Eastern Kern Air Pollution Control District

Rule 410.8
AEROSPACE ASSEMBLY AND COATING OPERATIONS

STAFF REPORT

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I. INTRODUCTION

The Eastern Kern Air Pollution Control District (District) is proposing to adopt amendments to Rule 410.8, Aerospace Assembly and Coating Operations. Rule 410.8 limits volatile organic compound (VOC) emissions from aerospace coatings and adhesives, and from cleaning, stripping, storing, and disposal of organic solvents and waste solvent materials associated with the use of aerospace coatings and adhesives.

Amendments to Rule 410.8 were initially intended to implement contingency measures to provide additional emission reductions in the event the District fails to meet reasonable further progress (RFP) milestones or fails to attain the 2008 Ozone national ambient air quality standard (NAAQS) or the 2015 Ozone NAAQS by the respective attainment date.

On May 17, 2022, the District held a public rule development workshop at the District Field Office in Tehachapi, CA; at this workshop District staff presented proposed amendments to Rule 410.8. A 30-day public review and comment period followed the workshop ending June 16, 2022. The District received comments from multiple entities expressing concerns regarding proposed lower VOC content limits of specialty coating categories and their impacts on being able to meet military specifications (MIL-SPEC) for safety and performance. A common theme was the time and cost necessary to research, develop, and obtain MIL-SPEC approval for new coatings compared to the projected emission reductions from lower VOC content requirements.

In a meeting held between the District, the California Air Resources Board (CARB) and United States Environmental Protection Agency (US EPA) held after the workshop, the District was informed that it was not meeting RFP requirements under the federal Clean Air Act (CAA); therefore, in order to have an approvable attainment plan, the District must assess its rules to be equivalent to the requirements of areas with a higher nonattainment classification (extreme nonattainment).

The District revised amendments to Rule 410.8 to meet this requirement and in response to comments received. A second rule development workshop was held on July 6, 2022 at the District Field Office in Tehachapi to present these revisions. A 30-day comment period will follow the workshop, ending August 5, 2022.

Amended Rule 410.8 is anticipated to be presented to the District's Governing Board for adoption at its regular Board Meeting to be held September 8, 2022, in Tehachapi, CA.

Appendix A is the revised strikeout underline version of Rule 410.8 (Aerospace Assembly & Coating Operations).

Appendix B the summary of comments received from the May 17, 2022 workshop, as well as the District's response.

Appendix C contains a cost-effectiveness analysis for installation of retrofit controls (carbon adsorption)

II. BACKGROUND

Aerospace surface coating operations are among the largest sources of VOC emission in the District. Permitted aerospace surface coating operations have a potential to emit of approximately 92 tons of VOC per year, with historical VOC emissions closer to 30 tons per year; this accounts for approximately 23% of VOC emitted from stationary sources at permitted facilities within the District. Therefore, additional emission reductions from this source category are anticipated to result in a more significant contribution towards attainment with the ozone NAAQS than other source groups, such as dry cleaning & auto body operations.

In light of the District's failure to attain the 2008 Ozone NAAQS by the Serious attainment date, and in accordance with Clean Air Act Sections 172(c)(9) and 182(c)(9), the District was required to implement contingency measures to go into effect if the District is unable to achieve RFP milestones or attain the Ozone NAAQS. In a September 2020 letter to CARB, the District committed to modifying Rule 410.8 to achieve a 10% emission reduction from the 2012 baseline emissions inventory for the category of 0.14 tons/day (280 lb/day) to satisfy contingency requirements.

The District was informed after initially presenting the contingency measures that the emission reductions from baseline levels necessary to meet the RFP requirements of the CAA were not projected to be achieved with the District's current rules and regulations. In order to have an approvable attainment plan while not meeting the RFP requirement, Section 182(c)(2)(B) of the CAA requires the District to include all measures achieved by sources in nonattainment areas of the next higher classification in its attainment plan. Therefore, amendments to Rule 410.8 must be phased after adoption, and .

There are two areas in California with a higher nonattainment classification (extreme nonattainment) than the District: the San Joaquin Valley and South Coast Air basins. Therefore, the District must compare its rules to these two areas and, if necessary, revise the rules to be equivalent to the comparable rule of San Joaquin Valley and/or South Coast.

III. PROPOSED REVISIONS TO RULE 410.8

Staff is proposing to amend Rule 410.8 by modifying rule exemptions, coating VOC content limits of some specialty coating categories; setting a VOC content limit for solvents used to clean coating application equipment outside of an enclosed device, and establishing a requirement to install emission control

device for surface coating operations with VOC emissions above the determined cost effectiveness threshold. These requirements are to be phased in upon adoption by the Board.

Appendix A shows all changes made to Rule 410.8, Aerospace Assembly and Coating Operations, in strikeout-underline form.

IV. VOC EMISSION REDUCTIONS

Reducing VOC emissions from surface coating operations are typically achieved through substitution to lower VOC content coatings and solvents, or through the use of add-on emission control devices.

Exemptions:
Rule 410.8 allows an exemption from the VOC content limits for coatings or refillable aerosols with separate formulations used in volumes of less than 50 gallons per year, provided the total of such formulations applied annually is less than 200 gallons. The other three air District's in the Mojave Desert Air Basin (Antelope Valley, Mojave Desert, South Coast) limit separate formulations to 20 gallons per year, but maintain the 200 gallons per year across all such formulations. Other California air Districts have more restrictive exemption thresholds. Imperial County APCD limits separate formulations to 20 gallons per year and a total of 50 gallons per year; San Joaquin Valley limits separate formulations to 1 gallon per day and 20 gallons per year, but no limits to the total of all such formulations applied.

Based on this review, lowering the low use exemption threshold for non-compliant coatings from 50 gallons per formulation per year to 20 gallons per formulation per year is achievable. This threshold reduction is estimated to provide approximately 1 pound per day (0.0005 ton/day) of VOC emission reductions.

Coating VOC Content:
As a first step in determining the feasibility of lowering coating and solvent VOC content thresholds, a review of coating VOC requirements of other California air district rules was performed. This review found over 20 categories of solvents, primers, coatings, adhesives, sealants, and maskants that other air districts had a lower VOC content requirements than Rule 410.8, with some of these limits having been in place for over 20 years. A summary of these categories can be found in Appendix B of this staff report.

The District initially proposed matching the lowest VOC content listed for many of the specialty coating categories; this was estimated to result in emission reductions of roughly 2 pounds per day (0.001 tons/day) of VOC. However, comments received from the US Air Force and aerospace manufacturers indicated that some categories proposed to be lowered would present significant economic and/or national security concerns, which are likely to outweigh the benefits of the VOC reductions.

Coating Application Equipment Cleaning Solvent:
Rule 410.8 does not currently set a VOC content requirement for organic solvents used for cleaning of coating application equipment, but prohibits the use of organic solvents unless specified cleaning methods intended to minimize solvent evaporation are used. Several other California air districts limit the VOC content or composite vapor pressure for application equipment cleaning solvents, or require the application equipment to be cleaned in an enclosed device.

Establishing a VOC content or composite partial pressure limit for these solvents is estimated to reduce VOC emissions by approximately 1.2 pound per day (0.0006 tons/day).

VOC Control Device Installation:
After estimating the emission reductions from creating more restrictive exemption thresholds and VOC content limits for coatings and solvents, the District was still well short of the reductions target the District provided to CARB. To address this, the District assessed the feasibility of installation of VOC control devices to provide the additional reductions needed to meet the 10% reduction target of 28 pounds per day (0.014 ton/day).

Control technologies available for reducing VOC emissions from surface coating operations include the following:

A. Carbon Adsorption
   Carbon adsorption uses a solid carbon-based filter (activated carbon or polymers) to remove VOC's from low to medium concentration gas streams. Gas molecules passing through the filter are selectively held onto the surface of the solid filter by attractive forces weaker and less specific than chemical bonds. Most VOCs can be removed ("desorbed") from the filter by increasing temperature, decreasing pressure, or introducing a stronger adsorbed material to displaced the captured VOCs. These removed VOCs are typically vented to an afterburner or oxidizer for destruction.

   Among types of adsorption equipment, the two most common are fixed-bed regenerable systems and disposable/rechargeable canisters. Fixed-bed units are typically used for continuous VOC containing exhaust streams, and are equipped with systems to desorb the carbon filter while it remains at its operating location. Canister type adsorbers are generally limited to controlling lower-volume and/or intermittent gas streams. They are not intended for desorption at their operating location, and are either returned to the manufacturer or regenerated at a central desorption facility onsite. Once the canister reaches a specified VOC content, the equipment is shut down, the saturated carbon or canister is removed, and fresh carbon or a new canister is installed for the next operating cycle.

When properly designed, operated and maintained, carbon adsorbers can achieve VOC removal efficiencies of 95 to 99 percent at input VOC concentrations of between 500 and 2,000 ppm in air.

B. Oxidizer

Oxidizers control VOC emissions by combusting VOC laden gas; the interaction of organic molecules at high temperatures (1400 ^{o}F or greater) breaks down the organic molecules into primarily waster and carbon dioxide, though emissions of nitrogen oxides, acidic gases, trace metals, and other hazardous air pollutants may also occur. The waste gas stream being treated by the oxidizer must be heated to its ignition temperature; this is typically accomplished through combustion of supplemental fuel (e.g. natural gas) in the oxidizer. The organic gas must remain at or above this desired temperature long enough to fully react with the oxygen (residence time), and there must be sufficient mixing of the organic gas and oxygen (referred to as turbulence) to ensure as much gas as possible is exposed to oxygen at the elevated temperatures.

The main types of thermal oxidizers are direct fire, catalytic, recuperative, and regenerative. Catalytic oxidizers make use of a catalyst to increase the rate of the combustion reaction, which lowers the required temperature of the oxidizer as well as supplemental fuel requirements. Recuperative thermal oxidizers recover waste heat from the combustion through heat exchangers placed in the hot outlet gas streams; this recovered heat can be used to preheat the VOC gas stream, heat & boil water for steam, or provide process heat for another operation at the facility. Regenerative thermal oxidizers utilize heat exchangers, constructed of ceramic materials able to withstand the high temperatures the oxidizer must reach for ignition of the gas stream, between the emission source & combustion chamber and the combustion chamber & exhaust stack. The inlet gas first passes through the first hot ceramic bed thereby heating the stream (and cooling the bed) to its ignition temperature. If the desired temperature is not attainable, a small amount of auxiliary fuel is added in the combustion chamber. The hot gases then react (releasing energy) in the combustion chamber and while passing through the second ceramic bed, thereby heating it to the combustion chamber outlet temperature. When the temperature of the outlet ceramic bed reaches a set temperature, the process flows are reversed (using valves in the ducting/piping) so that the inlet gas is now fed into the hot second ceramic bed and exits through the first ceramic bed.

When properly designed, operated and maintained, oxidizers can achieve VOC destruction efficiencies of 95 to 99.99 percent.

An assessment of the emission reductions necessary for VOC controls to be cost effective to install can be found in Appendix C. A review of permitted District aerospace coating operations indicate there could be as many as 16 coating operations where emission reductions could be sufficient to be cost effective to require add-on VOC controls. Installation of VOC control devices on these

operations is estimated to provide 28 pounds per day (0.014 ton/day) of VOC reductions.

V. COST EFFECTIVENESS

When assessing the cost effectiveness of a control technology, the total annual cost per ton (TACPT) of emission reductions is calculated and then compared to a cost-effectiveness "cutoff" threshold. The TACPT is calculated by dividing the total annual cost of the emission control system (sum of estimated capital recovery cost and annual operating cost) by the amount of emission reductions expected from use of the emission control system.

The last revision to Eastern Kern APCD's cost-effectiveness "cutoff" threshold was in the year 2000, set at $5,000 per ton. In 2021, the San Joaquin Valley Air Pollution Control District established a best available control technology BACT Policy cost-effectiveness threshold of $22,600 per ton of VOC reductions. Since the District must assess the rule to implement achieved measure from extreme nonattainment areas, the District selected the San Joaquin Valley APCD threshold for determining whether add-on controls were cost-effective.

In determining the cost effectiveness of the VOC control equipment, EPA's *Air Pollution Cost Control Manual* was consulted for each type of VOC control equipment previously described to determine the cost of installation and use of the equipment. Additionally, cost-effectiveness determinations by other California air districts for add-on control devices at aerospace surface coating operations were reviewed.

The Bay Area Air Quality Management District has had a Best Available Control Technology (BACT) determination for aerospace surface coatings operations in place since 1991 that listed carbon adsorption or thermal oxidation as generally cost-effective for operations that emit more than 25 pounds per day of VOC (~4.56 ton/yr). The Sacramento Metropolitan Air Quality Management District performed a BACT analysis in 2018 that determined a VOC control system was cost effective for aerospace coating operations that emitted more than 4,785 lb/yr (2.40 ton/yr) of VOC emissions.

A cost effectiveness analysis for carbon adsorption can be found in Appendix C of this staff report. The District's analysis found carbon adsorption to be cost-effective for operations that emit 3.50 tons or more of uncontrolled VOC per year (~ 28 lb/day).

A review of cost effectiveness analyses performed by other agencies indicated that an oxidizer would require more than double these uncontrolled emissions to be cost effective to install, so a cost-effectiveness analysis was not performed by the District for an oxidizer.

VI. ECONOMIC IMPACT

Pursuant to California Health & Safety Code (CH&SC) §40920.6(a), the District is required to analyze the cost effectiveness of new rules or rule amendments that implement Best Available Retrofit Control Technology (BARCT) or "all feasible measures" to control VOC. Among contingency measures added to Rule 410.8, proposed additional controls would constitute BARCT, and are therefore subject to the cost effectiveness analysis mandate.

Potential economic impacts from the proposed contingency measures include the cost of obtaining coatings and solvents with lower VOC formulations, as well as the cost to install and operate VOC emission control devices. A cost estimate for VOC emission controls has been provided in Appendix C. Enclosed spray equipment cleaning devices was estimated by Santa Barbara APCD in 2012 to cost as much as $2,800 ($3,400 when CPI adjusted).

New coating formulations are somewhat more challenging to predict a cost to implement, as some specialty coating categories have more complicated or challenging requirements than other. Comments received by the District indicated the total cost to develop and receive approval for lower VOC specialty coatings for use in military aerospace applications could be in the millions of dollars, which could correlate to annualized costs over $100,000 to achieve the lower VOC limit (not necessarily per company or facility).

VII. ENVIRONMENTAL IMPACTS

Environmental impacts of these contingency measures are a decrease in VOC emissions and associated decrease in tropospheric ozone.

The use of add-on control devices could result in generation of solid and liquid waste requiring further treatment (adsorber or condenser); this waste would likely be handled by existing waste treatment facilities.

Use of an oxidizer would result in an increase in emissions of nitrogen oxides, oxides of sulfur, and could increase particulate matter and toxic air contaminant emissions.

Pursuant to the Section 15061, Subsections (2) & (3) of the California Environmental Quality Act (CEQA) Guidelines, staff will prepare a Notice of Exemption for this project.

VIII. RULE CONSISTENCY ANALYSIS

Pursuant to CH&SC §40727.2, prior to adopting, amending, or repealing a rule or regulation, the District is required to perform a written analysis that identifies and compares the air pollution control elements of the rule with the corresponding elements of existing or proposed District and EPA rules, regulations, and guidelines that apply to the same source category. Rule elements that were

analyzed are emission limits or control efficiency, operating parameters and work practices, monitoring and testing, and recordkeeping and reporting requirements.

Results of Consistency Analysis

District Rules

Facilities subject to Rule 410.8 could also be subject to the following rules:

Rule 410, Organic Solvents

Rule 410.2, Disposal and Evaporation of Solvents

Rule 410.3, Organic Solvent Degreasing Operations

Rule 410.4, Metal, Plastic, and Pleasure Craft Parts and Products Coating Operations

Rule 410.4A, Motor Vehicle and Mobile Equipment Refinishing Operations

Rule 410.7, Graphic Arts

Rule 411, Storage of Organic Liquids

Rule 422, New and Modified Stationary Source Review Rule

Rule 423, National Emissions Standards for Hazardous Air Pollutants

Rule 432, Polyester Resin Operations

Rules 410, 410.2, and 410.4 include a provision that will exempt any source operation that is subject to, or specifically exempted by, Rule 410.8.

Rules 410.3, 410.4A, 410.7, 411, 422, and 423 are not in conflict with, nor are they inconsistent with the requirements of Rule 410.8.

EPA Rules and Regulations

A. EPA-Control Technique Guidelines (CTG)

1. CTG EPA-453/R-97-004 1997/12 applies to *Surface Coating Operations at Aerospace Manufacturing and Rework Operations* located in marginal, moderate, serious or severe ozone nonattainment areas that has the potential to emit greater than or equal to 25 tons/year of VOC, and equal to greater than 10 tons/year of VOC for extreme ozone nonattainment areas. Rule 410.8 requirements are currently more stringent than the CTG limits for 34 categories, and as stringent as the CTG in the 19 remaining categories; contingency requirements would further increase

the stringency of Rule 410.8. As such, District staff concludes that District Rule 410.8 is more stringent than the CTG.

2. CTG EPA-450/2-77-022 1977/11 applies to *VOC Emissions from Solvent Metal Cleaning* operations located in marginal, moderate, serious or severe ozone nonattainment areas that have the potential to emit greater than or equal to 25 tons/year of VOC, and equal to greater than 10 tons/year of VOC for extreme ozone nonattainment areas.

   This CTG applies to the use of the following degreasing equipment: cold cleaners, open top vapor degreasers, and conveyorized degreasers. The CTG identifies design and work practice standards for cold cleaners, open top vapor degreasers, and conveyorized degreasers, for example: cover the solvent tank, have a facility for waste solvent and draining cleaned parts, permanent labels on operating parts, close degreaser when not in use, drain parts until dripping ceases, no excessive splashing if solvent is sprayed. The CTG also identifies add-on controls such as refrigeration chillers and carbon control.

   Rule 410.8 identifies solvent VOC content limits or a control system with efficiencies of at least 90% capture and 95% control, and that would not allow more emissions than if compliant materials were utilized. The general solvent limit is 200 g/L; the coating stripper solvent limit is currently 300 g/L. Since the CTG does not identify control requirements any more stringent than Rule 410.8, District staff considers Rule 410.8 at least as stringent as the CTG.

B. EPA - Alternative Control Technology (ACT)

Currently no EPA ACT guidance document for aerospace coating operations.

C. Standards of Performance for New Stationary Sources (NSPS)

Currently no NSPS guidance document for aerospace coating operations.

D. National Emission Standards for Hazardous Air Pollutants (NESHAPs) and Maximum Achievable Control Technologies (MACTs)

NESHAPs and MACTs are requirements contained in 40 Code of Federal Regulations (CFR) Part 61 and 40 CFR Part 63. Since EPA has delegated the authority to implement most NESHAP requirements to the District, NESHAPs and MACTs promulgated by EPA are largely incorporated by reference into District Rule 423 (National Emission Standards for Hazardous Air Pollutants). It is important to mention that the District implements NESHAPs and MACTs by incorporating the emission standards as conditions of the Permits to Operate issued to affected sources.

40 CFR 63 Subpart GG (National Emission Standards for HAPs: Aerospace Manufacturing and Rework Facilities)

VOC content requirements described in the "Table of Standards" of Rule 410.8 are of equal or greater stringency as the requirements of 40 CFR §63.745(c) and §63.747(c). VOC control system requirements listed in Section V.F of Rule 410.8 are more stringent than the requirements of §63.745(d) and §63.747(d). Coating application equipment requirements of Section V.E of Rule 410.8 are equivalent to 40 CFR §63.745(f). Sections V.B and V.D of Rule 410.8 are approximately equivalent to 40 CFR §63.744(a), (b), & (d), as well as 40 CFR §63.748. 40 CFR §63.746 is not directly comparable to Section V.C of Rule 410.8, as it specifically applies to organic HAP in chemical strippers, and not all VOC.

IX. SOCIOECONOMIC IMPACTS

CH&SC §40728.5 exempts districts with a population of less than 500,000 persons from the requirement to assess the socioeconomic impacts of proposed rules. Eastern Kern County population is below 500,000 persons.

X. RULE APPROVAL PROCESS

The District accepted written comments and concerns from persons interested in Amended Rule 410.8, Aerospace Assembly & Coating Operations for a period of 30 days starting May 17, 2022 following the workshop held in Tehachapi. Appendix B contains a summary of comments received, and the District's response to the comments.

Staff anticipates the revised Rule will be adopted by the District's Governing Board at its September 8, 2022 meeting.

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REFERENCES

Antelope Valley Air Quality Management District Rule 1124 *"Aerospace Assembly and Component Manufacturing Operations"* (Amended 08/20/2013)

Antelope Valley Air Quality Management District Rule 1171 *"Solvent Cleaning Operations"* (Amended 08/21/2018)

Bay Area Air Quality Management District *Best Available Control Technology (BACT) Guideline Document #161.1.1* (09/06/1991)

Bay Area Air Quality Management District *Best Available Control Technology (BACT) Guideline Document #161.1.2* (09/06/1991)

Bay Area Air Quality Management District Regulation 8 Rue 29 *"Aerospace Assembly and Component Coating Operations"* (Amended 12/20/1995)

EPA *Air Pollution Cost Control Manual Section 3.1 – VOC Recapture Controls Chapter 1 – Carbon Adsorbers* (October 2018)

EPA *Air Pollution Cost Control Manual Section 3.2 – VOC Destruction Controls Chapter 2 – Incinerators and Oxidizers*

Imperial County Air Pollution Control District Rule 425 *"Aerospace Coating Operations"* (Amended 02/23/2010)

Mojave Desert Air Quality Management District Rule 1118 *"Aerospace Assembly, Rework, and Component Manufacturing Operations"* (Amended 06/08/2020)

Sacramento Metropolitan Air Quality Management District *Minor Source BACT Determination No.'s 182 & 183* (09/18/2018)

Sacramento Metropolitan Air Quality Management District Rule 456 *"Aerospace Assembly and Component Coating Operations"* (Amended 10/23/2008)

San Diego County Air Pollution Control District Rule 67.9 *"Aerospace Coating Operations"* (Amended 04/30/1997)

San Joaquin Valley Unified Air Pollution Control District *Best Available Control Technology (BACT) Policy* (revised 07/01/2021)

San Joaquin Valley Unified Air Pollution Control District Rule 4605 *"Aerospace Assembly and Component Coating Operations"* (Amended 06/16/2011)

Santa Barbara County Air Pollution Control District Rule 337 *"Surface Coating of Aerospace Vehicles and Components"* (Amended 06/21/2012)

South Coast Air Quality Management District Rule 1124 *"Aerospace Assembly and Component Manufacturing Operations"* (Amended 09/21/2001)

South Coast Air Quality Management District Rule 1171 *"Solvent Cleaning Operations"* (Amended 05/01/2009)

Ventura County Air Pollution Control District Rule 74.13 *"Aerospace Assembly and Component Manufacturing Operations"* (Amended 09/11/2012)

APPENDIX A:

PROPOSED REVISION RULE 410.8

AEROSPACE ASSEMBLY AND COATING OPERATIONS
STRIKEOUT UNDERLINE

RULE 410.8 Aerospace Assembly and Coating Operations - Adopted 3/13/2014 (Amended XX/XX/2022)

I. Purpose

The purpose of this rule is to limit volatile organic compound (VOC) emissions from aerospace coatings and adhesives, and from cleaning, stripping, storing, and disposal of organic solvents and waste solvent materials associated with the use of aerospace coatings and adhesives. This rule also provides administrative requirements for recording and measuring VOC emissions.

II. Applicability

Except as provided in Section IV, the provisions of this rule are applicable to the manufacturing, assembling, coating, masking, bonding, paint stripping, surface cleaning, service, and maintenance of aerospace components, and the cleanup of equipment, storage, and disposal of solvents and waste solvent materials associated with these operations.

III. Definitions

A. Ablative Coating: A coating that chars when exposed to open flame or extreme temperatures, as would occur during the failure of an engine casing or during aerodynamic heating. The ablative char surface serves as an insulative barrier, protecting adjacent components from heat or open flame.

B. Adhesion Promoter: A coating applied to a substrate in a monomolecular thickness to promote wetting and form a chemical bond with the subsequently applied material.

C. Adhesive: A substance that is used to bond one surface to another.

D. Adhesive Bonding Primer: A coating applied in a very thin film to aerospace adhesive bond detail components for corrosion inhibition and adhesion.

E. Aerosol Coating: A mixture of pigments, resins, and liquid and gaseous solvents and propellants packaged in a disposable container for hand-held application.

F. Aerospace Component: Any raw material, partial or completed fabricated part, assembly of parts, or completed unit of any aircraft, helicopter, missile, or space vehicle, including integral equipment such as models, mock-ups, prototypes, molds, jigs, tooling, hardware jackets, and test coupons.

G. Aerospace Material: Any coating, primer, adhesive, sealant, maskant, lubricant, stripper or hand-wipe cleaning or clean-up solvent used during the manufacturing, assembly, refinishing, maintenance or service of an aerospace component. Preservative oils and compounds, form release agents not containing solids, greases, and waxes are not aerospace materials for the purpose of this rule.

H. Antichafe Coating: A coating applied to areas of moving aerospace components which may rub during normal operation.

I. Antique Aerospace Vehicle or Component: An aircraft or component thereof that was built at least 30 years ago. An antique aerospace vehicle would not routinely be in commercial or military service in the capacity for which it was designed.

J. Anti-Wicking Wire Coating: The outer coating of a wire which prevents fluid wicking into the insulation of the wire.

K. Air Pollution Control Officer (APCO): Eastern Kern Air Pollution Control District Air Pollution Control Officer, or his designee.

L. ARB: California Air Resources Board.

M. ASTM: American Society for Testing and Materials.

N. Barrier Coating: A coating applied in a thin film to fasteners to inhibit dissimilar metal corrosion and to prevent galling.

O. Bearing Coating: A coating applied to an antifriction bearing, a bearing housing, or the area adjacent to such a bearing in order to facilitate bearing function or to protect the base material from excessive wear. A material shall not be classified as a bearing coating if it can also be classified as a dry lubricative material or a solid film lubricant.

P. Bonding Maskant: A temporary coating used to protect selected areas of aerospace parts from strong acid or alkaline solutions during processing for bonding

~~P.~~Q. Brush Coating: Manual application of coatings using brushes and rollers.

~~Q.~~R. Caulking and Smoothing Compounds: Semi-solid materials which are applied by hand application methods and are used to aerodynamically smooth exterior vehicle surfaces or fill cavities such as bolt hole accesses. A material shall not be classified as a caulking and smoothing compound if it can also be classified as a sealant.

~~R.~~S. Chemical Agent-Resistant Coating (CARC): An exterior topcoat designed to withstand exposure to chemical warfare agents or the decontaminants used on these agents.

~~S.~~T. Chemical Milling: The removal of metal by chemical action of acids or alkalis.

~~T.~~U. Clear Topcoat: A clear or semi-transparent coating applied over a primer for purposes such as appearance, identification, or protection.

~~U.~~V. Coating: A material applied onto or impregnated into a substrate for protective, decorative, or functional purposes. Such materials include, but are not limited to, paints, varnishes, sealers, and stains excluding preservative oils and compounds, form release agents not containing solids, greases, and waxes.

~~V.~~W. Commercial Exterior Aerodynamic Structure Primer: A primer utilized for the purpose of extended corrosion protection, which is only used on the exterior of passenger and cargo doors, supporting door structures, aerodynamic components, and structures of commercial aircraft which protrude from the fuselage, such as wings and attached components, control surfaces, horizontal stabilizer, vertical fins, wing-to-body fairings, antennae, landing gear and landing gear doors.

X. Commercial Interior Adhesive: Materials used in the bonding of passenger cabin interior components. These components must meet the FAA fireworthiness requirements.

Y. Compatible Substrate Primer: Includes two categories- compatible epoxy primer and adhesive primer. Compatible epoxy primer is primer that is compatible with the filled elastomeric coating and is epoxy based. The compatible substrate primer is an epoxy-polyamide primer used to promote adhesion of elastomeric coatings such as impact-resistant coatings. Adhesive primer is a coating that (1) inhibits corrosion and serves as a primer applied to bare metal surfaces or prior to adhesive application, or (2) is applied to surfaces that can be expected to contain fuel. Fuel tank coatings are excluded from this category

~~W.~~Z. Composite Partial Pressure: The sum of the partial pressures of the VOC compounds in a solvent. The VOC composite partial pressure is calculated as follows:

$$PP_c = \frac{\sum_{i=1}^{n} \frac{(W_i)(VP_i)}{MW_i}}{\frac{W_w}{MW_w} + \sum_{e=1}^{k} \frac{W_e}{MW_e} + \sum_{i=1}^{n} \frac{W_i}{MW_i}}$$

Where:

W_i	=	Weight of the "i"th VOC compound, in grams
W_w	=	Weight of water, in grams
W_e	=	Weight of exempt compound, in grams
MW_i	=	Molecular weight of the "i"th VOC compound, in grams per gram-mole
MW_w	=	Molecular weight of water, in grams per gram-mole
MW_e	=	Molecular weight of the "e"th exempt compound, in grams per gram-mole
PP_c	=	VOC composite partial pressure at 20°C (68°F), in mm Hg
VP_i	=	Vapor pressure of the "i"th VOC compound at 20°C (68°F), in mm Hg

~~X.~~AA. Conformal Coating: A coating applied to electrical conductors and circuit boards to protect them against electrical discharge damage and/or corrosion.

BB. Critical Use and Line Sealer Maskant: A temporary coating, not covered under other maskant categories, used to protect selected areas of aerospace parts from strong acid or alkaline solutions such as those used in anodizing, plating, chemical milling and processing of magnesium, titanium, high-strength steel, high-precision aluminum chemical milling of deep cuts, and aluminum chemical milling of complex shapes. Materials used for repairs or to bridge gaps left by scribing operations (i.e. line sealer) are also included in this category

CC. Cryogenic Flexible Primer: A primer designed to provide corrosion resistance, flexibility, and adhesion of subsequent coating systems when exposed to loads up to and surpassing the yield point of the substrate at cryogenic temperatures (−275 °F and below)

DD. Cryoprotective Coating: A coating that insulates cryogenic or subcooled surfaces to limit propellant boil-off, maintain structural integrity of metallic structures during ascent or re-entry, and prevent ice formation

EE. Corrosion Prevention Compound System: A coating system that provides corrosion protection by displacing water and penetrating mating surfaces, forming a protective barrier between the metal surface and moisture. Coatings containing oils or waxes are excluded from this category

FF. Cyanoacrylate Adhesive: A fast-setting, single component adhesive that cures at room temperature. Also known as “super glue.”

~~Y.~~GG. Decorative Laminate Primer: An adhesive bonding primer which is applied to a substrate to enhance adhesion between the decorative laminate and the subsequently applied substrate, and is cured at a maximum temperature of 250°F.

~~Z.~~HH. Dip Coating: The process in which a substrate is immersed in a solution (or dispersion) containing the coating and then withdrawn.

~~AA.~~II. Dry Lubricative Coating: A coating consisting of lauric acid, cetyl alcohol, waxes, or other non-cross linked or resin-bound materials which act as a dry lubricant or protective coat.

~~BB.~~JJ. Electric-Effect Coating: An electrically-conductive coating.

~~CC.~~KK. Electrodeposition: A dip coating application method where the paint solids are given an electrical charge which is then attracted to a substrate.

~~DD.~~LL. Electromagnetic Interference (EMI) Coating: A coating applied to space vehicles, missiles, aircraft radomes, and helicopter blades to disperse static energy or reduce electromagnetic interference.

~~EE.~~MM. Electronic Wire Coating: The outer electrical insulation coating applied to tape insulation of a wire specifically formulated to smooth and fill edges.

~~FF.~~NN. Electrostatic Application: A sufficient charging or atomized paint droplets to cause deposition principally by electrostatic attraction. This application shall be operated at a minimum 60 KV power.

OO. Elevated-Temperature Skydrol-Resistant Commercial Primer: A primer applied primarily to commercial aircraft (or commercial aircraft adapted for military use) that must withstand immersion in phosphate-ester (PE) hydraulic fluid (Skydrol 500b or equivalent) at the elevated temperature of 150 °F for 1,000 hours

~~GG.~~PP. EPA: United States Environmental Protection Agency.

~~HH.~~QQ. Epoxy Based Fuel Tank Coating: A coating which contains epoxy resin that is applied to integral fuel tank components of aircraft to protect the fuel tank from corrosion and the by-products of bacterial growth.

~~II.~~RR. Epoxy Polyamide: A tough chemically resistant polyamide-cured epoxy coating that provides long-term protection for alloys exposed to hot corrosive environments.

~~JJ.~~SS. Fastener Sealant: A sealant applied to a device used to join two or more parts together.

~~KK.~~TT. Fire Resistant Coating - ~~Civilian~~ (interior): A cabin interior coating that passes Federal Aviation Administration standards using the Ohio State University Heat Release, Fire and Burn Tests~~.~~ for civilian aircraft, is used on parts subject to the flammability requirements of MIL-STD-1630A and MIL-A-87721 for military aircraft, or is used on parts subject to the flammability requirements of SE-R-0006 and SSP 30233 for space vehicles.

UU. Flexible Primer: A primer that meets flexibility requirements such as those needed for adhesive bond primed fastener heads or on surfaces expected to contain fuel. The flexible coating is required because it provides a compatible, flexible substrate over bonded sheet rubber and rubber-type coatings as well as a flexible bridge between the fasteners, skin, and skin-to-skin joints on outer aircraft skins. This flexible bridge allows more topcoat flexibility around fasteners and decreases the chance of the topcoat cracking around the fasteners. The result is better corrosion resistance

~~LL.~~VV. Flight Test Coating: A coating applied to an aircraft prior to flight testing to protect the aircraft from corrosion and to provide required marking during flight test evaluation.

~~MM.~~WW. Flow Coating: A coating application system with no air supplied to the nozzle and where paint flows over the part and the excess coating drains back into a collection system.

~~NN.~~XX. Fuel Tank Adhesive: An adhesive used to bond components continuously exposed to fuel and which must be compatible with and used with fuel tank coatings.

~~OO.~~YY. Fuel Tank Coating: A coating applied to the interior of a fuel tank or areas of an aircraft that are continuously wetted by fuel to protect it from corrosion and/or bacterial growth.

~~PP.~~ZZ. Grams of VOC per Liter of Coating, Less Water and Exempt Compounds: The weight of VOC content per combined volume of VOC and coating solids and can be calculated by the following equation:

$$\text{Grams of VOC per liter of coating, less water and exempt compounds} = \frac{Ws - Ww - Wec}{Vm - Vw - Vec}$$

Where:
Ws = weight of volatile compounds (grams)
Ww = weight of water (grams)
Wec = weight of exempt compounds (grams)
Vm = volume of material (liters)
Vw = volume of water (liters)
Vec = volume of exempt compounds (liters)

~~QQ.~~AAA. Grams of VOC per Liter of Material: The weight of VOC per volume of material and can be calculated by the following equation:

$$\text{Grams of VOC per liter of material} = \frac{Ws - Ww - Wec}{Vm}$$

Where:
Ws = weight of volatile compounds (grams)
Ww = weight of water (grams)
Wec = weight of exempt compounds (grams)
Vm = volume of material (liters)

~~RR.~~BBB. Hand Application Methods: The application of coatings, sealants, or adhesives by non-mechanical hand-held equipment including but not limited to paint brushes, hand rollers, caulking guns, trowels, spatulas, syringe daubers, non-refillable aerosol cans, rags, and sponges.

~~SS.~~CCC. High Temperature Coating: A coating that is certified to withstand temperatures of more than 350°F.

~~TT.~~DDD. High-Volume, Low-Pressure (HVLP) Spray Equipment: Spray equipment permanently labeled as such and which is designed and operated between 0.1 and 10 pounds per square inch, gauge, (psig) air atomizing pressure measured dynamically at the center of the air cap and at the air horns and with liquid supply pressure less than 50 psig.

~~UU.~~EEE. Impact Resistant Coating: A flexible coating that protects aerospace components, such as aircraft landing gear, landing gear compartments, and other surfaces subject to abrasive impacts from runway debris.

FFF. Insulation Covering: Material that is applied to foam insulation to protect the insulation from mechanical or environmental damage

~~VV.~~GGG. Intermediate Release Coating: A thin coating applied beneath topcoats to assist in removing the topcoat in depainting operations and generally to allow the use of less hazardous depainting methods.

~~WW.~~HHH. Lacquer: A clear or pigmented coating formulated with a nitrocellulose or synthetic resin to dry by evaporation without a chemical reaction. Lacquers are resoluble in their original solvent.

~~XX.~~III. Liquid Leak: A visible solvent leak from a container at a rate of more than three drops per minute or a visible liquid mist.

~~YY.~~JJJ. Long Term Adhesive Bonding Primer (Metal to Structural Core Bonding): An adhesive bonding primer that has met the aircraft manufacturers' required performance characteristics following 6000 hours testing. Used for metal to structural core bonding and with an adhesive that is specified to be cured at 350°F ± 10°F.

~~ZZ.~~KKK. Maskant for Chemical Milling: A coating applied directly to an aerospace component to protect surface areas when chemical milling such component.

~~AAA.~~LLL. Metalizing Epoxy Coating: A coating that contains relatively large quantities of metallic pigmentation for appearance and/or added protection.

~~BBB.~~MMM. Mold Release: A coating applied to a mold surface to prevent the molded piece from sticking to the mold as it is removed.

~~CCC.~~NNN. Non-Absorbent Container: A container made of non-porous material that does not allow the migration of solvents through it.

~~DDD.~~OOO. Non-Leaking Container: A container without liquid leak.

~~EEE.~~PPP. Non-Structural Adhesive: An adhesive that bonds non-load carrying aircraft component in non-critical applications.

~~FFF.~~QQQ. Normal Business Hours: Monday through Friday, 8:00 am to 5:00 pm.

~~GGG.~~RRR. Optical Anti-Reflective Coating: A coating with a low reflectance in the infrared and visible wavelength range and is used for anti-reflection on or near optical and laser hardware.

~~HHH.~~SSS. Organic Solvent: The same as "Solvent."

~~III.~~TTT. Organic Solvent Cleaning: As defined in Rule 410.3, Organic Solvent Degreasing Operations.

~~JJJ.~~UUU. Part Marking Coating: Coatings or inks used to make identifying markings on materials, components, or assemblies. These markings may be permanent or temporary.

~~KKK.~~VVV. Phosphate Ester Resistant Wire Ink Coating: A coating that is used for surface identification, mark on aerospace wire or cable, and inhibits the corrosion caused by contact with phosphate ester type hydraulic fluids.

~~LLL.~~WWW. Pretreatment Coating: A coating which contains no more than 12 percent solids by weight and at least one-half (0.5) percent acid by weight and is applied directly to metal surfaces to provide surface etching, corrosion resistance, adhesion, and ease of stripping.

~~MMM.~~XXX. Primer: A coating applied directly to an aerospace component for purposes of corrosion prevention, protection from the environment, functional fluid resistance, and adhesion of subsequent coatings, adhesives, or sealants.

~~NNN.~~YYY. Radiation-Effect Coating: A coating which helps in the prevention of radar detection.

~~OOO.~~ZZZ. Rain Erosion Resistant Coating: A coating that protects leading edges, flaps, stabilizers, and engine inlet lips against erosion caused by rain during flight.

~~PPP.~~AAAA. Remanufactured Aircraft Part: An aerospace component that is built as a spare part or replacement part subject to an existing commercial aircraft specification.

~~QQQ.~~BBBB. Rocket Motor Nozzle Coating: A catalyzed epoxy coating system used in elevated temperature applications on rocket motor nozzles.

~~RRR.~~CCCC. Roll Coating: Application of coatings from a paint trough to a flat surface by mechanical series of rollers.

~~SSS.~~DDDD. Scale Inhibitor: A coating that is applied to the surface of a part prior to thermal processing to inhibit the formation of tenacious scale.

~~TTT.~~EEEE. SCAQMD: South Coast Air Quality Management District.

~~UUU.~~FFFF. Screen Print Ink: An ink used in screen printing processes during fabrication of decorative laminates and decals.

~~VVV.~~GGGG. Sealant: A viscous semisolid material that is applied with a syringe, caulking gun, or spatula to fill voids in order to seal out water, fuel, other liquids and solids, and in some cases air movement.

HHHH. Seal Coat Maskant: An overcoat applied over a maskant to improve abrasion and chemical resistance during production operations

~~WWW.~~IIII. Silicone Insulation Material: An insulating material applied to exterior metal surfaces for protection from high temperatures caused by atmospheric friction or engine exhaust. These materials differ from ablative coatings in that they are not "sacrificial".

~~XXX.~~JJJJ. Short Term Adhesive Bonding Primer: An adhesive bonding primer that has met the manufacturers' required performance characteristics following 1000 hours testing. Used for metal to metal and metal to structural core bonding with an adhesive which is specified to be cured at a temperature of 350°F ± 10°F.

~~YYY.~~KKKK. Solid Film Lubricant: A very thin coating consisting of a binder system containing as its chief pigment material one (1) or more of the following: molybdenum disulfide, graphite, polytetrafluoroethylene (PTFE) or other solids that act as a dry lubricant between closely-fitting surfaces.

~~ZZZ.~~LLLL. Solvent: As defined in Rule 410.3, Organic Solvent Degreasing Operations.

~~AAAA.~~MMMM. Sonic and Acoustic Applications: The use of aerospace materials on aerospace components that are subject to mechanical vibration or sound wave cavitation.

~~BBBB.~~NNNN. Space Vehicle Coating: A coating applied to a vehicle designed to travel and operate beyond earth's atmosphere.

~~CCCC.~~OOOO. Specialty Coating: A coating that, even though it meets the definition of a primer, topcoat, or self-priming topcoat, has additional performance criteria beyond those of primers, topcoats, and self-priming topcoats for specific applications. These performance criteria may include, but are not limited to, temperature or fire resistance, substrate compatibility, antireflection, temporary protection or marking, sealing, adhesively joining substrates, or enhanced corrosion protection.

~~DDDD.~~PPPP. Specialized Function Coating: A coating that fulfills specific engineering requirements that are limited in application and characterized by low volume usage. This category excludes coatings covered in other Specialty Coating categories.

~~EEEE.~~QQQQ. Stripper: A volatile liquid applied to remove a maskant for chemical processing, cured or dried paint, cured or dried paint residue, or temporary protective coating.

~~FFFF.~~RRRR. Structural Adhesive - Autoclavable: An adhesive used to bond load-carrying aircraft components and is cured by heat and pressure in an autoclave.

~~GGGG.~~SSSS. Structural Adhesive - Nonautoclavable: An adhesive cured under ambient conditions and is used to bond load-carrying aircraft components or other critical functions, such as nonstructural bonding near engines.

~~HHHH.~~TTTT. Surface Cleaning: Any method of cleaning outside of a degreaser, including, but not limited to, wipe cleaning and equipment flushing.

~~III.~~UUUU. Temporary Protective Coating: A coating applied to an aerospace component to protect it from mechanical and environmental damage during manufacturing or shipping.

~~JJJ.~~VVVV. Thermal Control Coating: A coating formulated with specific thermal conductive or radiative properties to permit temperature control of the substrate.

~~KKKK.~~WWWW. Topcoat: A coating applied over a primer for purposes such as appearance, identification, or protection.

~~LLLL.~~XXXX. Touch-Up Operation: The application of Aerospace Materials to repair minor surface damage and imperfections after the main coating process.

~~MMMM.~~YYYY. Transfer Efficiency: The ratio of the weight or volume of coating solids adhering to the part being coated to the weight or volume of coating solids used in the application process expressed as a percentage.

~~NNNN.~~ZZZZ. Unicoat: A coating that is applied directly to an aerospace component for purposes of corrosion protection, environmental protection, and functional fluid resistance that is not subsequently topcoated. A unicoat is used in lieu of the application of a primer and a topcoat.

~~OOOO.~~AAAAA. Volatile Organic Compounds (VOCs): ~~As defined in Rule 102, Definitions.~~ The definition contained in 40 CFR 51.100 shall apply, and is hereby incorporated by reference. In the event of any discrepancy between a definition contained in 40 CFR §51.100 and any definition specified above, the definition specified above shall control.

~~PPPP.~~BBBBB. Waste Solvent Material: Any solvent which may contain dirt, oil, metal particles, sludge, or waste products; or wiping material containing VOCs including, but not limited to, paper, cloth, sponge, rag, or cotton swab used in organic solvent cleaning.

~~QQQQ.~~CCCCC. Wet Fastener Installation Coating: A primer or sealant applied by dipping, brushing, or daubing to fasteners that are installed before the coating is cured.

~~RRRR.~~DDDDD. Wing Coating: A coating that is corrosion resistant and is resilient enough to withstand the flexing of wings.

IV. Exemptions

A. Jet engine or rocket engine flushing operations using any solvent other than trichloroethylene are exempt from this rule.

B. Coatings applied using non-refillable aerosol spray containers.

C. Except for the provisions of Section VI, VOC limits for solvents and strippers listed in Section V shall not apply to space vehicle manufacturing.

D. Except for the recordkeeping provisions of Sections VI.A.1 and VI.A.4, the requirements of Section V shall not apply to aerospace assembly and component coating facilities using not more than four (4) gallons of products containing VOCs per day. Solvent-containing materials used in operations subject to Rule 410.3, Organic Solvent Degreasing Operations shall not be included in this determination.

E. Except for the provisions of Section VI, Section V shall not apply to laboratories which apply coatings, solvents, and adhesives to test specimens for purpose of research, development, quality control, and testing for production-related operations. Any person claiming this exemption shall provide operational records, data, and calculations as determined by the APCO to be necessary to substantiate this claim.

F. Coatings that have been designated as “classified” by the Department of Defense or used on space vehicles are exempt from the VOC content limits of the following categories as listed in the Table of Standards:

1. Ablative Coating, Bearing Coating, Caulking and Smoothing Compounds, Chemical Agent-Resistant Coating, Electromagnetic Interference Coating,

Intermediate Release Coating, Lacquer, Metalized Epoxy Coating, Mold Release, Part Marking Coating, Rocket Motor Nozzle Coating, Silicone Insulation Material, Specialized Function Coating, Thermal Control Coating, Epoxy Polyamide, and Wet Fastener Installation Coating;

2. The Fastener Sealant category is exempt from the 600 g/l VOC limit but must still comply with ~~the~~ a 675 g/l VOC limit;

3. The Sealant (Extrudable/Rollable/Brushable) category is exempt from the 280 g/l VOC limit but must still comply with ~~the~~ a 600 g/l VOC limit.

G. Provisions of Section V.A. shall not apply to:

1. Prior to March 8, 2024, c~~C~~oatings or refillable aerosols with separate formulations that are used in volumes of less than fifty (50) gallons in any calendar year, provided that the total of such formulations applied annually by a facility is less than 200 gallons;

2. After March 8, 2024, coatings or refillable aerosols with separate formulations that are used in volumes of less than twenty (20) gallons in any calendar year, provided that the total of such formulations applied annually by a facility is less than 200 gallons.

2. Adhesives with separate formulations that are used in volumes of less than one half (0.5) gallon on any day or less than ten (10) gallons in any calendar year;

3. Touch-up coatings and stencil coatings not exceeding an area of 9 square feet per aircraft (An area larger than this may be approved by APCO as applicable for specific repair operations that occur infrequently); or

4. Rework operations performed on antique aerospace vehicles or associated components.

Any operator seeking to claim the exemption in Section IV.~~F~~G.1 or IV.G.2 shall notify the APCO in writing that substitute compliant coatings are not available. Coatings designated as "classified" by the Department of Defense, coatings used on space vehicles, touch-up coatings, and stencil coatings shall not be included in the volume of coatings used under this exemption.

H. The provisions of Section V.E. shall not apply to the application of coatings that contain less than 20 grams of VOC per liter of coating less water and exempt compounds.

V. Requirements

A. Aerospace Coatings and Adhesives: An operator shall not apply to any aerospace component, any coating, aerosol, or adhesive with a VOC content, less water and exempt compounds, as applied, in excess of the limits listed in the Table of Standards for Aerospace Component Products Containing VOCs.

TABLE OF STANDARDS
VOC CONTENT LIMITS FOR AEROSPACE COMPONENT COATING PRODUCTS
Content expressed in Grams per Liter
Less Water and Exempt Compounds

VOC Content Category	VOC Limit	
	Before 03/08/2024	On and After 03/08/2024
I. PRIMERS		
1. General	350	
2. Adhesive Bonding Primers		
a. Commercial Aircraft	250	
b. Military Aircraft	805	
3. Commercial Exterior Aerodynamic Structure Primer	650	350
4. Compatible Substrate Primer	780	350
5. Cryogenic Flexible Primer	645	350
6. Elevated-Temperature Skydrol-Resistant Commercial Primer	740	350
7. Flexible Primer	640	350
8. Low-Solids Corrosion Resistant Primer	350	
9. Primer Compatible with Rain Erosion-Resistant Coating	850	
II. COATINGS		
1. Ablative Coating	600	
2. Adhesion Promoter Coating	850	
3. Antichafe Coating	600	420
4. Bearing Coating	620[1]	
5. Chemical Agent-Resistant Coating	550[1]	500[1]
6. Conformal Coating	750	600
7. Cryoprotective Coating	600	
8. Electric~~omagnetic~~/Radiation Effect Coating	800	
9. Electromagnetic Interference (EMI) Coating	800[1]	
10. Fire-Resistant (Interior) Coating		
a. Civilian	650	
b. Military	800	
c. Space	800	
11. Flight-Test Coating		
a. Used on Missiles or Single Use Aircraft	420	
b. All Other	840	600
12. Fuel-Tank Coating		
a. General	420	
b. Rapid Cure	720	
13. High-Temperature Coating	850	720

14. Impact-Resistant Coating	420	
15. Intermediate Release Coating	750[1]	
16. Lacquer Coating	830	
17. Metallized Epoxy Coating	740[1]	700[1]
18. Mold Release Coatings	780[1]	762[1]
19. Optical Anti-Reflection Coating	700	
20. Part Marking Coating	850[1]	
21. Pretreatment Coating	780	
22. Rain Erosion-Resistant Coating	800	
23. Rocket Motor Nozzle Coating	660[1]	
24. Scale Inhibitor Coating	880	
25. Space-Vehicle Coatings, Other: (does not include Electric Discharge and EMI Protection Coating or Fire-Resistant (Interior) Coating)	1000	
26. Specialized Function Coating	890[1]	
27. Temporary Protective Coating	250	
28. Thermal Control Coating	800[1]	
29. Topcoat		
a. Clear	520	420
b. Epoxy Polyamide	660[1]	
c. Other	420	
30. Unicoat Coating (Self Priming Topcoats)	420	
31. Wet Fastener Installation Coating	675[1]	
32. Wing Coating	750	
33. Wire Coatings		
a. Electronic	420	
b. Anti-Wicking	420	
c. Pre-Bonding Etchant	420	
d. Phosphate Ester Resistant Ink	925	
III. ADHESIVES		
1. Commercial Interior Adhesive	760	
2. Cyanoacrylate Adhesive	1020	
3. Fuel-Tank Adhesive	620	
4. Non-Structural Adhesive	250	
5. Rocket Motor Bonding Adhesive	890	
6. Rubber-Based Adhesive	850	
7. Space Vehicle Adhesive	800	
8. Structural Adhesive		
a. Autoclavable	50	
b. High Temperature - Autoclavable	650	
c. Non-Autoclavable	850	700
IV. SEALANTS		

1. Rollable, Brushable or Extrudable Sealant	280[2]	
2. Fastener Sealant	675	600[3]
3. Other	600	
V. MASKANTS		
1. Bonding Maskant	1230	600
2. Critical Use and Line Sealer Maskant	750	650
3. Chemical Milling Maskant		
a. For use with Type I Etchant	250	
b. For use with Type II Etchant	160	
c. For Chemical Processing *Less water, Exempt Compounds and (PERC)	250*	
4. Photolithographic Maskant	850	
5. Seal Coat Maskant	1230	850
VI. LUBRICANTS --		
1. Fastener Installation Lubricant (applied at time of Aircraft/component assembly)		
a. Solid-Film Lubricant	880	
b. Dry Lubricative Material	675	
2. Fastener Lubricative Coating (applied at time of Fastener Manufacture)		
a. Solid-Film Lubricant	250	
b. Dry Lubricative Material	120	
c. Barrier Coating	420	
3. Non-Fastener Lubricative Coatings (applied at time of non-Fastener Manufacture)		
a. Solid-Film Lubricant	880	
b. Dry Lubricative Materials	675	
VII. OTHER		
1. Caulking and Smoothing Compound	850	
2. Corrosion Prevention Compound System	710	
3. Insulation Covering	740	
4. Screen Print Ink	840	
5. Silicone Insulation Material	850	

1 Coatings that have been designated as "classified" by the Department of Defense or coatings that are used on space vehicles are exempt from these coating limits.

2 Coatings that have been designated as "classified" by the Department of Defense or coatings that are used on space vehicles are exempt from the 280 g/l limit, but must comply with a 600 g/l limit.

3. Coatings that have been designated as "classified" by the Department of Defense or coatings that are used on space vehicles are exempt from the 600 g/l limit, but must comply with a 675 g/l limit.

B. Evaporative Loss Minimization

1. Surface Cleaning: No operator shall use a solvent for surface cleaning, clean-up, or jet engine or rocket engine gas path cleaning or flushing. N not exempt under Section IV of this rule, (excluding stripping coatings or cleaning coating application equipment), unless:

   a. The solvent contains less than 200 grams of VOC per liter (1.67 lb/gal) of material, as applied; or

   b. The VOC composite vapor pressure of the solvent is less than or equal to 45 mm Hg (0.87 psia) at a temperature of 68°F.

2. Coating Application Equipment Cleaning

   Prior to March 8, 2024, Aan operator shall not use VOC-containing materials to clean spray equipment used for the application of coatings, adhesives, or ink, unless one of the following methods is used:

   a. An enclosed system or equipment proven to be equally effective at controlling emissions is used for cleaning. The enclosed system must totally enclose spray guns, cups, nozzles, bowls, and other parts during washing, rinsing and draining procedures; be used according to the manufacturer's recommendations; and remain closed when not in use;

   b. Unatomized discharge of cleaning solvent into a waste container that is kept closed when not in use;

   c. Disassembled spray gun that is cleaned in a vat and kept closed when not in use; or

   d. Atomized spray into a waste container that is fitted with a device designed to capture atomized cleaning solvent emissions.

   On and after March 8, 2024, an operator shall not use VOC-containing materials to clean spray equipment used for the application of coatings, adhesives, or ink, unless one of the following methods is used:

   a. An enclosed system or equipment proven to be equally effective at controlling emissions is used for cleaning. The enclosed system must totally enclose spray guns, cups, nozzles, bowls, and other parts during washing, rinsing and draining procedures; be used according to the manufacturer's recommendations; and remain closed when not in use;

   b. Unatomized discharge of cleaning solvent containing not more than 25 grams of VOC per liter (g/L) of solvent or having a VOC composite partial pressure less

than or equal to 5 mm Hg @ 68 °F into a waste container that is kept closed when not in use;

c. Disassembled spray gun that is cleaned in a vat with solvent containing not more than 25 g/L of solvent or having a VOC composite partial pressure less than or equal to 5 mm Hg @ 68 °F and kept closed when not in use; or

d. Atomized spray of solvent containing not more than containing not more than 25 g/L of solvent or having a VOC composite partial pressure less than or equal to 5 mm Hg @ 68 °F into a waste container that is fitted with a device designed to capture atomized cleaning solvent emissions.

3. In lieu of compliance with Sections V.B.1. or V.B.2. an operator may control VOC emissions from surface cleaning operations or from cleaning coating application equipment with a VOC emission control system that meets the requirements of Section V.F.

C. Coating Strippers

1. No operator shall use or specify for use within the District a coating stripper unless it contains less than 300 grams of VOC per liter (2.5 lb/gal), as applied, or has a VOC composite vapor pressure of 9.5 mm Hg (0.18 psia) or less at 68°F.

2. In lieu of compliance with Section V.C.1, an operator may control emissions from coating stripper operations with a VOC emission control system that meets the requirements of Section V.F.

D. Storage and Disposal of VOC Containing Materials: An operator shall store or dispose of fresh or spent solvents, waste solvent cleaning materials such as cloth, paper, etc., coatings, adhesives, catalysts, and thinners in closed nonabsorbent and non-leaking containers. Storage containers shall remain closed at all times except when depositing or removing the contents or when empty.

E. Application Equipment Requirements: No operator shall apply any coating subject to the provisions of this rule unless one (1) of the following application methods is used:

1. Brush, dip, flow, or roll coating conducted in accordance with manufacturer's recommendations;

2. Electrostatic or Electrodeposition application conducted in accordance with manufacturer's recommendations;

3. HVLP spray equipment operated in accordance with manufacturer's recommendations:

a. HVLP spray equipment manufactured prior to January 1, 1996, the end user shall demonstrate that the gun meets HVLP spray equipment standards. Satisfactory proof will be either in the form of manufacturer's published technical material or by a demonstration using a certified air pressure tip gauge,

measuring the air atomizing pressure dynamically at the center of the air cap and at the air horns.

b. A person shall not sell or offer for sale for use within the District any HVLP spray equipment without a permanent marking denoting the maximum inlet air pressure in psig at which the gun will operate within the parameters specified in Section III.~~TT~~DDD.

4. Spray gun: If a spray gun is used, the end user must demonstrate that the gun meets the HVLP definition in Section III.~~TT~~DDD. in design and use. A satisfactory demonstration must be based on the manufacturer's published technical material on the design of the gun and by a demonstration of the operation of the gun using an air pressure tip gauge from the manufacturer of the gun.

5. Any alternative coating application method which has been demonstrated to achieve at least 65 percent transfer efficiency or the equivalent efficiency of HVLP spray equipment and approved, in writing, by APCO.

8. In lieu of compliance with Sections V.E.1. through V.E.5., an operator may control VOC emissions from application equipment with a VOC emission control system that meets the requirements of Section V.F.

F. VOC Emission Control System

1. As an alternative to meeting the requirements of Sections V.A., V.B., V.C., or V.E., an operator may install a VOC emission control system provided that the VOC emission control system meets all of the following requirements:

a.~~1.~~ The VOC emission control system shall be approved by the APCO.

b. ~~2.~~ The VOC emission control system shall comply with the requirements of Sections V.F.~~3~~1.c. through V.F.~~5~~1.e. during periods of emission-producing activities.

c.~~3.~~ The VOC emission control system collection device shall have a control efficiency of at least 95 percent, by weight.

d. ~~4.~~ The VOC emission control system can demonstrate a capture efficiency of at least 90 percent by weight.

e.~~5.~~ In no case shall compliance through the use of a VOC emission control system result in VOC emissions in excess of the VOC emissions which would result from compliance with applicable provisions of Sections V.A., V.B., V.C., or V.E.

~~6. The minimum required overall capture and control efficiency of an emission control system at which an equivalent or greater level of VOC reduction will be achieved shall be calculated by using the following equation:~~

$$CE = \left[1 - \left(\frac{VOC_{LWc}}{VOC_{LWn,Max}} x \frac{1 - (VOC_{LWn,Max} / D_{n,Max})}{1 - (VOC_{LWc} / D_c)} \right) \right] x\ 100$$

Where:

CE = Minimum Required Overall Capture and Control Efficiency, percent

VOC_{LWc} = VOC Limit, less water and exempt compounds

$VOC_{LWn,Max}$ = Maximum VOC content of noncompliant coating used in conjunction with a control device, less water and exempt compounds

$D_{n,Max}$ = Density of solvent, reducer, or thinner contained in the noncompliant coating, containing the maximum VOC content of the multi-component coating

D_c = Density of corresponding solvent, reducer, or thinner used in the compliant coating system.

2. Owners/operators of aerospace coating operations with the potential to emit more than 3.50 tons per year (7,000 pounds per year) of uncontrolled VOC shall be required to install a VOC emission control system meeting the requirements of Section V.F.1.a through V.F.1.d of this Rule.

G. Prohibition of Solicitation: No person shall solicit, specify, or require an operator to use any coating, solvent, spray equipment, or VOC emission control system that does not meet the limits or requirements of this rule.

H. Sell-Through/Existing Stock of Coatings: A coating manufactured prior to amendment date of this rule, that complied with the VOC Content limit(s) in effect at that time, may be sold, supplied, or offered for sale for 12 months after rule adoption date. Such a coating may be applied at any time, both before and after adoption date, provided manufacture Date-Code and VOC Content is clearly printed on coating container.

I. Specialized Military Coating Operations VOC Requirements: APCO may approve alternative VOC or vapor pressure limits for coatings, adhesives or solvents that are specified in specialized military Technical Orders, for which no viable substitutions are available. The owner/operator must submit a written request to the APCO, and present documentation and sufficient justification regarding the operation and materials.

VI. Administrative Requirements

A. Recordkeeping

1. An operator subject to the requirements of this rule shall have coating manufacturer's specifications, either listed on the coating container, product data

sheet, or on Safety Data Sheet (SDS), available for review and shall maintain daily records which show the following information as applicable:

a. Manufacturer name and type for each coating, solvent, thinner, reducer or stripper used;

b. Mix ratio by volume of components added to the original material prior to application;

c. Grams of VOC per liter of each coating, solvent, thinner, reducer, or stripper less water and exempt compounds, as applied;

d. Volume and method of application of each coating, solvent, thinner, reducer, or stripper applied; and

e. Vapor pressure of solvents used.

2. An operator shall maintain records to support that the following coatings have been specified for their intended application:

a. Adhesion promoter;
b. Antichafe coating;
c. Electric/radiation effect;
d. Fuel tank adhesive;
e. High temperature coating;
f. Impact resistant coating;
g. Optical anti-reflective coating;
h. Rain erosion resistant wing coating.

3. An operator using a VOC emission control system pursuant to Section V.F. as a means of complying with this Rule, shall maintain daily records of key system operating parameters and maintenance procedures, which will demonstrate continuous operation and compliance of the VOC emission control system during periods of emission-producing activities. Key system operating parameters are those necessary to ensure compliance with VOC limits. The parameters may include, but are not limited to, temperatures, pressures, and flow rates.

4. Records required by this Rule shall be retained for a minimum of five (5) years and made available on site during normal business hours to the APCO, ARB, or EPA upon request.

B. Test Methods

1. Coating and solvent VOC content shall be determined using EPA Method 24 or its constituent methods. The VOC content of coatings containing exempt halogenated VOCs shall be determined by using ARB Method 432, “Determination of Dichloromethane and 1,1,1- Trichloroethane in Paints and Coatings” (September 12, 1998). or SCAQMD Method 303 (Determination of Exempt Compounds).

2. The solid content of pretreatment coatings shall be determined using EPA Method 24. The acid content of pretreatment coatings shall be determined using ASTM Method D1613 06 (Standard Test for Acidity of Volatile Solvents and Chemical Intermediates used in Paint, Varnish, Lacquer and Related Products).

3. The test method for determining the fire resistance of an interior coating shall be Federal Aviation Administration-required Ohio State University Heat Release, Fire and Burn Tests.

4. The VOC composite vapor pressure of a blended solvent shall be determined by quantifying the amount of each organic compound in the blend using gas chromatographic analysis SCAQMD Test Method 308-91 "Quantitation of Compounds by Gas Chromatography" (February 1993) and by calculating the VOC composite vapor pressure of the solvent by summing the product of the vapor pressure of each pure component and its molar fraction. For the purpose of this calculation, the blend shall be assumed to be an ideal solution where Raoult's Law applies. The vapor pressure of each pure component shall be obtained from published reference manuals or handbooks.

5. VOC emissions from enclosed systems used to clean coating application equipment shall be determined by the manufacturer using the SCAQMD General Test Method for Determining Solvent Losses from Spray Gun Cleaning Systems.

6. The control efficiency of a VOC emission control system's control device(s) shall be determined using EPA Methods 2, 2A, 2C, or 2D for measuring flow rates and EPA Methods 25, 25A, or 25B for measuring the total gaseous organic concentrations at the inlet and outlet of the control device. EPA Method 18 or ARB Method 422, "Determination of Volatile Organic Compounds in Emissions from Stationary Sources" (September 12, 1990) shall be used to determine the emissions of exempt compounds. Other ARB, EPA, and ASTM methods verifying VOC emission control may be authorized by the Control Officer as applicable.

7. The capture efficiency of a VOC emission control system's collection device(s) shall be determined according to EPA's "Guidelines for Determining Capture Efficiency," January 9, 1995 and 40 CFR 51, Appendix M, Methods 204-204F, as applicable, or any other method approved by EPA, ARB, or APCO.

8. When more than one test method or set of test methods are specified for any emissions testing, a violation of any test established in Section VI.B. shall constitute a violation of the Rule.

C. Emission Control Plan

An owner/operator of an existing aerospace surface coating operation subject to this Rule shall submit to the Control Officer an Emission Control Plan, including:

1. List of each coating operation subject to the Rule, VOC emission limit for each operation, annual VOC emissions from each operation from the preceding three calendar years, and whether the operation is served by a VOC control device

2. Description of actions to be taken to meet the requirements of Subsection V.F.2. Such plan shall include any type of emissions control equipment to be applied to each operation and construction schedule

VII. Compliance Schedule

A. An owner/operator of any unit subject to Section V shall comply with the following schedule:

1. By March 31, 2023, submit to the Control Officer an Emission Control Plan pursuant to Section VI.C, including a complete application for an Authority to Construct, if necessary

2. By September 8, 2025, demonstrate full compliance with Section V.F.2 of this Rule

APPENDIX B:

PROPOSED REVISION RULE 410.8

AEROSPACE ASSEMBLY AND COATING OPERATIONS
RESPONSE TO COMMENTS

On May 17, 2022, the District held a public rule development workshop at the District's Field office in Tehachapi, CA, to present proposed amendments to Rule 410.8 (Aerospace Assembly and Coating Operations). The District submitted copies of the proposed amendments to the California Air Resources Board (CARB) and the Region IX office of the U.S. Environmental Protection Agency (EPA) in May 2022 for an initial 30-day review.

Industry representatives present at the 5/17/2022 workshop asked questions regarding the lower VOC content proposed for specialty coating

I. CARB/EPA COMMENTS

CARB and EPA did not provide specific comments on the proposed amendments. However, the District was informed that RFP requirements under Section 182 of the Clean Air Act were not being met, so proposed amendments could no longer be contingencies and are required to be implemented upon adoption. CARB and EPA would review the Rule amendments and provide comment after they are revised to meet this new requirement.

II. INDUSTRY/PUBLIC COMMENTS

The following comments were made by industry representatives at and following the 5/17/2022 workshop in Tehachapi, CA.

Edwards Air Force Base

Edwards Air Force Base submitted the following comments on June 16, 2022.

1. *Edwards AFB proposed to clarify the definition of Touch-up operation to assist in the determination of exemption to Rule 410.8. The definition seems ambiguous considering that most every aerospace coating operation we perform is a repair to the original aircraft or aircraft part. We seldom build or coat entire aircraft. We believe the intent of the rule is to exclude minor touch-up and repair operations that have little impact to emissions; however, we don't believe the intent of the rule is to exclude most or all of our operations. Therefore, we propose to quantify an exempt minor touch-up operation based on the area covered similar to touch-up coating operations as defined in Rule 410.4A Motor Vehicles and Mobile Equipment. We would like to incorporate feedback from others in the industry on what may be deemed an appropriate area for a minor touch-up operation.*

District Response

The District has revised the touch-up coating exemption as requested for additional clarity on what would constitute an exempt touch up operation.

2. *We request to add the option to use an alternate control efficiency demonstration as approved by EPA, ARB, and the APCO. The control efficiency does not specifically state that other test methods may be approved. As previously mentioned (Rule 410 Organic Solvents Amended 2022, Edwards AFB Comment #4) Edwards AFB would like to use alternate APCO approved ASTM test methods D3467 and D5528, verifying the condition of the activated carbon in the existing aerospace coatings paint booth. Edwards AFB requests the possibility to use this or other alternate approved test methods in order to utilize the existing control system.*

District Response
District revised per suggestion.

3. *We request a clarification to the equation used to determine the equivalent overall capture and control efficiency (CE) of and emission control system as this seems confusing and contradictory. The required control efficiency in the rule and BACT standard is 95% by weight and the capture efficiency is 90%. There are a very few settings that can be applied to a control device that can modify the rated control efficiency or capture efficiency. Adding compliant solvents or thinners to determine the equivalent capture and control efficiency may not be possible for some formulations and unnecessarily confuses the calculation. The calculation determining the VOC content already includes an adjustment for water and exempt compounds based on the amounts of the mix as applied.*

   Therefore, we suggest simplifying whether the noncompliant coating will meet the equivalent VOC limit in the table by using a mass balance comparison at the rated control and capture efficiency. The VOC content, density, and volume of the noncompliant coatings should be known as well as the required minimum capture and control efficiency of the control device. The controlled equivalent VOC content as applied should be compared to the VOC limit in the table. An example calculation is shown below.

$VOC_e = VOC_{LWn,Max} * V_n * (1-CE) * (1-E_{cap}) / m_n = VOC_{LWn,Max} * (1-CE) * (1-E_{cap}) / D_n$

Where:

VOCe = calculated equivalent VOC content to compare to Table 1

$VOC_{LWn,Max}$ = Maximum VOC content of noncompliant coating used in conjunction with a control device, less water and exempt compounds

V_n = Volume of coating as applied

CE = Control efficiency = 95% minimum

E_{cap} = Capture efficiency = 90% minimum

m_n = mass of noncompliant coating = Dn*Vn

Dn = Density of noncompliant coating

   The equivalent VOC for using noncompliant coatings with a control device meeting the minimum capture and control requirements (95% control, 90% capture) would be the VOC content as applied divided by the density of the noncompliant coating as applied multiplied by the overall capture and control efficiency. If this calculated equivalent VOC does not meet the limits in Table 1, then the noncompliant coating

cannot be used without further control. We suggest simplifying the control efficiency requirement as outlined below, in a redline/strikeout format.

"V. F. 5. To determine whether a noncompliant coating may be used within the control device to meet the equivalent VOC reduction that would be achieved by using compliant coatings, use the following calculation derived from a mass balance below:

$VOC_e = VOC_{LWn,Max} * V_n * (1-CE) * (1-E_{cap}) / m_n = VOC_{LWn,Max} * (1-CE) * (1-E_{cap}) / D_n$ or

$VOC_e = VOC_{LWn,Max} * (1-0.95) * (1-0.90) / D_n$

Where:

VOC_e = calculated equivalent VOC content to compare to Table 1

$VOC_{LWn,Max}$ = Maximum VOC content of noncompliant coating used in conjunction with a control device, less water and exempt compounds

V_n = Volume of coating as applied

CE = Control efficiency = 95% minimum

E_{cap} = Capture efficiency = 90% miminim

m_n = mass of noncompliant coating = $D_n * V_n$

D_n = Density of noncompliant coating

If the calculated equivalent VOC content does not meet the VOC content limit in Table 1, the noncompliant coating may not be used without the addition of further control methods. To assist in determining whether a compliant solvent or reducer may be used in conjunction with the control device, the following calculation method may be used.

The minimum required overall capture and control efficiency of an emission control system at which an equivalent or greater level of VOC reduction will be achieved shall be calculated by using the following equation:

*CE = 1-(VOC LWc/ VOC LWn,Max*1- VO LWn,Max/ Dn,Max/(1- (VOC LWc / Dc))*100*

Where:

CE = Minimum Required Overall Capture and Control Efficiency, percent

VOCLWc = VOC Limit, less water and exempt compounds

VOCLWn,Max = Maximum VOC content of noncompliant coating used in conjunction with a control device, less water and exempt compounds

Dn,Max = Density of solvent, reducer, or thinner contained in the noncompliant coating, containing the maximum VOC content of the multi-component coating

Dc = Density of corresponding solvent, reducer, or thinner used in the compliant coating system."

District Response

The District assessed the need for this equation to determine a minimum required capture and control efficiency in the rule. It is unlikely the minimum 85.5% capture and control efficiency required by the rule would not be sufficient to reduce emissions from a non-compliant coating to less than or equal to those of a compliant coating, and can cause confusion with the preceding requirements in the Rule for a minimum. South Coast AQMD Rule 1124, Antelope Valley AQMD Rule 1124, and Mojave Desert AQMD Rule 1118 do not contain this calculation to determine a required minimum control efficiency for non-compliant coatings. Additionally, installation of a control device to use non-compliant coating(s) would require an Authority to Construct, in which case the District would assess compliance with the requirement to not exceed the emissions from the use of a compliant coating.

Therefore, the District has elected to remove this section from the Rule.

4. *Evaluation of Edwards' coatings: Preliminary analysis shows the average (over 5 years) annual VOC emissions for all coating types covered by rule 410.8 amounts to 2085 pounds of VOC. If all coatings could be replaced by coatings within the new limits, emissions would be 1980 pounds of VOC. With the reduction in VOC limits, Edwards found ~ 120 gallons of use was not compliant. Given the reduction in allowed non-compliant coating from 200 gallons to 50 gallons, the rules as structured would require some form of controls or exemption on 70 gallons of use.*

District Response
The District has revised the proposed low use exemption thresholds to 20 gallons/year per formulation, 200 gallons/year total, which matches the other 3 air Districts within the Mojave Desert Air Basin (Antelope Valley, Mojave Desert, South Coast).

5. Overall comments:

   In cases where compliant materials are not available, research, development, testing and implementation of compliant alternatives is typically a multimillion dollar multiyear effort for aerospace systems. Based on previous material substitution projects (e.g. non-chrome primer, ODS elimination and VOC reductions) compliance is not simply a matter of ordering new compliant materials from manufactures. Please consider these constraints when setting VOC limits and phase-in schedules.

   EKAPCD did a detailed analysis of other district's rules to select the lowest published VOC content as the new standard for EKAPCD. However, when reaching out to aerospace manufactures and military installations in districts with lower VOC limits, we found little to no parallel with the types of aircraft and processes Edwards operates. Therefore we believe some VOC reductions that appear to be achieved in practice (implemented for years in a rule book) may have few to no relevant users. For example the Sacramento metro limits for Electric/Radiation Effect Coating and Electrostatic Discharge/EMI Coating are 600 g/L where all other districts' limits are 800 g/L. Though there are aerospace companies in the Sacramento area, to our knowledge none extensively use these coatings.

   Many Articles tested at Edwards AFB employ low observable (LO) coating systems (Electric/Radiation Effect Coating). These articles have stealth technology because significant reductions in their radar signature make them essentially invisible to radar. Among the methods used to achieve stealth, specially engineered materials that absorb the energy from radar are applied over substrates. These materials are referred to as RAM, or Radar Absorbing Materials. These high-tech coatings reduce the radar cross section (RCS) by absorbing and attenuating the reflection of microwaves.

   RAMs can be classified into two types according to their interactions with radar waves: (i) magnetic absorbers and (ii) dielectric absorbers. RAMs with magnetic absorption employ a magnetic hysteresis effect, which is obtained when particles

like ferrites are used as fillers in a polymeric (paint/coating). Dielectric absorbers depend on the ohmic loss of energy achieved by fillers like carbon, graphite, conducting polymers, or metal particles or powders in a polymeric coatings. Many of these coatings are applied in layers (sometimes referred as stacking) forming a system that attains the desired effects. Within the LO design, each layer has a specific purpose, so in some cases a coating can be formulated with lower VOC content, but other layers with differing requirements in the system cannot. Therefore when evaluating the list of coatings applied to achieve LO please be aware various coatings in this category cannot be substituted for each other.

LO coating systems can be applied to dry film-thickness of as much as 50 mils, (equivalent to a stack of 50 sheets of paper). Adhesion promoters are frequently used to bond one coating to another in the layering process. It is vital the various layers forming an LO system do not delaminate, resulting in the substrate losing its low observable characteristics. An LO delamination can jeopardize the asset's mission and ultimately impact national defense.

There is a wide range of polymers used in radar-absorbing coatings. The choice of materials depends on the type of application. Polyurethanes, epoxy and thermoplastic polymers such as polyphenylene sulphide (PPS) are the preferred material since their mechanical strength, erosion resistance and ability to withstand physical and chemical extremes are excellent. Magnetic absorber RAMs are based on carbonyl iron, spinel ferrites, and hexaferrites. These materials are loaded as fillers in a flexible matrix consisting of elastomeric polymers such as polyisoprene, neoprene, nitrile rubber, silicone, urethanes and fluoroelastomers. The thickness and magnetic properties of these materials are highly controlled.

Dielectric absorbers are obtained from combinations of: (i) rigid or polymeric matrices such as epoxy, phenolic, bismaleimide, polyurethane, polyimide and silicone resins; and (ii) both inorganic (carbon, graphite, titanates, carbides, nitrides, etc.) and organic (conducting polymer) materials. Ensuring the proper adhesion promoter is used with these specialized materials is of the utmost importance. The chemistry and application of the various RAM materials must be maintained to exact film thicknesses to achieve LO characteristics.

Reducing the VOC-content of adhesion promoters would initiate a significant redesign effort to engineer the polymer cure mechanisms in almost every sequence of painting performed on LO assets. This would include complete reformulation and assessment to ensure the materials function and can be applied as needed to support all the activities. Reformulation and subsequent testing can take years.

Accordingly, the U.S. Air Force requests additional provisions to the proposed revision of Rule 410.8 for a military exemption for "mission-critical aerospace". The military exemption is needed because the proposed revision will likely create unacceptable critical mission limitations and delays that would jeopardize national security. The coatings used by the U.S. Air Force for mission-critical aerospace

(i.e., military aircraft and associated deployable support equipment) are formulated to very strict and specific performance standards to meet the military-unique austere performance conditions (e.g., combat situations). For military aircraft the performance standards are detailed in Military Specifications or MIL-SPECs. The Air Force and associated aerospace contractors are obligated to meet all required MIL-SPECs during the initial manufacture, subsequent repair or ongoing preventive maintenance.

The major concern is promulgation of coating limits below current Mil-Spec requirements. Without the use of these carefully formulated MIL-SPEC coatings, mission-critical aerospace (i.e., military aircraft and associated deployable support equipment) could fail during mission activities. Hence, the proposed revision to Rule 410.8 could create unacceptable limitations or delays that jeopardize national security. Therefore, the U.S. Air Force is requesting a military exemption for mission-critical aerospace defaulting to the requirements of the Aerospace NESHAP, 40 CFR 63 Subpart GG for mission-critical aerospace.

Aerospace coatings are much different than most of coatings used on automobiles, architecture, etc. VOC limits currently in place coincide with 40 CFR § 63.745 - Standards: Primer, Topcoat, and Specialty Coating Application Operations, and that the coatings currently being used by the aerospace industry have been formulated to meet the lowest achievable emission limit.

Aerospace coatings are among the most technically advanced as they operate in a very dynamic and hostile environment. These coatings are designed with high-performance to withstand extremes in pressure, temperature, and Mach number. At high altitudes, they also protect surfaces from extreme ultraviolet (UV) contact and prevent corrosion and temperature fluctuations. Military aircraft require specialized protective coatings in order to maintain operational readiness.

District Response

The District has revised the limits to electric and radiation effect coatings and adhesion promotor coatings as requested.

In regard to the request for a “mission critical aerospace” exemption from Rule 410.8 limits that are lower than the NESHAP, several coating category VOC limits in Rule 410.8 have been more stringent than the NESHAP since 2014 (ex. adhesive bonding primers, optical anti-reflective coatings). The District currently allows exemptions from VOC content limits in several coating categories for coatings deemed “classified” by the Department of Defense, and allows for the Control Officer to authorize alternative VOC or vapor pressure limits for coatings, adhesives, or solvents specified in military Technical Orders when viable substitutions are not available. Additional exemptions to those already in in Rule 410.8 could result in an increase in VOC emissions from aerospace coating operations, which would be contradictory to the intent of this rule revision. Additional discussion and assessment of potential emissions will be necessary prior to including this exemption in the rule.

6. Comments specific to rule language:

   On page 16 of the strike out copy of rule 410.8, at (6), the minimum overall capture and control efficiency calculation for VOC controls is presented. In the denominator of the second term the variable Dc is used. Dc is defined as "Density of corresponding solvent, reducer, or thinner used in the compliant coating system." This statement presumes a corresponding compliant coating is available. However for many uses there is no compliant coating system that performs the exact function (if there is, in most cases we would use it). Therefore we recommend removing this calculation and simply requiring control efficiency that results in the pounds of VOC emissions to be at least as low as the VOC standard. For example, if 10 liters of 800 g/L coating material will be used for a category that is regulated to 600 g/L, uncontrolled emissions would be 8 kg of VOC. If 10 L of a compliant coating is used, the emissions would be 6 kg of VOC. Therefore the control device would need to capture at least 2 kg of the 8 kg to be compliant.

District Response
See response to comment 4 from Edwards Air Force Base.

7. *The definitions section lists item LLLL "Touch-Up Operation: The application of Aerospace Materials to repair minor surface damage and imperfections after the main coating process." Edwards' rarely completes a "main coating process". Most assets tested at Edwards arrive with a factory applied coating system and it is only in the course of maintenance (e.g. removing access panels, replacing parts and fastener) that original coatings need repair or "Touch-up".*

   On the other hand Edwards also fabricates and applies coatings to various fixtures and brackets needed in the course of testing. In those cases the coating is not "Touch-up" (and not entitled to an exemption), between these use cases some additional definition would be helpful. Please consider a reasonable area limitation for touchup, doing so would provide an unambiguous limit.

District Response
See response to comment 1 from Edwards Air Force Base.

Lockheed Martin
Lockheed Martin submitted the following written comments regarding Rule410.8 amendments on June 14, 2022

Lockheed Martin Aeronautics Company (LM) reviewed the proposed changes to Regulation 410.8 and we offer the following observations and recommendations as the proposed revisions are a significant change from current regulatory policy and could impact our day-to-day operations.

LM recently acquired All Comp, a facility located in Rosamond and Edwards Air Force Base (EAFB) Air Force Research Laboratory (AFRL). Both locations fall under EKAPCD jurisdiction. LM is committed to investing and further developing these aerospace advance technology operations at both locations. To support aerospace innovation and production, LM recently added new carbon vessel equipment at AFRL and is planning to grow the operation at the Rosamond facility. The Rosamond expansion will involve several new furnaces, new reactors and a spray booth. Overall, LM is excited to promote the economic development of Eastern Kern and will continue to financially invest in the technology and people of Kern County.

Rosamond and AFRL facility growth prospects are tied to Rule 410.8. Operations at Rosamond are an extension of our core Advance Development Programs (ADP) rooted at Palmdale Plant 10. Both facilities will inevitably be working towards manufacturing articles that need to meet the Department of Defense (DoD) military specifications (MIL-SPEC). In our preliminary review of the proposed new VOC limits, we found several to be problematic based on current technology. For example, several of our adhesion promoters, structural non-autoclavable adhesives, and rain erosion resistant coatings would not meet the Rule 410.8 proposed VOC limits.

LM recognizes the District's efforts in comparing the VOC limits between neighboring air districts. However, aerospace industry compliance with more stringent VOC limits requires a significant engineering effort to reevaluate, reformulate and reassess material function and application to flying and non-flying articles. Reformulation and subsequent testing can take years. In addition, there will be requirements to obtain DoD approval before any new material can be applied to an article.

LM recommends EKAPCD not amend the current VOC limits for these coatings. LM will collaborate with the District to identify other contingency measures and offer any additional support as identified by the District.

District Response
The District has revised the VOC limit for adhesion promoters and rain-erosion resistant coatings to current limits; the proposed VOC limit for structural non-autoclavable adhesives has been revised from 250 g/L to 700 g/L, matching the current limit from Mojave Desert AQMD.

NASA Armstrong Flight Research Center (AFRC)
NASA AFRC submitted the following written comments regarding Rule410.8 amendments on June 16, 2022

AFRC routinely performs aerospace coating operations at various locations throughout its Main Campus, located at Edwards Air Force Base. The VOC limits proposed in this rule could impact operations and research at AFRC due to the specific performance standards required by aerospace specifications that are mission essential.

The coatings currently used by AFRC are VOC compliant with the following:

- *Aerospace National Emissions Standards for Hazardous Air Pollutants (NESHAP), 40 CFR Subpart GG;*
- *Antelope Valley Air Quality Management District (AVAQMD) Rule 1124 - Aerospace Assembly and Component Manufacturing Operations;*
- *Eastern Kern Air Pollution Control District (EKAPCD) Rule 410.8 - Aerospace Assembly and Coating Operations,*

VOC limits in place currently coincide with 40 CFR §63.745 – Standards: Primer, Topcoat, and Specialty Coating Application Operations, and that the coatings currently being used by the aerospace industry have been formulated to meet the lowest achievable emission limit. Aerospace coatings are technically formulated to operate in a very dynamic environment.

AFRC is a test bed for aerodynamics research and flying laboratories exploration which requires flying at higher altitudes. These technically formulated aerospace coatings are intended for higher altitudes, to protect the surface from extreme ultraviolet (UV) contact and prevents corrosion and temperature fluctuations. These coatings are applied to many sections of an aircraft, including the fuselage frame, wing frame, and tail frame.

Due to technical requirements needed by the aerospace industry, lowering the VOC limits for certain coatings may impact their formulation which could result in decreased performance and potential safety concerns.

AFRC requests that VOC limits currently listed in Rule 410.8 remain the same.

If these contingency measures go into effect, the current approach to lower the VC limits needs to be reassessed to consider the time needed to adjust operations and meet the provisions outlined in the rule. Because these proposed VOC limits are adopted form several different air Districts, a gradual approach, or phase-in option, is necessary for industries throughout the Eastern Kern Air Pollution Control District to adapt to the proposed limits.

District Response
The District has revised the phase-in period for categories with proposed lower VOC content limits from 60 days to 18 months.

Northrop Grumman
Northrop Grumman submitted the following written comments regarding Rule410.8 amendments on June 3, 2022

Currently, NGC performs aerospace coating operations at the Mojave Air & Space Port. The proposed Volatile Organic Compound (VOC) limits to the rule could impact NGC. The coatings currently used by NGC are VOC compliant with the following:

- *Aerospace National Emissions Standards for Hazardous Air Pollutants (NESHAP), 40 CFR Subpart GG;*
- *Antelope Valley Air Quality Management District (AVAQMD) Rule 1124 - Aerospace Assembly and Component Manufacturing Operations;*
- *Mojave Desert Air Quality Management District (MDAQMD) Rule 1118 - Aerospace Assembly, Rework and Component Manufacturing Operations, and*
- *South Coast Air Quality Management District (SCAQMD) Rule 1124 – Aerospace Assembly and Component Manufacturing Operations*

Lowering the VOC limits would essentially create a new Maximum Achievable Control Technology (MACT) Floor for aerospace coatings.

In 2017, NGC, along with other major aerospace companies worked closely with the Environmental Protection Agency (EPA) to develop Control Techniques Guidelines and Alternative Control Techniques Documents for Reducing Ozone — Causing Emissions. The aerospace industry worked cooperatively with the EPA's Risk and Technology Review (RTR) team in the development of organic and inorganic emissions from specialty coating application operations at aerospace facilities.

Coatings used by the aerospace industry are formulated to very strict and specific performance standards. For military aircraft the performance standards are detailed in Military Specifications or MIL-SPECs. Aerospace contractors are obligated to meet all required MIL-SPECs during the initial manufacture, subsequent repair or ongoing preventive maintenance. One area of concern is how the proposed coating limits compare with current Mil-Spec requirements. NGC is very concerned that our customer will be requiring the use of Mil-Spec approved materials that will become non-complaint with the revision of your rule.

The District proposes lowering the VOC limit for Electric or Radiation Effect Coatings (ERECs). The development of the ERECs used today took many years to formulate and were developed with the existing 800 grams per liter VOC limit in mind. Lowering the regulatory limit to 600 grams per liter could result in many of the EREC coatings becoming noncompliant. Lowering the VOC limits would require a large effort to reformulate and qualify replacement coatings at significant cost with limited emission reductions.

NGC requests that the VOC limit currently listed in Rule 410.8 not be changed.

District Response

The District concurs with NGC on electric and radiation effect coatings, and has revised the Table of Standards per suggestion.

Stratolaunch
The Stratolaunch representative at the workshop asked:
“Does the 3.50 ton per year emission threshold requiring a VOC control device to be installed apply on a facility wide basis?”

District Response
The 3.50 ton per year threshold would be on a per operation (i.e. per permit) emission basis, not a facility wide basis.

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APPENDIX C:

PROPOSED REVISION RULE 410.8

AEROSPACE ASSEMBLY AND COATING OPERATIONS
COST EFFECTIVENESS ANALYSIS

Step 1: Determining Amount of Carbon Required

$M_c = M_{cl} \times f$
$M_c, M_{cl} = amount\ of\ carbon\ required\ (lb)$
$f = extra\ capacity\ factor\ (dimensionless)$

$M_{cl} = \frac{m_{voc}}{w_c}\theta_A$
$M_{cl} = amount\ of\ carbon\ required\ (lb)$
$m_{voc} = maximum\ VOC\ inlet\ loading\ \left(\frac{lb}{hr}\right)$
$\theta_A = adsorption\ time$
$w_c = working\ capacity$

$f = \left(1 + \frac{N_D}{N_A}\right)$
$N_D = \#\ of\ desorbing\ carbon\ beds\ during\ coating\ operations$
$N_A = \#\ of\ adsorbing\ carbon\ beds\ during\ coating\ operations$

Maximum estimated VOC emissions: 100 lb/hr (District permits/evaluations)
Maximum daily time spent in adsorption: 16 hours (conservative estimate)
Working capacity of carbon: 0.25 (SMAQMD BACT analysis for aerospace coating)

$M_{cl} = 100\frac{lb}{hr} \times \frac{1}{0.25} \times 16\ hr = 6{,}400\ lb\ carbon$

Carbon canisters are desorbed outside of operating hours; N_D=0, f=1

$M_c = 6{,}400\ lb \times 1 = 6{,}400\ lb$

Carbon Cost: $3.70 (Comment letter on SMAQMD BACT Determination, CPI adjusted to 2022)

Carbon Life: 5 Years

Step 2: Total Capital Investment

Direct Costs

Carbon Canister options (from EPA Cost Control Manual, Section 3.1, Chapter 1, p. 1-26)

Canister Size (lb carbon)	Maximum Flow Rate (cfm)	Canister Type	2018 Price ($)		2022 CPI Adjusted Price ($)	
			Virgin Carbon	Reactivated Carbon	Virgin Carbon	Reactivated Carbon
1,000	600	Epoxy-Lined Steel	6,600	-	7,486	-
1,000	1,000	Epoxy-Lined Steel	11,500	7,000	13,044	7,940
2,000	2,000	Epoxy-Lined Steel	19,000	10,000	21,551	11,343
2,000	750	Carbon Steel	22,000	13,200	24,954	14,972
3,000	2,000	Epoxy-Lined Steel	13,900	-	15,766	-
4,100	8,000	Polypropylene	45,000	-	51,042	-
5,000	2,500	Carbon Steel	42,600	20,100	48,320	22,799
8,000	4,500	Carbon Steel	66,000	30,000	74,862	34,028
10,000	18,000	Polypropylene	94,500	-	107,188	-

Number of Canisters Needed

Canister Size (lb carbon)	Maximum Flow Rate (cfm)	Canister Type	# of canisters	Cost ($)
1,000	600	Epoxy-Lined Steel	7	52,403
1,000	1,000	Epoxy-Lined Steel	7	91,308
2,000	2,000	Epoxy-Lined Steel	4	86,204
2,000	750	Carbon Steel	4	99,815
3,000	2,000	Epoxy-Lined Steel	3	47,299
4,100	8,000	Polypropylene	2	102,084
5,000	2,500	Carbon Steel	2	96,639
8,000	4,500	Carbon Steel	1	74,861
10,000	18,000	Polypropylene	1	107,188

Instrumentation: 10% of equipment cost (EPA cost Control Manual, Section 1, Ch. 2, p. 26)
Freight: 10% of equipment cost (EPA cost Control Manual, Section 1, Ch. 2, p. 26)
Sales Tax: 10.5% (Los Angeles, CA)
Handling & Erection: 14% of equipment cost (EPA cost Control Manual, Section 3.1, Ch. 1, p. 26)
Piping: 2% of equipment cost (EPA cost Control Manual, Section 3.1, Ch. 1, p. 26)
No site prep, buildings, foundation/supports, electrical, insulation, or painting required for canister units

Indirect Costs
Engineering: 10% of equipment cost (EPA cost Control Manual, Section 3.1, Ch. 1, p. 26)
Construction/Field Expenses: 5% of equipment cost (EPA cost Control Manual, Section 3.1, Ch. 1, p. 26)
Start-up: 2% of equipment cost (EPA cost Control Manual, Section 3.1, Ch. 1, p. 26)
Performance Test: 1% of equipment cost (EPA cost Control Manual, Section 3.1, Ch. 1, p. 26)
Contractor Fees: 10% of Direct + Indirect costs
Contingencies: 40% (conservative to account for retrofit)

Purchased Equipment	$47,299
Instrumentation	$4,729
Freight	$4,729
Sales Tax	$4,966
Handling & Erection	$6,621
Piping	$945
Direct Costs	$69,293
Engineering	$4,729
Construction/Field Expenses	$2,364
Start-up	$945
Performance Test	$472
Indirect Costs	$8,513
Contractor Fees	$7,780
Contingencies	$31,122
Total Capital Investment (TCI)	$116,710
Interest Rate	0.04
Equipment Life (Years)	10
Capital Recovery Factor (CRF)	0.1233
Capital Recovery Cost (CRC)	$14,389

Step 3: Annual Costs

Direct Annual Costs
Labor wage- $20.55/hr (Bureau of Labor Statistics Occupation Code: 51-9122)
Operator Labor – 0.5 hr/shift, 1 shift/day, 260 days/yr (130 hr/yr)
Material cost same as labor (SMAQMD BACT Analysis)
Booth fan motor size increase needed: 10-hp
0.746 kW/hp
Fan operating hours/year – 2,080
$/kW – 0.1341

Indirect Annual Costs
Overhead - $3,586 (SMAQMD BACT Analysis, CPI adjusted to 2022)
Administrative Charges: $231 (SMAQMD BACT Analysis, CPI adjusted to 2022)
Property Tax: $115 (SMAQMD BACT Analysis, CPI adjusted to 2022)
Insurance: $115 (SMAQMD BACT Analysis, CPI adjusted to 2022)

Annual Costs	
Labor	$2,671
Material	$2,671
Electrical	$2,080
Total Direct Annual Costs	$7,423
Overhead	$3,586
Administrative Charges	$231
Property Tax	$115
Insurance	$115
Total Indirect Annual Costs	$4,047

Step 4: Total Annual Cost

Capital Recovery Cost (CRC)	$14,389
Direct Annual Costs	$7,423
Indirect Annual Costs	$4,047
Carbon Replaced (lb)	9,000
Carbon Replacement Cost	$33,300
Total Annual Cost	**$66,583**

Step 5: Cost Effectiveness

Cost Effectiveness Threshold (per ton, SJVAPCD)	$22,600
Tons of VOC Reduction to be Cost Effective	2.95
Overall VOC Control Efficiency (Rule 410.8)	85.5%
Uncontrolled Emissions (tons/year)	3.45

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