coating-Specialty High Gloss Catalyzed Coating	0.42 kg/l (3.5 lb/gal)		
	Paper coating – all others	0.35 kg/l (2.9 lb/gal)		
	Vinyl Coating	0.45 kg/l (3.8 lb/gal)		

^a Numerical limits are as applied, minus water and exempt compounds, unless otherwise noted.

**Appendix C: Summary of State Regulations for Paper, Film, and Foil Surface Coating Facilities (not including California)
(continued)**

State/Locality	Operations Covered	VOC Numerical Limit^a	Compliance Method	Citation
Illinois (Chicago areas)	Fabric Coating	0.28 kg/l (2.3 lb/gal)	<ol style="list-style-type: none"> 1. apply coatings that, during each day, do not exceed the daily-weighted average VOC content limit 2. use a capture and control system which has an overall VOC emission reduction of 81% and the control device has a 90% efficiency 3. capture and control system reduces VOC emissions to meet the applicable VOC emission limit. <p>Exemptions: Coating plants in which combined actual uncontrolled VOC emissions do not exceed 6.8 kg/day (15 lb/day); or touch-up and repair coatings used by a vinyl if the source-wide volume is less than 0.95 l (1 quart) per eight-hour period or exceeds 209 l/yr (55 gal/yr) for any rolling twelve-month period. No cleaning material regulations.</p>	Title 35, Subtitle B, Chapter I; Subchapter c, Part 218, Subpart F, sections 218.204(c), (e) and (f) and 218.205(a) and 218.207(b) and 218.208(a) and (c)
	Paper coating	0.28 kg/l (2.3 lb/gal)		
	Vinyl Coating	0.28 kg/l (2.3 lb/gal)		
Illinois (Metro East areas)	Fabric Coating	0.28 kg/l (2.3 lb/gal)	<ol style="list-style-type: none"> 1. apply coatings that, during each day, do not exceed the daily-weighted average VOC content limit 2. use a capture and control system which has an 	Title 35, Subtitle B, Chapter I; Subchapter c, Part 219 Subpart F,
	Paper coating	0.28 kg/l (2.3 lb/gal)		

^a Numerical limits are as applied, minus water and exempt compounds, unless otherwise noted.

**Appendix C: Summary of State Regulations for Paper, Film, and Foil Surface Coating Facilities (not including California)
(continued)**

State/Locality	Operations Covered	VOC Numerical Limit ^a	Compliance Method	Citation
	Vinyl Coating	0.28 kg/l (2.3 lb/gal)	<p>overall VOC emission reduction of 81% and the control device has a 90% efficiency</p> <p>3. capture and control system reduces VOC emissions to meet the applicable VOC emission limit.</p> <p>Exemptions: Coating plants in which combined actual uncontrolled VOC emissions do not exceed 6.8 kg/day (15 lb/day); or touch-up and repair coatings used by a vinyl if the source-wide volume is less than 0.95 l (1 quart) per eight-hour period or exceeds 209 l/yr (55 gal/yr) for any rolling twelve-month period.</p> <p>No cleaning material regulations.</p>	sections 219.204(c), (e) and (f) and 219.205(a) and 219.207(b) and 219.208(a) and (c)
Indiana	Fabric Coating	0.35 kg/l (2.9 lb/gal)	<p>1. Use compliant coatings or</p> <p>2. Fabric and vinyl coating operations can install capture and control devices with an overall efficiency greater than 67.5% given that the capture efficiency is greater than 75% and the control device efficiency is greater than 90%</p>	IDEM Air Pollution Control Board title 326 326 IAC 8-2-1, 8-2-5, 8-2-11
	Paper coating	0.35 kg/l (2.9 lb/gal)	<p>Exemptions: Facilities existing before 1/1/80 not located in Clark, Elkhart, Floyd, Lake, Marion, Porter, and St. Joseph Counties which have potential emissions less than 90.7 Mg/yr (100 tpy); Facilities constructed after 1/1/80 located in any county with potential emissions less than</p>	

^a Numerical limits are as applied, minus water and exempt compounds, unless otherwise noted.

**Appendix C: Summary of State Regulations for Paper, Film, and Foil Surface Coating Facilities (not including California)
(continued)**

State/Locality	Operations Covered	VOC Numerical Limit ^a	Compliance Method	Citation
	Vinyl Coating	0.58 kg/l (4.8 lb/gal)	22.7 Mg/yr (25 tpy), Facilities existing before 7/1/90 and not located in Clark, Elkhart, Floyd, Lake, Marion, Porter, and St. Joseph Counties and facilities constructed after 7/1/90 and located in any county with actual uncontrolled emissions less than 15 lb VOC/day No cleaning material regulations.	
Iowa	POWC – Incorporated by Reference, Subpart JJJJ			
Kansas ^g				
Kentucky	Fabric Coating	15 % by weight of VOCs net input into the facility OR 0.35 kg/l (2.9 lb/gal)	Exemptions: facility with actual uncontrolled emissions less than 3 lb/hr; 15 lb/day; or 10 tpy based on maximum production and 8,760 hr/yr. Low use coating if plantwide consumption is less than or equal to 55 gal/previous 12 months No cleaning material regulations.	401 KAR 61:120
	Paper Coating	15 % by weight of VOCs net input into the facility OR 0.35 kg/l (2.9 lb/gal)		

^g Kansas has no applicable air regulations. No cleaning material regulations.

^a Numerical limits are as applied, minus water and exempt compounds, unless otherwise noted.

**Appendix C: Summary of State Regulations for Paper, Film, and Foil Surface Coating Facilities (not including California)
(continued)**

State/Locality	Operations Covered	VOC Numerical Limit ^a	Compliance Method	Citation
	Vinyl Coating	15 % by weight of VOCs net input into the facility OR 0.45 kg/l (3.8 lb/gal)		
Louisiana	Fabric Coating	0.28 kg/l (2.3 lb/gal)	<ol style="list-style-type: none"> 1. capture system with at least 80% efficiency 2. Low solvent coating 3. incinerator with at least 90% control efficiency 4. carbon adsorption <p>Exemptions: all emission units subject to the same limitation that emit less than 6.8 kg VOC per day (15 lb/day) and 1.4 kg/hr (3 lb/hr) combined No cleaning material regulations.</p>	LAC Title 33 2123.A, C
	Paper coating	0.28 kg/l (2.3 lb/gal)		
	Vinyl Coating	0.28 kg/l (2.3 lb/gal)		
Maine	Fabric Coating	0.35 kg/l (2.9 lb/gal)	<ol style="list-style-type: none"> 1. Low solvent coating 2. Capture and control system that gets 95% control or 4.9 lb/gal solids 	06 096 Chapter 123 3.A and B; and Chapter 129 1.E, 3.B and C
	Paper coating	0.35 kg/l (2.9 lb/gal)		

^a Numerical limits are as applied, minus water and exempt compounds, unless otherwise noted.

**Appendix C: Summary of State Regulations for Paper, Film, and Foil Surface Coating Facilities (not including California)
(continued)**

State/Locality	Operations Covered	VOC Numerical Limit ^a	Compliance Method	Citation
	Vinyl Coating	0.45 kg/l (3.8 lb/gal)	Exemptions: maximum theoretical VOC emissions from all coating units, lines or operations under the same surface coating category less than 10 tpy. Or Coating units, lines or operations whose total actual coatings usage from all coating units, lines or operations under the same surface coating category is less than 50 gal/yr of coatings. OR facilities that use powder coatings or other non-VOC coating methods. No cleaning material regulations.	
Maryland	Fabric Coating	0.35 kg/l (2.9 lb/gal)	<ol style="list-style-type: none"> 1. use low VOC coatings or adhesives; 2. use a control device that, results in an emission reduction equal to or greater than the emission reduction that would have been achieved by complying low use VOC coatings 3. reduce emissions by using water-based coatings, resins, inks, or similar products that contain less than 25 percent VOC by volume of the volatile portion of the product; or 4. an alternative method approved by authority Exemptions: Facilities with emissions less than 20 lb VOC/day No cleaning material regulations.	ACM Subtitle 11 26.11.19.02 and .07
	Paper Coating	0.35 kg/l (2.9 lb/gal)		
	Vinyl Coating	0.45 kg/l (3.8 lb/gal)		
Massachusetts	Fabric Coating	4.8 lb/gal, as applied (does not exclude water)	<ol style="list-style-type: none"> 1. Use low/no solvent coatings 2. Use add-on controls 3. Use Daily weighted averaging 	310 CMR 7.18(14), (15) and (16)

^a Numerical limits are as applied, minus water and exempt compounds, unless otherwise noted.

**Appendix C: Summary of State Regulations for Paper, Film, and Foil Surface Coating Facilities (not including California)
(continued)**

State/Locality	Operations Covered	VOC Numerical Limit ^a	Compliance Method	Citation
	Paper Coating	4.8 lb/gal, as applied (does not exclude water)	Exemptions: facilities for which the total amount of all coatings exempted is less than 55 gal on a 12-month rolling period and facilities with uncontrolled VOC emissions less than 15 lb/day Keep records of cleaning materials usage	
	Vinyl Coating	7.8 lb/gal, as applied (does not exclude water)		
Michigan	Fabric Coating	2.9 lb/gal	<ol style="list-style-type: none"> 1. Use compliant coatings 2. Use volume weighted average emissions coating content 3. Use add-on controls combined with volume weighted average Exemptions: Facilities with a combined actual VOC emission rate less than 100 lb/day or 2,000 lb/month and facilities may exclude low-use coatings that total 55 gallons or less per rolling 12-month period. No cleaning materials regulations	R336.1610(2), (7) and (8) and R 336.2040(12)(a) and (b)
	Paper Coating	2.9 lb/gal		
	Vinyl Coating	3.8 lb/gal		
Minnesota	POWC – Incorporated by Reference, Subpart JJJJ			
Mississippi	POWC – Incorporated by Reference, Subpart JJJJ			
Missouri	Fabric Coating	2.9 lb/gal	<ol style="list-style-type: none"> 1. Comply with daily volume-weighted average, as applied, on a lb/gal coating basis 2. comply with daily volume-weighted average, 	10 CSR 10-2.230(1)(A) and (B), (4) and (5)
	Paper Coating	2.9 lb/gal		
	Vinyl Coating	3.8 lb/gal		

^a Numerical limits are as applied, minus water and exempt compounds, unless otherwise noted.

**Appendix C: Summary of State Regulations for Paper, Film, and Foil Surface Coating Facilities (not including California)
(continued)**

State/Locality	Operations Covered	VOC Numerical Limit ^a	Compliance Method	Citation
	Other coatings	3 lb/gal	<p>as applied, on a lb/gal coating solids basis;</p> <p>3. comply with a combination of capture and control system and daily volume-weighted average.</p> <p>Exemptions: Does not apply to sources located outside of Clay, Jackson, and Platte counties. And sources with total uncontrolled potential VOC emissions is less than 6.8 kg/day (2.7 tpy). No cleaning material regulations.</p>	
Montana	POWC – Incorporated by Reference, Subpart JJJJ			
Nebraska	POWC – Incorporated by Reference, Subpart JJJJ			
Nevada ^h				
New Hampshire	Fabric Coating	0.35 kg/l (2.9 lb/gal)	<p>1. Use compliant coatings</p> <p>2. Use add-on controls</p> <p>3. Implement a “bubble” and comply with the calculated solids-based emission rate limit</p>	NH CAR Chapter Env-A1200
	Paper Coating	0.35 kg/l (2.9 lb/gal)		

^h Nevada has no air regulations applicable to the PFF industry. There are two local agencies as well, but they do not have applicable regulations. No cleaning material regulations.

^a Numerical limits are as applied, minus water and exempt compounds, unless otherwise noted.

**Appendix C: Summary of State Regulations for Paper, Film, and Foil Surface Coating Facilities (not including California)
(continued)**

State/Locality	Operations Covered	VOC Numerical Limit ^a	Compliance Method	Citation
	Vinyl Coating	0.45 kg/l (3.8 lb/gal)	4. Meet either an approved coatings-based or an approved solids-based modified emission limit using RACT order provisions Exemptions: (1) sources with theoretical potential emissions less than 10 tons VOC per any consecutive 12-month period since December 31, 1989; (2) No cleaning materials regulations.	
New Jersey	Fabric Coating	0.35 kg/l (2.9 lb/gal)	1. Control emissions by 90 percent 2. control emissions such that the hourly VOC emission rate does not exceed a calculated max hourly emission rate Exemptions: total surface coating formulation containing VOC are applied at a rate less than ½ gallon per hour and 2 ½ gallons per day No cleaning materials regulations.	NJAC Title 7, Chapter 27, subchapter 16 7:27-16.7
	Paper Coating	0.35 kg/l (2.9 lb/gal)		
	Vinyl Coating	0.45 kg/l (3.8 lb/gal)		
New Mexico ⁱ	POWC – Incorporated by Reference, Subpart JJJJ			
New York	Fabric Coating	2.9 lb/gal	1. Use a VOC incinerator that with 80% removal efficiency	NY ECL part 228 Sections 228.1, 3,
	Paper Coating	2.9 lb/gal		

ⁱ New Mexico has a local agency with air regulations, but they could not be accessed on the Internet.h

^a Numerical limits are as applied, minus water and exempt compounds, unless otherwise noted.

**Appendix C: Summary of State Regulations for Paper, Film, and Foil Surface Coating Facilities (not including California)
(continued)**

State/Locality	Operations Covered	VOC Numerical Limit ^a	Compliance Method	Citation
	Vinyl Coating	3.8 lb/gal	<p>2. determine overall removal efficiency of an air cleaning device on a solids as applied basis unless the air cleaning device has an 85% removal efficiency</p> <p>Exemptions: Low-use coatings where the combined facility-wide usage is less than 55 gallons on a 12-month rolling average</p> <p>Use work practices to minimize VOC emissions from cleaning materials.</p>	and 7
North Carolina	Fabric Coating	4.8 lb/gal coating solids, OR 2.9 lb/gal if using a control device	<p>Exemptions: Sources with VOC emissions less than 15 lb/day</p> <p>No cleaning material regulations.</p>	NCAC 2D.0920 and 21
	Paper Coating	4.8 lb/gal coating solids, OR 2.9 lb/gal if using a control device		
	Vinyl Coating	7.9 lb/gal coating solids, OR 3.8 lb/gal if using a control device		
North Dakota ^j				

^j North Dakota does not have applicable air regulations.

^a Numerical limits are as applied, minus water and exempt compounds, unless otherwise noted.

**Appendix C: Summary of State Regulations for Paper, Film, and Foil Surface Coating Facilities (not including California)
(continued)**

State/Locality	Operations Covered	VOC Numerical Limit^a	Compliance Method	Citation
Ohio	Fabric coating	4.8 lb/gal (if using a control system) OR 2.9 lb/gal coating	<ol style="list-style-type: none"> 1. use a capture and control system with overall VOC emission reduction greater than 81%, by weight, in the overall VOC emissions from the coating line; and 2. the control equipment has an VOC emission reduction efficiency of 90% by weight 3. vinyl coating line: install capture system with 75% control efficiency and a control system that reduces emissions by 90% <p>Exemption: a paper coating line which has a maximum application of coating materials less than 3 gal/day</p>	OAC 3745-21-09(F), (G), and (H)
	Paper coating	4.8 lb/gal (if using a control system) OR 2.9 lb/gal coating		
	Vinyl coating	4.8 lb/gal (excluding water and exempt solvents) OR 25% VOC by volume		
	Cleaning materials	6.8 kg/day (15 lb/day) and 1.4 kg/hr (3 lb/hr) Or Reduce emissions by 85%	Any article, machine, equipment, or other contrivance in which substances which contain liquid organic materials, come into contact with a flame or are baked, heat-cured, or polymerized, in the presence of O ₂ ;	
	Cleaning materials	18.1 kg.day (40 lb/day); 3.6 kg/hr (8 lb/hr) Or Reduce emissions by 85%	For conditions not described above for employing, evaporating, or drying any photochemically reactive material or substance containing photochemically reactive materials.	

^a Numerical limits are as applied, minus water and exempt compounds, unless otherwise noted.

**Appendix C: Summary of State Regulations for Paper, Film, and Foil Surface Coating Facilities (not including California)
(continued)**

State/Locality	Operations Covered	VOC Numerical Limit^a	Compliance Method	Citation
Oklahoma - attainment areas not in Tulsa County	Coating Operations	Ranges from 4.8 to 6.5 lb/gal (depending on type of coating)	1. compliant coatings 2. incineration, absorption, adsorption, or other process so long as emissions are no more than they would be using compliant coatings Exemptions: sources that emit less than 100 lb/day of VOC. Include VOC emissions from clean up in determining compliance	Title 252, Chapter 100, 252:100-37-25
Oklahoma - Tulsa County	Coating operations	Ranges from 3.0 to 4.3 lb/gal (depending on type of coating)	1. compliant coatings 2. incineration, absorption, or other equipment so long as emissions are no more than they would be using compliant coatings, and at least 85% overall control efficiency Include VOC emissions from clean up in determining compliance	Title 252, Chapter 100, 252:100-39-46
Oregon	Fabric Coating	2.9 lb/gal	1. Use low solvent coatings; 2. Use an incineration system that gets 90% control or	OAR 340-232-0160
	Paper Coating	2.9 lb/gal		
	Vinyl Coating	3.8 lb/gal		

^a Numerical limits are as applied, minus water and exempt compounds, unless otherwise noted.

**Appendix C: Summary of State Regulations for Paper, Film, and Foil Surface Coating Facilities (not including California)
(continued)**

State/Locality	Operations Covered	VOC Numerical Limit ^a	Compliance Method	Citation
	Existing Coating of Paper & Film in the Medford-Ashland AQMA	55 lb/100 sq yards of material per pass	3. An equivalent means of control Exemptions: Sources whose potential VOC emissions are less than 10 tpy (or 3 lb VOC/hr or 15 lb VOC/day actual). Keep records of cleaning materials usage	
Pennsylvania	Fabric Coating	0.58 kg/l coating solids (4.84 lb/gal)	1. Use compliant coatings, as applied. 2. Use combination of compliant coatings and capture and control systems Exemptions: A facility that has had actual VOC emissions less than 1.4 kg/hr (3 lb/hr), 7 kg/day (15 lb/day) or 2,455 kg/yr (2.7 tpy) during any calendar year since January 1, 1987 No cleaning material regulations.	129-52
	Paper Coating	0.58 kg/l coating solids (4.84 lb/gal)		
	Vinyl Coating	0.92 kg/l coating solids (7.69 lb/gal)		
Rhode Island	Fabric coating	4.8 lb/gal coating solids or 2.9 lb/gal coating	1. Reduce VOC emissions by 95% using a control system; 2. Use compliant coatings; 3. Use control systems to meet coating content limits; 4. Use daily-weighted averaging 5. Use an approved alternative method Exemptions: Actual uncontrolled VOC emissions are less than 15 lb/day since 12/31/89. Keep records of cleaning materials usage.	Air Pollution Control Regulation No. 19
	Paper coating	4.8 lb/gal coating solids or 2.9 lb/gal coating		
	Vinyl coating	3.8 lb/gal coating solids or 7.86 lb/gal coating		

^a Numerical limits are as applied, minus water and exempt compounds, unless otherwise noted.

**Appendix C: Summary of State Regulations for Paper, Film, and Foil Surface Coating Facilities (not including California)
(continued)**

State/Locality	Operations Covered	VOC Numerical Limit^a	Compliance Method	Citation
South Carolina	Fabric coating	0.35 kg/l (2.9 lb/gal)	1. Low solvent technology 2. incineration that reduces VOC emissions by 90 percent 3. carbon bed solvent recovery or 4. alternative technology Exemptions: plants with total potential VOC emissions less than 550 pounds (250 kilograms) in any one day (nominal size - 100 tons per year) or more than 150 pounds (68 kilograms) in any one hour. Keep records of cleanup materials	62.5, St. 5, Part B and C
	Paper coating	0.35 kg/l (2.9 lb/gal)		
	Vinyl coating	0.45 kg/l (3.8 lb/gal)		
South Dakota	POWC – Incorporated by Reference, Subpart JJJJ			
Tennessee	Fabric coating	0.35 kg/l (2.9 lb/gal)	1. Use compliant coatings; 2. Meet limit using weighted average VOC content 3. Reduce emissions by 95% using capture and	1200-3-18-14, 15, 16
	Paper coating	0.35 kg/l (2.9 lb/gal)		

^a Numerical limits are as applied, minus water and exempt compounds, unless otherwise noted.

**Appendix C: Summary of State Regulations for Paper, Film, and Foil Surface Coating Facilities (not including California)
(continued)**

State/Locality	Operations Covered	VOC Numerical Limit ^a	Compliance Method	Citation
	Vinyl coating	0.45 kg/l (3.8 lb/gal)	control system Exemptions: Facilities located in Davidson, Rutherford, Sumner, Williamson, or Wilson County with actual uncontrolled VOC emissions from all paper coating operations less than 6.8 kg (15 lb) per day or whose max theoretical VOC emissions from all paper coating operations are less than 10 tpy. Facilities in Hamilton or Shelby County with potential VOC emissions from all paper coating operations less than 25 tpy, Facilities located in any other county with potential VOC emissions from all paper coating operations less than 100 tpy. No cleaning material regulations.	
Texas – Beaumont/Port Arthur, Dallas/ Fort Worth, El	Fabric Coating	2.9 lb/gal (0.35 kg/l)	1. Use compliant coatings; 2. Use a vapor control system that gets 80% overall control or 3. Any alternate methods of control must be	TAC Title 30, Part 1, Chapter 115, Subchapter E, Division 2, Rule
	Paper Coating	2.9 lb/gal (0.35 kg/l)		

^a Numerical limits are as applied, minus water and exempt compounds, unless otherwise noted.

**Appendix C: Summary of State Regulations for Paper, Film, and Foil Surface Coating Facilities (not including California)
(continued)**

State/Locality	Operations Covered	VOC Numerical Limit ^a	Compliance Method	Citation
Paso, and Houston/ Galveston Areas	Vinyl Coating	3.8 lb/gal (0.45 kg/l) not including plastisol	approved Exemptions: (1) Sources that emit uncontrolled VOC less than 3 lb/hr or 15 lb in any consecutive 24-hr period. (2) sources that emit uncontrolled VOC less than 100 lb in any consecutive 24-hr period if documentation is received and approved that demonstrates that the performance criteria cannot be achieved with compliant coatings and control equipment is not technically or economically feasible. (3) a source with total coating and solvent usage is less than 150 gal in any consecutive 12-month period. (4) aerosol spray cans No cleaning material regulations.	§§115.420 through 115.427

^a Numerical limits are as applied, minus water and exempt compounds, unless otherwise noted.

**Appendix C: Summary of State Regulations for Paper, Film, and Foil Surface Coating Facilities (not including California)
(continued)**

State/Locality	Operations Covered	VOC Numerical Limit^a	Compliance Method	Citation
Texas – Gregg, Nueces, and Victoria Counties	Fabric Coating	2.9 lb/gal (0.35 kg/l)	<ol style="list-style-type: none"> 1. Use compliant coatings; 2. Use a vapor control system that gets 80% overall control or 3. Any alternate methods of control must be approved Exemptions: (1) Sources that emit uncontrolled VOC less than 550 lb in any consecutive 24-hr period. (2) aerosol spray cans No cleaning material regulations.	TAC Title 30, Part 1, Chapter 115, Subchapter E, Division 2, Rule §§115.420 through 115.427
	Paper Coating	2.9 lb/gal (0.35 kg/l)		
	Vinyl Coating	3.8 lb/gal (0.45 kg/l) not including plastisol		
Utah	Fabric coating	0.35 kg/l (2.9 lb/gal) OR 4.8 lb/gal coating solids	<ol style="list-style-type: none"> 1. Use low solvent technology coatings; 2. Reduce VOC emissions by 90% using an incinerator or using a carbon adsorber Exemptions: Sources whose VOC emissions are less than 6.8 kg (15 lb) in any 24 hour period, nor more than 1.4 kg (3 lb) in any one hour Work practices to minimize VOC emissions from cleaning materials	R307-340-2 and 11
	Paper coating	0.35 kg/l (2.9 lb/gal) OR 4.8 lb/gal coating solids		
	Vinyl coating	0.45 kg/l (3.8 lb/gal) OR 7.9 lb/gal coating solids		

^a Numerical limits are as applied, minus water and exempt compounds, unless otherwise noted.

**Appendix C: Summary of State Regulations for Paper, Film, and Foil Surface Coating Facilities (not including California)
(continued)**

State/Locality	Operations Covered	VOC Numerical Limit^a	Compliance Method	Citation
Vermont	Paper Coating	2.9 lb/gal	1. Daily weighted average of VOC content must comply with VOC limit. 2. install capture and control device where the overall reduction efficiency is greater than or equal to the required reduction efficiency (an efficiency is not specified). Exemptions: Paper coating sources that have actual uncontrolled VOC emissions less than 15 lb/day. Other VOC sources with allowable VOC emissions less than 50 tpy any year since 1/1/90. No cleaning material regulations.	5-253.10
	Other coating sources	3.5 lb/gal		
Virginia	Fabric Coating	2.9 lb/gal	1. Use of waterborne coatings; 2. Use of high-solids coatings; 3. Carbon adsorption; 4. Incineration; or 5. Any technology with an equivalent control efficiency when compared to the use of a coating complying with the VOC limit Exemptions: Coating plants with actual VOC emissions less than 2.7 tpy, 15 lb/day and 3 lb/hr. All VOC emissions from purging or washing solvents must be included. No cleaning material regulations.	9 VAC 5-40-4330 and 9 VAC 5-40-4480
	Paper Coating	2.9 lb/gal		
	Vinyl coating	3.8 lb/gal		
Washington	Fabric coating	0.35 kg/l (2.9 lb/gal)	Exemption: Coating and dryer operations with potential uncontrolled VOC emissions less than	WAC 173-490-040(6)

^a Numerical limits are as applied, minus water and exempt compounds, unless otherwise noted.

**Appendix C: Summary of State Regulations for Paper, Film, and Foil Surface Coating Facilities (not including California)
(continued)**

State/Locality	Operations Covered	VOC Numerical Limit ^a	Compliance Method	Citation
	Paper coating	0.35 kg/l (2.9 lb/gal)	18 kg (40 lb)/24-hr period. No cleaning material regulations.	
	Vinyl coating	0.45 kg/l (3.8 lb/gal)		
West Virginia	Fabric coating	0.35 kg/l (2.9 lb/gal)	1. Daily weighted emission limitation 2. use a capture and control system with an overall emission reduction of 95% Exemptions: coating operations at facilities with uncontrolled actual VOC emissions less than 0.68 kg (15 lb) per day.	§42-21-13, 14, and 15
	Paper coating	0.35 kg/l (2.9 lb/gal)		
	Vinyl coating	0.45 kg/l (3.8 lb/gal)		
	Cleaning Materials	6.8 kg/day (15 lb/day)	Use work practices to minimize emissions. Do not use VOCs for cleanup activities unless equipment is used to collect the cleaning compounds and to minimize their evaporation to the atmosphere.	
Wisconsin	Fabric coating	0.35 kg/l (2.9 lb/gal) OR 4.8 lb/gal coating solids	1. Use of low solvent coatings 2. Use a vapor recovery system 3. Use incinerator with a 90% emission reduction 4. Daily volume-weighted average Exemptions: coating operations at facilities with uncontrolled actual VOC emissions less than 0.68 kg (15 lb) per day. No cleaning material regulations.	NR 422.04 , 07 and 08
	Paper coating	0.35 kg/l (2.9 lb/gal) OR 4.8 lb/gal coating solids		

^a Numerical limits are as applied, minus water and exempt compounds, unless otherwise noted.

**Appendix C: Summary of State Regulations for Paper, Film, and Foil Surface Coating Facilities (not including California)
(continued)**

State/Locality	Operations Covered	VOC Numerical Limit ^a	Compliance Method	Citation
	Vinyl coating	0.45 kg/l (3.8 lb/gal) OR 7.9 lb/gal coating solids		
Wyoming	POWC – Incorporated by Reference, Subpart JJJJ			

^a Numerical limits are as applied, minus water and exempt compounds, unless otherwise noted.

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Appendix D

Summary of California Regulations for Paper, Film, and Foil Surface Coating Facilities

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Appendix D: Summary of California Regulations for Paper, Film, and Foil Surface Coating Facilities

Operation	Material	VOC limitation	Compliance Requirements	Citation
Antelope Valley Air Pollution Control District				
Paper, fabric and film	Coating	Content limit of 265 g/l as applied (except water and exempt compounds)	<ol style="list-style-type: none"> 1. Use compliant coatings; or use an collection system that has a capture efficiency of at least 90 %, by weight and the control device has an emission reduction efficiency of 95 % by weight or to an outlet concentration of 50 ppmv (as carbon) 2. Coatings containing 20 g VOC/l material or more must be applied using hand application methods; HVLP spray (air dried coatings only); or one of the following coaters: flow, roll, dip, foam, and die. Alternative coating methods must be approved. 3. Containers and mixing tanks must be free from leaks and covered except when adding or removing materials, cleaning or when the container is empty. 4. Solvent cleaning must use one of the following: wipe cleaning; closed containers or hand held spray bottles w/out propellant-induced force; cleaning equipment which has a solvent container that is closed at all times (except when adding or removing parts or during repair); remote reservoir cleaner; non-atomized solvent flow where solvent is collected in a container or collection system that is closed at all times except for solvent collection and pressure relief (as needed) openings; and solvent flushing methods where solvent is collected in a container or collection 	AVAQMD Rule 1128 and 1171
	Plastisol	Content limit of 20 g/l as applied (except water and exempt compounds)		
	Wash primer	Content limit of 265 g/l material used		

Appendix D: Summary of California Regulations for Paper, Film, and Foil Surface Coating Facilities (continued)

Operation	Material	VOC limitation	Compliance Requirements	Citation
	Solvent cleaning materials (excluding hand wipeing)	Content limit of 950 g/l (7.9l g/gal) and VOC composite partial pressure of 35 mm Hg @20°C (68°F)	<p>system that is closed at all times except for solvent collection and pressure relief (as needed) openings (discharged solvent must be collected into containers without atomizing into the air and solvent may be flushed through the system by air or hydraulic pressure or by pumping).</p> <p>5. All VOC-containing solvents must be stored in non-absorbent, non-leaking containers which must be kept closed at all times, except when filling or emptying. Cloth and paper containing with VOC-laden solvents should be stored in closed, non-absorbent, non-leaking containers.</p> <p>6. Use closed containers for disposal of cloth or paper used in stripping cured coatings that are impregnated with solvent containing VOC</p> <p>Exemptions: operations using aerosol coating products, application of coatings to fine arts paintings, scenic or theatrical backgrounds for motion pictures, television, and theater.</p>	

Appendix D: Summary of California Regulations for Paper, Film, and Foil Surface Coating Facilities (continued)

Operation	Material	VOC limitation	Compliance Requirements	Citation
Bay Area Air Quality Management District				
Paper, fabric, and film	Coating lines that emit more than 6.5 kg/day (14.3 lb/day)	Content limit of 265 g/l (2.2 lb/gal), as applied (excluding water) or emission limit of 120 g/l (1 lb/gal) as applied, excluding water (using an approved control system)	<ol style="list-style-type: none"> 1. Use an approved control system 2. Use low-solvent coatings that meet the content limit 3. Keep all containers storing organic solvents or tanks for mixing coatings covered at all times except when material is being added or removed, when the tank or container is being cleaned, or when the container is empty. 4. Do not allow leaks from containers storing organic solvents or from tanks used for mixing coatings. 5. Do not utilize open containers to store or dispose of cloth or paper laden with organic compounds that is used for surface preparation, cleanup or coating removal. 6. Do not store spent or fresh organic compounds to be used for surface preparation, cleanup or coating removal in open containers. <p>Exemptions: Operations that manufacture flexible packaging materials for packaging food or healthcare products for human or animal consumption and where the coating is applied on the same line as printing or decorative design. These operations are subject to Rule 20 (Graphic Arts Printing and Coating Operations).</p>	BAAQMD 8-12

Appendix D: Summary of California Regulations for Paper, Film, and Foil Surface Coating Facilities (continued)

Operation	Material	VOC limitation	Compliance Requirements	Citation
	Coating lines that emit less than 6.5 kg/day (14.3 lb/day)	Emission limit of 4,533 kg/yr (5 tpy); or Coating content limit of 420 g/l (3.5 lb/gal), as applied (excluding water or exempt compounds) and solvent content limit of 50 g/l (0.42 lb/gal)	<ol style="list-style-type: none"> 1. Meet emission limit or use compliant coatings or use an emission control system with an overall efficiency of 85% or 90% for an incinerator. 2. For solvents used for surface preparation or cleanup must either use a control system with an overall control efficiency of 85% or more; or one of the following (1) use closed containers for the storage or disposal of cloth or paper used for solvent surface preparation and cleanup; and (2) use organic solvent for the cleanup of spray equipment, including paint lines, with a compliant VOC content unless either the (a) solvent is pressurized through spray equipment with atomizing air off or dispensed from a small non-atomizing container, and collected and stored in a closed container until recycled or properly disposed of offsite; or (b) a spray gun washer subject to and in compliance with the requirements of Regulation 8, Rule 16 is used; and (3) close containers of solvent or coating when not in use. <p>Exemptions: surface coating using non-refillable aerosol cans; film cleaning operations using 1,1,1-trichloroethane exclusively</p>	BAAQMD 8-4
El Dorado County Air Quality Management District				
Machinery, process, or operation with the potential to emit organic compounds	Any that come into contact with a flame, or are baked, heat cured, or heat-polymerized in the presence of O ₂	15 lb/day and 3 lb/hr	<ol style="list-style-type: none"> 1. Reduce VOC emissions by 85% or more; or equip process with BACT 2. Do not dispose or allow the release of organic compounds from storage or transfer operations of more than 1.5 gal of liquid (or equivalent amount of vapor). <p>Exemptions: (1) stationary storage containers less than 250 gal; (2) any single use or operation which annually uses a total volume of VOC which is less than the emission limits, unless it is part of a large operation subject to regulation; and (3) sources in existence before March 1, 1984.</p>	EDCAQMD Rule 216
	Any that are conducted at or below ambient temperatures	40 lb/day and 8 lb/hr (emissions from air or heat drying for the first 12 hours must be included)		

Appendix D: Summary of California Regulations for Paper, Film, and Foil Surface Coating Facilities (continued)

Operation	Material	VOC limitation	Compliance Requirements	Citation
Solvent Cleaners	Solvents used on substrates during the manufacturing process or for surface preparation	70 g VOC/l material	<ol style="list-style-type: none"> 1. Use complaint cleaning materials AND Use one of the following cleaning devices or methods: <ol style="list-style-type: none"> a. Wipe cleaning; b. Non propellant spray bottles or containers c. Cleaning equipment which has a solvent container that can be, and is, closed during cleaning operations, except when depositing and removing objects, and is closed during non-operation with the exception of maintenance and repair to the cleaning equipment itself; d. Non-atomized solvent flow method where the cleaning solvent is collected in a container or a collection system which is closed except for solvent collection openings and, if necessary, openings to avoid excessive pressure build-up inside the container; or e. Solvent flushing method where the cleaning solvent is discharged into a container which is closed except for solvent collection openings and, if necessary, openings to avoid excessive pressure build-up inside the container. The discharged solvent from the equipment must be collected into containers without atomizing into the open air. The solvent may be flushed through the system by air or hydraulic pressure, or by pumping. 2. Use a collection and control system that collects at least 90 percent of the emissions and reduces VOC emissions by at least 95 percent or has an outlet concentration less than 50 ppmw (as carbon) 	EDCAQMD Rule 235
	Solvents used for maintenance and repair	900 g VOC/l material and a composite partial pressure of 20 mm Hg or less at 20°C (68°F)		
	Solvents used for cleaning coatings or adhesives application equipment	950 g VOC/l material and a composite partial pressure of 35 mm Hg or less at 20°C (68°F)		
	Solvents used for cleaning polyester resin application equipment	200 g VOC/l material; or 1,100 g VOC/l and composite partial pressure of 1.0 mm Hg or less at 20°C (68°F) or solvent reclamation system		

Appendix D: Summary of California Regulations for Paper, Film, and Foil Surface Coating Facilities (continued)

Operation	Material	VOC limitation	Compliance Requirements	Citation
Great Basin Unified Air Pollution Control District				
Organic solvents or solvent containing materials	Any that come into contact with a flame, or are baked, heat cured, or heat-polymerized in the presence of O ₂	15 lb/day and 3 lb/hr	1. Reduce VOC emissions by 85% or more 2. Control emissions by incineration with an emission reduction of 90% or use adsorption, or another approved method of control. Exemptions: (1) transport of storage of organic containing materials; (2) the volatile content of materials consists of only water and non-photochemically reactive organic solvents containing less than 20% by volume of VOC, and does not come into contact with a flame; (3) the volatile content of materials consists of only water and non-photochemically reactive organic solvents and more than 50% by volume of VOC is evaporated prior to entering a chamber heated above ambient temperature, and does not come into contact with a flame; and (4) the solvent content is less than 5% by volume of non-photochemically reactive organic solvents, and does not come into contact with a flame.	GBUAPCD Rule 417
	Photochemically ^a reactive solvent (except solvents that are baked, heat cured or heat-polymerized)	40 lb/day and 8 lb/hr (emissions from air or heat drying for the first 12 hours must be included)		
	Non-photochemically reactive solvent (except solvents that are baked, heat cured or heat-polymerized)	3,000 lb/day and 450 lb/hr (emissions from air or heat drying for the first 12 hours must be included)		

^a A photochemically reactive solvent is any solvent with an aggregate of more than 20 percent of its total volume composed of the following chemicals or which exceeds any of the following individual percentage composition limitations, referred to by the total volume of solvent: (1) A combination of hydrocarbons, alcohols, aldehydes, esters, ethers, or ketons having an olefinic or cyclo-olefinic type of unsaturation: 5 percent; (2) A combination of aromatic compounds with eight or more carbon atoms to the molecule except ethylbenzene: 8 percent; (3) A combination of ethylbenzene, ketons having branched hydrocarbon structures, trichloroethylene or toluene: 20 percent. Whenever any organic solvent or any constituent of an organic solvent may be classified from its chemical structure into more than one of the above groups or organic compounds, it shall be considered as a member of the most reactive chemical group that is, that group having the least allowable percentage of the total volume of solvents.

Appendix D: Summary of California Regulations for Paper, Film, and Foil Surface Coating Facilities (continued)

Operation	Material	VOC limitation	Compliance Requirements	Citation
Imperial County Air Pollution Control District				
Organic solvents or solvent containing materials	Any that come into contact with a flame, or are baked, heat cured, or heat-polymerized in the presence of O ₂	15 lb/day and 3 lb/hr	<ol style="list-style-type: none"> 1. Emissions from cleanup with photo-chemically reactive solvents must be included in compliance determination 2. Reduce VOC emissions by 85% or more using a capture and control system (an incinerator must have an emission reduction of 90% or more). <p>Exemptions: (1) transport of storage of organic containing materials; and (2) the volatile content of materials consists of only water and non-photochemically reactive organic solvents containing less than 20% by volume of VOC, and does not come into contact with a flame; and (3) use, application, evaporation, or drying halogenated hydrocarbons or perchloroethylene.</p>	ICAPCD Rule 417
	Photochemically ^b reactive solvent (except solvents that are baked, heat cured or heat-polymerized)	40 lb/day and 8 lb/hr (emissions from air or heat drying for the first 12 hours must be included)		

^b A photochemically reactive solvent is any solvent with an aggregate of more than 20 percent of its total volume composed of the chemical compounds classified below or which exceeds any of the following individual percentage composition limitations, referred to the total volume of solvent: (1) A combination of hydrocarbons, alcohols, aldehydes, esters, ethers, or ketones having an olefinic or cyclo-olefinic type of unsaturation: 5 percent; (2) a combination of aromatic compounds with eight or more carbon atoms to the molecule except ethylbenzene: 8 percent; (3) a combination of ethylbenzene, ketones having branched hydrocarbon structures, or toluene: 20 percent.

Appendix D: Summary of California Regulations for Paper, Film, and Foil Surface Coating Facilities (continued)

Operation	Material	VOC limitation	Compliance Requirements	Citation
Kern County Air Pollution Control District				
Organic solvents or solvent containing materials	Any that come into contact with a flame, or are baked, heat cured, or heat-polymerized in the presence of O ₂	15 lb/day	1. Reduce VOC emissions by 85% using an incinerator with an emission reduction of 90%; or adsorption, or another approved method of control. Exemptions: (1) transport of storage of organic containing materials; (2) the volatile content of materials consists of only water and non-photochemically reactive organic solvents containing less than 20% by volume of VOC and does not come into contact with a flame; (3) the solvent content is less than 20% by volume of non-photochemically reactive organic solvents and does not come into contact with a flame; and (4) use, application, evaporation, or drying halogenated hydrocarbons or perchloroethylene.	KCAPCD Rule 410
	Photochemically ^c reactive solvent (except solvents that are baked, heat cured or heat-polymerized)	40 lb/day (emissions from air or heat drying for the first 12 hours must be included)		
	Non-photochemically reactive solvent (except solvents that are baked, heat cured or heat-polymerized)	3,000 lb/day (emissions from air or heat drying for the first 12 hours must be included)		

^c A photochemically reactive solvent is any solvent with an aggregate of more than 20 percent of its total volume composed of the following chemicals or which exceeds any of the following individual percentage composition limitations, referred to by the total volume of solvent: (1) A combination of hydrocarbons, alcohols, aldehydes, esters, ethers, or ketons having an olefinic or cyclo-olefinic type of unsaturation: 5 percent; (2) A combination of aromatic compounds with eight or more carbon atoms to the molecule except ethylbenzene: 8 percent; (3) A combination of ethylbenzene, ketons having branched hydrocarbon structures, trichloroethylene or toluene: 20 percent. Whenever any organic solvent or any constituent of an organic solvent may be classified from its chemical structure into more than one of the above groups or organic compounds, it shall be considered as a member of the most reactive chemical group that is, that group having the least allowable percentage of the total volume of solvents.

Appendix D: Summary of California Regulations for Paper, Film, and Foil Surface Coating Facilities (continued)

Operation	Material	VOC limitation	Compliance Requirements	Citation
Mojave Desert Air Quality Management District				
Organic solvents or solvent containing materials	All VOC containing materials	540 kg/month (1,190 lb/month)	<ol style="list-style-type: none"> 1. For VOC-containing materials: <ol style="list-style-type: none"> a. use product reformulation or substitution; b. process changes; c. improvement of operational efficiency; d. development of innovative technology; or e. install a collection and control system that reduces emissions by 85% or more provided that capture system has a capture efficiency of 90% by weight and the control system has a destruction efficiency of 95% or more by weight or an output concentration of 50 ppm (as carbon) 2. Non-VOC organic compounds <ol style="list-style-type: none"> a. include the drying period of 12 hrs after application of solvent 3. Store all VOC containing materials in nonabsorbent, non-leaking containers which must be kept closed at all times (except during emptying or filling). 4. Dispose of all VOC containing materials to prevent evaporation into the atmosphere. <p>Exemptions: (1) transport or storage of organic solvent materials; (2) use of 1,1,1-trichloroethylene, methylene chloride, and trichlorofluoroethane; and (3) aerosol products</p>	MDAQMD Rule 442
	Non-VOC containing organic solvent	272 kg/day (600 lb/day) on a 30-day rolling average		

Appendix D: Summary of California Regulations for Paper, Film, and Foil Surface Coating Facilities (continued)

Operation	Material	VOC limitation	Compliance Requirements	Citation
Monterey Bay Unified Air Pollution Control District				
Organic solvents or solvent containing materials	Any that come into contact with a flame, or are baked, heat cured, or heat-polymerized at a temperature of 194°F (90°C) in the presence of O ₂	15 lb/day	1. Emissions from cleanup with solvents must be included in compliance determination 2. Reduce VOC emissions by 85% or more using a capture and control system (an incinerator must have an emission reduction of 90% or more). Exemptions: (1) transport or storage of solvent materials; (2) any source in existing prior to March 19, 2001 with actual VOC emissions less than 15 lb/day (solvents that are baked, heat-cured, heat-polymerized or exposed to flame) or 40 lb/day (solvents that are not baked, heat-cured, heat-polymerized or exposed to flame)	MBUAPCD Rule 416
	Any that do not come into contact with a flame, or are not baked, heat cured, or heat-polymerized in the presence of O ₂	40 lb/day (emissions from air or heat drying for the first 12 hours must be included)		

Appendix D: Summary of California Regulations for Paper, Film, and Foil Surface Coating Facilities (continued)

Operation	Material	VOC limitation	Compliance Requirements	Citation
Placer County Air Pollution Control District				
Organic solvents or solvent containing materials	Any that come into contact with a flame, or are baked, heat cured, or heat-polymerized in the presence of O ₂	15 lb/day and 3 lb/hr	<ol style="list-style-type: none"> 1. Reduce VOC emissions by 85% or more by incineration (if incinerator has an emission emission reduction of 90% or more), adsorption, or another approved method of control. 3. Do not dispose or allow the release of organic compounds from storage or transfer operations of more than 1.5 gal of liquid (or equivalent amount of vapor). 4. Emissions from cleanup with solvents must be included in compliance determination <p>Exemptions: (1) transport of storage of organic containing materials; (2) the volatile content of materials consists of only water and non-photochemically reactive organic solvents containing less than 20% by volume of VOC, and does not come into contact with a flame; and (3) the solvent content is less than 20% by volume of non-photochemically reactive organic solvents, and does not come into contact with a flame.</p>	PLAAPCD Rule 219
	Photochemically ^d reactive solvent (except solvents that are baked, heat cured or heat-polymerized)	40 lb/day and 8 lb/hr (emissions from air or heat drying for the first 12 hours must be included)		
	Non-photochemically reactive solvent (except solvents that are baked, heat cured or heat-polymerized)	3,000 lb/day and 450 lb/hr (emissions from air or heat drying for the first 12 hours must be included)		

^d A photochemically reactive solvent is any solvent with an aggregate of more than 20 percent of its total volume composed of chemicals compounds classified below or which exceed any of the following individual percentage composition limitations, referred to by the total volume of solvent: (1) A combination of hydrocarbons, alcohols, aldehydes, esters, ethers, or ketones having an olefinic or cyclo-olefinic type of unsaturation: 5 percent; (2) A combination of aromatic compounds with eight or more carbon atoms to the molecule except ethylbenzene: 8 percent; (3) A combination of ethylbenzene, ketones having branched hydrocarbon structures, trichloroethylene or toluene: 20 percent. Whenever any organic solvent or any constituent of an organic solvent may be classified from its chemical structure into more than one of the above groups or organic compounds, it shall be considered as a member of the most reactive chemical group that is, that group having the least allowable percentage of the total volume of solvents.

Appendix D: Summary of California Regulations for Paper, Film, and Foil Surface Coating Facilities (continued)

Operation	Material	VOC limitation	Compliance Requirements	Citation
Paper treating operations	Melamine resin coating	0.1 lb VOC/gal coating as applied (except for water and exempt compounds)	<ol style="list-style-type: none"> 1. Use compliant coatings or use a capture and control system that has an overall efficiency of 85% by weight 2. Total VOC emissions including control must meet the level of coating content limits. 	PLAAPCD Rule 230
	Phenolic resin coating	1.75 lb VOC/gal coating as applied (except for water and exempt compounds)		
Solvent Cleaners	Solvents used on substrates during the manufacturing process or for surface preparation	70 g VOC/l material	<ol style="list-style-type: none"> 2. Use complaint cleaning materials AND Use one of the following cleaning devices or methods: <ol style="list-style-type: none"> a. Wipe cleaning; b. Non propellant spray bottles or containers c. No spray discharge into open air 3. Use a collection and control system that collects at least 90 percent of the emissions and reduces VOC emissions by at least 95 percent or has an outlet concentration less than 50 ppmw (as carbon) 	PLAAPCD Rule 240
	Solvents used for maintenance and repair	900 g VOC/l material and a composite partial pressure of 20 mm Hg or less at 20°C (68°F)		
	Solvents used for cleaning coatings or adhesives application equipment	950 g VOC/l material and a composite partial pressure of 35 mm Hg or less at 20°C (68°F)		

Appendix D: Summary of California Regulations for Paper, Film, and Foil Surface Coating Facilities (continued)

Operation	Material	VOC limitation	Compliance Requirements	Citation
	Solvents used for cleaning polyester resin application equipment	200 g VOC/l material; or 1,100 g VOC/l and composite partial pressure of 1.0 mm Hg or less at 20°C (68°F) or solvent reclamation system		

Appendix D: Summary of California Regulations for Paper, Film, and Foil Surface Coating Facilities (continued)

Operation	Material	VOC limitation	Compliance Requirements	Citation
Sacramento Metropolitan Air Quality Management District				
Organic solvents or solvent containing materials	Any that come into contact with a flame, or are baked, heat cured, or heat-polymerized in the presence of O ₂	6.8 kg (15 lb) per day and 1.4 kg (3.1lb) per hour	<ol style="list-style-type: none"> 1. Reduce VOC emissions by 85% overall using an incinerator (incinerator must have an emission reduction of 90% or more); or adsorption, or another approved method of control. 2. Emissions from cleanup with solvents must be included in compliance determination 3. Do not dispose of 5 liters (1.3 gal) per day of a photochemically reactive solvent or solvent containing materials such that they are emitted to the atmosphere. <p>Exemptions: (1) transport of storage of organic containing materials; (2) the volatile content of materials consists of only water and non-photochemically reactive organic solvents containing less than 20% by volume of VOC and does not come into contact with a flame; (3) the solvent content is less than 20% by volume of non-photochemically reactive organic solvents and does not come into contact with a flame; and (4) use, application, evaporation, or drying halogenated hydrocarbons or perchloroethylene.</p>	KCAPCD Rule 410
	Photochemically ^e reactive solvent (except solvents that are baked, heat cured or heat-polymerized)	18 kg (40 lb) per day and 3.6 kg (7.9 lb) per hour (emissions from air or heat drying for the first 12 hours must be included)		

^e A photochemically reactive solvent is any solvent with an aggregate of more than 20 percent of its total volume composed of the following chemicals or which exceeds any of the following individual percentage composition limitations, referred to by the total volume of solvent: (1) A combination of hydrocarbons, alcohols, aldehydes, esters, ethers, or ketons having an olefinic or cyclo-olefinic type of unsaturation: 5 percent; (2) A combination of aromatic compounds with eight or more carbon atoms to the molecule except ethylbenzene: 8 percent; (3) A combination of ethylbenzene, ketons having branched hydrocarbon structures, trichloroethylene or toluene: 20 percent. Whenever any organic solvent or any constituent of an organic solvent may be classified from its chemical structure into more than one of the above groups or organic compounds, it shall be considered as a member of the most reactive chemical group that is, that group having the least allowable percentage of the total volume of solvents.

Appendix D: Summary of California Regulations for Paper, Film, and Foil Surface Coating Facilities (continued)

Operation	Material	VOC limitation	Compliance Requirements	Citation
	Non-photochemically reactive solvent (except solvents that are baked, heat cured or heat-polymerized)	1,350 kg (3,000 lb)/day and 200 kg (441 lb)/hr (emissions from air or heat drying for the first 12 hours must be included)		
Solvent Cleaning Materials	General cleaning activities, product cleaning during manufacturing or surface preparation for coatings, adhesives, sealants, or ink application; Repair and maintenance cleaning	50 g VOC/l (0.42 lb/gal)	<ol style="list-style-type: none"> 4. Use complaint cleaning materials AND Use one of the following cleaning devices or methods: <ol style="list-style-type: none"> a. Wipe cleaning; b. Cleaning with closed containers or by using hand held spray bottles or containers without a propellant-induced force; c. Using cleaning equipment which has a solvent container that is closed during cleaning operations, except when depositing and removing objects, and is closed during non-operation with the exception of maintenance and repair to the cleaning equipment itself; d. Using a remote reservoir degreaser, non-vapor degreaser, or vapor degreaser used as required under Rule 454. e. Using solvent flushing method where the cleaning solvent is discharged into a container which is closed except for solvent collection openings and, if necessary, openings to avoid excessive pressure build-up inside the container. The discharged solvent from the equipment must be collected into containers without atomizing into the open air. The solvent may be flushed through the system by air or hydraulic pressure, or by pumping. 5. Use a collection and control system that collects at least 90 percent of the emissions and reduces VOC emissions by at least 95 percent or has an outlet concentration less than 50 ppmw (as carbon) 	KCAPCD Rule 466

Appendix D: Summary of California Regulations for Paper, Film, and Foil Surface Coating Facilities (continued)

Operation	Material	VOC limitation	Compliance Requirements	Citation
San Diego County Air Pollution Control District				
Paper, Film and Fabric	Coating lines	Content limit of 265 g/l as applied (excluding water)	<ol style="list-style-type: none"> 1. Use compliant coatings or reduce VOC emissions using a control system with a combined collection and abatement efficiency of 90% by weight or more; 2. Containers and mixing tanks must be free from liquid leaks and must be covered except when adding or removing materials, cleaning, or when the container is empty; 3. Use compliant cleaning materials or use a system that totally encloses the component parts being cleaned during washing, rinsing, and draining or the cleaning 4. Transfer the cleaning solvent through the application equipment, without exposure to air, into a container which has completely covers the container and has no visible holes, breaks, openings or separations between adjoining components 5. Coating or cleaning solvent container must display the content of methylene chloride, CFC-11, CFC-12, CFC-113, CFC-114, or CFC-115 <p>Exemption: Any application process that has VOC emissions less than 14.3 lb (6.5 kg) per day</p>	SDAPCD Rule 67.5
	Cleaning materials	Content limit of 200 g/l		
Pressure sensitive tap and label manufacturing	Coating lines	Content limit of 0.20 kg VOC/kg coating solids as applied (average for month)	<ol style="list-style-type: none"> 1. Use compliant coatings or reduce emissions by 90% overall over a calendar month or calculate a weighted average emission reduction <p>Exemption: VOC input is less than 45 Mg (49.6 tons) of VOC per 12-month period</p>	SDAPCD Rule 260.440
Organic solvents or solvent containing materials	Any that come into contact with a flame, or are baked, heat cured, or heat-polymerized in the presence of O ₂	6.8 kg (15 lb) per day and 1.4 kg (3.1lb) per hour	<ol style="list-style-type: none"> 1. Reduce VOC emissions by 85% overall using an incinerator; or adsorption; or another approved method of control. 2. Emissions from cleanup with solvents must be included in compliance determination 3. Do not dispose of 5 liters (1.3 gal) per day of photochemically reactive solvent or solvent containing materials such that they are emitted to the atmosphere. 	SDAPCD Rule 66

Appendix D: Summary of California Regulations for Paper, Film, and Foil Surface Coating Facilities (continued)

Operation	Material	VOC limitation	Compliance Requirements	Citation
	Photochemically ^f reactive solvent (except solvents that are baked, heat cured or heat-polymerized)	18 kg (40 lb) per day and 3.6 kg (7.9 lb) per hour (emissions from air or heat drying for the first 12 hours must be included)	Exemptions: (1) the organic solvent content of surface coating do not exceed 30% by volume, excluding water and does not come into contact with a flame; (2) the use of any air-dried material which contains less than 420 g/l of coating applied (excluding water or exempt compounds) (3) the use of a baked coating material which contains less than 360 g/l of coating as applied (excluding water or exempt compounds) and (4) any equipment, process or operation which has implemented BACT or LAER as a result of NSR	
	Non-photochemically reactive solvent (except solvents that are baked, heat cured or heat-polymerized)	1,350 kg (3,000 lb)/day and 200 kg (441 lb)/hr (emissions from air or heat drying for the first 12 hours must be included)		

^f The compositional limitations of any organic solvent referred to are the volume percentages of the following photochemically reactive compounds, compared to the total solvent volume: (1) A combination of hydrocarbons, alcohols, aldehydes, esters, ethers, or ketones having an olefinic or cyclo-olefinic type of unsaturation: 5 percent; (2) A combination of aromatic compounds with eight or more carbon atoms to the molecule except ethylbenzene: 8 percent; (3) A combination of ethylbenzene, ketones having branched hydrocarbon structures, trichloroethylene or toluene: 20 percent. (4) any aggregate of (1), (2), or (3) above, provided their individual volume percentages are not exceeded: 20 percent. Whenever any organic solvent or any constituent of an organic solvent may be classified from its chemical structure into more than one of the above groups or organic compounds, it shall be considered as a member of the most reactive chemical group that is, that group having the least allowable percentage of the total volume of solvents.

Appendix D: Summary of California Regulations for Paper, Film, and Foil Surface Coating Facilities (continued)

Operation	Material	VOC limitation	Compliance Requirements	Citation
San Joaquin Valley Unified Air Pollution Control District				
Organic solvents or solvent containing materials	Any that come into contact with a flame, or are baked, heat cured, or heat-polymerized in the presence of O ₂	15 lb/ day (emissions from air or heat drying for the first 12 hours must be included)	<ol style="list-style-type: none"> 1. Reduce VOC emissions by 85% overall using an incinerator (incinerator must have an emission reduction of 90% or more); or adsorption, or another approved method of control. 2. Emissions from cleanup with solvents must be included in compliance determination 3. All solvents must be stored in non-absorbent, non-leaking containers which must be kept closed at all times, except when filling or emptying. Cloth and paper containing laden with solvents should be stored in closed, non-absorbent, non-leaking containers. <p>Exemptions: (1) transport of storage of organic containing materials; (2) the volatile content of materials consists of only water and non-photochemically reactive organic solvents containing less than 20% by volume of VOC and does not come into contact with a flame; (3) use, application, evaporation, or drying halogenated hydrocarbons or perchloroethylene; (4) solvents containing less than 50 grams of VOC/liter of material.; (5) operation that uses 55 gallons or less of organic solvents on a 365-day rolling average.</p>	SJVUAPCD Rule 4661 and 4663
	Photochemically [§] reactive solvent (except solvents that are baked, heat cured or heat-polymerized)	40 lb/day (emissions from air or heat drying for the first 12 hours must be included)		
	Non-photochemically reactive solvent (except solvents that are baked, heat cured or heat-polymerized)	3,000 lb/day (emissions from air or heat drying for the first 12 hours must be included)		

[§] A photochemically reactive solvent is any solvent with an aggregate of more than 20 percent of its total volume composed of the following chemicals or which exceeds any of the following individual percentage composition limitations, referred to by the total volume of solvent: (1) A combination of hydrocarbons, alcohols, aldehydes, esters, ethers, or ketons having an olefinic or cyclo-olefinic type of unsaturation: 5 percent; (2) A combination of aromatic compounds with eight or more carbon atoms to the molecule except ethylbenzene: 8 percent; (3) A combination of ethylbenzene, ketons having branched hydrocarbon structures, trichloroethylene or toluene: 20 percent. Whenever any organic solvent or any constituent of an organic solvent may be classified from its chemical structure into more than one of the above groups or organic compounds, it shall be considered as a member of the most reactive chemical group that is, that group having the least allowable percentage of the total volume of solvents.

Appendix D: Summary of California Regulations for Paper, Film, and Foil Surface Coating Facilities (continued)

Operation	Material	VOC limitation	Compliance Requirements	Citation
	Solvent cleaning materials (excluding hand wipeing)	Content limit of 550 g/l (4.6 g/gal) and VOC composite partial pressure of 35 mm Hg @20°C (68°F)		

Appendix D: Summary of California Regulations for Paper, Film, and Foil Surface Coating Facilities (continued)

Operation	Material	VOC limitation	Compliance Requirements	Citation
San Luis Obispo County Air Pollution Control District				
Organic solvents or solvent containing materials	Any that come into contact with a flame, or are baked, heat cured, or heat-polymerized in the presence of O ₂	15 lb/day and 3 lb/hr	<ol style="list-style-type: none"> Reduce VOC emissions by 85% using an incinerator (the incinerator must have an emission reduction of 90%); or adsorption, or another approved method of control. Include emissions from the cleanup with photochemically reactive solvents in compliance determination <p>Exemptions: (1) transport of storage of organic containing materials; (2) the volatile content of materials consists of only water and non-photochemically reactive organic solvents containing less than 20% by volume of VOC and does not come into contact with a flame; (3) use, application, evaporation, or drying halogenated hydrocarbons or perchloroethylene.</p>	SLOCAPCD Rule 407
	Photochemically ^h reactive solvent (except solvents that are baked, heat cured or heat-polymerized)	40 lb/day and 8 lb/hr (emissions from air or heat drying for the first 12 hours must be included)		
	Non-photochemically reactive solvent (except solvents that are baked, heat cured or heat-polymerized)	3,000 lb/day and 450 lb/hr (emissions from air or heat drying for the first 12 hours must be included)		

^h A photochemically reactive solvent is any solvent with an aggregate of more than 20 percent of its total volume composed of the following chemicals or which exceeds any of the following individual percentage composition limitations, referred to by the total volume of solvent: (1) A combination of hydrocarbons, alcohols, aldehydes, esters, ethers, or ketons having an olefinic or cyclo-olefinic type of unsaturation: 5 percent; (2) A combination of aromatic compounds with eight or more carbon atoms to the molecule except ethylbenzene: 8 percent; (3) A combination of ethylbenzene, ketons having branched hydrocarbon structures, trichloroethylene or toluene: 20 percent. Whenever any organic solvent or any constituent of an organic solvent may be classified from its chemical structure into more than one of the above groups or organic compounds, it shall be considered as a member of the most reactive chemical group that is, that group having the least allowable percentage of the total volume of solvents.

Appendix D: Summary of California Regulations for Paper, Film, and Foil Surface Coating Facilities (continued)

Operation	Material	VOC limitation	Compliance Requirements	Citation
Santa Barbara County Air Pollution Control District				
Organic solvents or solvent containing materials	Any that come into contact with a flame, or are baked, heat cured, or heat-polymerized in the presence of O ₂	15 lb/day and 3 lb/hr	1. Reduce VOC emissions by 85% using an incinerator (the incinerator must have an emission reduction of 90%); or adsorption, or another approved method of control. 2. Include emissions from the cleanup with photochemically reactive solvents in compliance determination Exemptions: (1) transport of storage of organic containing materials; (2) the volatile content of materials consists of only water and non-photochemically reactive organic solvents containing less than 20% by volume of VOC and does not come into contact with a flame; (3) use, application, evaporation, or drying halogenated hydrocarbons or perchloroethylene.	SBAPCD Rule 317
	Photochemically ⁱ reactive solvent (except solvents that are baked, heat cured or heat-polymerized)	40 lb/day and 8 lb/hr (emissions from air or heat drying for the first 12 hours must be included)		
	Non-photochemically reactive solvent (except solvents that are baked, heat cured or heat-polymerized)	3,000 lb/day and 450 lb/hr (emissions from air or heat drying for the first 12 hours must be included)		

ⁱ A photochemically reactive solvent is any solvent with an aggregate of more than 20 percent of its total volume composed of the following chemicals or which exceeds any of the following individual percentage composition limitations, referred to by the total volume of solvent: (1) A combination of hydrocarbons, alcohols, aldehydes, esters, ethers, or ketons having an olefinic or cyclo-olefinic type of unsaturation: 5 percent; (2) A combination of aromatic compounds with eight or more carbon atoms to the molecule except ethylbenzene: 8 percent; (3) A combination of ethylbenzene, ketons having branched hydrocarbon structures, trichloroethylene or toluene: 20 percent. Whenever any organic solvent or any constituent of an organic solvent may be classified from its chemical structure into more than one of the above groups or organic compounds, it shall be considered as a member of the most reactive chemical group that is, that group having the least allowable percentage of the total volume of solvents.

Appendix D: Summary of California Regulations for Paper, Film, and Foil Surface Coating Facilities (continued)

Operation	Material	VOC limitation	Compliance Requirements	Citation
Shasta County Air Quality Management District				
Organic solvents or solvent containing materials	Any that come into contact with a flame, or are baked, heat cured, or heat-polymerized in the presence of O ₂ at temperatures above 400°F	15 lb/day	1. Reduce VOC emissions by 85% 2. Include emissions from the cleanup with photochemically reactive solvents in compliance determination Exemptions: (1) use, application, evaporation, or drying halogenated hydrocarbons or perchloroethylene.	SHAAQMD Rule 3:4
	Photochemically ^j reactive solvent (except solvents that are baked, heat cured or heat-polymerized)	40 lb/day		
	Any photochemically reactive substance	40 lb/day		

^j A photochemically reactive solvent is any solvent with an aggregate of more than 20 percent of its total volume composed of the following chemicals or which exceeds any of the following individual percentage composition limitations, referred to by the total volume of solvent: (1) A combination of hydrocarbons, alcohols, aldehydes, esters, ethers, or ketons having an olefinic or cyclo-olefinic type of unsaturation: 5 percent; (2) A combination of aromatic compounds with eight or more carbon atoms to the molecule except ethylbenzene: 8 percent; (3) A combination of ethylbenzene, ketons having branched hydrocarbon structures, trichloroethylene or toluene: 20 percent. Whenever any organic solvent or any constituent of an organic solvent may be classified from its chemical structure into more than one of the above groups or organic compounds, it shall be considered as a member of the most reactive chemical group that is, that group having the least allowable percentage of the total volume of solvents.

Appendix D: Summary of California Regulations for Paper, Film, and Foil Surface Coating Facilities (continued)

Operation	Material	VOC limitation	Compliance Requirements	Citation
South Coast Air Quality Management District				
Paper, Film and Fabric	Coating lines	Content limit of 265 g/l as applied (excluding water and exempt compounds)	<ol style="list-style-type: none"> 1. Use compliant materials ; or use an collection system that has a capture efficiency of at least 90 % by weight and the control device has an emission reduction efficiency of 95 % by weight or to an outlet concentration of 50 ppmv (as carbon) 2. Coatings must be applied using hand application methods; HVLP spray (air dried coatings only); or one of the following coaters: flow, roll, dip, foam, and die. Alternative coating methods must be approved. 3. Containers and mixing tanks must be free from leaks and covered except when adding or removing materials, cleaning or when the container is empty. 4. Solvent cleaning must use one of the following: wipe cleaning; closed containers or hand held spray bottles w/out propellant-induced force; cleaning equipment which has a solvent container that is closed at all times (except when adding or removing parts or during repair); remote reservoir cleaner; non-atomized solvent flow where solvent is collected in a container or collection system that is closed at all times except for solvent collection and pressure relief (as needed) openings; and solvent flushing methods where solvent is collected in a container or collection system that is closed at all times except for solvent collection and pressure relief (as needed) openings (discharged solvent must be collected into containers without atomizing into the air and solvent may be flushed through the system by air or hydraulic pressure or by pumping). 5. All VOC-containing solvents must be stored in non-absorbent, non- 	SCAQMD Rule 1128 and 1171
	Plastisol	Content limit of 20 g/l as applied (except water and exempt compounds)		
	Wash primer	Content limit of 265 g/l material used		

Appendix D: Summary of California Regulations for Paper, Film, and Foil Surface Coating Facilities (continued)

Operation	Material	VOC limitation	Compliance Requirements	Citation
	Cleaning materials	Content limit of 25 g/l (or 0.21 lb/gal)	leaking containers which must be kept closed at all times, except when filling or emptying. Cloth and paper containing with VOC-laden solvents should be stored in closed, non-absorbent, non-leaking containers. 6. Use closed containers for disposal of cloth or paper used in stripping cured coatings that are impregnated with solvent containing VOC Exemption: Any application process that has VOC emissions less than 14.3 lb (6.5 kg) per day	
Tehama County Air Pollution Control District				
Organic solvents or solvent containing materials	Any that come into contact with a flame, or are baked, heat cured, or heat-polymerized in the presence of O ₂ at temperatures above 400°F	15 lb/day	1. Reduce VOC emissions by 85% 2. Include emissions from the cleanup with photochemically reactive solvents in compliance determination Exemptions: (1) use, application, evaporation, or drying halogenated hydrocarbons or perchloroethylene.	TCAPCD Rule 4:22

Appendix D: Summary of California Regulations for Paper, Film, and Foil Surface Coating Facilities (continued)

Operation	Material	VOC limitation	Compliance Requirements	Citation
	Photochemically ^k reactive solvent (except solvents that are baked, heat cured or heat-polymerized)	40 lb/day		
	Any photochemically reactive substance	40 lb/day		

^k A photochemically reactive solvent is any solvent with an aggregate of more than 20 percent of its total volume composed of the following chemicals or which exceeds any of the following individual percentage composition limitations, referred to by the total volume of solvent: (1) A combination of hydrocarbons, alcohols, aldehydes, esters, ethers, or ketons having an olefinic or cyclo-olefinic type of unsaturation: 5 percent; (2) A combination of aromatic compounds with eight or more carbon atoms to the molecule except ethylbenzene: 8 percent; (3) A combination of ethylbenzene, ketons having branched hydrocarbon structures, trichloroethylene or toluene: 20 percent. Whenever any organic solvent or any constituent of an organic solvent may be classified from its chemical structure into more than one of the above groups or organic compounds, it shall be considered as a member of the most reactive chemical group that is, that group having the least allowable percentage of the total volume of solvents.

Appendix D: Summary of California Regulations for Paper, Film, and Foil Surface Coating Facilities (continued)

Operation	Material	VOC limitation	Compliance Requirements	Citation
Ventura County Air Pollution Control District				
Paper, Fabric, and Film	Coating materials	Content limit of 265 g/l, as applied (excluding water and exempt compounds)	<ol style="list-style-type: none"> 1. Use compliant materials or reduce emissions by a combined capture and destruction efficiency of 90%, on a 24-hr rolling average or if the coating applied contains more than 1,200 g/l or ROC as applied (excluding water and exempt solvents), limit ROC emissions to 120 g/l as applied (excluding water and exempt solvents) on a 24-hr average. 2. All containers and mixing equipment containing ROC material must not leak and must be covered when in use, except for when adding or removing materials. <p>Exemptions: ROC emission limits do not apply during the first 24 hours of a scheduled carbon adsorption system startup.</p>	VCAPCD Rule 74.3
	Reactive organic compound (ROC) emissions	Emission limit of 120 g/l (1 lb/gal) as applied, excluding water and exempt compounds)		
	Cleanup solvents	200 g ROC/l material used		

Appendix D: Summary of California Regulations for Paper, Film, and Foil Surface Coating Facilities (continued)

Operation	Material	VOC limitation	Compliance Requirements	Citation
Yolo-Solano Air Quality Management District				
Organic solvents or solvent containing materials	Any that come into contact with a flame, or are baked, heat cured, or heat-polymerized in the presence of O ₂	15 lb/day and 3 lb/hr	<ol style="list-style-type: none"> 1. Reduce VOC emissions by 85% 2. Include emissions from the cleanup with photochemically reactive solvents in compliance determination 3. Do not dispose or allow the release of photochemically reactive solvents more than 1.5 gal of liquid (or equivalent amount of vapor). <p>Exemptions: (1) transport of storage of organic containing materials; (2) the volatile content of materials consists of only water and non-photochemically reactive organic solvents containing less than 20% by volume of VOC and does not come into contact with a flame; (3) use, application, evaporation, or drying saturated halogenated organic solvents or perchloroethylene.</p>	
	Photochemically ¹ reactive solvent (except solvents that are baked, heat cured or heat-polymerized)	40 lb/day and 8 lb/hr (emissions from air or heat drying for the first 12 hours must be included)		
	Non-photochemically reactive solvent (except solvents that are baked, heat cured or heat-polymerized)	3,000 lb/day and 450 lb/hr (emissions from air or heat drying for the first 12 hours must be included)		

¹ A photochemically reactive solvent is any solvent with an aggregate of more than 20 percent of its total volume composed of the following chemicals or which exceeds any of the following individual percentage composition limitations, referred to by the total volume of solvent: (1) A combination of hydrocarbons, alcohols, aldehydes, esters, ethers, or ketons having an olefinic or cyclo-olefinic type of unsaturation: 5 percent; (2) A combination of aromatic compounds with eight or more carbon atoms to the molecule except ethylbenzene: 8 percent; (3) A combination of ethylbenzene, ketons having branched hydrocarbon structures, trichloroethylene or toluene: 20 percent. Whenever any organic solvent or any constituent of an organic solvent may be classified from its chemical structure into more than one of the above groups or organic compounds, it shall be considered as a member of the most reactive chemical group that is, that group having the least allowable percentage of the total volume of solvents.

Appendix D: Summary of California Regulations for Paper, Film, and Foil Surface Coating Facilities (continued)

Operation	Material	VOC limitation	Compliance Requirements	Citation
Solvent Cleaners	Solvents used on substrates during the manufacturing process or for surface preparation	200 g VOC/l material	3. Use complaint cleaning materials AND Use one of the following cleaning devices or methods: <ol style="list-style-type: none"> a. Wipe cleaning; b. Spray bottles or containers with a maximum capacity of 16 fluid ounces without a propellant-induced force; c. Cleaning equipment which has a solvent container that can be, and is, closed during cleaning operations, except when depositing and removing objects, and is closed during non-operation with the exception of maintenance and repair to the cleaning equipment itself; d. Cleaning device or mechanism which has been determined by the Air Pollution Control Officer to result in equivalent or lower emissions; e. Remote reservoir cold cleaner used f. Non-atomized solvent flow method where the cleaning solvent is collected in a container or a collection system which is closed except for solvent collection openings and, if necessary, openings to avoid excessive pressure build-up inside the container; or g. Solvent flushing method where the cleaning solvent is discharged into a container which is closed except for solvent collection openings and, if necessary, openings to avoid excessive pressure build-up inside the container. The discharged solvent from the equipment must be collected into containers without atomizing into the open air. The solvent may be flushed through the system by air or hydraulic pressure, or by pumping. 4. Use a collection and control system that collects at least 90 percent of the emissions and reduces VOC emissions by at least 95 percent or has an outlet concentration less than 50 ppmw (as carbon)	YSAQMD 2.31, Section 300
	Solvents used for maintenance and repair	900 g VOC/l material and a composite partial pressure of 20 mm Hg or less at 20°C (68°F)		
	Solvents used for cleaning coatings or adhesives application equipment	950 g VOC/l material and a composite partial pressure of 35 mm Hg or less at 20°C (68°F)		
	Solvents used for cleaning polyester resin application equipment	200 g VOC/l material; or 1,100 g VOC/l and composite partial pressure of 1.0 mm Hg or less at 20°C (68°F) or solvent reclamation system		

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