Control Techniques Guidelines for Automobile and Light-Duty Truck Assembly Coatings

DRAFT
July 1, 2008

This page intentionally left blank

EPA XXX/R-XX-XXX
Date

Control Techniques Guidelines for Automobile and Light-Duty Truck Assembly Coatings

U.S. Environmental Protection Agency
Office of Air Quality Planning and Standards
Sector Policies and Programs Division
Research Triangle Park, NC

This page intentionally left blank.

TABLE OF CONTENTS

This page intentionally left blank.

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). Auto and light-duty truck assembly 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 automobile and light-duty truck assembly coatings. In developing this CTG, EPA, among other things, evaluated the sources of VOC emissions from the automobile and light-duty truck assembly 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 automobile and light-duty truck assembly coating.

States can use the recommendations in this CTG to inform their own determination as to what constitutes RACT for VOCs for automobile and light-duty truck assembly 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 automobile and light-duty truck assembly 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 automobile and light-duty truck assembly coatings.

II. Background and Overview

There have been three federal actions that affect automobile and light-duty truck assembly coating operations. In May 1977, EPA issued a CTG document (1977 CTG) for controlling VOC emissions from surface coating of automobiles and light-duty trucks.[1] In December 1980, EPA promulgated the new source performance standards (NSPS) for automobile and light-duty truck assembly coating operations (1980 NSPS).[2] In April 2004, EPA promulgated the National Emission Standards for Hazardous Air Pollutants: Surface Coating of Automobiles and Light-Duty Trucks (2004 NESHAP).[3]

The 1977 CTG, the 1980 NSPS and the 2004 NESHAP provide a thorough discussion of the automobile and light-duty truck assembly coating industry, the nature of VOC emissions (or in the case of the 2004 NESHAP, organic 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 1980 NSPS establishes VOC emissions limits, whereas the 2004 NESHAP establishes organic HAP emissions limits and does not address non-HAP VOC.

At least 14 States and one California air pollution control district have specific regulations that control VOC emissions from automobile and light-duty truck assembly coating. 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 1980 NSPS, the 2004 NESHAP, existing State and local VOC emission reduction approaches, and data provided by the industry in 2008.

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 automobile and light-duty truck assembly coating industry, including the types of automobile and light-duty trucks, 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 automobile and light-duty truck assembly 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 automobile and light-duty truck[a] assembly coating operations. Please see section IV of this CTG for a description of the auto and light-duty truck assembly coatings category under section 183(e) of the CAA. 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 automobile and light-duty truck assembly coating operation at a facility where the total actual VOC emissions from all automobile and light-duty truck assembly coating operations, including related cleaning activities, at that facility are equal to or exceed 6.8 kg/day (15 lb/day), 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 2 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-VOC content coatings. Furthermore, based on the April 2004 ozone nonattainment designations, we estimate that all of the automobile and light-duty truck surface coating facilities are located in ozone nonattainment areas and emit 6.8 kg/day (15 lb/day) or more. Therefore, we expect that our recommendations in this CTG would apply to all automobile and light-duty truck surface coating facilities in ozone nonattainment areas.

Furthermore, we recommend that states consider structuring their RACT rules to provide facilities that coat bodies and/or body parts of heavier vehicles[b] with the option of meeting either the state RACT requirements for the automobile and light-duty truck coating category or the

---

[a] Automobile means a motor vehicle designed to carry up to eight passengers, excluding vans, sport utility vehicles, and motor vehicles designed primarily to transport light loads of property. Light-duty truck means vans, sport utility vehicles, and motor vehicles designed prjmarily to transport light loads of property with gross vehicle weight rating of 8,500 lbs or less.

[b] Heavier vehicles includes all vehicles that meet the definition of the term "other motor vehicles", as defined at 40 CFR § 63.3176 (the NESHAP for Surface Coating of Automobiles and Light-Duty Trucks).

state RACT requirements for the miscellaneous metal products or plastic parts coatings categories. Heavier vehicle coatings are included in the Miscellaneous Metal Products and Plastic Parts Coatings categories under section 183(e) and are therefore covered in the CTG for Miscellaneous Metal and Plastic Parts Coatings. We note, however, that some automobile and light-duty truck surface coating facilities also coat heavier vehicle bodies or body parts for heavier vehicles. The heavier vehicle bodies or body parts for heavier vehicles may be coated using the same equipment and materials that are used to coat automobile and light-duty truck bodies or body parts for automobiles and light-duty trucks. The permit requirements for the heavier vehicle portion of these combined use paint shops are often structured in the same way as permit requirements for automobile and light-duty truck paint shops. Also, some facilities that coat only heavier vehicle bodies or body parts for heavier vehicles have paint shops that are designed and operated in the same manner as paint shops that are used to coat automobile and light-duty truck bodies and body parts for automobiles and light-duty trucks. The permit requirements for these heavier vehicle paint shops are often structured in the same way as permit requirements for automobile and light-duty truck paint shops.

In light of the above, providing heavier vehicle coating facilities with the option of meeting the state RACT requirements for the automobile and light-duty truck coating category in lieu of the requirements for Miscellaneous Metal Products or Plastic Parts categories will provide for the most consistency with existing permit requirements and simplify compliance demonstration requirements for these facilities. Furthermore, in light of the stringency of our recommended control measures in this CTG, we believe that facilities that choose this alternative will achieve at least equivalent, if not greater, control of VOC emissions. For the reasons stated above, we recommend that state RACT rules provide heavier vehicle coating facilities the option of meeting either the state RACT requirements for miscellaneous metals and plastic parts coatings or the state RACT requirements for auto and light-duty truck coatings.

For purposes of determining whether a facility meets our recommended applicability threshold, aggregate emissions, before consideration of control, from all automobile and light-duty truck assembly coating operations (including related cleaning activities) at a given facility are included.

In developing 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 an equivalent applicability threshold, 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.

There are currently 52 automobile and light-duty truck assembly facilities that engage in surface coating operations in the United States. The highest concentration of these facilities are in Michigan, Illinois, Indiana, and Ohio.

For the development of this CTG, we considered VOC emissions data from information gathered during the development of the 2004 NESHAP. We also considered VOC emissions data submitted in 2008 by the Alliance of Automobile Manufacturers member companies and non-member companies.

The 2004 NESHAP survey collected information for 61 facilities in operation in 1996. Although information regarding HAP emissions was the main focus of the NESHAP survey, information regarding VOC emissions was also submitted.

The Alliance for Automobile Manufacturers member companies and non-member companies submitted VOC emissions data for calendar years 2006 and 2007. Emissions information from surface coating operations during automobile and light-duty truck manufacturing was provided on a daily minimum, daily maximum, and daily and monthly average basis. Information was provided for 52 facilities located in the United States.

The 2002 National Emissions Inventory (NEI) contains information for 48 of these 52 facilities. (The other four facilities were not yet operating in 2002.) These 48 facilities reported actual VOC emissions totaling approximately 27,500 tons in 2002.

IV. Process Description and Sources of VOC Emissions

The auto and light-duty truck assembly coatings product category under section 183(e) of the CAA includes the coatings that are applied to new automobile or new light-duty truck bodies, or body parts for new automobiles or new light-duty trucks. The large majority of these coatings are specifically formulated, marketed and sold for this end use and are applied at automobile or light-duty truck assembly plants. However, this 183(e) category also includes coatings used in facilities that perform these coating operations on a contractual basis. This category does not include coatings used at plastic or composites molding facilities as described in the Surface Coating of Automobiles and Light-Duty Trucks NESHAP (40 CFR part 63, subpart IIII).

Automobile and light-duty truck coatings enhance a vehicle's durability and appearance. Some of the coating system characteristics that automobile and light-duty truck manufacturers test for include adhesion, water resistance, humidity resistance, salt spray resistance, color, gloss, acid etch resistance, and stone chip resistance. The primary coatings used are electrodeposition primer, primer-surfacer (including anti-chip coatings), topcoat (basecoat and clearcoat) and final repair. These coating are included in the automobile and light-duty truck assembly coatings product category and are addressed in this draft CTG.

Sealers, deadeners, transit coatings, cavity waxes, adhesives, glass bonding primers, and glass bonding adhesives are also used at automobile or light-duty truck assembly plants. These other coatings are included in the miscellaneous metal products coatings, plastic parts coatings, or miscellaneous industrial adhesives product categories and addressed in the draft CTGs for those product categories. We seek comments on whether the use of these materials in the production of new automobiles and new light-duty trucks should instead be included in the auto and light-duty truck assembly coatings category. In addition, we seek comments, including supporting VOC content information, on appropriate control recommendations specifically for the use of these materials in the production of new automobiles and new light-duty trucks if EPA were to include such use of these materials in the auto and light-duty truck assembly coatings category and address them in the CTG for automobile and light-duty truck assembly coatings.

A. Process Description

The coating process for automobiles and light-duty trucks consists of the following operations: (1) surface preparation, (2) priming operations, (3) topcoat operations, (4) final repair operations, and (5) cleaning activities. In addition, cleaning activities are performed in support of the surface coating operation. These operations and activities are further described below.

1. Surface Preparation

Surface preparation occurs before coatings are applied. During this preparation stage, the body of an automobile or light-duty truck is assembled, anticorrosion operations are performed, and any plastic parts to be finished with the body are installed.

2. Priming Operations

After the body has been assembled, anticorrosion operations have been performed, and plastic parts to be finished with the body are installed, priming operations begin. The purpose of the priming operations is to further prepare the body for finishing by applying various layers of coatings designed to protect the metal surface from corrosion and assure good adhesion of subsequent coatings.

First, an electrodeposited primer (EDP) coating is applied to the body using a method in which a negatively charged automobile or light-duty truck body is immersed in a positively charged bath of waterborne electrodeposition primer. The coating particles (resin and pigment) migrate toward the body and are deposited onto the body surface, creating a strong bond between the coating and the body to provide a durable coating. Once the coating application deposition is completed, the body is rinsed in a succession of individual spray and/or immersion rinse stations and then dried with an automatic air blow-off. Following the rinsing stage (including the automatic air blow-off), the deposited coating is cured in an electrodeposition curing oven.

After curing, the body is further water-proofed by sealing spot-welded joints of the body. After sealing, the body proceeds to the anti-chip booth where anti-chip coatings are applied to protect the vulnerable areas of the body.

Next, a primer-surfacer coating is applied. The purpose of the primer-surfacer coating is to provide "filling" or hide minor imperfections in the body, provide additional protection to the vehicle body, and bolster the appearance of the topcoats. Primer-surfacer coatings are applied by spray application in a water-wash spray booth. Following application of the primer-surfacer, the body is baked to cure the film, minimize dirt pickup, and reduce processing time.

3. Topcoat Operations

The next step of the coating process is the spray application of the topcoat, which usually consists of a basecoat (color) and a clearcoat. The purpose of the clearcoat is to add luster and durability to the vehicle finish and protect the total coating system against solvents, chemical agents, water, weather, and other environmental effects.

After the topcoat (i.e., a basecoat and a clearcoat) is applied, the automobile or light-duty truck body or body parts proceed to a flash-off area, where a certain level of solvent evaporation occurs. This step is designed to prevent bubble formation during curing in the bake oven. After flash-off, the automobile and light-duty truck bodies or body parts are then dried/cured in bake ovens.

4. Final Repair Operations

Final repair means the operations performed and coating(s) applied to completely-assembled motor vehicles or to parts that are not yet on a completely assembled motor vehicle to correct damage or imperfections in the coating. The curing of the coatings applied in these operations is accomplished at a lower temperature than that used for curing primer-surfacer and topcoat. This lower temperature cure avoids the need to send parts that are not yet on a completely assembled vehicle through the same type of curing process used for primer-surfacer and topcoat and is necessary to protect heat sensitive components on completely assembled motor vehicles.

5. Cleaning Activities

Cleaning materials are used for several purposes, including the removal of coating residue or other unwanted materials from equipment related to the coating operations such as spray guns, transfer lines (e.g., tubing or piping), tanks, and the interior of spray booths. These cleaning materials are typically mixtures of organic solvents.

Work practices are widely used throughout the automobile and light-duty truck manufacturing industry to reduce VOC emissions from cleaning operations. These measures include covering mixing tanks and storing solvents and solvent soaked rags and wipes in closed containers. Another method is the use of low-VOC content or low vapor pressure cleaning materials. However, there is insufficient information available to correlate VOC content or vapor pressure to specific cleaning steps.

B. <u>Sources of VOC Emissions</u>

VOC emissions depend on VOC content, transfer efficiency, and the presence and extent of VOC control equipment. To lower VOC content, liquid coatings can be reformulated. VOC contents and emission rates for solvent-borne and waterborne materials also have overlapping ranges.

The VOC emissions from automobile and light-duty truck assembly coating operations are primarily a result of evaporation of the VOC contained in the coatings and cleaning materials used in these operations.[c] The primary VOC emissions from automobile and light-duty truck assembly coatings occur during coating application/flash-off and drying/curing of the coatings. The remaining emissions occur mainly 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. Another source of VOC emissions from automobile and light-duty truck assembly coating operations is cleaning materials. The VOC are emitted when solvents evaporate from the cleaning materials during use. In most 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 VOC emissions from coating application occur when solvent evaporates from the coating as it is being applied to the vehicle part or body. The transfer efficiency (the ratio of the amount of coating solids deposited onto the surface of the object to the total amount of coating solids sprayed while applying the coating to the object) of a coating application method affects the amount of VOC emitted during coating application. A coating application method that is more efficient in transferring coatings to the substrate will reduce the volume of coatings (and therefore solvents) needed per given amount of production, thus reducing VOC emissions.

Until the 1970's, the majority of coatings used in the automobile and light-duty truck manufacturing industry were conventional solvent-borne coatings, which have high VOC content. Due to a combination of regulation at the State and federal level, technology development and competitive factors, the industry has steadily moved to lower VOC content coatings. These alternative coatings include powder coatings, waterborne coatings, and higher solids solvent-borne coatings. The utilization of these alternative coatings in conjunction with efficient spray application equipment, such as electrostatic spray, is the primary method that is currently being used at auto and light-duty truck assembly coating operations to reduce VOC emissions from the coatings. In addition, many facilities control the exhaust from their bake ovens. Some facilities have also employed partial spray booth controls by venting spray booth emissions, principally from automated spray zones, through an add-on control device such as an oxidizer or hybrid (concentrator followed by an oxidizer) control system.

Powder anti-chip and primer-surfacer coatings are used at some automobile and light-duty truck assembly plants. Powder coating produces minimal amounts of VOC emissions. Powder coating is applied via powder delivery systems, which in most cases is an electrostatic spray. Because powder coatings are applied as dried particles, no VOC are released during the

[c] In a previous notice, EPA stated that the cleaning operations associated with certain specified section 183(e) consumer and commercial product categories, including the automobile and light duty truck assembly coatings category, would not be covered by EPA's 2006 CTG for industrial cleaning solvents (71 FR 44522, 44540, August 4, 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. Accordingly, this CTG addresses VOC emissions from cleaning operations associated with the automobile and light-duty truck assembly coatings category.

application operation. Depending on the powder formulation, some volatile emissions may occur when the powder is heated during the curing step. In any event, any volatile emissions from the heating of powder coatings would generally be much less than the volatile emissions from the heating of liquid coatings during the curing operations. Powder coating applications are best suited for long production runs of consistently sized parts without color changes. Powder anti-chip and primer-surfacer coatings are used at some automobile and light-duty truck assembly plants.

Waterborne coatings produce less VOC emissions than conventional solvent-borne coatings primarily because a large portion of the organic solvent carrier (VOC) is replaced with water. Waterborne electrodeposition primers are used at almost every automobile and light-duty truck assembly plant. Waterborne primer-surfacer and waterborne basecoat are used at some automobile and light-duty truck assembly plants. Waterborne primer-surfacer and waterborne basecoat are applied by a combination of manual and automatic, and electrostatic and non-electrostatic spray techniques.

Higher solids solvent-borne coatings contain more solids than “conventional” (pre-1980) solvent-borne coatings. These coatings contain less organic solvent (VOC) per unit volume of solids than conventional solvent-borne coatings. Thus, a lesser amount of VOC emissions are released during coating preparation, application, and curing to deliver a given amount of coating solids. Higher solids primer-surfacer and basecoat are used at some automobile and light-duty truck assembly plants. Higher solids clearcoat is used at every automobile and light-duty truck assembly plant. Higher solids primer-surfacer and basecoat are applied by a combination of manual and automatic, and electrostatic and non-electrostatic spray techniques.

Additional VOC emissions occur in the flash-off area after coatings are applied and in baking ovens where drying and curing occurs.

2. Cleaning Materials

Cleaning materials are another source of VOC emitted by automobile and light duty truck 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.[d] Water and exempt compounds thereby reduce the VOC composite vapor pressure of cleaning materials in which they are present. Although use of lower vapor pressure cleaning materials may reduce VOC emissions, insufficient information is available to correlate cleaning material vapor

[d] 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.

pressure to specific cleaning steps in the automobile and light-duty truck surface coating industry. Similarly, cleaning materials with low VOC content would generate less VOC emissions than materials with high VOC content; however, insufficient information is available to correlate cleaning material VOC content to specific cleaning steps in this industry.

V. <u>Available Controls and Regulatory Approaches</u>

As previously mentioned, there are two main sources of VOC emissions from automobile and light-duty truck assembly coating operations: (1) evaporation of VOC from the coatings and drying; 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. <u>Available Controls for VOC Emissions from Coatings and Drying</u>

There are two general emission control techniques for reducing VOC emissions from automobile and light-duty truck assembly coatings: pollution prevention measures, and emission capture and add-on control systems. Pollution prevention is the most prevalent control technique being used by the automobile and light-duty truck manufacturing industry. Add-on control systems are also used in this industry. Provided below is a summary of these control techniques.

1. Pollution Prevention Measures

Pollution prevention measures applicable to the automobile and light-duty truck manufacturing industry, including product substitution/reformulation, work practice procedures, and equipment substitution, may be used to decrease VOC emissions from coating application operations. Lower VOC content coatings, such as powder coatings, higher solids solvent-borne 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 reduces 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 replace higher-solvent coatings with coatings containing little or no solvents. As previously discussed, these coatings include waterborne coatings, higher solids solvent-borne coatings, and electrodeposition coatings. The use of higher solids and waterborne coatings has increased since the 1970's.

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 through work practices by effectively controlling material preparation and using proper equipment maintenance procedures.

Equipment Substitution

The use of efficient coating application equipment reduces VOC emission by increasing the coating transfer efficiency (i.e., the percentage of coating solids used that is deposited onto the substrate). Since the 1970's the spray equipment used to apply automobile and light-duty truck assembly coatings has become increasingly automated. A significant amount of coating is applied by reciprocators or robots. At the same time there has also been an increase in the amount of paint applied electrostatically.

2. Emission Capture and Add-on Control Systems

In addition to pollution prevention measures, VOC emissions from automobile and light-duty truck assembly 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, many facilities control the exhaust from their bake ovens. Some facilities have also employed partial spray booth controls by venting spray booth emissions, principally from automated spray zones, through an add-on control device such as an oxidizer or hybrid (concentrator followed by an oxidizer) control system. 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 collect solvent-laden air from process vents (e.g., spray booth, flash-off or bake oven vents) and direct the captured air to a control device. The majority of VOC emissions from automobile and light-duty truck assembly coating occur in the spray booth. These emissions can be ducted from the spray booth directly to the control device. Similarly, flash-off area or bake oven exhaust can be ducted directly to the control device. Spray booths and bake ovens are the principal elements of the capture system.

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 automobile and light-duty truck assembly coatings operations: combustion (thermal or catalytic oxidation) and recovery (adsorption). While many types of control devices can be used to reduce VOC emissions, the following summary covers those control devices known to be used with automobile and light-duty truck surface coating operations: oxidation and hybrid systems (concentrator followed by an oxidizer).

Oxidation destroys VOC emissions in an exhaust stream by exposing the stream to an oxidizing atmosphere at high temperatures. Oxidizers are typically used in the automobile and light-duty truck surface coating industry to control bake oven exhaust emissions. 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.

Hybrid systems consist of a concentrator followed by an oxidizer. Hybrid systems are used in the automobile and light-duty truck surface coating industry to control spray booth exhaust emissions, most often exhaust from automated zones of the spray booth. The concentrator is typically a carbon or zeolite rotor. The concentrator reduces the volume and increases the VOC concentration of the inlet stream to the oxidizer.

Spray booth exhaust contains overspray particles. The majority of these particles are removed by the spray booth water wash. Additional pretreatment of the spray booth exhaust is required before it passes through a concentrator. This additional pretreatment may be done with dry filters or a dry electrostatic precipitator.

In addition, there are other control technologies known to reduce VOC emissions, but they are not currently being used in the automobile and light-duty truck surface coating industry. These alternative control technologies include condensation, biofiltration, and UV oxidation. .

B. Available Controls for VOC Emissions from Cleaning Materials

Pollution prevention measures, such as work practices, are the most common emission control technique for reducing VOC emissions from cleaning materials. Work practice procedures reduce VOC emission during cleaning operations by reducing the amount of VOC that can evaporate due to exposure to air. Product substitution/reformulation is another type of pollution prevention measures.

No add-on control technologies are being used specifically for reducing VOC emissions from cleaning operations associated with automobile and light-duty truck assembly coating. However, if cleaning operations are performed within a capture system that is ducted to an add-on control system, the VOC emissions from the cleaning operations would be reduced by the add-on control.

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, there is insufficient information available to correlate VOC content or vapor pressure to specific cleaning steps.

2. Work Practice Procedures

Work practice procedures are commonly used in the automobile and light-duty truck manufacturing industry to reduce VOC emissions from cleaning operations. These procedures include the following:

- 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. <u>Existing Federal, State, and Local Recommendations or Regulations</u>

The following discussion is a summary of three EPA actions, as well as State and local regulations, which address VOC emissions from automobile and light-duty truck assembly coating processes.

Three previous EPA actions affected automobile and light-duty truck assembly coating operations:

- CTG for Surface Coating of Cans, Coils, Paper, Fabrics, Automobiles, and Light-Duty Trucks (1977).
- New Source Performance Standard for Automobile and Light- Duty Truck Surface Coating Operations, 40 CFR Part 60, subpart MM (1980).
- National Emission Standards for Hazardous Air Pollutants for Surface Coating of Automobile and Light-Duty Trucks, 40 CFR 63, subpart IIII (2004).

1. The 1977 CTG

In 1977, EPA issued a CTG document entitled "Control of Volatile Organic Emissions from Existing Stationary Sources Volume II: Surface Coating of Cans, Coils, Paper, Fabrics, Automobiles, and Light-Duty Trucks. (EPA-450/2-77-008) The 1977 CTG and subsequent implementation guidance provided RACT recommendations for controlling VOC emissions from automobile and light-duty truck assembly surface coating operations. These recommendations are summarized in Table 1.

The subsequent implementation guidance included the publication in 1988 of a document titled "Protocol for Determining the Daily Volatile Organic Compound Emission Rate of Automobile and Light-Duty Truck Topcoat Operations" (EPA-450/3-88-018). This document is commonly referred to as the Automobile Topcoat Protocol. The Automobile Topcoat Protocol provides procedures and calculations for determining the daily VOC emission rate of automobile and light-duty truck topcoat operations. These procedures and calculations can also be applied to primer-surfacer operations. Most automobile and light-duty truck facilities use the 1988 protocol for both their topcoat and primer-surfacer operations.

Table 1. 1977 CTG Recommended VOC Emission Limits for Automobile and Light-Duty Truck Surface Coatings

Electrodeposition primer operation	0.14 kg VOC/liter (1.2 lbs/gal) of coating, excluding water and exempt compounds[e], or 0.17 kg VOC/liter (1.4 lb VOC/gallon) of coating solids deposited
Primer-surfacer (guidecoat) operation	1.8 kg VOC/liter (15.1 lb VOC/gallon) of coating solids deposited on a daily average basis as determined by following the procedures in the Automobile Topcoat Protocol.
Topcoat operation	1.8 kg VOC/liter (15.1 lb VOC/gallon) of coating solids deposited on a daily average basis as determined by following the procedures in the Automobile Topcoat Protocol.
Final repair operation	0.58 kg VOC/liter (4.8 lbs/gal) of coating, excluding water and exempt compounds

2. The 1980 NSPS

In 1980, EPA promulgated an NSPS for surface coating of automobile and light-duty trucks (40 CFR part 60 subpart MM). The NSPS established the emission limits calculated on a monthly basis for each primecoat operation, guidecoat (primer-surfacer) operation, and topcoat operation located in an automobile or light-duty truck assembly plant constructed, reconstructed, or modified after October 5, 1979 (Table 2). The NSPS does not apply to plastic body component coating operations or to all-plastic automobile or light-duty truck bodies coated on separate coating lines. The VOC emission limit for primecoat operations depends on the solids turnover ratio (R_t). The solids turnover ratio is the ratio of total volume of coating solids added to the EDP system in a calendar month to the total volumetric design capacity of the EDP system. The NSPS limits and the 1977 CTG recommendations for primer-surfacer and topcoat cannot be directly compared because of differences in the compliance period (monthly for the NSPS limits and daily for the CTG recommendations) and how transfer efficiency is considered (table values for the NSPS limits and actual transfer efficiency testing for the CTG recommendations).

[e] 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.

Table 2. 1980 NSPS VOC Emission Limits for Automobile and Light-duty Truck Surface Coatings

Primecoat Operations (Non-EDP)	0.17 kg VOC/liter (1.42 lb/gal) coating solids applied		
Primecoat Operations (EDP)	When $R_t \geq 0.16$:	When $0.040 \leq R_t < 0.160$:	When $R_t < 0.040$:
	0.17 kg VOC/liter (1.42 lb/gal) coating solids applied	$0.17 \times 350^{0.160-R_t}$ kg VOC/liter ($0.17 \times 350^{0.160-R_t}$ x 8.34 lb/gal) coating solids applied	No VOC emission limit
Guidecoat Operations (including the guidecoat application, flash-off area, and oven)	1.40 kg VOC/liter (11.7 lb/gal) coating solids applied		
Topcoat Operations (including topcoat application, flash-off area, and oven)	1.47 kg VOC/liter (12.3 lb/gal) coating solids applied		

3. The 2004 NESHAP

In 2004, EPA promulgated the National Emissions Standards for Hazardous Air Pollutants: Surface Coating of Automobile and Light-Duty Trucks, 40 CFR, part 63, subpart IIII. The areas covered by the NESHAP include all the equipment used to apply coating to new automobile or light-duty truck bodies or body parts and to dry or cure the coatings after application; all storage containers and mixing vessels in which vehicle body coatings, thinners, and cleaning materials are stored and mixed; all manual and automated equipment and containers used for conveying vehicle body coatings, thinners, and cleaning materials; and all storage containers and all manual and automated equipment and containers used to convey waste materials generated by an automobile and light-duty truck assembly coating operation.

The 2004 NESHAP for automobile and light-duty truck assembly coating imposed organic HAP emission limitations calculated on a monthly basis for existing sources. More stringent limits apply to new sources (i.e., sources that commenced construction after December 24, 2002). The NESHAP also sets emission limits for coatings not included in the CTG or NSPS, including glass bonding primer, glass bonding adhesive, and some coatings and thinners. The limits for automobile and light-duty truck assembly coating for existing and new sources are summarized in Table 3 below.

Table 3. 2004 NESHAP HAP Emission Limits for Automobile and Light-Duty Truck Surface Coatings

Combined primer-surfacer, topcoat, final repair, glass bonding primer, and glass bonding adhesive operation plus all coatings and thinners, except for deadener materials and for adhesive and sealer materials that are not components of glass bonding systems, used in coating operations added to the affected source	0.060 kg organic HAP/liter of coating solids deposited (0.50 lb/gal) for new or reconstructed affected sources 0.132 kg organic HAP/liter of coating solids deposited (1.10 lb/gal) for existing affected sources
Combined electrodeposition primer, primer-surfacer, topcoat, final repair, glass bonding primer, and glass bonding adhesive operation plus all coatings and thinners, except for deadener materials and for adhesive and sealer materials that are not components of glass bonding systems, used in coating operations added to the affected source	0.036 kg organic HAP/liter of coating solids deposited (0.30 lb/gal) for new or reconstructed affected sources 0.072 kg organic HAP/liter of coating solids deposited (0.60 lb/gal) for existing affected sources

The 2004 NESHAP for automobile and light-duty truck assembly coating also specified work practices to minimize organic HAP emissions from the storage, mixing, and conveying of coatings, thinners, cleaning materials, and from handling waste materials generated by the coating operation.

4. Existing State and Local VOC Requirements

In addition to the EPA actions described above, at least 14 States and one California air pollution control district have regulations that control VOC emissions from automobile and light-duty truck assembly coating.

Most of the state rules reviewed had limits that are consistent with the 1977 CTG recommended limits. The state rules are summarized in Appendix B.

VI. <u>Recommended Control Techniques</u>

This CTG recommends the following VOC reduction measures: VOC emission limits for coating operations; work practices for storage and handling of coatings, thinners, and coating waste materials; and work practices for the handling and use of cleaning materials.

During the development of the 2004 NESHAP, EPA identified 61 automobile and light-duty truck assembly facilities operating in 1999. In 2008, the Alliance of Automobile Manufacturers, an industry trade association representing the majority of these facilities, provided EPA information from its member companies. Non-member companies also submitted information to EPA. EPA reviewed and evaluated this information in conjunction with developing this CTG. In total, EPA received information for 52 facilities. The information included VOC emission rates for EDP, primer-surfacer, and topcoat operations on a daily and monthly average for the calendar years 2006 and 2007. Most facilities also provided data showing maximum and minimum daily values, as well. The VOC emission limits recommended in this CTG are based on 2006 and 2007 data from currently operating automobile and light-duty truck assembly coating operations, and the work practices recommendations mirror those found in the NESHAP.

For cleaning materials, we are recommending work practices to reduce VOC emissions. We do not have information available to correlate VOC content or vapor pressure to specific cleaning steps. Therefore, we are not recommending VOC content or VOC composite vapor pressure limits for cleaning materials.

The following discussion summarizes our specific recommendations for coating operations and cleaning materials used in automobile and light-duty truck assembly coating operations.

A. Coatings

The following VOC emission limits are recommended to reduce VOC emissions from the coatings during the coating operations (Table 5). The categories reflect the current processes that are used at automobile and light-duty truck assembly coating facilities. For all the operations, except for final repair, the recommended limits are based on data supplied by the Alliance of Automobile Manufacturers member companies and non-member companies in 2008.

The recommended limits for electrodeposition primer, primer-surfacer and topcoat are more stringent than State rules, most of which are based on the 1977 CTG and or the NSPS limits. For final repair operations, no information was presented in the industry submittals. Therefore, we chose to recommend the limits for final repair recommended in the 1977 CTG. Additionally, an alternative emission limit for combined primer-surfacer and topcoat applications is recommended because in some facilities these processes are becoming progressively indistinguishable from each other.

In conjunction with this draft CTG we have prepared a draft revision of the Automobile Topcoat Protocol. The draft revised protocol includes new sections on accounting for control of spray booth emissions and instructions for applying the protocol to primer-surfacer operations. We recommend that facilities refer to the procedures and calculations in the draft revised protocol for determining the daily VOC emission rate of automobile and light-duty truck primer-surfacer and topcoat operations. We plan to issue the final revised protocol concurrently with the final CTG.

Table 5. Recommended VOC Emission Limits for Automobile and Light-Duty Truck Assembly Coatings

Electrodeposition primer (EDP) operations (including application area, spray/rinse stations, and curing oven)	0.084 kg VOC/liter of deposited solids (0.7 lb VOC/gal deposited solids) on a monthly average basis.
Primer-surfacer operations (including application area, flash-off area, and oven)	1.44 kg of VOC/liter of deposited solids (12.0 lbs VOC/gal deposited solids) on a daily average basis as determined by following the procedures in the draft revised Automobile Topcoat Protocol.
Topcoat operations (including application area, flash-off area, and oven)	1.44 kg VOC/liter of deposited solids (12.0 lb VOC/gal deposited solids) on a daily average basis as determined by following the procedures in the draft revised Automobile Topcoat Protocol.
Final repair operations	0.58 kg VOC/liter (4.8 lb VOC/gallon of coating) less water and less exempt solvents.
Combined primer-surfacer and topcoat operations	1.44 kg VOC/liter of deposited solids (12.0 lb VOC/gal deposited solids) on a daily average basis as determined by following the procedures in the draft revised Automobile Topcoat Protocol.

Additionally, the CTG recommends work practices to reduce emissions from coating operations, such as covering open containers.

The recommended emission limits for primer-surfacer and topcoat operations can be achieved with a combination of higher-solid solvent-borne coatings, efficient application equipment and bake oven exhaust control. The primer-surfacer and topcoat operations at many facilities are performing significantly better than the recommended emission limits by using some combination of powder primer-surfacer, waterborne primer-surfacer or basecoat, and partial control of spray booth exhaust (principally from automated spray booth zones). The cost and cost-effectiveness of retrofitting or converting a facility using higher-solid solvent-borne coatings, efficient application equipment and bake oven exhaust control to one that uses powder primer-surfacer, waterborne primer-surfacer or basecoat, or partial control of spray booth exhaust, is not believed to be reasonable in the context of RACT.

B. Work Practices for Coating-Related Activities and Cleaning Materials

In addition to the control options above, this CTG recommends work practices to further reduce VOC emissions from automobile and light-duty truck assembly coating-related activities. Although VOC reductions achieved by implementing the work practices that we recommend for these coating-related activities may not be quantifiable, they are beneficial to the overall goal of reducing VOC emissions.

We recommend work practices for storage, mixing, 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; (4) convey VOC-containing coatings, thinners, and coating-related waste materials from one location to another in closed containers or pipes; and (5) minimize VOC emission from cleaning of storage, mixing, and conveying equipment.

Additionally, we recommend that each facility develop and implement a work practice plan to minimize VOC emissions from cleaning and from purging of equipment associated with all coating operations for which emission limits are recommended in this CTG. We recommend that the plan specify practices and procedures to ensure that VOC emissions from the following operations are minimized:

- Vehicle body wiping;
- Coating line purging;
- Flushing of coating systems;
- Cleaning of spray booth grates;
- Cleaning of spray booth walls;
- Cleaning of spray booth equipment;
- Cleaning external spray booth areas; and
- Other housekeeping measures (e.g., keeping solvent-laden rags in closed containers.)

The recommended work practice plan is an enhancement of the plan required in the 2004 NESHAP, and is not an entirely new plan. Most elements of the NESHAP plan, which is directed at reducing organic HAP, are also consistent with reducing VOC emissions.

VII. <u>Emission Reductions and Cost Effectiveness of Recommended Control Options</u>

Based on information supplied by the Alliance of Automobile Manufacturers and other manufacturers , we estimated that there are a total of 52 automobile and light-duty truck assembly plants in the U.S. Using the 2004 ozone nonattainment designations, we determined that 33 of these facilities are in ozone nonattainment areas. The 2002 National Emissions Inventory (NEI) contains information for 32 of these 33 facilities. These 32 facilities reported actual VOC emissions totaling approximately 19,500 tons in 2002.

Auto and light-duty truck coating facilities have reduced the VOC emissions from their coating operations to comply with the NSPS, NESHAP, and State rules. The recommended VOC emission rates described above reflect the control measures that are currently being implemented by these facilities. Consequently, there is no additional cost to implement the draft CTG recommendations for coatings. For the same reason, we do not anticipate additional VOC emission reduction from coatings.

The draft CTG also recommends work practices for reducing VOC emissions from both coatings and cleaning materials. We believe that our work practice recommendations in the draft

CTG will result in a net cost savings. Implementing work practices reduces the amount of coatings and cleaning materials used by decreasing evaporation.

VIII. References

1. Control of Volatile Organic Emissions from Existing Stationary Sources - Volume II: Surface Coating of Cans, Coil, Paper, Fabrics, Automobiles, and Light-Duty Trucks. Publication No. EPA-450/2-77-008. U. S. Environmental Protection Agency, Research Triangle Park, NC. May 1977. The cover page of this document is presented in Appendix A. The full document is available as a separate item in docket EPA-HQ-OAR-2008-0413 at www.regulations.gov .

2. U.S. Environmental Protection Agency. Standards of Performance for Automobile and Light-duty Truck Surface Coating Operations. 40 CFR part 60, subpart MM. December 24, 1980.

3. U.S. Environmental Protection Agency. National Emission Standards for Hazardous Air Pollutants: Surface Coating of Automobiles and Light-Duty Trucks. 40 CFR part 63, subpart IIII. April 26, 2004

Appendix A

1977 CTG for Surface Coating of Cans, Coils, Paper, Fabrics, Automobiles, and Light-Duty Trucks

The cover page of this document is presented here. The full document is available as a separate item in docket EPA-HQ-OAR-2008-0413 at www.regulations.gov .

CAN COATING
AP-42
Section 4.2.2.f
Reference Number
2

EPA-450/2-77-008
May 1977
(OAQPS NO. 1.2-073)

OAQPS GUIDELINES

CONTROL OF VOLATILE ORGANIC EMISSIONS FROM EXISTING STATIONARY SOURCES - VOLUME II: SURFACE COATING OF CANS, COILS, PAPER, FABRICS, AUTOMOBILES, AND LIGHT-DUTY TRUCKS

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

This page intentionally left blank.

Appendix B

Summary of Selected State Regulations for Automobile and Light-Duty Truck Assembly Coatings (including Bay Area AQMD)

<table>
<tr><th rowspan="2">State</th><th rowspan="2">Regulation</th><th colspan="4">Standards</th></tr>
<tr><th>Prime</th><th>Primer-surfacer</th><th>Topcoat</th><th>Final Repair</th></tr>
<tr><td>Alabama</td><td>335-3-6-.11</td><td>1.2 lb/GCEWE</td><td>2.8 lb/GCEWE</td><td>2.8 lb/GCEWE</td><td>4.8 lb/GCEWE</td></tr>
<tr><td>Delaware</td><td>Reg 24, Sec 13</td><td><u>EDP</u>:
Same as NSPS

1.2 lb/GCEWE</td><td>2.8 lb/GCEWE as applied
15.1 lb/GSA</td><td>2.8 lb/GCEWE as applied
15.1 lb/GSA</td><td>4.8 lb/GCEWE as applied
34.2 lb/GSA</td></tr>
<tr><td>Illinois</td><td>Title 35, part 215</td><td>1.2 lb/gal

<u>Chicago and Metro East</u>:
1.2 lb/gal</td><td>2.8 lb/gal

<u>Chicago and Metro East</u>:
15.1 lb/gal</td><td>2.8 lb/gal

<u>Chicago and Metro East</u>:
15.1 lb/gal</td><td>4.8 lb/gal</td></tr>
<tr><td>Indiana</td><td>326 IAC 8-1</td><td>1.9 lb/GCEWE</td><td></td><td>2.8 lb/GCEWE</td><td>4.8 lb/GCEWE</td></tr>
<tr><td>Kansas</td><td>KAR 28-19-63</td><td>1.2 lb/GCEWE</td><td>2.8 lb/GCEWE
15.1 lb/GSA</td><td>2.8 lb/GCEWE
15.1 lb/GSA</td><td>4.8 lb/GCEWE</td></tr>
<tr><td rowspan="2">Kentucky</td><td rowspan="2">401 KAR 61:090</td><td><u>EDP</u>:
1.2 lb/GCEWE,
OR
≥55 vol% solids organic-borne prime coat applied with ≥50% TE.</td><td>2.8 lb/ GCEWE,
OR
≥55 vol% solids organic-borne prime coat applied with ≥65% TE,
OR
15.1 lb/GSA</td><td>2.8 lb/ GCEWE,
OR
≥50 vol% solids organic-borne prime coat applied with ≥65% TE,
OR
15.1 lb/GSA</td><td>4.8 lb/ GCEWE,
AND
≥65% TE.</td></tr>
<tr><td colspan="4">If coatings limits on operations are not met, then ≤15 wt% of the VOCs net input into the affected facility. Low-use coatings are exempt from this limit if the plantwide consumption of these coatings in the aggregate is less than or equal to fifty-five (55) gallons during the previous twelve (12) months.</td></tr>
<tr><td>Louisiana</td><td>LAC 33:III.2123</td><td>1.2 lb/GCEWE</td><td>2.8 lb/GCEWE as applied
15.1 lb/GSA</td><td>2.8 lb/GCEWE as applied
15.1 lb/GSA</td><td>4.8 lb/GCEWE</td></tr>
<tr><td>Michigan</td><td>R 336.1610</td><td>1.2 lb/GCEWE</td><td>14.9 lb/GSA</td><td>14.9 lb/GSA</td><td>4.8 lb/GCEWE</td></tr>
<tr><td>Mississippi</td><td></td><td colspan="4">No Regulation</td></tr>
</table>

<table>
<tr><th rowspan="2">State</th><th rowspan="2">Regulation</th><th colspan="4">Standards</th></tr>
<tr><th>Prime</th><th>Primer-surfacer</th><th>Topcoat</th><th>Final Repair</th></tr>
<tr><td>Missouri</td><td>10 CSR 10-2.230
10 CSR 10-5.330</td><td>KC Metro Area:
Ford and GM: Prime w/EDP: 1.2 lb/GCEWE

STL Metro Area:
15.1 lb/gal of solids applied
Chrysler: Prime w/EDP: 1.2 lb/gal of coating excluding water and exempts; Prime: 2.8 lb/gal
Ford: Prime w/EDP: 1.2 lb/gal of coating excluding water and exempts; Prime: 3.2 lb/gal
GM: Prime w/EDP: 1.2 lb/gal of coating excluding water and exempts</td><td>KC Metro Area:
Ford and GM: 15.1 lb/GAS, or for GM, 3.0 lb/GCEWE

STL Metro Area:
15.1 lb/gal of solids applied
Chrysler and GM: 2.8 lb/gal of coating excluding water and exempts
Ford: 3.2 lb/gal of coating excluding water and exempts</td><td>KC Metro Area:
Ford and GM: 15.1 lb/gal of solids applied, or
Ford: 3.6 lb/gal of coating excluding water and exempts;
GM: 5.0 lb/gal of coating excluding water and exempts

STL Metro Area:
15.1 lb/gal of solids applied
Chrysler: 2.5 lb/gal of coating excluding water and exempts
Ford: 3.6 lb/gal of coating excluding water and exempts
GM: 2.8 lb/gal of coating excluding water and exempts</td><td>KC Metro Area:
Ford and GM: 4.8 lb/gal of coating excluding water and exempts

STL Metro Area:
Chrysler, Ford, GM: 4.8 lb/gal of coating excluding water and exempts</td></tr>
<tr><td>Ohio</td><td>3745-21-09</td><td>EDP:
Same as NSPS

Non-EDP Prime:
1.9 lb/GCEWE, or
2.6 lb/GS w/control</td><td>Guidecoat or surfacer coating:
2.8 lb/GCEWE, or
15.1 lb/GSA</td><td>2.8 lb/GCEWE, or
15.1 lb/GAS</td><td>4.8 lb/GCEWE, or
13.8 lb/GS w/control</td></tr>
<tr><td rowspan="2">Bay Area AQMD</td><td rowspan="2">Reg 8, Rule 13</td><td>EPP:
1.2 lb/GCEWE, or
90% CE</td><td>15.0 lb/GSA</td><td>15.0 lb/GSA</td><td>4.8 lb/GCEWE</td></tr>
<tr><td colspan="4">Flexible Parts:
1. Flexible primer: 4.1 lb/GCEWE
2. Clear topcoat: 3.8 lb/GCEWE
3. Basecoat/clearcoat: 4.5 lb/GCEWE
OR, 90% CE.

Offline Coatings:
2.8 lb/GCEWE, or
90% CE.</td></tr>
<tr><td>South Carolina</td><td>Reg 61-62.60</td><td colspan="4">NSPS</td></tr>
</table>

State	Regulation	Standards			
		Prime	Primer-surfacer	Topcoat	Final Repair
Tennessee	1200-3-18-.11	EDP: *Same as NSPS* Non-EDP Prime: 1.9 lb/GCEWE, or 2.6 lb/GS w/control	Guidecoat or surfacer coating: 2.8 lb/GCEWE, or 15.1 lb/GSA	2.8 lb/GCEWE, or 15.1 lb/GSA	4.8 lb/GCEWE, or 13.8 lb/GS w/control
Texas	Chapter 115	1.2 lb/GCEWE	2.8 lb/GCEWE, or 15.1 lb/GSA	2.8 lb/GCEWE, or 15.1 lb/GSA	4.8 lb/GCEWE
Wisconsin	NR 422.09	EDP: 1.2 lb/GCEW	2.8 lb/GCEW	2.8 lb/GCEW	4.8 lb/GCEW

CE = control efficiency
EDP = electrodeposition primer
EPP = electrophoretic primer
GCEW = gallon of solids excluding water
GCEWE = gallon of coating excluding water and exempt compounds
GS = gallon of solids
GSA = gallon of solids applied
NSPS = New Source Performance Standard (40 CFR 60, subpart MM)
R_t = Solids Turnover Ratio
TE = Transfer Efficiency