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Control Techniques Guidelines for Metal Furniture Coatings

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Control Techniques Guidelines for Metal Furniture Coatings

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TABLE OF CONTENTS

I. Introduction..... 1

II. Background and Overview 2

III. Applicability 3

IV. Process Description and Sources of VOC Emissions..... 5

 A. Process Description 5

 1. Surface Preparation..... 5

 2. Coating Application..... 6

 3. Cleaning activities 8

 B. Sources of VOC Emissions 8

 1. Coatings 9

 2. Cleaning Materials..... 11

V. Available Controls and Regulatory Approaches 11

 A. Available Controls for VOC Emissions from Coatings 11

 1. Pollution Prevention Measures 11

 2. Emission Capture and Add-on Control Systems 13

 B. Available Controls for VOC Emissions from Cleaning Materials 15

 1. Product Substitution/Reformulation 16

 2. Work Practice Procedures..... 16

 C. Existing Federal, State, and Local Recommendations or Regulations 16

 1. The 1977 CTG 16

 2. The 1982 NSPS..... 18

 3. The 2003 NESHAP..... 18

 4. Existing State and Local VOC Requirements 19

VI. Recommended Control Options 21

 A. Emission Limit Based on Low-VOC Coatings 22

 B. Optional Add-on Controls for Coating Operations 22

 C. Work Practices for Coating-Related Activities 22

 D. Work Practices for Cleaning Materials..... 23

VII. Cost Effectiveness of Recommended Control Options..... 23

VIII. References..... 24

Appendix A: 1977 CTG for Metal Furniture Coating

Appendix B: Summary of State and Local Regulations for Metal Furniture Coating (not including California)

Appendix C: Summary of California Air District Regulations for Metal Furniture Coating

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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 CAA.

Clean Air Act 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). Metal Furniture 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 VOCs from metal furniture coating. In developing this CTG, EPA, among other things, evaluated the sources of VOC emissions from the metal furniture 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 metal furniture coating.

States can use the recommendations in this CTG to inform their own determination as to what constitutes RACT for VOCs for metal furniture coatings in their particular nonattainment areas. There are several hazardous air pollutants (HAPs) 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 metal furniture 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.

Clean Air Act section 182(b)(2) requires that a CTG issued between November 15, 1990, and the date of attainment include the date by which States subject to section 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 metal furniture 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 that affect metal furniture surface coating operations. In December 1977, EPA issued a CTG document (1977 CTG) for controlling VOC emissions from surface coating of metal furniture.¹ In October 1982, EPA promulgated the new source performance standards (NSPS) for surface coating of metal furniture (1982 NSPS).² In May 2003, EPA promulgated the National Emission Standards for Hazardous Air Pollutants: Surface Coating of Metal Furniture (2003 NESHAP).³

The 1977 CTG, the 1982 NSPS and the 2003 NESHAP provide a thorough discussion of the metal furniture coating industry, the nature of VOC emissions (or in the case of the 2003 NESHAP, volatile HAP emissions) from this industry, available control technologies for addressing such emissions, the costs of available control options, and other items. The 1977 CTG recommends and the 1982 NSPS establishes VOC emissions limits, whereas the 2003 NESHAP establishes organic HAP emissions limits and does not address non-HAP VOC.

At least 36 States and several local jurisdictions have specific regulations that control VOC emissions from metal furniture coating (or for metal parts and products coating in general). 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.

EPA developed the recommended approaches contained in this document after reviewing the 1977 CTG, the 1982 NSPS, and the 2003 NESHAP and existing State and local VOC emission reduction approaches.

The remainder of this document is divided into six sections. Section III describes the scope of sources to which the control recommendations in this CTG could apply. Section IV describes the metal furniture surface coating industry, including the types of metal furniture products, the coating materials and the coating processes, and identifies the sources of VOC emissions from those 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 metal furniture coating. Section VII discusses the cost-effectiveness of the recommended control approaches. Section VIII contains a list of references.

III. Applicability

This CTG provides control recommendations for reducing VOC emissions stemming from the use of coatings in metal furniture surface coating operations. Coatings include paints, sealants, caulks, inks, adhesives, and maskants.^a This section addresses EPA's recommendations as to the scope of entities to which the RACT recommendations in this CTG should apply. 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 each metal furniture surface coating unit at a facility where the total actual VOC emissions associated with all aspects of all of the metal furniture coating operations at that facility 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 powder or UV cure coatings (these coatings will be discussed in more detail in section IV.B.1 of this document). Furthermore, based on the 2002 NEI data and the 2004 ozone nonattainment designations, facilities emitting below the recommended threshold level collectively emit less than 4 percent of the total reported VOC emissions from metal furniture surface coating facilities in ozone nonattainment areas. For these reasons, we did not extend our recommendations in this 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 metal furniture coating operations at a given facility are included.

^a Decorative, protective, or functional materials that consist only of protective oils for metal, acids, bases, or any combination of these substances are not considered metal furniture coatings.

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.

The 2002 National Emission Inventory (NEI) and a questionnaire sent to industry by EPA during the development of the 2003 NESHAP development (data requested by EPA in 1997 and 1998) were used as the source of emissions data and statistical information concerning the metal furniture surface coating industry as a whole. There were several discrepancies in the number of facilities reported in the 2002 NEI versus the 1997 and 1998 NESHAP questionnaires.

Results from the NESHAP questionnaires indicated that there were approximately 3000 facilities that produce metal furniture parts or products. These facilities were located throughout the U.S., with the highest concentration of facilities in California, Michigan, New York, Florida, and Illinois.⁴ Although information regarding HAP emissions was the main focus of the NESHAP questionnaires, information regarding VOC emissions was submitted from 22 of the 85 facilities surveyed. These facilities reported actual VOC emissions totaling approximately 1,300 tpy for 1997/1998. This total only accounts for VOC emissions generated by these metal furniture facilities from coatings.

In developing this draft CTG, the 2002 NEI database was queried for VOC emissions generated by facilities that were listed under the following SIC codes: 2514, 2522, 2531, 2542, 2599, 3429, 3469, 3495, 3645, 3646, 3821, and 3843 (the SIC used for the 2003 NESHAP development). This query resulted in 456 facilities as compared to the 3,000 facilities identified during the development of the 2003 NESHAP. The VOC emissions from the 456 metal furniture surface coating facilities in the 2002 NEI totaled approximately 7,980 tpy. This total accounts for all of the VOC emissions generated by these facilities and does not specify the amount generated by just metal furniture coating operations. Of the 456 facilities identified in the 2002 NEI, 289 facilities were located in ozone nonattainment areas and 143 of the facilities located in ozone nonattainment areas emit more than the 6.8 kg/day (15 lb day) VOC applicability threshold described above.

As stated above, the information presented in BID for the 2003 NESHAP indicated that there are about 3,000 metal furniture facilities in the United States. This information was based on 1997 Census data for the Standard Industrial Classification (SIC) codes that describe the metal furniture industry. In contrast, the 2002 Census data (obtained using the North American Industry Classification (NAICS) codes that correspond to the previously used SIC codes) indicated that there are about 1,000 metal furniture facilities. We have found that the NAICS codes are in some cases very broad in their description of applicable products. As a result, some of the NAICS codes include parts and products that are beyond the scope of the metal furniture industry as defined in this document. Thus, the 2002 Census data for the number of facilities listed under these NAICS tend to overestimate the number

of metal furniture surface coating facilities by including facilities that do not manufacture metal furniture parts or products. Therefore, we believe that the NEI data most accurately predict the total number of metal furniture facilities.

IV. Process Description and Sources of VOC Emissions

The metal furniture coatings product category under section 183(e) of the CAA includes the coatings that are applied to the surfaces of metal furniture. A metal furniture substrate is the furniture or components of furniture constructed either entirely or partially from metal. Metal furniture includes, but is not limited to, the following types of products: household, office, institutional, laboratory, hospital, public building, restaurant, barber and beauty shop, and dental furniture, as well as components of these products. Metal furniture also includes office and store fixtures, partitions, shelving, lockers, lamps and lighting fixtures, and wastebaskets. Metal furniture coatings include paints and adhesives and are typically applied without a primer. Higher solids and powder coatings are used extensively in the metal furniture surface coating industry. Metal furniture coatings provide a covering, finish, or functional or protective layer, and can also provide a decorative finish to metal furniture.

A. Process Description

Metal furniture coatings serve decorative, protective and functional purposes. Coatings protect the metal from corrosion by providing resistance to moisture, heat, and sometimes the outdoor elements. Coatings for each type of metal furniture have special requirements and contain unique properties because each type will be exposed to somewhat different corrosive elements. The coating must also be durable and have excellent adhesion properties to avoid peeling or chipping. Finally, the coatings for many products provide decorative appeal.

The metal furniture manufacturing process may be divided into four main unit operations: (1) raw material preparation, (2) surface preparation, (3) coating and adhesive application operations, and (4) assembly. In addition, cleaning activities are performed in support of the surface coating operation. The majority of the raw material preparation operations and assembly operations are mechanical in nature and involve no VOC emissions. Surface preparation, coating application operations, and cleaning activities utilize VOC-containing compounds (i.e., coatings, thinners, and/or cleaning materials) and are further described below.

1. Surface Preparation

Before a metal furniture component or product can be coated, its surface must be thoroughly cleaned. The cleaning operation consists of the following basic processing steps: (1) alkaline or acid cleaning, (2) water rinse, (3) phosphate treatment (typically iron phosphate), (4) water rinse, and (5) pretreatment and/or water rinse. The last step involves drying the parts in an oven. In general, the cleaning chemicals used in this cleaning operation contain little VOC and therefore generate negligible emissions.

In the alkaline or acid cleaning step, metal furniture components or products are sprayed with, or immersed in, a cleaning solution to dissolve and remove oil, grease, and dirt. This solution, which can be alkaline or acidic, typically includes one or more other ingredients such as surfactants or corrosion inhibitors. Generally, acid-based solutions are preferred for removing corrosion and scale from metal pieces. However, because alkaline formulations are generally somewhat milder, they are recommended for certain metal substrates when the corrosivity of acid solutions is a concern.

The cleaning step is followed by a phosphate treatment. The purpose of this treatment is to provide corrosion resistance to the surface of the metal part. The final pretreatment step, if utilized, may be a rust inhibitor or adhesion promoter.

Following each treatment step, the metal furniture component or product is typically sent through several rinse stages in series. A counterflow rinsing system is commonly utilized. A counterflow rinsing system is a sequence of rinse steps in which replenished rinse water moves in the opposite direction of the component or product flow. The components or products being cleaned progress from dirtier to cleaner rinse water. The system maximizes water use by adding fresh water only at the final rinse step in the sequence. Thus, the metal furniture components or products are exposed to the cleanest rinse water just before proceeding to the next treatment step.

An alternate cleaning method prior to coating is an enclosed shot-blasting operation. The operation uses steel shot (fine particles) to abrasively remove dirt and grease, as well as to smooth rough edges and welds. The operation can also be used to remove cured coatings when parts require rework. Although the steel shot is recycled back to the enclosure containing the metal furniture parts or components, a small amount of particulate matter emissions is generated by this operation. However, the cleaning operation does not involve any liquid chemicals, and no wastewater discharge is produced.

2. Coating Application

Surface coating is accomplished by applying a coating to the metal part, followed by curing or drying the coating. The coating itself may be in the form of a liquid or powder, and may be applied by spraying or dipping.

There are several different types of applicators that may be used to apply coatings. The most common types of coating applicators include: air atomized spray coating, electrostatic spray coating, high volume/low pressure (HVLP) spray coating, dip coating, flow coating, roll coating, electrocoating, and autophoretic coating.⁴

Spray coating is an application process where coatings are spray applied in a booth by manual or automatic means. In some instances, productivity is maximized by using automatic application followed by manual touchup. Typically, overspray is collected within the booth on either dry filter media or a waterwash booth. Air flow in a booth equipped with

dry filter media generally passes from the spray applicator, over the metal furniture component or product, and through a dry filter bank. Waterwash booths are less commonly used in the metal furniture industry. In a waterwash booth, air is drawn through a continuous curtain of moving water and overspray is removed by contact with the water. In addition, overspray hits the booth walls and is washed down by the water flow. In booths equipped with dry filters and waterwash booths, the overspray can be collected on a series of baffles in front of the the dry filters or waterwash, and the collected overspray can be reused. This recycling method substantially reduces both air emissions and waste (including spent dry filters) generated by the coating application operation.

In *electrostatic spraying*, the coating is charged and the part is grounded thereby attracting the atomized coating to the part. Nearly all metal furniture spray coatings are electrostatically applied.

HVLP systems have improved nozzles which provide better air and fluid flow, and allows for gentler atomization of the air stream. These nozzles or atomizers shape the air/spray pattern and guide the atomized coating particles to the product being coated.

Dip coating is another available method for applying liquid coating. It is typically used on parts that do not require a high-quality appearance, such as interior components of a filing cabinet. The metal furniture components or products to be coated are manually or automatically dipped into a tank containing the coating. The metal furniture components or products are then withdrawn from the tank and any excess coating is allowed to drain, thus achieving very high coating transfer efficiencies. Typical systems have some means of recirculation of the tank contents, filters to remove paint sediment and solid contaminants, and means for controlling viscosity of the fluid. Because the tank opening exposes a large surface area of liquid coating, solvent losses occur from the tank. To maintain the desired coating viscosity in the tank, these losses are compensated by adding thinner (water or solvent, depending on the coating used).

Flow coating is similar to dip coating and involves conveying the metal furniture component or product over an enclosed sink, where the coating is applied at low pressure as the item passes under a series of nozzles. Excess coating drains back into the sink, is filtered, and pumped back into a coating holding tank. A typical flow coater tank is enclosed and is smaller than the equivalent dip coating tank. As a result, less coating is used and less solvent is evaporated than in dip tank operations. This application method results in an increase in production rate.

Roll coating application is used for high viscosity coatings, particularly adhesives, and for small surface areas. In most instances, the adhesive is activated by pressure, not heat. The adhesive is typically spray applied to both the substrate and laminate, and then the two parts are assembled.

Electrocoating (electrodeposition) is a specialized form of dip coating where opposite electric charges are applied to the waterborne coating and the part. The coating is

deposited on the part by means of electrical attraction, which produces a more uniform coating on the part than traditional dip application.

Autophoretic coating consists of a series of dip tanks in which the parts to be coated are immersed and cleaned. After cleaning, the coating solids are deposited on the surface of the parts via chemical reaction. The coating solids are then heat cured. The only reported use of autophoretic coatings for metal furniture applications was a black coating, which effectively limits its use to parts hidden from view.

Powder coatings are applied almost exclusively by means of electrostatic spray in the metal furniture surface coating industry. The electrostatic spray gun directs the flow of powder to the product. If a powder recovery system is used, the oversprayed powder is recovered and recycled. Powder coatings may also be applied using a dip application operation. The part to be coated is first heated to a temperature above the powder's melting point. The hot part is then immersed in a fluidized bed of the powder, melting the powder in contact with it and forming a continuous coating on the part.

After each of the liquid and powder coating applications described above, the applied coating is heat dried or cured or air dried or cured after application, with the exception of adhesives which are activated by pressure. For liquid spray and dip coating operation, the coated parts are typically first slowly moved through a flash-off area after the coating application operation to allow solvents in the coating to evaporate slowly and thus avoid bubbling of the coating while it is curing in the oven. After application of powder coatings, the coated metal furniture components or products are conveyed directly to an oven (there is no flash-off area for powder coatings) and heated to cure the powder. This curing process melts the powder, forming a continuous coating. Following the curing step, the final unit is assembled (if necessary) and packaged for shipment.

3. Cleaning activities

Cleaning activities other than surface preparation also occur at metal furniture 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 the cleaning of spray guns, transfer lines (e.g., tubing or piping), tanks, and the interior of spray booths. These cleaning materials are typically mixtures of VOC-containing solvents.

B. Sources of VOC Emissions

Primarily, VOC emissions from metal furniture surface coating processes result from the evaporation of the volatile components of the coatings and cleaning materials.^b In most

^b In a previous notice, EPA identified specific categories, including metal furniture surface 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.

cases, VOC emissions from surface preparation, storage, handling, and waste/wastewater operations are relatively small. The following discussion describes these primary emission sources (coatings and cleaning materials).

1. Coatings

The primary VOC emissions from metal furniture coatings occur during coating application/flash-off and drying/curing of the coatings. The remaining emissions are primarily from mixing and/or thinning. The VOC emissions from mixing and thinning of coatings occur from displacement of VOC-laden air in containers used to mix coatings containing solvents (thinners) prior to coating application. The displacement of VOC-laden air can also occur during filling of containers and can be caused by changes in temperature, changes in barometric pressure, or agitation during mixing.

The VOC emissions from coating application occur when solvent evaporates from the coating as it is being applied to the part. The transfer efficiency (the percent of coating applied to the metal furniture component or product) of a coating application method affects the amount of VOC emitted during coating application. The more efficient a coating application method is in transferring coatings to the metal furniture component or product, the lower the volume of coatings (and therefore solvents) needed per given amount of production; thus resulting in lower VOC emissions. Conventional air atomized spray equipment utilizes high atomizing air pressure with typical transfer efficiencies of 25 to 40 percent.⁴

After being coated by any of the typical coating methods (e.g., spray coating or dip coating), the metal furniture components or products are dried/cured. Prior to entering the ovens, solvents in the coatings evaporate slowly in the flash-off area to prevent bubble formation during curing. The amount of VOC emissions from the flash-off area depends on the type of coating used, the speed of the coating line (*i.e.*, how quickly the component or product moves through the flash-off area), and the distance between the application area and the bake oven. For liquid spray applications, it is estimated that 65-80 percent of the volatiles are emitted during the application and flash-off operations, and the remaining 20-35 percent from the drying/curing operation.

For powder coatings, the curing/drying step melts the powder and forms a continuous coating on the metal furniture component or product. For liquid coatings, this step removes any remaining volatiles from the coating. The cured coatings provide the desired decorative and/or protective characteristics. The VOC emissions during the curing/drying process result from the evaporation of the remaining solvents in the dryer.

Until the 1970's, conventional solvent-based coatings, with high VOC content, were the majority of coatings used in the metal furniture industry. Due to increased regulation at the State and federal level, the industry has steadily moved to lower VOC content coatings. These alternative coatings include powder coatings, waterborne coatings, higher solids coatings, and ultraviolet coatings. The following discussion summarizes each of these alternative coating formulations.

Powder Coatings. The use of powder coating systems in the metal furniture manufacturing industry has increased. Many metal furniture manufacturing facilities have replaced existing liquid coating lines with powder coating lines. Compared to conventional liquid coating systems, powder coating produces minimal amounts of VOC emissions because powder coatings are applied as dried particles, no VOC are released during the application operation, and volatile emissions from the curing operation, if any, are generally much less than the volatile emissions from liquid coating systems. Powder coating is applied via powder delivery systems, which in most cases is an electrostatic spray. Particulate emissions resulting from the application of powder coatings can be minimized through the implementation of a recovery and recycling process (reuse of overspray). Depending on the powder formulation, some volatile emissions may occur when the powder is heated during the curing step. Powder coating applications are best suited for long production runs of consistently sized parts without color changes.

Waterborne Coatings. Waterborne coatings produce minimal VOC emissions primarily because a large portion of the solvent carrier is replaced with water. The water component can constitute as much as 80 percent of the coating, with the remaining 20 percent being the coating solids. Waterborne coatings are used widely in other industries, most often when there is a primer applied to the substrate prior to the waterborne coating. The use of waterborne coatings is limited in the metal furniture manufacturing industry because they tend to corrode mild steel and some stainless steels, and the primer keeps the water from contacting the metal substrate. Because primers are used only rarely in the metal furniture industry, the use of waterborne coatings is more limited in this industry.

Higher Solids Coatings. These coatings contain at least 60 percent by volume of coating solids. VOC emissions are reduced through the use of these coatings because they contain less solvent per unit volume of solids than conventional solvent-based coatings. Thus, a lesser amount of VOC emissions are released during coating preparation, application, and curing to deliver a given amount of coating solids.

Ultraviolet Coatings. Ultraviolet (UV) curable liquid and UV curable powder coatings are used for heat sensitive substrates as they allow for low curing temperatures. UV liquid coatings have been used for several decades on parts made of wood, composite, and metal, but are not commonly used in the metal furniture industry. Because the entire coating must be exposed to the UV light source to achieve complete curing of the UV coating, UV curable coating applications present problems in the metal furniture industry. Pigmentation used in the majority of metal furniture coatings blocks the UV light. The shape of the metal furniture also presents curing problems. Metal furniture products typically have bends or are box-shaped, creating areas which would be shaded from the UV light source.

2. Cleaning Materials

Cleaning materials are another source of VOC emitted by metal furniture surface coating operations. The VOC are emitted when solvents evaporate from the cleaning materials during use.

Cleaning materials with low-VOC composite vapor pressure and/or low-VOC content generate less VOC emissions than materials with higher VOC vapor pressure and/or content. The VOC composite vapor pressure of a cleaning material is a weighted average of the vapor pressures of the VOC components of that cleaning material. The vapor pressure of each VOC component is weighted by the mole fraction of that VOC component in the whole cleaning material, including non-VOC components such as water or exempt compounds.^c Water and exempt compounds thereby reduce the VOC composite vapor pressure of cleaning materials in which they are present. Although use of lower pressure cleaning materials may reduce VOC emissions, little information is available regarding the use of cleaning materials with low VOC composite vapor pressure in the metal furniture surface coating industry. Similarly, cleaning materials with low VOC content would generate less VOC emissions than materials with high VOC content; however, little information is available regarding the use of cleaning materials with low VOC content in this industry.

V. Available Controls and Regulatory Approaches

As previously mentioned, there are two main sources of VOC emissions from metal furniture 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 existing federal, State, and local VOC recommendations or requirements that address these emissions.

A. Available Controls for VOC Emissions from Coatings

There are two general emission control techniques for reducing VOC emissions from metal furniture coatings: pollution prevention measures, and emission capture and add-on control systems. Pollution prevention is the most prevalent control technique being used by the metal furniture surface coating industry. Add-on control systems are available to the industry, but few facilities utilize this control technique. Provided below is a summary of these control techniques.

1. Pollution Prevention Measures

Pollution prevention measures applicable to the metal furniture manufacturing industry, including product substitution/reformulation, work practice procedures, and

^c Exempt compounds are those classified by EPA as having negligible photochemical reactivity as listed in 40 CFR 51.100 (s). Exempt compounds are not considered to be VOC.

equipment substitution, may be used to decrease VOC emissions from coating application operations. Lower VOC content coatings, such as powder coatings, higher solids coatings and waterborne coatings, may be used to reduce VOC emissions by reducing or eliminating the organic solvent present in the coating. Work practice procedures may also result in VOC emission reductions during the coating process by reducing coating waste. The use of efficient coating application equipment can reduce VOC emission by increasing the coating transfer efficiency (i.e., the percentage of coating solids used that is deposited onto the substrate).

Product substitution/Reformulation

One pollution prevention measure is to substitute higher-solvent coatings with coatings containing little or no solvents. As previously discussed, these coatings include powder coatings, waterborne coatings, higher solids coatings, UV coatings, electrocoatings, and autophoretic coatings. The use of higher solids, powder and waterborne coatings has increased since 1977. Manufacturers have developed and are continuing to develop waterborne and powder coating formulations that replace conventional organic solvent-borne coatings. These coatings are generally available and often are not produced and marketed specifically for metal furniture surface coating. Conversion to powder coatings (for example) can lower VOC emissions greatly, and most metal furniture coating operations are capable of converting to these coatings. However, the currently available low-VOC coatings or coatings with no solvents do not meet the performance requirements of some metal furniture and therefore are not viable options for these products' production.

Work Practices

Work practice procedures are physical actions intended to affect emission reductions. Because work practice procedures are specifically tailored to an industry, they may vary from a few manual operations to a complex program.

Coating waste is generated during coating material preparation, coating application, and equipment cleaning. If coating waste is reduced, overall VOC emissions from coating operations will be reduced because less VOC coating material will be needed for production. Coating waste may be reduced by effectively controlling material preparation, maximizing the amount of coating transferred to the part through the use of application methods with higher transfer efficiencies and proper form (spray technique), and using proper equipment maintenance procedures.

Equipment Substitution

The use of the more effective application equipment also reduces VOC emissions. Conventional air atomized application systems utilize high atomizing air pressure with typical transfer efficiencies of 25 to 40 percent.

More modern technologies, such as electrostatic and high volume/low pressure (HVLP) spray equipment, can achieve much higher transfer efficiencies. The increase in transfer efficiency translates to a decrease in usage of materials containing VOC.

In electrostatic spraying, the coating is charged and the part is grounded thereby attracting the atomized coating to the part. Transfer efficiencies of up to 90 percent may be achieved depending on the product shape, size, and substrate. Nearly all metal furniture spray coatings are electrostatically applied.

HVLP systems have improved nozzles which provide better air and fluid flow, and allows for gentler atomization of the air stream. These nozzles or atomizers shape the air/spray pattern and guide the atomized coating particles to the product being coated.

2. Emission Capture and Add-on Control Systems

In addition to pollution prevention measures, VOC emissions from metal furniture surface coating application 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. As stated previously, although capture systems and add-on control devices are available to the metal furniture surface coating industry, EPA is aware of only a few cases where this control technology is utilized by the industry.⁴ The majority of VOC emissions from metal furniture coating operations occur in the spray booth. Spray booths typically exhaust a high volume of air with a low concentration of VOC which can result in a high cost of control.

Capture Systems

Capture systems, such as hoods and enclosures, collect solvent-laden air from process vents (*e.g.*, spray booth or bake oven vents) and/or fugitive emissions (*e.g.*, flash-off area) and direct the captured air to a control device. The majority of VOC emissions from metal furniture surface coating occur in the spray booth. These emissions can be ducted from the spray booth directly to the control device. Similarly, bake oven exhaust can be ducted directly to the control device. Spray booths and bake ovens are the principal elements of the capture system. In addition, hoods, floor sweeps or enclosures can be used to collect fugitive emissions from solvents that evaporate from other parts of the coating line, such as the flash-off areas, and route them to a control device.

The design of the capture system can greatly contribute to the overall VOC control efficiency. An efficient capture system maximizes the capture of emissions and minimizes the capture of dilution air. Spray booth and bake oven design and air management can reduce the volume of exhaust air and increase the VOC concentration of the exhaust air which can reduce the cost of control. Facilities may combine several captured VOC-laden streams and duct them to a single control device.

Add-on Control Systems

Add-on controls reduce the amount of VOC emissions by either destruction or recovery with or without recycling of VOC emission in the exhaust streams. Two categories of add-on control devices are typically used by the metal furniture surface coating industry: combustion (thermal or catalytic oxidation) and recovery (adsorption and absorption). 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 absorption. In addition, there are other control measures known to reduce VOC emissions, but are not currently being used in the metal furniture 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 lower combustion temperatures 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 coating application operations with high and constant concentrations of VOC.

Adsorption occurs when the unbalanced molecular forces on the surface of solids (the adsorbant) attract and retain gases and particulate matter that come in contact with the solid. Several materials are widely used as the adsorbent, such as activated carbon, organic resin polymer, and inorganic materials. Each has substantial surface area per unit volume. Carbon adsorbers are most commonly used in the metal furniture 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. 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 bed 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.⁵ In contrast to combustion, carbon adsorption does not destroy the VOC it removes from the air stream. Carbon adsorbers used in metal furniture surface coating are thermally regenerated, usually by passing steam through the carbon beds.⁶ 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.⁶ 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.⁷

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.⁶

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. In addition, adsorption is usually used for coating application exhaust streams at ambient temperature up to approximately 38°C (100°F). Therefore, cooling and dehumidification may also be required as pretreatment in some cases.⁵ Adding equipment, such as a dehumidification system, increases the costs associated with the use of a carbon adsorption system.

Absorption is the process by which a gas stream is contacted with a liquid so that one or more of the components of the gas stream will dissolve in the liquid. Water is the most common absorbent, but organic solvents may also be used. Removal efficiency can be enhanced by the addition of reactive chemical additives to the absorbent to increase solubility of the absorbed pollutant or change the equilibrium.

Alternative control technologies, such as condensation, biodegradation, and UV oxidation are applicable for control of VOC emissions from coatings. However, EPA is not aware of any metal furniture surface coating facilities currently using these types of control technologies.⁴

B. Available Controls for VOC Emissions from 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 metal furniture 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 emission 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 metal furniture surface coating.

However, if cleaning operations are performed within a capture system that is ducted to an add-on control system, such as a PTE routed to a thermal oxidizer, the VOC emissions from the cleaning operations would be reduced by destruction in the thermal oxidizer.

1. Product Substitution/Reformulation

Reducing the composite VOC 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 metal furniture industry.

2. Work Practice Procedures

Work practice procedures are commonly used in the metal furniture industry to reduce VOC emissions from cleaning operations. The following work practice procedures are used to reduce VOC emissions from metal furniture cleaning operations:

- Cover mixing and storage vessels for VOC-containing cleaning materials, and cleaning waste materials except when adding, removing, or mixing contents;
- Use closed containers or pipes to store and convey VOC-containing cleaning and cleaning waste materials;
- Minimize spills of VOC-containing cleaning and cleaning waste materials; and
- Minimize VOC emissions during cleaning operations.

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

The following discussion is a summary of three EPA actions, as well as State and local regulations, that address VOC emissions from metal furniture coating processes. Table 1 outlines these Federal, State and local provisions and the bases for these provisions. In addition, appendices B and C summarize the State and local provisions.

1. The 1977 CTG

The 1977 CTG recommended limiting VOC emissions from the facility's metal furniture coating line, which consists of the coating application area, the flash-off area, and the curing oven, to 0.36 kg/l (3.0 lb/gal) of coating, excluding water and exempt compounds, as applied. This emission limit was based on the use of low-VOC coatings and is approximately equivalent to the use of conventional high solvent content coatings in conjunction with an add-on control system with an overall control efficiency (taking into account capture and control) of 81 percent. At the time, it was believed that most metal furniture facilities would seek to meet future regulations through the use of low-VOC coatings rather than using add-on control technologies. Cleaning materials were not addressed in the 1977 CTG.

Equivalent solid-based limits for metal furniture coating operations were presented in *A Guideline for Surface Coating Calculations*” (EPA-340/1-86-016).⁸ For metal

Table 1. Summary of Existing Requirements

Existing Regulation	Emission Limit	Basis for Emission Limit
Metal Furniture Coating CTG (December 1977)	Recommended VOC emission limit of 3.0 lb VOC/gal of coating, excluding water and exempt compounds, as applied	Calculated based on the use of higher solids coatings (59.2 percent by volume solids). Associated with a baseline transfer efficiency of 60 percent
Metal Furniture NSPS (October 29, 1982)	VOC emission limit of 7.5 lb VOC/gal of coating solids deposited from any surface coating operation on a metal furniture surface coating line	More stringent than the 1977 CTG recommendation
Metal Furniture NESHAP (May 23, 2003)	Existing sources: HAP emission limit of 0.83 lb organic HAP/ gal coating solids used	MACT level of control based on 1997/1998 survey of coating materials used in the industry
California - Bay Area Regulation 8, Rule 14 (Originally adopted March 7, 1979 with last amendment October 16, 2002)	Method of coating application must have a transfer efficiency of 65% or greater and then a VOC emission limit for baked coatings of 2.3 lb/gal (0.275 kg/l) of coating, excluding water and exempt compounds, as applied and for air-dried coatings of 2.8 lb/gal (0.34 kg/l) of coating, excluding water and exempt compounds, as applied	Similar to the 1977 CTG but using a coating with 69 percent solids and a transfer efficiency of 65 percent
State Regulations: 36 State and local jurisdiction rules specifically for metal furniture coating operations were identified	VOC emission limit of 3.0 lb VOC/gal of coating, excluding water and exempt compounds, as applied, or an overall emission reduction of 90 percent by utilization of an add-on control device	1977 CTG

furniture surface coating operations, the 1977 CTG-equivalent limit was 0.60 kg/l (5.1 lb/gal) of 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 1982 NSPS

The 1982 NSPS applies to metal furniture surface coating operations that commenced construction, modification, or reconstruction after November 28, 1980. The 1982 NSPS defines surface coating operations in the rule to include prime coat and topcoat operations, and the standards apply to the coating application station, flash-off area, and curing oven. Any metal furniture surface coating operation that uses less than 3,842 l/yr coating (as applied) is required to keep records of coating usage but is exempt from the other NSPS provisions. The 1982 NSPS establishes a VOC limit of 0.90 kg VOC/l (7.5 lb VOC/gal) coating solids deposited. This limit was based on the use of coatings with around 62 volume percent solids, applied at 60 percent transfer efficiency, and using an assumed VOC density of 0.88 kg/l (7.36 lb/gal).

The 1982 NSPS applies to the same metal furniture surface coating operations as the 1977 CTG: the coating application area, the flash-off area, and the curing oven. Because the 1982 NSPS VOC emission limit is in terms of coating solids deposited and the 1977 CTG-equivalent limit is in terms of coating solids used, it is difficult to directly compare the two limits. During the implementation of the 1977 CTG, a baseline of 60 percent (i.e. 0.60 gal of coating solids deposited per gal coating solids used)⁸ was used to estimate an as-applied CTG-equivalent limit. By applying the 60-percent transfer efficiency to the 1977 CTG-equivalent limit of 0.60 kg VOC/l (5.1 lb VOC/gal) solids used, the CTG-equivalent limit would be 1.01 kg VOC/l (8.4 lb VOC/gal) coating solids deposited. Based on this baseline transfer efficiency, the 1982 NSPS limit is more stringent than the 1977 CTG-equivalent limit when converted to a solids deposited basis. Cleaning materials were not addressed in the 1982 NSPS.

3. The 2003 NESHAP

The 2003 NESHAP applies to “major” sources of HAP emissions, which are 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. Where the 1977 CTG and the 1982 NSPS cover individual coating lines, the 2003 NESHAP covers the collection of all of the following operations and equipment at a facility:

- coating operations (which are defined to include equipment used for surface preparation, coating application, and equipment cleaning);
- storage containers and mixing vessels in which coatings, thinners, and cleaning materials are stored or mixed;
- manual and automated equipment and containers and pumps and piping used for conveying coatings, thinners, and cleaning materials; and

- storage containers, pumps and piping, and manual and automated equipment and containers used for conveying waste materials generated by a coating operation.

The 2003 NESHAP imposes an organic HAP emission limitation of 0.10 kg organic HAP/l (0.83 lb organic HAP/gal) of coating solids used for sources in operation on or before April 24, 2002 (existing sources), and no organic HAP emissions are allowed for new sources (sources which started up after April 24, 2002). For purposes of determining compliance, the organic HAP emissions are the total emissions from coatings, thinners, and cleaning materials.

Compliance with the 2003 NESHAP can be demonstrated by any of three methods: (1) *compliant coatings option*, where all coatings used have organic HAP contents that individually meet the organic HAP emission limit, and all thinners and cleaning materials contain no organic HAP; (2) *emission rate without add-on controls option*, where the monthly average organic HAP emission rate is equal to or less than the organic HAP emission limit; or (3) *emission rate with add-on controls option*, where the monthly emission rate, taking into account the emission reduction achieved through the use of one or more control devices, is equal to or less than the organic HAP emission limit.

If a facility is demonstrating compliance by using the emission rate with add-on controls option, the 2003 NESHAP requires the facility to develop a work practice plan to minimize organic HAP emissions from the storage, mixing, and conveying of coatings, thinners and cleaning materials used in the coating operations, as well as organic HAP emissions from waste materials generated by such operations. At a minimum, the work practice plan must include the following elements:

- All organic-HAP-containing coatings, thinners, cleaning materials, and waste materials must be stored in closed containers. Ensure that these containers are kept closed at all times except when depositing or removing these materials from the containers.
- Spills of organic-HAP-containing coatings, thinners, cleaning materials, and waste materials must be minimized.
- Organic-HAP-containing coatings, thinners, cleaning materials, and waste materials must be conveyed from one location to another in closed containers or pipes.
- Mixing vessels which contain organic-HAP-containing coatings and other materials must be closed except when adding to, removing, or mixing the contents.
- Emissions of organic HAP must be minimized during cleaning of storage, mixing, and conveying equipment.

4. Existing State and Local VOC Requirements

In addition to the EPA actions described above, at least 36 States and local jurisdictions have regulations that control VOC emissions from metal furniture coating (or for metal parts and products coating in general). The vast majority of these States (32 States) have incorporated the 1977 CTG VOC emissions limit of 0.36 kg VOC/l (3.0 lb VOC/gal) of coating applied (minus water). Two States incorporated the CTG-equivalent

limit of 0.60 kg VOC/l solids used. Appendix B summarizes the applicable rules for all States except California. The applicable rules for all of the California Districts are summarized in Appendix C. Generally, compliance with the State and local jurisdiction emission limits can be achieved using coatings that meet the VOC emission limits or by the installation of a capture and add-on control system. Some states specify the use of incinerators and/or carbon adsorbers.

The California Bay Area Air Quality Management District (Bay Area) has adopted limits that are more stringent than the 1977 CTG recommendation. The Bay Area has established two VOC emission limits for surface coatings of metal furniture: (1) 275 g VOC/l (2.3 lb VOC/gal) of coating, excluding water and exempt compounds, as applied for baked coating; and (2) 340 g VOC/l (2.8 lb VOC/gal) of coating, excluding water and exempt compounds, as applied for air-dried coating. In addition, the Bay Area rule requires the use of coating application equipment that can meet a 65 percent or greater transfer efficiency. Per the Bay Area regulation, compliance with the standard's 65 percent or greater transfer efficiency can be achieved by properly operated electrostatic application or HVLP spray, flow coat, roller coat, dip coat including electrodeposition, and brush coat.

Like the Bay Area's limits, the VOC emissions limits established by the South Coast Air Quality Management District (South Coast) for the coating of metal parts and products (which includes metal furniture using a general multi-component coating) are: (1) 275 g VOC/l (2.3 lb VOC/gal) of coating, excluding water and exempt compounds, as applied for baked coating; and (2) 340 g VOC/l (2.8 lb VOC/gal) of coating, excluding water and exempt compounds, as applied for air-dried coating. The South Coast regulation specifies the use of the following application methods: electrostatic application, flow coat, dip coat, roll coat, HVLP spray, hand application methods, or other coating application method capable of achieving a transfer efficiency equivalent or better than that achieved by HVLP spraying. As an alternative to the emissions limit and operating equipment requirement, the South Coast regulation allows the use of capture and control equipment to collect at least 90 percent by weight of the VOC emissions generated by the sources of VOC emissions (capture efficiency) and to reduce VOC emissions from an emission collection system by at least 95 percent by weight (control efficiency).

Several jurisdictions in California have requirements to regulate the VOC emissions from cleaning materials used in the metal furniture 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 ten States that have cleaning material regulations that apply to metal furniture surface coating operations. Of these, nine 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.

VI. Recommended Control Options

Based on a review of the 1977 CTG, the 1982 NSPS, the 2003 NESHAP, and the current State and local requirements discussed above, we are recommending emission limits for controlling the VOC emissions from the coatings used by metal furniture manufacturing facilities and work practices to further reduce VOC emissions from coatings as well as to minimize emissions from cleaning materials used in metal furniture surface coating processes.

To control VOC emissions from coatings used in metal furniture surface coating, we are recommending two alternatives for controlling VOC emissions for coating operations: (1) an emission limit that can be achieved through the use of low-VOC materials; and (2) an overall control efficiency of 90 percent for facilities that choose to use add-on controls instead of low-VOC materials. The low-VOC materials recommendation consists of an emission limit of 0.275 kg VOC/l (2.3 lb VOC/gal) of coating, excluding water and exempt compounds, as applied and the use of specified application methods. These recommendations are based on California's Bay Area and South Coast regulations for metal furniture surface coating facilities.

We estimate that the control measures under either recommendation would reduce VOC emissions from metal furniture coating operations by about 60 percent (a reduction of 2,040 tpy of VOC from the nonattainment area facilities above the recommended 6.8 kg/day (15 lb/day). In our analysis of the impacts of the recommended level of control, we have assumed that all facilities will choose to utilize the low-VOC coating materials alternative. We made this assumption for two reasons. First, we believe that complying low-VOC coating materials are already widely available at a cost that is not significantly greater than the cost of coating materials with higher VOC contents. Secondly, the use of add-on controls to reduce emissions from typical spray coating operations would be a more costly alternative.

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 these work practices for the same reasons stated above for coating application, the use of add-on controls to reduce emissions from cleaning operations at metal furniture 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 system 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 metal furniture surface coating operations. Therefore, we are not recommending the use of a VOC content or VOC composite vapor pressure limit for cleaning materials

The following discussion summarizes our specific recommendations for coating operations and cleaning materials used in metal furniture surface coating operations. As previously discussed in Section III, we are recommending applying the emission limit to facilities emitting more than 6.8 kg VOC/day (15 lb VOC/day).

A. Emission Limit Based on Low-VOC Coatings

For the recommended emission limit of 0.275 kg VOC/l (2.3 lb VOC/gal) coating, excluding water and exempt compounds, as applied, we are recommending that all VOC-containing materials (i.e., coatings and thinners) used by each metal furniture surface coating unit are included when determining the coating unit's emission rate. In addition, we also recommend the use of one or more of the following application methods: electrostatic application, HVLP spray, flow coat, roller coat, dip coat including electrodeposition, or other coating application method capable of achieving a transfer efficiency equivalent or better than that achieved by HVLP spraying. This recommendation is based on the Bay Area baked coating VOC emission limit and the South Coast general multi-component coating VOC emission limit (from the metal parts and products coating regulation which includes metal furniture).

B. Optional Add-on Controls for Coating Operations

Should product performance requirements or other needs dictate the use of higher-VOC materials than those that would meet the recommended emission limit, a facility could choose to use add-on control equipment with an overall control efficiency of 90 percent. Add-on devices include oxidizers and solvent recovery systems, which coupled with capture systems to collect the VOC being released at the affected facilities, can achieve an overall control efficiency of 90 percent. This control option, like the low-VOC material option noted above, applies to all coatings and thinners applied to metal furniture components or products.

C. Work Practices for Coating-Related Activities

In addition to the control options above, this CTG recommends work practices to further reduce VOC emissions from metal furniture surface coating-related activities. Although VOC reductions achieved by implementing the recommended work practices may not be quantifiable, they are beneficial to the overall goal of reducing VOC emissions. We recommend work practices for storage, mixing operations, and handling operations for coatings, thinners, and coating-related waste materials. Specifically, we recommend the following work practices: (1) store all VOC-containing coatings, thinners, and coating-related waste materials in closed containers; (2) ensure that mixing and storage containers used for VOC-containing coatings, thinners, and coating-related waste materials are kept closed at all times except when depositing or removing these materials; (3) minimize spills of VOC-containing coatings, thinners, and coating-related waste materials; and (4) convey VOC-containing coatings, thinners, and coating-related waste materials from one location to another in closed containers or pipes.

D. Work Practices for Cleaning Materials

This CTG recommends work practices to reduce VOC emissions from cleaning materials used in metal furniture surface coating operations. Although VOC reductions achieved by implementing the recommended work practices may not be quantifiable, they are beneficial to the overall goal of reducing VOC emissions. We recommend work practices for storage, mixing operations, and handling operations for cleaning materials. Specifically, we recommend the following work practices: (1) store all VOC-containing cleaning materials and used shop towels in closed containers; (2) ensure that mixing and storage containers used for VOC-containing cleaning 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 (5) minimize VOC emission from cleaning of storage, mixing, and conveying equipment.

VII. Cost Effectiveness of Recommended Control Options

We used the 2002 National Emissions Inventory (NEI) database to estimate the number of metal furniture manufacturing facilities. Based on the 2002 NEI, we estimated that there are a total of 456 metal furniture facilities in the U.S. Using the 2004 ozone nonattainment designations, we estimated that a total of 289 of these facilities are in ozone nonattainment areas. Based on the NEI VOC emissions data, 143 of the 289 facilities in ozone nonattainment areas emitted at or above the 6.8 kg/day (15 lb/day) recommended VOC emissions applicability threshold. These 143 facilities emitted a total of about 3,100 Mg of VOC per year (Mg/yr) (3,400 tons per year (tpy)), or an average of about 21 Mg/yr (23 tpy) of VOC per facility.

As previously mentioned, the recommendations in this draft CTG are similar to the Bay Area and South Coast regulations governing metal furniture surface coating operations. The cost effectiveness related to the implementation of these regulations was not estimated during their development. Therefore, cost-effectiveness estimates for the recommended control levels were determined using the approach used during the 2003 NESHAP development. Although the 2003 NESHAP regulates organic HAP, the 2003 NESHAP cost estimates are relevant to this CTG's recommended levels of control because they are based on the use of the same control measures (i.e., use of low-HAP coatings and work practices) for metal furniture coatings and cleaning materials as those recommended in this CTG.

In our analysis of the impacts of implementing the recommended level of control in this draft CTG, we have assumed that all metal furniture surface coating facilities will choose to utilize the low-VOC coating materials alternative. We made this assumption for two reasons. First, we believe that low-VOC coating materials that can meet the level of control recommended in the draft CTG are already widely available at a cost that is not significantly greater than the cost of coating materials with higher VOC contents. Secondly,

the use of add-on controls to reduce emissions from typical spray coating operations is a more costly alternative.

According to studies performed for the development of the 2003 NESHAP, the cost averaged across all sizes of facilities, was as high as \$1,670 per facility.⁴ We believe that this estimate also represents the cost of implementing this draft CTG's recommended VOC limit which, as we previously explained, is based on the same control measures as the 2003 NESHAP organic HAP emission limit. For the 144 facilities we identified as being impacted by this draft CTG, the annual cost was estimated to be as high as \$240,500. Again using studies conducted as part of the development of the 2003 NESHAP, the VOC emission reduction was estimated to be 60 percent from baseline.⁴ For the 144 identified facilities, this would result in an emission reduction of 1,860 Mg/yr (2,040 tpy). Therefore, the cost effectiveness was estimated to be about \$129 per Mg (\$118 per ton) of VOC emission reduction.

VIII. References

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Appendix A

1977 CTG for Metal Furniture Coating

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EPA-450/2-77-032
December 1977
(OAQPS No. 1.2-086)

GUIDELINE SERIES

**CONTROL OF VOLATILE
ORGANIC EMISSIONS
FROM EXISTING
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COATING OF METAL
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Appendix B

Summary of State and Local Regulations for Metal Furniture Coating (not including California)

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Table B-1. Summary of State and Local Regulations for Metal Furniture Coating (not including California)

State/Locality	Operations Covered	VOC Numerical Limit (minus water and exempt compounds)	Compliance Method	Citation
Alabama (Jefferson County)	Metal furniture coating	0.36 kg/l (3.0 lb/gal) as applied (excluding water)	<p>For sources located in Jefferson County:</p> <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</p>	Alabama DEM Air Division Chapter 335-3-6-.24 and 335-3-6-.32(3)

Table B-1. Summary of State and Local Regulations for Metal Furniture Coating (not including California)

State/Locality	Operations Covered	VOC Numerical Limit (minus water and exempt compounds)	Compliance Method	Citation
Alabama (except Jefferson County)	Metal furniture coating	0.36 kg/l (3.0 lb/gal) as applied (excluding water)	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	Alabama DEM Air Division Chapters 335-3-6-.01 and 335-3-6-.11(3)
Alaska ^d				
Arizona	Incorporated by Reference, 40 CFR 60, Subpart EE (NSPS) and 40 CFR 63, Subpart RRRR (NESHAP)			
Arizona/Pima	Incorporated by Reference, 40 CFR 60, Subpart EE (NSPS) and 40 CFR 63, Subpart RRRR (NESHAP)			
Arizona/Pinal	Incorporated by Reference, 40 CFR 60, Subpart EE (NSPS) and 40 CFR 63, Subpart RRRR (NESHAP)			

^d Alaska does not have applicable air regulations.

Table B-1. Summary of State and Local Regulations for Metal Furniture Coating (not including California)

State/Locality	Operations Covered	VOC Numerical Limit (minus water and exempt compounds)	Compliance Method	Citation
Arizona/Maricopa	Metal furniture coating	0.36 kg/l (3.0 lb/gal) as applied	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). Coatings containing less than 0.14 lb/gal VOC.	Regulation III, Rule 336, section 301 through 306
	Cleaning Materials	35 mm Hg at 20°C	Work practices to minimize emissions of applicable equipment	
Arkansas ^e				

^e Arkansas does not have applicable air regulations.

Table B-1. Summary of State and Local Regulations for Metal Furniture Coating (not including California)

State/Locality	Operations Covered	VOC Numerical Limit (minus water and exempt compounds)	Compliance Method	Citation
Colorado	Metal furniture coating	0.36 kg/l (3.0 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: metal furniture 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.H
Connecticut	Metal furniture coating	0.36 kg/l (3.0 lb/gal) as applied	<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 premises 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-174-20(p)
Delaware	Metal furniture coating	0.35 kg/l (2.9 lb/gal) as applied	<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 19

Table B-1. Summary of State and Local Regulations for Metal Furniture Coating (not including California)

State/Locality	Operations Covered	VOC Numerical Limit (minus water and exempt compounds)	Compliance Method	Citation
	Cleaning Materials		<p>Does not apply to hand-wipe cleaning operations</p> <p>Use work practices to minimize emissions. Perform a solvent usage study to determine permit requirements. User-defined and operation specific.</p>	
Florida	Metal furniture coating	0.36 kg/l (3.0 lb/gal) as applied (excluding water)	<p>1. use of compliant coatings;</p> <p>2. use of incineration that reduces VOC emissions by 90 percent.</p> <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</p> <p>No cleaning material regulations.</p>	FAC Chapter 62-296.500, 505

Table B-1. Summary of State and Local Regulations for Metal Furniture Coating (not including California)

State/Locality	Operations Covered	VOC Numerical Limit (minus water and exempt compounds)	Compliance Method	Citation
Georgia	Metal furniture coating	3.0 lb/gal (excluding water) 5.06 lb/gal coating solids as applied	<ol style="list-style-type: none"> 1. use low solvent compliant coating technology 2. use 24-hr weighted average of low solvent coating on a single coating line that meets 5.06 lb VOC/gal coating solids (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 5.06 lb VOC/gal coating solids <p>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 materials regulations.</p>	GDNR OGCA 12-9-1 391-3-1-.02(2)(y)
Hawaii ^f				
Idaho	Incorporated by Reference, 40 CFR 60, Subpart EE (NSPS) and 40 CFR 63, Subpart RRRR (NESHAP)			

^f Hawaii does not have applicable air regulations.

Table B-1. Summary of State and Local Regulations for Metal Furniture Coating (not including California)

State/Locality	Operations Covered	VOC Numerical Limit (minus water and exempt compounds)	Compliance Method	Citation
Illinois (not including Chicago and Metro East areas)	Metal furniture coating	0.36 kg/l (3.0 lb/gal)	<ol style="list-style-type: none"> 1. 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. 2. 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 coating source 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 materials regulations.</p>	Title 35, Subtitle B, Chapter I; Subchapter c, Part 215, Subpart F, sections 215.204(g), 215.205(b) and 215.206 (a) and (b)
Illinois (Chicago areas)	Metal furniture coating, air dried	0.34 kg/l (2.8 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 218, Subpart F,

Table B-1. Summary of State and Local Regulations for Metal Furniture Coating (not including California)

State/Locality	Operations Covered	VOC Numerical Limit (minus water and exempt compounds)	Compliance Method	Citation
	Metal furniture coating, baked	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 coating source 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 218.204(g), 218.205(h), 218.207(b), 218.208(a) and (c)
Illinois (Metro East areas)	Metal furniture coating, air dried	0.34 kg/l (2.8 lb/gal)	<p>1. apply coatings that, during each day, do not exceed the daily-weighted average VOC content limit</p> <p>2. use a capture and control system which has an 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 coating source 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 materials regulations.</p>	Title 35, Subtitle B, Chapter I; Subchapter c, Part 219 Subpart F, sections 219.204(g), 219.205(a), 219.207(b), 219.208(a) and (c)
	Metal furniture coating, baked	0.28 kg/l (2.3 lb/gal)		

Table B-1. Summary of State and Local Regulations for Metal Furniture Coating (not including California)

State/Locality	Operations Covered	VOC Numerical Limit (minus water and exempt compounds)	Compliance Method	Citation
Indiana	Metal furniture coating	0.36 kg/l (3.0 lb/gal) (excluding water)	<ol style="list-style-type: none"> 1. use compliant coatings 2. carbon adsorption 3. incineration 4. higher solids coatings 5. waterborne coatings 6. equivalent emission limitation based on transfer efficiency <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 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.</p>	IDEM Air Pollution Control Board title 326 326 IAC 8-1-2, 8-2-1, 8-2-6, 8-2-11
Iowa	Incorporated by Reference, 40 CFR 60, Subpart EE (NSPS) and 40 CFR 63, Subpart RRRR (NESHAP)			
Kansas	Metal furniture coating	3.0 lb/gal	<ol style="list-style-type: none"> 1. use compliant coatings 2. use coatings that meet limit on a daily weighted average basis 3. capture and control system with an overall emission reduction of at least 90% <p>Exemptions: Facility with facility-wide VOC PTE less than 3 tpy. Facilities located outside of ozone nonattainment areas.</p>	Kansas AQR 28-19-73(c), (f), (k)

Table B-1. Summary of State and Local Regulations for Metal Furniture Coating (not including California)

State/Locality	Operations Covered	VOC Numerical Limit (minus water and exempt compounds)	Compliance Method	Citation
Kentucky	Metal furniture coating	3.0 lb/gal for new sources or 15 % by weight of VOCs net input into the facility for existing sources	Exemptions: Coatings with VOC content less than 0.36 kg/l (3.0 lb/gal). 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 materials regulations.	401 KAR 61:120
Louisiana	Metal furniture coating	0.36 kg/l (3.0 lb/gal) (minus water and exempt solvent)	<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 Exemptions: All emission units subject to the same limitation that emit less than 6.8 kg VOC per day (15 lb/day) and 1.3 kg/hr (3 lb/hr) combined. Surface coating facilities in Ascension, Calcasieu, East Baton Rouge, Iberville, Livingston, Pointe Coupee, and West Baton Rouge parishes that when controlled have a potential to emit a combined weight (total from the property) of VOCs less than 10 tons in any consecutive 12 calendar months are exempt from the provisions of Subsection C. Surface coating facilities on any property in parishes other than Ascension, Calcasieu, East Baton Rouge, Iberville, Livingston, Pointe Coupee, and West Baton Rouge that when uncontrolled have a potential to emit a combined weight of VOCs less than 100 pounds (45 kilograms) in any consecutive 24-hour period are exempt from the provisions of Subsection C. No cleaning materials regulations.	LAC Title 33 2123.A, C

Table B-1. Summary of State and Local Regulations for Metal Furniture Coating (not including California)

State/Locality	Operations Covered	VOC Numerical Limit (minus water and exempt compounds)	Compliance Method	Citation
Maine	Metal furniture coating	0.36 kg/l (3.0 lb/gal)	1. Low solvent coating 2. Capture and control system that gets 95% control or 4.9 lb/gal solids 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 materials regulations.	06 096 Chapter 129 1.A, 1.E, 3.D

Table B-1. Summary of State and Local Regulations for Metal Furniture Coating (not including California)

State/Locality	Operations Covered	VOC Numerical Limit (minus water and exempt compounds)	Compliance Method	Citation
Maryland	Metal furniture coating	0.36 kg/l (3.0 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 No cleaning materials regulations.	ACM Subtitle 11 26.11.19.02 and .08
Massachusetts	Metal furniture coating	5.1 lb/gal solids applied	<ol style="list-style-type: none"> 1. Use low/no solvent coatings 2. Use add-on controls 3. Use daily weighted averaging 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.	310 CMR 7.18(3)
Michigan	Metal furniture coating	3.0 lb/gal (as applied, minus water), or 8.4 lb/gal coating solids applied	<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), (8), (11)

Table B-1. Summary of State and Local Regulations for Metal Furniture Coating (not including California)

State/Locality	Operations Covered	VOC Numerical Limit (minus water and exempt compounds)	Compliance Method	Citation
Minnesota	Incorporated by Reference, 40 CFR 60, Subpart EE (NSPS) and 40 CFR 63, Subpart RRRR (NESHAP)			
Mississippi	Incorporated by Reference, 40 CFR 60, Subpart EE (NSPS) and 40 CFR 63, Subpart RRRR (NESHAP)			
Missouri	Metal furniture coating	3.0 lb/gal (as applied, minus water)	<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, as applied, on a lb/gal coating solids basis; 3. comply with a combination of capture and control system and daily volume-weighted average. <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 materials regulations.</p>	10 CSR 10-2.230(1)(A) and (B), (4) and (5)
Montana	Incorporated by Reference, 40 CFR 60, Subpart EE (NSPS) and 40 CFR 63, Subpart RRRR (NESHAP)			
Nebraska	Incorporated by Reference, 40 CFR 60, Subpart EE (NSPS) and 40 CFR 63, Subpart RRRR (NESHAP)			
Nevada ^g				
New Hampshire	Metal furniture coating	0.36 kg/l (3.0 lb/gal)	<ol style="list-style-type: none"> 1. use compliant coatings 2. add-on control device or bubble and comply with solids-based emission rate <p>Exemptions: Minor VOC sources with total VOC emissions less than 5 tpy. Sources that already meet or exceed RACT requirements. Facilities with VOC PTE less than 10 tpy. No cleaning materials regulations.</p>	NHCAR, Chapter ENV-A 1200, 1204.02(b), (c), (d), 1204.12

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

Table B-1. Summary of State and Local Regulations for Metal Furniture Coating (not including California)

State/Locality	Operations Covered	VOC Numerical Limit (minus water and exempt compounds)	Compliance Method	Citation
New Jersey	Metal furniture coating	0.36 kg/l (3.0 lb/gal) (minus water)	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. Surface coating operations with VOC PTE less than 3 lb/hr. No cleaning materials regulations.	NJAC Title 7, Chapter 27, subchapter 16 7:27-16.7
New Mexico ^h	Incorporated by Reference, 40 CFR 60, Subpart EE (NSPS) and 40 CFR 63, Subpart RRRR (NESHAP)			
New York		3.0 lb/gal	1. Use a VOC incinerator that with 80% removal efficiency 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 Exemptions: Low-use coatings where the combined facility-wide usage is less than 55 gallons on a 12-month rolling average Use work practices to minimize VOC emissions from cleaning materials.	NY ECL part 228 Sections 228.1, 3, and 7
North Carolina	Metal furniture coating	5.1 lb/gal coating solids, as applied or if using a control device, 3.0 lb/gal coating, as applied	Exemptions: Sources with VOC emissions less than 15 lb/day No cleaning materials regulations.	NCAC 2D.0922
North Dakota ⁱ	Incorporation by Reference, 40 CFR 60, Subpart EE (NSPS)			

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

ⁱ North Dakota does not have applicable air regulations.

Table B-1. Summary of State and Local Regulations for Metal Furniture Coating (not including California)

State/Locality	Operations Covered	VOC Numerical Limit (minus water and exempt compounds)	Compliance Method	Citation
Ohio	Metal furniture coating	3.0 lb/gal coating 4.8 lb/gal solids (if using a control system)	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 the control equipment has an VOC emission reduction efficiency of 90% by weight Exemptions: Total VOC emissions from coating operations are less than 15 lb/day before add-on control.	OAC 3745-21-09(I)
	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 baked, heat-cured, or polymerized, in the presence of O ₂ .	OAC 3745-21-07 (G)(4)
	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.	
Oklahoma Attainment areas	Metal furniture coating, various coating types	4.8 – 6.5 lb/gal	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 cleanup in determining compliance	Title 252, Chapter 100, 252:100-37-25

Table B-1. Summary of State and Local Regulations for Metal Furniture Coating (not including California)

State/Locality	Operations Covered	VOC Numerical Limit (minus water and exempt compounds)	Compliance Method	Citation
Oklahoma Tulsa County	Metal furniture coating, various coating types	3.0 – 4.3 lg/gal	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 cleanup in determining compliance.	Title 252, Chapter 100, 252:100-39-46
Oregon	Metal furniture coating	3.0 lb/gal (as applied)	1. Use low solvent coatings; 2. Use an incineration system that gets 90% control or 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.	OAR 340-232-0160

Table B-1. Summary of State and Local Regulations for Metal Furniture Coating (not including California)

State/Locality	Operations Covered	VOC Numerical Limit (minus water and exempt compounds)	Compliance Method	Citation
Pennsylvania	Metal furniture coating	0.61 kg/l coating solids (5.06 lb/gal coating solids)	<ol style="list-style-type: none"> 1. Use compliant coatings, as applied. 2. Use combination of compliant coatings and capture and control systems <p>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</p> <p>No cleaning materials regulations.</p>	129-52
Rhode Island		5.06 lb/gal coating solids or 3.0 lb/gal coating (excluding water and exempt solvents)	<ol style="list-style-type: none"> 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 <p>Exemptions: Actual uncontrolled VOC emissions are less than 15 lb/day since 12/31/89.</p> <p>Keep records of cleaning materials usage</p>	Air Pollution Control Regulation No. 19
South Carolina	Metal furniture coating	0.36 kg/l (3.0 lb/gal) as applied	<ol style="list-style-type: none"> 1. Low solvent technology 2. incineration that reduces VOC emissions by 90 percent 3. carbon bed solvent recovery or 4. alternative technology <p>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.</p> <p>Keep records of cleanup materials.</p>	62.5, St. 5, Part D
South Dakota	Incorporated by Reference, 40 CFR 63, Subpart RRRR (NESHAP)			

Table B-1. Summary of State and Local Regulations for Metal Furniture Coating (not including California)

State/Locality	Operations Covered	VOC Numerical Limit (minus water and exempt compounds)	Compliance Method	Citation
Tennessee	Metal furniture coating	0.36 kg/l (3.0 lb/gal), excluding water and/or exempt compounds, as applied	<ol style="list-style-type: none"> 1. Use compliant coatings; 2. Meet limit using weighted average VOC content 3. Reduce emissions by 95% using capture and control system <p>Exemptions: Facilities located in Davidson, Rutherford, Sumner, Williamson, or Wilson County with actual uncontrolled VOC emissions from all metal furniture 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 metal furniture coating operations less than 25 tpy, Facilities located in any other county with potential VOC emissions from all metal furniture coating operations less than 100 tpy.</p> <p>No cleaning materials regulations.</p>	1200-3-18-17

Table B-1. Summary of State and Local Regulations for Metal Furniture Coating (not including California)

State/Locality	Operations Covered	VOC Numerical Limit (minus water and exempt compounds)	Compliance Method	Citation
Texas ^j				
Utah	Metal furniture coating	0.36 kg/l (3.0 lb/gal) coating or 5.1 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 3. use a carbon adsorber 4. use water-borne electrodeposition 5. use water-borne spray, dip, or flowcoat 6. use powder coatings 7. use higher solids coatings <p>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.</p>	R307-340-2, 5, and 11
Vermont	Metal furniture coating, various coatings	3.0 – 4.3 lb/gal	<ol style="list-style-type: none"> 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). <p>Exemptions: Metal furnitue coating sources that have actual uncontrolled VOC emissions less than 5 lb/day. No cleaning materials regulations.</p>	5-253.13

^j Could not access Texas air regulations website.

Table B-1. Summary of State and Local Regulations for Metal Furniture Coating (not including California)

State/Locality	Operations Covered	VOC Numerical Limit (minus water and exempt compounds)	Compliance Method	Citation
Virginia	Metal furniture coating	3.0 lb/gal, as applied (excluding water)	<ol style="list-style-type: none"> 1. Use of waterborne or electrodeposited waterborne coatings; 2. Use of high-solids coatings; 3. Use of powder coatings; 4. Carbon adsorption; 5. Incineration; or 6. Any technology with an equivalent control efficiency when compared to the use of a coating complying with the VOC limit No cleaning materials regulations.	9 VAC 5-40-4610, 4630, 4640
Washington	Incorporated by Reference, 40 CFR 60, Subpart EE (NSPS) and 40 CFR 63, Subpart RRRR (NESHAP)			
West Virginia	Metal furniture coating	0.36 kg/l (3.0 lb/gal) coating	<ol style="list-style-type: none"> 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 6.8 kg (15 lb) per day.	§45-21-16
	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	Metal furniture coating	0.36 kg/l (3.0 lb/gal) coating	<ol style="list-style-type: none"> 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 materials regulations.	NR 422.04 , 10

Table B-1. Summary of State and Local Regulations for Metal Furniture Coating (not including California)

State/Locality	Operations Covered	VOC Numerical Limit (minus water and exempt compounds)	Compliance Method	Citation
Wyoming	Incorporated by Reference, 40 CFR 60, Subpart EE (NSPS) and 40 CFR 63, Subpart RRRR (NESHAP)			

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Appendix C

Summary of California Air District Regulations for Metal Furniture Coating

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Table C-1. Summary of California Air District Regulations for Metal Furniture Coating

Operation	Material	VOC limitation	Compliance Requirements	Citation
Antelope Valley Air Pollution Control District				
Metal coating	General coatings, air dried	Content limit of 340 g/l as applied (less 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 must be applied using the following types of equipment: electrostatic attraction, flow, roll, dip, HVLP, or hand application. Alternative coating methods must be approved and achieve at least 65% transfer efficiency. 3. 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). 4. 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. 5. Use closed containers for disposal of cloth or paper used in stripping cured coatings that are impregnated with solvent containing VOC 	AVAQMD Rule 1107 and 1171
	General coatings, baked	Content limit of 275 g/l as applied (less water and exempt compounds)		
	Specialty coatings (non-military), air dried	Content limit of 420 g/l as applied (less water and exempt compounds)		
	Specialty coatings (non-military), baked	Content limit of 275-420 g/l as applied (less water and exempt compounds)		
	Solvent cleaning materials	Content limit of 950 g/l (7.9l g/gal) and VOC composite partial pressure of 35 mm Hg @ 20°C (68°F)		

Table C-1. Summary of California Air District Regulations for Metal Furniture Coating

Operation	Material	VOC limitation	Compliance Requirements	Citation
Bay Area Air Quality Management District				
Metal furniture coating	Air dried coatings	Content limit of 340 g/l (2.8 lb/gal), as applied (less water)	<ol style="list-style-type: none"> 1. Use an approved control system. 2. Use low-solvent coatings that meet the content limit. 3. Use closed containers to store or dispose of cloth or paper laden with organic compounds that is used for surface preparation, cleanup or coating removal. 4. Close containers of fresh solvent, coating, or catalyst when not in use. 5. Materials used for cleanup of spray equipment and surface preparation must contain no more than 50 g/l (0.42 lb/gal) VOC. 	BAAQMD 8-14
	Baked coatings	Content limit of 275 g/l (2.3 lb/gal), as applied (less water)		
	Specialty coatings, air dried	Content limit of 420 g/l (3.5 lb/gal), as applied (less water)		
	Specialty coatings, baked	Content limit of 360-420 g/l (3.0-3.5 lb/gal), as applied (less water)		

Table C-1. Summary of California Air District Regulations for Metal Furniture Coating

Operation	Material	VOC limitation	Compliance Requirements	Citation
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 of 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)		
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. 	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)		

Table C-1. Summary of California Air District Regulations for Metal Furniture Coating

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	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)	

Table C-1. Summary of California Air District Regulations for Metal Furniture Coating

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	<ol style="list-style-type: none"> 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. <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 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.</p>	GBUAPCD Rule 417
	Photochemically 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)		

Table C-1. Summary of California Air District Regulations for Metal Furniture Coating

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 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)		

Table C-1. Summary of California Air District Regulations for Metal Furniture Coating

Operation	Material	VOC limitation	Compliance Requirements	Citation
Kern County Air Pollution Control District				
Metal Coatings	General coatings, air dried	Content limit of 420 g/l (3.5 lb/gal) (less water and exempt compounds)	<ol style="list-style-type: none"> 1. Use compliant coatings. 2. Use air pollution control equipment with a capture efficiency of at least 85% and a control device efficiency of at least 90%. 3. Coatings must be applied using electrostatic, electrodeposition, HVLP, brush, dip, roll, or other method that achieves at least 65% transfer efficiency. 	KCAPCD Rule 410-4
	General coatings, baked	Content limit of 275 g/l (2.3 lb/gal) (less water and exempt compounds)		
	Specialty coatings, air dried	Content limit of 340-420 g/l (2.8-3.5 lb/gal) (less water and exempt compounds)		
	Specialty coatings, baked	Content limit of 275-420 g/l (2.3-3.5 lb/gal) (less water and exempt compounds)		
	Surface cleaning and stripping materials	Content limit of 200 g/l (1.7 lb/gal) (less water and exempt compounds)		

Table C-1. Summary of California Air District Regulations for Metal Furniture Coating

Operation	Material	VOC limitation	Compliance Requirements	Citation
	Coating application equipment cleaning materials	Content limit of 950 g/l (7.9 lb/gal) (less water and exempt compounds) and VOC partial pressure ≤ 35 mmHg at 20°C		

Table C-1. Summary of California Air District Regulations for Metal Furniture Coating

Operation	Material	VOC limitation	Compliance Requirements	Citation
Mojave Desert Air Quality Management District				
Metal parts and products	General coatings, air dried	Content limit of 420 g/l (3.5 lb/gal) (less water and exempt compounds)	<ol style="list-style-type: none"> 1. Use compliant coatings. 2. Use air pollution control equipment with combined capture and control efficiency of at least 85%. 3. Cleanup solvent must be collected in closed container. 4. Coating application equipment must be disassembled and cleaned in an enclosed system. 5. Coatings must be applied using electrostatic, HVLP, dip, hand application, or other equivalent method. 	MDAQMD Rule 1115
	General coatings, baked	Content limit of 360 g/l (3.0 lb/gal) (less water and exempt compounds)		
	Specialty coatings (non-military), air dried	Content limit of 420-520 g/l (3.5-4.3 lb/gal) (less water and exempt compounds)		
	Specialty coatings (non-military), baked	Content limit of 275-420 g/l (2.3-3.5 lb/gal) (less water and exempt compounds)		
	Surface preparation and cleanup solvent	Content limit of 200 g/l (1.67 lb/gal) (less water and exempt compounds); or Boiling point \geq 190°C; or Total VOC vapor pressure \leq 20 mmHg at 20°C		

Table C-1. Summary of California Air District Regulations for Metal Furniture Coating

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	<ol style="list-style-type: none"> Emissions from cleanup with solvents must be included in compliance determination 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 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)</p>	MBUAPCD Rule 416
	Any that do not come into contact with a flame, or are not baked, heat cured, or heat-polymerized	40 lb/day (emissions from air or heat drying for the first 12 hours must be included)		
Metal parts and products	General coatings, air dried	Content limit of 420 g/l (3.5 lb/gal) (less water and exempt compounds)	<ol style="list-style-type: none"> Use compliant coatings. Use air pollution control equipment with combined capture and control efficiency of at least 90%. <p>Exemptions: facilities that use less than 55 gallons of coating per year</p>	MBUAPCD Rule 434
	General coatings, baked	Content limit of 360 g/l (3.0 lb/gal) (less water and exempt compounds)		
	Specialty coatings, air dried	Content limit of 420-780 g/l (3.5-6.5 lb/gal) (less water and exempt compounds)		

Table C-1. Summary of California Air District Regulations for Metal Furniture Coating

Operation	Material	VOC limitation	Compliance Requirements	Citation
	Specialty coatings, baked	Content limit of 360-780 g/l (3.0-6.5 lb/gal) (less water and exempt compounds)		

Table C-1. Summary of California Air District Regulations for Metal Furniture Coating

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 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)		
	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"> 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. No spray discharge into open air 2. Use a collection and control system that collects at least 90 percent of 	PLAAPCD Rule 240

Table C-1. Summary of California Air District Regulations for Metal Furniture Coating

Operation	Material	VOC limitation	Compliance Requirements	Citation
	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)	the emissions and reduces VOC emissions by at least 95 percent or has an outlet concentration less than 50 ppmw (as carbon)	
	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		

Table C-1. Summary of California Air District Regulations for Metal Furniture Coating

Operation	Material	VOC limitation	Compliance Requirements	Citation
Sacramento Metropolitan Air Quality Management District				
Metal parts and products	Air dried coatings	Content limit of 340 g/l (2.8 lb/gal) (less water and exempt compounds)	<ol style="list-style-type: none"> 1. Use compliant coatings. 2. Use emission control equipment with an overall control efficiency of at least 85%. 3. Use closed containers for disposal of cloth, paper, or sponges. 4. Do not use VOC-containing material for cleaning coating application equipment unless cleanup solvent VOC content limit is met or cleaning is performed in an enclosed cleaner. 5. Coatings must be applied using roll, dip, electrostatic, flow, HVLP, LVLP, hand application, or other approved method. 	SMAQMD Rule 451
	Baked coatings	Content limit of 275 g/l (2.3 lb/gal) (less water and exempt compounds)		
	Strippers	Content limit of 200 g/l (1.7 lb/gal) (less water and exempt compounds)		
	Solvent for cleanup of application equipment and surface preparation	Content limit of 72 g/l (0.6 lb/gal) (less water and exempt compounds)		

Table C-1. Summary of California Air District Regulations for Metal Furniture Coating

Operation	Material	VOC limitation	Compliance Requirements	Citation
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"> 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. 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. 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) 	KCAPCD Rule 466

Table C-1. Summary of California Air District Regulations for Metal Furniture Coating

Operation	Material	VOC limitation	Compliance Requirements	Citation
San Diego County Air Pollution Control District				
Metal parts and products	General coatings, air dried	Content limit of 340 g/l (less water and exempt compounds)	<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 85% by weight or more. 2. Cleaning of coating application equipment alternatively can be carried out in a manner that minimizes emissions or within enclosed equipment. <p>Exemption: Any coating operation that uses less than 20 gallons of coating per consecutive 12-month period.</p>	SDAPCD Rule 67.3
	General coatings, baked	Content limit of 275 g/l (less water and exempt compounds)		
	Specialty coatings, air dried	Content limit of 420 g/l (less water and exempt compounds)		
	Specialty coatings, baked	Content limit of 360-420 g/l (less water and exempt compounds)		
	Surface preparation and cleanup solvent	Content limit of 200 g/l (1.67 lb/gal) (less water and exempt compounds); or Boiling point \geq 190°C; or Total VOC vapor pressure \leq 20 mmHg at 20°C		

Table C-1. Summary of California Air District Regulations for Metal Furniture Coating

Operation	Material	VOC limitation	Compliance Requirements	Citation
San Joaquin Valley Unified Air Pollution Control District				
Metal parts and products	General coatings, air dried	Content limit of 340 g/l (2.8 lb/gal) (less water and exempt compounds)	<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. Cleaning of coating application equipment alternatively can be carried out in a manner that minimizes emissions or within enclosed equipment. 3. Coatings must be applied using the following application equipment: electrostatic, electrodeposition, HVLP, flow, roll, dip, brush, continuous, or other method that achieves at least 65% transfer efficiency. <p>Exemption: Any coating operation that uses less than 20 gallons of coating per consecutive 365-day period.</p>	SJVUAPCD Rule 4603
	General coatings, baked	Content limit of 275 g/l (2.3 lb/gal) (less water and exempt compounds)		
	Specialty coatings, air dried	Content limit of 420 g/l (3.5 lb/gal) (less water and exempt compounds)		
	Specialty coatings, baked	Content limit of 360-420 g/l (3.0-3.5 lb/gal) (less water and exempt compounds)		
	Surface preparation, repair, and maintenance solvents	Content limit of 50 g/l (0.42 lb/gal) (less water and exempt compounds)		
	Coating application equipment cleaning solvents	Content limit of 550 g/l (4.6 lb/gal) (less water and exempt compounds)		

Table C-1. Summary of California Air District Regulations for Metal Furniture Coating

Operation	Material	VOC limitation	Compliance Requirements	Citation
San Luis Obispo County Air Pollution Control District				
Metal parts and products	General coatings, air dried	Content limit of 340 g/l (2.8 lb/gal) (less water and exempt compounds)	<ol style="list-style-type: none"> 1. Must apply coatings using electrostatic, flow, dip, HVLP, or equivalent. 2. VOC-containing materials must be stored in closed containers. 3. Cannot use VOC-containing materials for spray equipment cleanup unless an enclosed gun washer is used or a gun washer using a solvent with a vapor pressure less than 45 mmHg (0.87 psi) at 20°C (68°F). <p>Exemptions: (1) coatings used in volumes of less than 20 gal/yr; (2) sources using not more than 4 gal/day (monthly average) of solvent-containing materials; (3) sources using a control device demonstrated to have the same emission reduction as this rule.</p>	SLOCAPCD Rule 411
	General coatings, baked	Content limit of 275 g/l (2.3 lb/gal) (less water and exempt compounds)		
	Specialty coatings, air dried	Content limit of 340-800 g/l (2.8-6.7 lb/gal) (less water and exempt compounds)		
	Specialty coatings, baked	Content limit of 275-800 g/l (2.3-6.7 lb/gal) (less water and exempt compounds)		

Table C-1. Summary of California Air District Regulations for Metal Furniture Coating

Operation	Material	VOC limitation	Compliance Requirements	Citation
Santa Barbara County Air Pollution Control District				
Metal parts and products	General coatings, air dried	Content limit of 340 g/l (less water and exempt compounds)	<ol style="list-style-type: none"> 1. Use add-on control system with at least 90% capture efficiency and 95% control efficiency. 2. Apply coatings using the following methods: electrostatic, flow, dip, HVLP, electrodeposition, hand application, touch-up guns, or other approved method that achieves at least 65% transfer efficiency. 3. Store reactive VOC-containing materials in closed containers. 4. Organics in coating thinners and reducers shall not be photochemically active. <p>Exemptions: (1) coatings used in volumes less than 20 gal/day; total of all such coatings not to exceed 55 gal/yr.</p>	SBAPCD Rule 322, 330
	General coatings, baked	Content limit of 275 g/l (less water and exempt compounds)		
	Industrial maintenance coatings, air dried	Content limit of 420 g/l (less water and exempt compounds)		
	Powder coatings	Content limit of 50 g/l (less water and exempt compounds)		

Table C-1. Summary of California Air District Regulations for Metal Furniture Coating

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 reactive solvent (except solvents that are baked, heat cured or heat-polymerized)	40 lb/day		
	Any photochemically reactive substance	40 lb/day		

Table C-1. Summary of California Air District Regulations for Metal Furniture Coating

Operation	Material	VOC limitation	Compliance Requirements	Citation
South Coast Air Quality Management District				
Metal parts and products	General coatings, one component	Content limit of 275 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 5 ppmv VOC. 2. Coatings must be applied using hand application methods, HVLP spray, flow, roll, dip. 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-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. 7. Stripping materials limited to 200 g/l <p>Exemption: Any application process that has VOC emissions less than 14.3 lb (6.5 kg) per day</p>	SCAQMD Rule 1107 and 1171
	General coatings, multicomponent, air dried	Content limit of 340 g/l as applied (except water and exempt compounds)		
	General coatings, multicomponent, baked	Content limit of 275 g/l as applied (excluding water and exempt compounds)		
	Specialty coatings, air dried and baked	Content limit of 275-420 g/l as applied (excluding water and exempt compounds)		
	Cleaning materials	Content limit of 25 g/l (0.21 lb/gal)		

Table C-1. Summary of California Air District Regulations for Metal Furniture Coating

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

Table C-1. Summary of California Air District Regulations for Metal Furniture Coating

Operation	Material	VOC limitation	Compliance Requirements	Citation
Ventura County Air Pollution Control District				
Metal parts and products	General coatings, air dried	Content limit of 340 g ROC/1 (2.8 lb/gal), 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 85%. 2. Apply coatings using electrostatic, flow, dip, HVLP, hand, or other approved method that achieves at least 65% transfer efficiency. 3. Use enclosed gun washer and solvent with a vapor pressure of <45 mmHg at 20°C. Exemptions: (1) source that emits <200 lb ROC/rolling 12-month period; (2) Cleaning solvent ROC limit does not apply where total usage of noncomplying cleaners does not exceed 5 gal/rolling 12-month period.	VCAPCD Rule 74.12
	General coatings, baked	Content limit of 275 g ROC/1 (2.3 lb/gal), as applied (excluding water and exempt compounds)		
	Specialty coatings, air dried	Content limit of 340-420 g ROC/1 (2.8-3.5 lb/gal), as applied (excluding water and exempt compounds)		
	Specialty coatings, baked	Content limit of 275-420 g ROC/1 (2.3-3.5 lb/gal), as applied (excluding water and exempt compounds)		

Table C-1. Summary of California Air District Regulations for Metal Furniture Coating

Operation	Material	VOC limitation	Compliance Requirements	Citation
	Surface preparation and cleanup solvents	70 g ROC/l material used		

Table C-1. Summary of California Air District Regulations for Metal Furniture Coating

Operation	Material	VOC limitation	Compliance Requirements	Citation
Yolo-Solano Air Quality Management District				
Metal parts and products	General coatings, air dried	Content limit of 340 g ROC/1 (2.8 lb/gal), as applied (excluding water and exempt compounds)	<ol style="list-style-type: none"> 1. Use capture and control system with overall control efficiency of at least 85%. 2. Do not use VOC-containing materials for cleanup unless collected in a closed container or guns cleaned in an enclosed washer. 3. Use closed container for disposal of cloth, paper, and other materials containing solvents. 4. Apply coatings using electrostatic, HVLP, flow, dip, hand, or roll. <p>Exemptions: (1) coatings used in volumes less than 55 gal/yr</p>	
	General coatings, baked	Content limit of 275 g ROC/1 (2.3 lb/gal), as applied (excluding water and exempt compounds)		
	Specialty coatings, air dried	Content limit of 420 g ROC/1 (3.5 lb/gal), as applied (excluding water and exempt compounds)		
	Specialty coatings, baked	Content limit of 360-420 g ROC/1 (3.0-3.5 lb/gal), as applied (excluding water and exempt compounds)		

Table C-1. Summary of California Air District Regulations for Metal Furniture Coating

Operation	Material	VOC limitation	Compliance Requirements	Citation
	Surface preparation solvents	200 g/l		
Solvent Cleaners	Solvents used on substrates during the manufacturing process or for surface preparation	200 g VOC/l material	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. 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. 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)	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		