

Draft Staff Report for

PROPOSED RULE 1144 – LUBRICANTS, METAL WORKING FLUIDS AND RUST INHIBITORS

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APPENDIX A – Lubricant, Metal Working Fluid and Rust Inhibitor VOC Content Test Results

EXECUTIVE SUMMARY

Proposed Rule 1144 is designed to reduce VOC emissions from the use of lubricants, metal working fluids and rust inhibitors used at industrial facilities during the manufacturing and assembly process of parts and products.

Lubricants, metal working fluids and rust inhibitors are categorized under miscellaneous solvent operations. A direct-contact lubricant is a fluid that comes into direct contact with the product or part during manufacturing or assembly to reduce heat and friction and to prolong the life of tools and machinery. A metal working fluid improves product quality and carries away debris. A rust inhibitor prevents or protects metal surfaces from corrosion.

Most direct-contact lubricants, metal working fluids and rust inhibitors are currently subject to Rule 442 - Usage of Solvents, which addresses VOC emissions from VOC-containing materials that are not subject to VOC limits in any Regulation XI rule. A small subset of aerospace fastener lubricative coatings are subject to Rule 1124 – Aerospace Assembly and Component Manufacturing Operations. Although the California Air Resources Board (CARB) regulates consumer lubricants, currently, no other local, state or federal regulations or emissions restrictions specifically pertaining to industrial lubricants, metal working fluids or rust inhibitors.

The proposed rule will apply to VOC emissions from steel tube and spring manufacturers, steel mills, aerospace manufacturers, automobile part manufacturers and rebuilders and machine shops including broaching, drilling, drawing, forging, grinding, heading, honing, milling, stamping, tapping, thread cutting and turning operations.

Staff proposes the following requirements for Proposed Rule 1144:

- Establish a VOC limit of 50 grams per liter (g/l) of material for vanishing oils and lubricants used in direct contact with parts and products during manufacturing and assembly, effective January 1, 2010. Establish VOC limits of 200 g/l of material for spindle machine oil and 200 g/l for general metal working fluids effective January 1, 2012. Establish a VOC limit of 300 g/l of material for rust inhibitors effective January 1, 2010, with a further reduction to 50 g/l effective January 1, 2012.
- Prohibit the sale of non-compliant lubricants and rust inhibitors. Exceptions are made for fluids subject to CARB consumer products regulation found in Title 17 of the California Code of Regulations, beginning at Section 94507, and viscosity additives reported to the District.
- Allow lubricants, metal working fluids and rust inhibitors manufactured prior to the appropriate effective date to be sold or applied for six months.
- Require containers for lubricants, metal working fluids and rust inhibitors to display the date of manufacture and VOC content as supplied and after recommended dilution.
- Exempt certain applications, including lapping, sinker electrical discharge machining (EDM), high profile aircraft corrosion inhibitors and aerosol aerospace rust inhibitors where alternative low-VOC formulations are not available. Exempt rust inhibitors subject to a military specification, military standard or Product Part Approval Process (PPAP) as well as consumer products from VOC limits until January 1, 2011.
- Exempt consumer products from the labeling requirements.

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If approved, the proposed rule amendments will fully implement control measure CTS-01 in the 2007 Air Quality Management Plan. The resolutions to the rule will include a technology review one year prior to the January 1, 2012 general metal working fluid limit.

As proposed, the rule will reduce emissions by 3.32 tons per day with an estimated annualized cost of \$9.0 million dollars. The overall cost-effectiveness of the proposed rule is conservatively estimated to be \$7,427 per ton of VOC emissions reduced.

BACKGROUND

Nationally, some 1.2 million workers are employed in machine finishing, machine tooling, and other metalworking and metal-forming operations that lubricant, metal working fluids and rust inhibitors. In its Fabricated Metal Sector Notebook (1995), EPA estimates 10.2 percent of the fabricated metal industry are located in California. According to listings in the California Manufacturers Register, the South Coast Air Basin accounts for approximately 70 percent of the industry in California. In 2008, there are more than 12,000 machine shops in the 4 county area serviced by AQMD. Of these machine shops, the U.S. Census (2002) estimates that 88 percent have fewer than twenty employees. Typical industries using lubricants, metal working fluids and rust inhibitors include:

- Aerospace
- Machine Shop (Job Shop)
- Steel Mills
- Auto Rebuild
- Screw Machine
- Steel Tubes (Pipes)
- Steel Springs
- Captive

Captive machine shops are machine shops located inside of another type of business (aerospace, automotive, etc.) that supports the business but are not the primary aspect of that business.

Metal working shops tend to be small businesses that generally do not use paints, coating, inks or adhesives, routinely use very low VOC content cleaning solvents, and have limited interaction with the AQMD. Rule 219 – Equipment Not Requiring a Written Permit Pursuant to Regulation II, exempts machining equipment that use lubricants, metal working fluids and rust inhibitors with VOC contents less than 50 grams per liter (g/l) or a VOC composite partial pressure of 20 mm Hg. Nearly all lubricants, metal working fluids and rust inhibitors, including those with a high-VOC content, have a VOC composite of 5 mm Hg or less. Thus metal working shops rarely have permits with the District. Typical operations include:

- Broaching – Gear manufacturing utilizing keyway, slots or spline.
- Drilling – Producing cylindrical holes
- Drawing – Forming flat sheet metal into “cup-shaped” parts. If the depth of the formed cup is equal to or greater than the radius of the cup, the process is called deep drawing.
- Forging – Shaping metal by using localized compressive forces. Cold forging is done at room temperature or near room temperature. Hot forging is done at a high temperature, which makes metal easier to shape and less likely to fracture. Common forging processes include: roll forging, swaging, cogging, open-die forging, impression-die forging, press forging, automatic hot forging and upsetting.
- Grinding – Producing a fine finish using an abrasive wheel or belt.

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- Heading – A metal forging process that involves rapidly punching a blank into a die to form a desired shape without adding heat. Cold heading is most frequently used to produce fasteners such as bolts and screws without adding heat.
- Honing – Manufacturing of precision bores to improve the geometry, surface finish and dimensional control of the finished part.
- Milling – Cutting using a precisely controlled rotating cutter which rotates about the spindle axis and a table to which the workpiece is affixed. The cutter and workpiece move relative to each other, generating a toolpath along which material is removed.
- Rust Preventative/Inhibitor – Preventing corrosion on ferrous materials and some nonferrous materials
- Stamping – Punching sheet metal strips using a press tool which is loaded on a press to form the sheet into a desired shape.
- Tapping – Creating threaded holes in parts or boring into parts and pipelines
- Threading – Thread cutting and thread rolling applications for pipes and bolts
- Turning – Producing cylindrical parts
- Wire drawing – Reducing or changing the diameter of a wire or rod by pulling the wire or rod through a single or series of drawing die(s).

Lubricants, metal working fluids and rust inhibitors are complex mixtures of oils, emulsifiers, anti-weld agents, corrosion inhibitors, extreme pressure additives, buffers (alkaline reserve), biocides, and other additives. Some products contain extreme pressure (EP) additives containing chlorinated, sulfurized, or phosphorus-type extreme pressure ingredients. There are numerous formulations, ranging from straight oils (such as petroleum oils) to water-based fluids, which include soluble oils and semi-synthetic/synthetic fluids. In general, higher oil content provides better lubricity while higher water content allows more rapid cooling.

- **Straight oil (neat oil) fluids** are refined petroleum or vegetable oils. Straight oils are not designed to be diluted with water.
- **Soluble oil (emulsifiable oil) fluids** are combinations of 30 percent to 85 percent straight oils and emulsifiers that may include other performance additives. Soluble oils are diluted with 5 to 40 parts water.
- **Semi-synthetic fluids** contain a lower amount of straight oil in the concentrate (5 percent to 30 percent), more emulsifiers, and 30 percent to 50 percent water. The concentrate is further diluted with 10 to 40 parts water.
- **Synthetic fluids** contain no petroleum oils and may be water soluble or water dispersible. The synthetic concentrate is diluted with 10 to 40 parts water.

In preparation for potential rule making activity, the AQMD and U.S. EPA Region IX co-sponsored a report by the Institute for Research and Technical Assistance to identify, test and demonstrate alternative low-VOC materials for vanishing oils and rust inhibitors. Completed in 2006, the report, Assessment, Development and Demonstration of Alternatives to VOC-Emitting Lubricants, Vanishing Oil and Rust Inhibitors concludes that “alternative low-VOC materials for a variety of different types of metal working operations are available and cost effective.” Thirteen facilities participated in the study that reviewed stamping, honing, cutting, forming and rust inhibitor applications. In each high-VOC application, a low-VOC alternative was demonstrated to have equivalent performance. Some of the participants found that their cost increased with the alternatives, but the majority realized a cost-savings.

PROPOSED RULE

Staff proposes the following requirements for PR 1144:

Purpose and Applicability

The purpose of the proposed rule is to reduce VOC emissions from lubricants, metal working fluids and rust inhibitors used at industrial facilities during manufacturing operations where the fluids come in direct contact with the parts and products. Such operations will include metal working or metal removal activities during the manufacturing and assembly of products and goods. Examples of these activities include, but are not limited to, broaching, drilling, drawing, forging, grinding, heading, honing, milling, stamping, tapping, thread cutting, turning and wire drawing. Fluids used for rust and corrosion prevention and inhibition during manufacturing and assembly of products and goods are also included.

The proposed rule is not intended to regulate the use of lubricants or rust inhibitors for commercial, institutional or household use. Repair and maintenance activities are also not subject to the rule unless the parts on which the fluids are applied are resold. For example, parts taken from machinery or vehicles that are repaired using fluids and then placed back into the same machinery or vehicles are not covered by the rule. Likewise, general maintenance and rust inhibition of buildings, vehicles or equipment are not subject to the rule. Examples include motor oil, elevator grease, and care and maintenance of door hinges. Finally, lubricants that do not directly come into contact with parts and products during manufacturing, such as turbine oil, enclosed spindle oil and hydraulic fluids are not subject to the rule.

Operations and substances already subject to VOC limits in Regulation XI will not be subject to the limits, labeling requirements and prohibition of sales proposed in this rule. Such substances include solid film lubricants, dry lubricative materials and barrier coatings subject to Rule 1124. Paints and coatings intended to completely cure and leave a solid, permanent film to beautify and protect metal surfaces are subject to other coating rules in Regulation XI and are not subject to this rule. Examples include aerospace, architectural, auto body, and metal paints and coatings where applicable VOC limits are in Rules 1113 – Architectural Coatings, Rule 1124, Rule 1151 – Motor Vehicle and Mobile Equipment Non-Assembly Line Coating Operations and Rule 1107 – Coating of Metal Parts and Products, respectively.

A prohibition of sale is included in the rule. Thus, the proposed rule also applies to anyone who manufactures for use, supplies, solicits, sells or offers for sale lubricants and rust inhibitors subject to the rule. The prohibition of sale will not apply to fluids sold as viscosity additives provided that they are reported to the District. Reporting requirements include the name of the product, volume sold, date of delivery, calculated VOC content after recommended dilution and the purchasing facility's name, address and contact person. Consumer products subject to the CARB consumer products regulation found in Title 17 of the California Code of Regulations, beginning at Section 94507, are also exempted from the prohibition of sale. As noted above, the use of lubricants, metal working fluids and rust inhibitors in households and general maintenance of buildings, vehicles or equipment is also not subject to this rule. But, consumer product lubricants and rust inhibitors used during manufacture and assembly of products and goods are subject to this regulation, effective January 1, 2011; facilities using such products must meet the applicable VOC content limits.

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Requirements

The proposed rule will establish a VOC limit of 50 g/l of material for vanishing oils and lubricants that are in direct contact with parts and products during manufacturing and assembly, effective January 1, 2010. General metal working fluids must meet a 200 g/l limit effective January 1, 2012. Spindle machine oils will be allowed to meet a 200 g/l VOC limit. This will allow the continued practice of oil recycling where light oil viscosity additives are used to reduce viscosity and avoid excessive oil disposal. The proposed rule will also establish a VOC limit of 300 g/l of material for rust inhibitors effective January 1, 2010 with a further reduction to 50 g/l effective January 1, 2012. The VOC content limits apply to the fluids as they are used, including dilution. Water or exempt solvents are included when calculating material volume. Thus, a lubricant concentrate with a VOC content of 75 g/l that is diluted with water at a ratio of two parts water to one part lubricant concentrate (2:1) would have a VOC content of 25 g/l. Many soluble, semi-synthetic and synthetic metal working fluids are heavily diluted with water when used. Typical dilution ratios range from five parts water to one part metal working fluid concentrate to 40 or more parts water to one part concentrate. Evaporation and contamination during use will cause the VOC content to fluctuate. Manufacturers and suppliers believe the fluctuation could be as high as 30 percent. This could cause fluids with 25 g/l VOC content to increase to nearly 35 g/l VOC content without regular monitoring. Monitoring the fluid beyond what is necessary to facilitate proper operating parameters will increase labor costs.

An estimated 89 percent of lubricants and metal working fluids have a VOC content of 200 g/l of material or less after dilution. The soluble, semi-synthetic and synthetic metal working fluids have low VOC because of the high water content of those fluids. However, many straight oils have low VOC because they are essentially non-volatile. Laboratory testing showed that 19 of 21 metal working fluid samples had VOC contents that would meet the proposed limit. The results are summarized in Table I.

Table I – Laboratory Results for Lubricants

Type	VOC Results Method 313
Coolants	141* - 210* g/l
General Lubricants	<30 – 78 g/l
Cutting/Grinding Metal Working Fluids	
Cold heading	29* g/l
Cutting	<60 – 172 g/l
Grinding	<90 – 172* g/l
Machining	<112 – 179* g/l
Milling	71 g/l
Stamping (Vanishing)	527 - 729 g/l

*Before dilution

Low-VOC products are available, and in most cases exclusively used for broaching, drilling, drawing, forging, heading, honing, milling, tapping, threading, turning and wire drawing. Most cutting and grinding applications also use low-VOC products as well as nearly all coolants and lubricants.

Light Oils

Light oils with viscosities lower than 20 centistokes at 40°C and stamping oils are likely not to meet the proposed limits. In addition to being used as viscosity additives, light oils are used as lubricants for older high speed spindle machines and as metal working fluids for other

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applications. Newer spindle machines use heavily water-diluted products and are designed to be resistant to water corrosion while older machines are not. Older machines will need reformulated alternatives to the light oil they currently use in order to meet the proposed VOC limits, provide sufficient lubricity and cooling properties, remain low in viscosity and provide corrosion resistance to the machinery. Cutting fluids will also need to be reformulated for use during high precision aluminum parts machining. Such fluids include synthetic and vegetable ester products. Alternatively, heavier oils that are non-volatile could be substituted. Based on discussions with industry, and recognizing the use of light oils as metal working fluids, the implementation dates have been delayed to January 1, 2012.

Vanishing Oils

Vanishing oils are designed to evaporate off quickly leaving no residue. They are typically comprised primarily of solvent such as kerosene or mineral spirits and commonly are just the neat solvent themselves. Conventional vanishing oils have VOC contents ranging from 600 g/l to 750 g/l. Vanishing oils leave a light coating of lubricant on the part during processing and then evaporate shortly thereafter. They need to provide enough lubricity to prevent machinery and parts from seizing, but they provide very little protection to tooling. They are used because they evaporate and later cleaning operations are unnecessary. Vanishing oils should not leave behind tacky or gummy residues. Because parts on which vanishing oils are applied are not cleaned afterwards, the vanishing oil must not encourage corrosion and may even provide some small amount of corrosion protection.

Alternatives to high solvent content vanishing oils include water-dilutable metal working fluids and straight oils. Water-dilutable metal working fluids used in a vanishing oil applications have sufficient rust preventative compounds to protect parts when the water evaporates. They provide sufficient lubricity but, like traditional vanishing oils, provide little tooling protection. Because they are so dilute, they evaporate leaving a dry, light protective film that is not tacky or gummy. Parts machined in this manner were found to have similar or superior corrosion protection to parts machined with vanishing oil, and did not require subsequent cleaning according to an AQMD co-sponsored report, "Assessment, Development and Demonstration of Alternatives to VOC-Emitting Lubricants, Vanishing Oils and Rust Inhibitors." The high water content of the water-dilutable metal working fluids used in these applications makes them less expensive than vanishing oils.

Use of a straight oil as a vanishing oil alternative could also provide acceptable results in certain situations. There would be little if any evaporation, but the residue would not be tacky or gummy and corrosion protection would be excellent. Cleaning would be required, however, and would increase to some extent, facility's processing cost. Therefore, with consideration for the numerous compliant alternatives available, the proposed limits for vanishing oils have an implementation date of January 1, 2010.

Rust Inhibitors

The rule will limit rust inhibitors, including rust preventatives and corrosion inhibitors, to a VOC content of 300 g/l or material by January 1, 2010, with further reductions to 50 g/l of material in 2012. Some facilities use rust inhibitors that are nearly identical in composition and VOC content to vanishing oils. Metal parts are coated, usually by dipping or application by rag, with a formulation of solvent such as mineral spirits or kerosene that may also contain small amounts of heavier oils and/or wax. The solvent evaporates away, leaving behind a small amount of heavier oil, wax or trace amounts of the solvent that coats the metal surface with a water repellent or

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protective layer. The heavier oils and wax provide much more protection than does the evaporated solvent.

Water-based rust inhibitors have very low VOC content after dilution and are formulated to leave behind a nearly invisible protective coating after the water evaporates. The protective coating is soluble in water but still protects steel, cast iron, and other ferrous parts from in-plant corrosion and outdoor shipping environments. An added benefit of the coating is that it can be easily removed using mild aqueous cleaners if required. Water-based rust inhibitors are comparable in price to the solvent-based rust inhibitors.

Alternative lower VOC straight oil rust inhibitors coat a metal surface with an oil that rejects water. Over a long time the oil may thicken into a nearly solid protective coating. These products provide excellent long-term protection and while they have a higher cost per gallon, they are superior in quality to most high VOC products. Straight oil rust inhibitors may contain small amounts of solvents, and the VOC content of such products tested ranges from less than 25 g/l to 266 g/l. Laboratory testing results of rust inhibitors is summarized in Table II.

Table II – VOC Content of Rust Inhibitors

Cleaner/Rust Inhibitor	<25 – 760 g/l
Consumer/General	514 g/l
Rust Inhibitor	<10 – 266 g/l
Rust Inhibitor/Stamping	51* - 125 g/l

*Before dilution

A use and sell-through provision has been included in this rule that will allow products manufactured before the effective date of the rule to be sold and used for up to six months after the effective date. This will allow manufacturers, suppliers and users to deplete their existing inventories. To facilitate this provision, manufacturers and suppliers will be required to display the date or a date code of manufacture on the container beginning January 2010.

Sale in the AQMD of lubricants, metal working fluids and rust inhibitors, is prohibited unless the lubricants, metal working fluids and rust inhibitors meet the VOC limits of this rule. The prohibition will not apply to products sold in this District for shipment outside of this District or for shipment to other manufacturers for repackaging. It will also not apply to fluids subject to CARB consumer products regulation, as set forth in Title 17 of the California Code of Regulations, beginning at Section 94507. Finally, a provision has been included to allow the sale of light oils used as viscosity additives in order to support recycling oil used in spindle machines, thereby minimizing the use of virgin material and lowering the cost for users. Manufacturers and distributors utilizing this provision must report the name of the additive, volume sold, date of delivery, calculated VOC content after recommended dilution, and the purchasing facility's name, address and contact person. These provisions will help to redirect the burden of determining the compliance status of products from the machine shops and other users to the manufacturers and suppliers who are more familiar with VOC determination.

In addition to displaying the date of manufacture on the container, the container must also display the maximum VOC content (1) as supplied and (2) after dilution as recommended by the manufacturer. The prohibition of sale will apply to manufacturers and suppliers who manufacture for use, sell, offer for sale or distribute directly. Manufacturers that sell products through independent distributors may be able to discharge liability under this provision, provided

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they forewarned the independent distributors in writing about the compliance status of the product. However, independent distributors will be subject to the prohibition of sale.

A provision has been included that allows a facility, if it so chooses, to use high-VOC lubricants and rust inhibitors where the emissions are vented to a control device that has a capture efficiency of 90 percent or more on a mass basis and a control efficiency of 95 percent or more on a mass basis, or to a maximum 5 ppm VOC by volume from the exhaust. While it is very unlikely that any facility will install a control device just to meet the proposed rule, some facilities already have control devices that control emissions from work areas that contain lubricants or rust inhibitors. In those instances, the emissions are already being reduced and further restrictions are unnecessary.

Recordkeeping Requirements

Many of the facilities subject to the provisions of this rule are small businesses with limited interaction with the District. Those small facilities with operations and equipment that do not use paints, coatings, solvents or adhesives and do not require permits with the District are unlikely to have had experience in keeping daily records. Rule 109 – Recordkeeping for Volatile Organic Compound Emissions requires stationary sources using VOC containing materials to keep records to determine rule applicability and rule compliance. Records are usually required on a daily basis, but for most of the product categories the material VOC content of products in use are below 50 g/l. Products with VOC contents, after applicable dilution, of less than 50 g/l are “Super Compliant Materials” and qualify for exemption from recordkeeping at facilities that do not exceed four tons of VOC emissions in any calendar year, determined by annual recordkeeping. Facilities that emit more than four tons of VOC annually may qualify for the monthly recordkeeping option.

Test Methods and Procedures

While there is no formal regulatory requirement to use a particular test method for determining VOC content of lubricants, metal working fluids or rust inhibitors, the default method used is U.S. EPA Reference Method 24 (Method 24). Method 24 was designed to determine the VOC content of coatings and inks only. It was not intended to be used for the fluids addressed in this proposed rule, though there is no other U.S. EPA approved test method other than Method 24 for them. Method 24 determines the VOC content of a product by measuring the water and the non-volatile fraction. The remainder is considered VOC (less exempt solvents). The non-volatile fraction is determined by placing the sample in a forced air oven at 110°C for sixty minutes. Duplicate samples are run to validate the results.

An alternative method is SCAQMD Method 313 – Determination of Volatile Organic Compounds (VOC) by Gas Chromatograph/Mass Spectrometry (GC/MS) originally approved for use in 1991. The principle of this U.S. EPA-approved method is to inject a liquid sample into GC/MS and sum the concentrations of the individual compounds. The oven is initially at 50°C and kept there for five minutes. It is ramped up 15°C per minute until the sample reaches 200°C. It is then held at 200°C for fifteen minutes. The total specified sampling period is 30 minutes, and previous testing has indicated that methyl palmitate elutes at the 30 minute mark. All compounds, besides water and exempt solvents, that elute prior to methyl palmitate are considered to be VOC.

The District has revised the test method, SCAQMD Method 313L – Determination of VOC Hydrocarbon Compounds in Lubricants, primarily to accommodate equipment changes. The

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column type (DB624) and length of column (30 meters) have changed, thereby changing the times when various peaks appear. However, the order of the peaks remains unchanged and methyl palmitate will continue to be used as the marker compound defining volatility. The temperature in the GC oven will continue to be raised after the methyl palmitate peak is reached until the entire sample elutes. Only peaks that occur at or before the methyl palmitate peak are considered when determining VOC content by quantifying the peaks using a Flame Ionization Detector (FID). By specifying the column type and length, the flow and temperature may be varied without altering the VOC content results as long as the methyl palmitate marker compound is identified. This would be useful when trying to further resolve peaks especially when water or exempt compounds are present. The revised protocol is referred to as a GC/FID method. Method 313L has been used extensively for low-VOC solvents and consumer products certified by the AQMD in its Clean Air Solvent and Clean Air Choices Cleaner certification programs. The results from the certification program have shown the method to be reliable and accurate for both high water content and heavy oil products.

In an effort to evaluate the VOC content, various samples were initially tested using Method 24. For high VOC fluids such as vanishing oils and high solvent content rust preventatives with VOC contents well above 50 grams/liter, reproducible results were easily attainable. However, the non-volatile portion of low vapor pressure metal working fluid samples failed repeatability requirements over three separate tests. Therefore, the results of the Method 24 testing for these samples were not acceptable. The same samples were tested using Method 313L and the results were repeatable. Table III compares the samples that were tested using both test methods. Method 313L yielded comparable VOC content results for high VOC lubricants and much lower VOC contents for low volatility lubricants.

Table III – Comparison of Results by Test Method

Type	Application	Results Method 24	Results Method 313
Straight	Vanishing / Stamping	740 g/l	750 g/l
Straight	Machining / Grinding	120 g/l*	<25 g/l
Straight	Machining / Grinding	170 g/l*	180 g/l

*Failed repeatability requirements

Because of its improved accuracy and repeatability, Method 313L using the alternative column and GC/FID will be used to determine VOC content for the proposed rule and the final protocol for testing has been released to the public. Aqueous metal working fluid samples were tested neat and at the recommended dilution ratio to verify that the method would provide consistent results at very low VOC content levels. The results, indicated in Table IV, demonstrate that Method 313L provides sufficiently accurate results.

Table IV – Dilute Sample Results

Sample ID (Dilution ratio)	Neat	Predicted	Tested
Sample 001 (8%)	20 g/l	2 g/l	2 g/l
Sample 002 (10%)	140 g/l	14 g/l	10 g/l
Sample 003 (20%)	140 g/l	28 g/l	8 g/l

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Test methods to determine flash point and the capture and control efficiency of a control device are also included.

Exemptions

Some highly specialized applications have been exempted from the proposed regulation. Lapping and sinker EDM are small usage applications (less than 0.01 and 0.03 tons per day of VOC emissions, respectively) where alternative low-VOC formulations have not been identified. Rust inhibitors and direct-contact lubricants used on assembled aircraft and avionics will also be exempted. These fluids provide protection for flight instruments and major aircraft structures including upper edge floor beams, wheel wells, pressure decks and center wing sections. VOC emissions from these aerospace direct-contact lubricants and corrosion inhibitors are less than 0.002 ton per day. Finally, small very specialized operations conducted on space vehicles components, where fluids may adsorb into coatings and adhesives and then off-gas when the spacecraft reaches outer space, will also be exempted.

An exemption that expires January 1, 2011 has been included for rust inhibitors used in association with military specifications, military standards, Department of Defense documents or Production Part Approval Processes. Based on feedback from industry, especially end-users, additional time is necessary to conduct replacement trials, determine customer acceptability and to make changes to military specifications and/or PPAP specifications.

Exemptions for consumer products to the rule's labeling requirements and sales prohibition are included in the proposed rule. These products are already subject to Title 17 of the California Code of Regulations, beginning at Section 94507, also known as the California Consumer Product Regulation. The California Consumer Product Regulation includes statewide labeling requirements and a sales prohibition for consumer products, and the proposed rule will not add further requirements. The use of these products during the manufacture and assembly of products and parts, will also be exempted until January 1, 2011. Afterwards, consumer products used during manufacturing and assembly must meet the same VOC limits as industrial products. From a survey done of local machine shops, there will be a one year delay in approximately 0.007 tons per day of VOC emissions.

Lubricants, metal working fluids and rust inhibitors used in a controlled environment, where emissions are captured by a control device, are not subject to the VOC limits nor are they subject to the rule's prohibition of sales provision. Likewise, lubricants, metal working fluids and rust inhibitors manufactured or sold for use outside the District will not be subject to the labeling requirements of the proposed rule. The intent of the proposed rule is to regulate only the products being manufactured or sold for use inside the District.

Finally, lubricants, metal working fluids and rust inhibitors already subject to VOC limits in Regulation XI will not be subject to the limits, labeling requirements and prohibition of sales proposed in this rule. These will include solid film lubricants, dry lubricative materials and barrier coatings subject to Rule 1124. Paints and coatings intended to completely cure and leave a solid, permanent film to beautify and protect metal surfaces are also exempt. Paints and coatings are subject to other coating rules in Regulation XI.

EMISSION INVENTORY

The overall national inventory of metal working fluids was taken from the International Lubricant Manufacturers Association (2003). It indicates that 117 million gallons were sold nationwide (see Table V).

Table V – National Sales

Lubricant and Metalworking Fluid Type	Amount Sold (millions of gallons/year)
Straight	27.3
Soluble	49.3
Semi-Synthetic	21.7
Synthetic	18.9
Total	117.2

EPA, in its Fabricated Metal Sector Notebook (1995), estimates 10.2 percent of the fabricated metal industry is located in California. According to listings in the California Manufacturers Register, the Basin accounts for approximately 70 percent of the industry in California. This would indicate that 8.3 million gallons of industrial lubricants and metal working fluids were sold in the Basin in 2006 (see Table VI).

Table VI – Ratio of National Sales to South Coast Air Basin Sales

Lubricants and Metal Working Fluid	Amount Sold Nationwide (millions of gallons/year)	Amount Sold in California (millions of gallons/year)	Amount Sold in South Coast (thousands of gallons/year)
Straight	27.3	2.8	2,000
Soluble	49.3	5.0	3,500
Semi-Synthetic	21.7	2.2	1,500
Synthetic	18.9	1.9	1,300
Total	117.2	11.9	8,300

To supplement these estimates, in 2006, the AQMD conducted a survey of local metal working fluid manufacturers, suppliers and users. The survey data indicated that those local manufacturers and suppliers annually sold 4.2 million gallons of industrial lubricants, metal working fluids, rust inhibitors and solvent in the Basin (see Table VII). Presumably, the solvents are used as vanishing oils, rust preventatives, for thinning other metal working fluids or cleaning.

Table VII – Volume Surveyed

Fluid Type	Volume Surveyed (thousand gallons)
Lubricants and Metal Working Fluids	2,564.6
Light Oil	48.9
100 SUS Naphthenic Oil	1,119.2
Vanishing Oil	64.1
Rust Inhibitors	155.7
Solvent	238.0
Total	4,190.5

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Approximately 30 percent or 71,000 gallons of the 238,000 gallons of solvents reported in the survey are used for cleaning applications subject to Rule 1124 and cannot be included in the VOC emission inventory for this rule making activity.

Table VIII – Applicable Volume

Fluid Type	Applicable Volume Surveyed (thousand gallons)
General MWF and Lubricants	2,564.6
Light Oil	48.9
100 SUS Naphthenic Oil	1,119.2
Vanishing Oil	64.1
Rust Inhibitors	155.7
Solvent	167.0
Total	4,119.5

Of the 4.2 million gallons, only 11 percent of the sales were high-VOC light oils, vanishing oils, rust preventatives and solvents. However, an additional 27 percent are petroleum-based metal working fluids with relatively low VOC contents but in significant enough volumes to warrant future consideration.

A serious drawback from the survey and national sales data was the lack of VOC information on the lubricants and metal working fluids. More than eighty percent of the volume surveyed listed the VOC content as “None” or not determined. Therefore, the AQMD sampled a broad range of products from local manufacturers and suppliers and performed VOC testing to establish a more accurate emissions inventory.

SCAQMD Test Method 313L was applied to 35 samples including consumer product multipurpose lubricants, synthetic water-dilutable coolants, and bio-based machining oils. Table IX summarizes the VOC results for these various products. The complete test results are included in Appendix A – Lubricant, Metal Working Fluid and Rust Inhibitor VOC Content Test Results. Two of three general lubricants tested had VOC contents below 50 g/l. All three coolants had VOC contents below 50 g/l after recommended dilution. All metal working fluids with specified applications, except vanishing/stamping fluids and light oils, also had VOC contents below the proposed limits. Rust preventatives showed the most variability, ranging from less than 10 g/l to over 760 g/l. Soluble and vegetable based rust preventatives had the lowest VOC content. The traditionally formulated rust preventatives had significantly higher VOC contents. However, two petroleum-based rust preventatives were tested and determined to have VOC contents below the 300 g/l proposed limit effective in 2010.

The completed test results indicate that most lubricants and non petroleum-based metal working fluids have a relatively low VOC content. Excluding rust preventatives, all but the vanishing/stamping fluids had VOC contents at 200 g/l or below. However, light oils such as naphthenic oils with viscosities of 40 SUS and 60 SUS had VOC contents of 840 g/l and 540 g/l respectively. Naphthenic oil with a viscosity of 100 SUS had a VOC content of 180 g/l. The VOC content of rust preventatives ranged from <25 g/l to 760 g/l.

Table IX – Test Results Using SCAQMD Method 313L

Type	VOC Content	# of Samples
Coolants	28* - 210* g/l	3
Industrial Lubricants	<10 – 190* g/l	4
Rust Preventatives		
Cleaner/Rust Preventative	<25 – 760 g/l	2
Consumer/General	514 g/l	1
Rust Preventative	<10 – 560 g/l	4
Rust Preventative/Stamping	51* - 125 g/l	2
Cutting/Grinding Lubricants		
Cold heading	2 g/l	1
Cutting	<10 – 13 g/l	2
Grinding	<10 – 146* g/l	3
Machining	<25 – 162* g/l	5
Metal Removal	12 g/l	1
Milling	70 g/l	1
Stamping (Vanishing)	650 - 750 g/l	3
Naphthenic Oil (40 SUS)	840 g/l	1
Naphthenic Oil (60 SUS)	540 g/l	1
Naphthenic Oil (100 SUS)	180 g/l	1

*Before dilution

After analyzing the sample results, the survey information and national sales data provide a clearer picture of the emission inventory from lubricants and rust inhibitors. Using the sales weighted average from the survey information and the sample test results, industrial lubricants and metal working fluids, excluding light oils, have a sales weighted average VOC content of 25 g/l or less. Because EPA method 24 results were repeatable for high VOC products, and confirmed using SCAQMD Test Method 313L, the sales weighted average VOC content was used directly from the survey information for vanishing oils, rust inhibitors and solvent. Light oil VOC content information was determined using Method 313L. Vanishing oils reported in the survey had a sales weighted average VOC content of 710 g/l. Light oils, excluding naphthenic oils with a viscosity of 100 SUS, solvent-based rust inhibitors and straight solvents used in lubricant and rust inhibition operations had sales weighted average VOC contents of 870 g/l, 660 g/l and 790 g/l, respectively. Naphthenic oil with a viscosity of 100 SUS had a VOC content of 180 g/l. Using this methodology, the VOC emission inventory for the proposed rule is estimated to be 6.81 tons per day and is summarized in Table X.

Table X – Surveyed Emission Inventory

MWF Type	Volume Surveyed (thousand gallons)	Sales Weighted Average VOC Content (g/l)	Total VOC Emission (tons per day)
General MWF and Lubes	2,564.6	25	0.73
Light Oil	48.9	870	0.49
100 SUS Naphthenic Oil	1,119.2	180	2.40
Vanishing Oil	64.1	710	0.52
Rust Inhibitors	155.7	660	1.17
Solvent	167.0	790	1.50
Total	4,119.5	N/A	6.81

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The AQMD survey correlated well with the ratio of lubricants to metal working fluids compared to national sales data. National sales data indicates 67 percent of applicable sales are industrial lubricant and 33 percent are metal working fluids. The survey data shows 63 percent of applicable fluids are industrial lubricants and 37 percent are metal working fluids. It appears that the survey of local manufacturers and suppliers conducted by the AQMD captured just over half of the metal working fluid sales predicted by the national sales figures. The survey data could be extended to regional and national manufacturers and suppliers if necessary. Extrapolating from national sales figures, the overall VOC emission inventory can be as high as 13.3 tons per day as seen in Table XI.

Table XI – Emission Inventory from National Sales

MWF Type	Volume Projected (thousand gallons)	Sales Weighted Average VOC Content (g/l)	Total VOC Emission (tons per day)
General MWF and Lubricants	5,081.1	25	1.45
Light Oil	96.8	870	0.96
100 SUS Naphthenic Oil	2,217.4	180	4.56
Vanishing Oil	127	710	1.03
Rust Inhibitors	308.4	660	2.32
Solvent	330.8	790	2.98
Total	8,161.8	N/A	13.30

EMISSION REDUCTIONS

The proposed rule will establish a VOC content limit of 50 g/l for direct contact lubricants and vanishing oils effective January 1, 2010. General metal working fluids and spindle oils will be required to meet a 200 g/l effective January 1, 2012. Rust inhibitors will initially be limited to 300 g/l effective January 1, 2010, with further reductions to 50 g/l will be required in 2012. Exemptions are included for lapping, sinker EDM and aerospace avionic and assembled aircraft direct-contact lubricants and rust inhibitors.

For approximately 89 percent of fluids subject to the rule, the proposed limit will have no impact as most general metal working fluids and lubricants already have VOC contents that are less than 25 g/l. These low VOC fluids account for only about 25 percent of the overall VOC emissions.

However, the rule will produce substantial VOC emission reductions from light oils, vanishing oils, rust inhibitors, and solvents used to dilute lubricants or metal working fluids or used directly as vanishing oils or rust inhibitors. The solvent usage is distributed over light oils, vanishing oils and rust inhibitors in the same ratio as the sales volume (20 percent, 23 percent and 57 percent respectively). Implementation dates, based on extensive discussions and feedback from end-users and suppliers, have been adjusted to focus on reductions in VOCs from solvents over the first few years, with an extension of placing requirements on light oils for three years after rule adoption. This approach addresses many technical concerns expressed by industry and provides additional time for further analysis of the VOC test method results.

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Approximately ten percent of the volume (15,600 gallons) of rust inhibitors sold is used for specified operations such as military specification, military standards or PPAP according to the Independent Lubricant Manufacturers Association (ILMA). Those uses will be exempt until 2011 and emission reductions (0.06 tons per day) from those uses will be realized in 2011. Limiting the VOC content of rust inhibitors, excluding specified rust inhibitors, and solvents used in rust inhibitors to 300 g/l will reduce VOC emissions by 1.11 tons per day by 2010 (1.17 tons per day by 2011). Table XII, below, summarizes the emission reductions

**Table XII – Emission Reductions Realized in 2010
(Vanishing Oils and Rust Inhibitors)**

Fluid Type	Volume Surveyed (thousand gallons)	Sales Weighted Ave VOC Content (g/l)	Proposed VOC Content (g/l)	Percent Reduction	Total VOC Emission Inventory (tons per day)	Total VOC Emission Reduction (tons per day)
Rust Inhibitors	140.1	660	300	55%	1.06	0.58
Solvent (Rust Inhibitors)	95.2	790	300	62%	0.86	0.53
Specified Rust Inhibitors	15.6	660	300	55%	0.12	0.06*
Vanishing Oil	64.1	710	50	93%	0.52	0.50
Solvent (Vanishing Oil)	38.4	790	50	94%	0.35	0.33
Total	337.8				2.81	2.00

* Realized January 1, 2011

Finally, in 2012, the limits for general metal working fluids and light oil will become effective. Additionally, the limit for rust inhibitors will be lowered to 50 g/l. This will further reduce VOC emission from rust inhibitor and metal working fluid operations by another 1.32 ton per day (see Table XIII).

**Table XIII – Emission Reductions Realized in 2012
(Rust Inhibitors)**

Fluid Type	Volume Surveyed (thousand gallons)	Sales Weighted Ave VOC Content (g/l)	Proposed VOC Content (g/l)	Percent Reduction	Total VOC Emission Inventory (tons per day)	Total VOC Emission Reduction (tons per day)
Rust Inhibitors	155.7	300	50	83%	0.53	0.44
Solvent (Rust Inhibitors)	95.2	300	50	83%	0.33	0.27
Light Oil	48.9	870	200	77%	0.49	0.38
Solvent (Light Oil)	33.4	790	200	75%	0.30	0.23
Total	333.2				1.33	1.32

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At full implementation, PR 1144 will achieve 3.32 tons per day of VOC reductions based on survey results only. Projecting from the AQMD survey data to national sales figures, the potential emission reductions would nearly double to 6.72 tons of VOC emissions reduced.

Table XIV – Emission Reductions from National Sales

MWF Type	Volume Projected (thousand gallons)	Sales Weighted Ave VOC Content (g/l)	Proposed VOC Content	Percent Reduction	Total VOC Emission Inventory (tons per day)	Total VOC Emission Reduction (tons per day)
General MWF	7,294	25	50	0%	2.08	0.00
Light Oil	97	870	200	77%	1.02	0.79
100 SUS Naphthenic Oil	2,217	180	200	0%	4.56	0.00
Vanishing Oil	127	710	50	94%	1.03	0.97
Rust Inhibitors	308	660	50	93%	2.32	2.16
Solvent	331	790	50	90%	2.99	2.69
Total	8,166				14.00	6.61

Multiple low-VOC commercially available products have been identified in numerous applications. In many applications, the only products in use are low-VOC products already in compliance with the proposed limits. Cold heading, drawing, honing, forging, milling machining and metal removal fluids as well as coolants and industrial lubricants were all found to have low-VOC content products in widespread use. For applications where high VOC products were identified, aqueous-, bio- and petroleum-based technologies were identified and demonstrated in field testing. Those alternatives were analyzed and found to have VOC contents that would meet the proposed limits.

The transition to low-VOC content lubricants, metal working fluids and rust inhibitors is not expected to increase criteria pollutants or global warming gases. The substitution of one type of fluid with another will not have an impact on criteria pollutants other than VOC. The increased use of control equipment is considered very unlikely, and therefore not expected to be a source of increased pollutants. There may be some negligible decrease in global warming gases from shipping MWF concentrates instead of ready-to-use products because concentrates weigh less, reducing fuel consumption during transit.

COST AND COST-EFFECTIVENESS

The use of low-VOC alternatives to light oils, vanishing oils and rust inhibitors is expected to increase costs for machinery, including skimmers, decanters, mixers, sump cleaners and possibly cleaning equipment. In addition, there would be an overall increase in the cost of fluids. On an individual facility basis, the costs may be significant, insignificant or even a cost savings.

For alternatives to vanishing oils, companies would ideally use a water soluble MWF that would not require cleaning. The soluble lubricants are heavily diluted with water and would likely cost less than a vanishing oil potentially resulting in a cost savings. They would have rust preventative compounds to prevent corrosion and evaporate leaving behind a light, corrosion protective film.

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However, the worst case scenario for shops using vanishing oils would be to use an oil that would require cleaning of the product afterwards. The shops would need to purchase cleaning equipment, automated handling equipment, cleaning chemistry, and pay for added electricity.

For a typical shop using 240 gallons of vanishing oil annually, the shop would face an estimated annualized capital cost of \$9,700, \$2,900 in cleaning chemistry and disposal costs and \$3,800 in increased electrical costs. The lubricant cost would decrease by \$1,300 annually. The total maximum annual cost per typical facility would be \$15,100.

Table XV - Maximum Increased Cost per Vanishing Oil Facility

	Annual Cost
Capital (annualized)	
Cleaning Equipment	\$6,100
Automated Handling	\$4,900
Cleaning Chemistry	\$1,900
Disposal	\$1,000
Electricity	\$3,800
Lubricant	<\$1,300>
Total	\$16,400

Using the most conservative assumption for all vanishing oil usage (64,100 gallons), the maximum overall annual cost would be \$4.4 million.

Total Volume of Vanishing Oil	Typical facility usage	Number of Facilities
64,100 gallons	240 gallons	267

Number of Facilities	Cost per facility	Total Annual Cost
267	\$16,400	\$4.4 million

The conversion from high VOC rust inhibitors to low VOC rust inhibitors would only involve changes in chemical formulae. The equipment (tanks) would remain the same and there would be no added electrical costs. Alternative formulae have a higher cost, but since many of the rust inhibitors are diluted with water, the cost would be much more comparable to the high VOC rust inhibitors.

Again, the worst case scenario is evaluated and it is assumed that non-dilutable rust inhibitors are used. The cost of mineral spirits used as a rust inhibitor is approximately \$3.60 per gallon. The alternative bio-based rust inhibitor sells for \$8.30 per gallon, a \$4.70 increase per gallon. The alternative rust inhibitor would be used in the same volume as the mineral spirits. The cost increase over 155,700 thousand gallons would be \$0.7 million dollars annually.

Total Volume of Rust Inhibitor	Increased cost per gallon	Total Annual Cost
155,700 gallons	\$4.70	\$0.7 million

Alternatives to the use of light oils in spindle machines include synthetic ester-based metal working fluids. These alternatives generally cost more per gallon and require specialized equipment such as skimmers, decanters, mixers, and sump cleaners. However, the alternative

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fluids provide better cooling and lubricity leading to faster machining speed which translates into lower labor costs. The increased cost of fluid and equipment to a typical machine shop with eight equipment operators would be approximately \$3,100. The labor savings realized would be about 10 percent or roughly \$25,000 per year in an eight operator shop.

Some shops may opt for a direct replacement of slightly heavier straight oil to avoid having to purchase equipment. The cost of the light oil currently is \$4.30 per gallon and the alternative low-VOC straight oil would be approximately \$3 per gallon higher. Using the more conservative \$3 per gallon increase as opposed to potential cost savings, the maximum cost to spindle machine shops would be \$0.1 million annually.

Total Volume of Light Oils	Increased cost per gallon	Total Annual Cost
48,900 gallons	\$3	\$0.1 million

Solvent can be used as a vanishing oil, rust inhibitor or diluent for light oils. When determining costs, the solvent usage is distributed over light oils, vanishing oils and rust inhibitors in the same ratio as the sales volume (20 percent, 23 percent and 57 percent respectively). Thus 33,400 are attributed towards light oils, 38,400 gallons are attributed towards vanishing oil, and 95,200 gallons of solvent are used as rust inhibitors. The same worst-case methodology is used for light oil, vanishing oil and rust inhibitors to determine the cost of replacing the solvent. The total cost for solvent replacement would be \$2.9 million.

Total Volume of Solvent Used as Light Oil Diluent	Increased Cost per Gallon	Total Annual Cost
38,400 gallons	\$3	\$0.1 million

Likewise,

Total Volume of Solvent Used as Vanishing Oil	Typical facility usage	Number of Facilities
38,400 gallons	240 gallons	160

Number of Facilities	Cost per facility	Total Annual Cost
160	\$15,100	\$2.4 million

Finally,

Total Volume of Solvent Used as Rust Inhibitor	Increased cost per gallon	Total Annual Cost
95,200 gallons	\$4.70	\$0.4 million

Some shops may be required to do additional record keeping demonstrating that their annual emissions remain below four tons. Four tons of emissions from lubricants and rust inhibitors at 50 g/l (0.4 pounds per gallon) would be equivalent to over 19,000 gallons used per year. Of 115 machine shops surveyed, fewer than eight percent used lubricants and rust inhibitors in sufficient quantities to remotely approach the four ton annual limit. Of the more than 12,000 affected facilities, an estimated 2,000 would require a more thorough review of annual records. From discussions and experience with facilities conducting record keeping, it is estimated that the process of gathering the year's purchase records would require about eight hours of labor per facility. At \$20 per hour, the annual increase in record keeping costs would be \$20/hour * 8

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hours/facility * 2,000 facilities = \$0.1 million. Shops that use light oils or rust inhibitors with higher than 50 g/l VOC content would be required to track additions to their fluid systems. There are 112 shops using light oils for machining and an estimated 600 facilities that would need to track high VOC rust inhibitor usage. These systems are usually changed monthly or less frequently. At \$20 per hour, the annual increase in record keeping costs for those shops would be \$20/hour * 12 hours/facility * 712 facilities = \$0.2 million. The remaining facilities would require a negligible effort to demonstrate that their annual usage was below the four ton annual limit. The total annual increase in cost due to record keeping would be \$0.5 million.

Manufacturers and suppliers will also be required to determine the VOC content of their products and to label containers with the VOC content and a date of manufacture or date code. Laboratory testing using a modified version of SCAQMD Test Method 313L costs between \$200 and \$500 per sample according to several analytic laboratories that perform the testing. Manufacturers and suppliers offer hundreds of products each. Many of those are similar with slight variations on the additives incorporated in the product. Manufacturers and suppliers may be able to test some subset of products and be able to calculate the VOC content of their remaining products. Others will insist on testing every product to insure rule compliance. Conservatively assuming that there are 10,000 applicable products and every product would be laboratory tested at \$350, there would be a one time cost of \$3.5 million. Annualized over ten years, the additional annual cost to manufacturers and suppliers would be \$0.4 million. Most containers use computerized labels that can be altered by simple reprogramming. The cost to alter those labels is considered negligible.

As proposed, the rule will reduce emissions by 3.32 tons per day with an estimated cost of \$9.0 million dollars. The maximum overall cost-effectiveness of the proposed amendment will be \$7,427 per ton of VOC emissions reduced on a conservative basis. However, studies conducted on the use of compliant rust inhibitors and lubricants actually showed an overall reduction in costs, yielding a cost savings to the facility.

Table XVI – Maximum Cost-Effectiveness

MWF Type	Volume Surveyed (thousand gallons)	Total VOC Emission Inventory (tons per day)	Total VOC Emission Reduction (tons per day)	Maximum Cost (millions)
General MWF	3,683.8	1.05	0	\$0.0
Light Oil	48.9	0.49	0.45	\$0.1
Vanishing Oil	64.1	0.52	0.5	\$4.4
Rust Inhibitors	155.7	1.17	1.08	\$0.7
Solvent	167	1.50	1.41	\$2.9
Record keeping	N/A	N/A	N/A	\$0.5
Laboratory Testing	N/A	N/A	N/A	\$0.4
Total	4,119.50	4.73	3.44	\$9.0

INCREMENTAL COST-EFFECTIVENESS

Health and Safety Code Section 40920.6 requires the AQMD to perform an incremental cost analysis when adopting a Best Available Retrofit Control Technology (BARCT) rule or feasible measure required by the California Clean Air Act. To perform this analysis, the AQMD must (1) identify one or more control options achieving the emission reduction objectives for the proposed rule, (2) determine the cost effectiveness for each option, and (3) calculate the incremental cost effectiveness for each option. To determine incremental costs, the AQMD must “calculate the difference in the dollar costs divided by the difference in the emission reduction potentials between each progressively more stringent potential control option as compared to the next less expensive control option.”

Proposed Rule 1144 implements Control Measure CTS-01 from the 2007 Air Quality Management Plan. Because Control Measure CTS-01 is intended to meet feasible measure requirements under the California Clean Air Act, an incremental cost analysis is required and is presented in this section.

Several alternative options were evaluated including one more stringent standard and three less stringent standards. The first alternative examined was to require all lubricants, metal working fluids and rust inhibitors to meet a VOC content limit of 25 g/l. Similar low-VOC formulations would be utilized but machine operators would have to monitor the fluids to ensure that evaporation or contaminants did not make the fluid non-compliant. Two other alternatives examined would have allowed all fluids to meet VOC content limits of 100 g/l and 200 g/l. This would have allowed some affected operations to dilute fluids with lower cost light oils. However, they would have been required to maintain daily records, and vanishing oil operations would have continued to require a cleaning process. Finally, the installation and use of control devices to limit VOC content in lieu of a VOC content limit was analyzed. While no process changes would have been necessary, there would have been considerable costs from the installation of the control devices. Additionally, the control device would not have been as effective in reducing emission as reformulation. Because the control device option was unlike the other alternatives, it was compared to the least stringent (200 g/l) option.

The incremental cost analysis shows that further lowering the limit to 25 g/l would have increased costs by \$3.5 million over the proposed limit and only net another 0.17 tons per day of VOC emissions. The analysis also shows that requiring control devices in lieu of VOC limits would have been cost prohibitive. Finally, the analysis indicates that over 0.7 tons per day (from 2.61 tons per day to 3.32 tons per day) of VOC emission reductions would be achieved with only a six percent increase (from \$8.5 million to \$9.0 million) in overall cost (see Table XVII below).

Table XVII – Incremental Cost-Effectiveness

VOC Limit	Emission Reductions (tons per day)	Annual Cost (million)	Incremental Cost (\$ per additional ton reduction)
25	3.49	\$12.5	\$56,406
50	3.32	\$9.0	\$1,015
100	3.05	\$8.9	\$2,491
200	2.61	\$8.5	N/A
Control Device	3.19	\$324.0	\$1,490,316

COMMENTS AND RESPONSES

This section reflects the public comments received during the public workshop held September 23, 2008, the public consultation meeting held October 29, 2008 and subsequent public comment periods and staff responses.

Comment 1

We request that SCAQMD delay the rulemaking process. The test method was only recently released and there is insufficient time to determine applications that may be affected. The current effective date, coupled with the aggressive rule making schedule, is infeasible. Thousands of companies may need to implement alternatives. Manufacturers and suppliers do not have sufficient support staff to test and implement alternatives. In addition to delaying the rule, we recommend delaying the effective dates for the proposed rule. We suggest an exemption for light oils or to delay the effective date for metal working fluids, except vanishing oils, until 2012. The AQMD should also consider phased-in or staged limits.

Response

While not every potential product has had the VOC content definitively determined, it is clear that high-solvent content metal working fluids and rust inhibitors, light oils and straight solvents are within the purview of the rule. As part of the rule development process, staff has identified numerous commercially available products already complying with the proposed limits. Also, the Public Hearing has been moved from December 2008 to January 2009 to provide more time for public review and input. Nevertheless, to provide more transition time for manufacturers to reformulate and test their products, the proposed rule has been modified to delay the effective dates for lubricants, metal working fluids, and rust preventatives. Direct-contact lubricants will be subject to the rule beginning 2010. Rust inhibitors will have staged limits with a 300 g/l limit in 2010 dropping to 50 g/l in 2012. Limits for metal working fluids, except vanishing oils, will have an effective date of 2012. The delay in the effective dates should allow adequate time for alternative low-VOC formulations to be identified and tested, as well as for revising existing PPAP and military specifications and to provide time for industry to become familiar with the VOC test method. Furthermore, an exemption has been added to delay the 300 g/l VOC limit applicable to rust inhibitors for products used under PPAP and military specifications by one year, providing a two year window requested by industry to revise the applicable specifications. Lastly, exemptions for certain low-volume categories have been added to the proposed rule to alleviate reformulation efforts for those categories.

Comment 2

Special consideration should be given for applications specified for operations where fluid usage is dictated by military specification, PPAP or customer specifications. We believe a one year delay should be allowed to determine which fluids are affected, contact customers to advise them of the rule making and initiate replacement trials. We also ask for an additional year beyond the delay to determine customer acceptability.

Response

High-solvent content metal working fluids and rust inhibitors, light oils and straight solvents will be the affected formulations and while manufacturers have a large number of products, only a small subset will require further testing to determine compliance. We agree that replacement trials to determine customer acceptability and changes to military specifications and/or PPAP specifications will take additional time. Therefore, as noted above, the proposed rule has been

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modified to delay the effective date to provide more transition time for manufacturers to reformulate and test their products, as well as amending specifications. An exemption has been added to delay the 300 g/l VOC limit applicable to rust inhibitors for products used under PPAP and military specifications by an additional year.

Comment 3

There was insufficient notice for the public workshop. Many shops had not received notice of the meeting until the weekend before the workshop.

Response

All stakeholders in staff's distribution list that had expressed an interest in participating in the public workshop and rule development process were notified by e-mail ten days in advance of the meeting. Staff also asked the stakeholders to forward the meeting notice to others who may be interested. Notices were mailed to over 7,000 potentially interested entities that were not included in staff's distribution list. Newspaper notice in all four counties was also provided. Sufficient notice was provided to meet statutory requirements for notice of the Board hearing. However, an additional meeting, a Public Consultation Meeting, was held in late October with sufficient notice provided by mail for potentially impacted facilities. This provided another opportunity for the regulated community to provide comments regarding the proposed rule. Further, in addition to the public workshop and consultation meetings, staff will continue meeting with representatives of the impacted industry through its ongoing working group meetings to continue addressing any pending issues.

Comment 4

The referenced test method remains a draft and has not been validated, peer reviewed and/or accepted by testing organizations such as American Society for Testing and Materials (ASTM), American Oil Chemists Society (AOCS), American Chemical Society (ACS) for metal working fluids. A poor test method is the worst thing that could happen in this regulation. Has SCAQMD Test Method 313L been validated for VOC testing of neat oil or emulsion samples? Labs that can conduct this method have not been identified and their experience with the method has not been evaluated.

Response

EPA Method 24 does not produce repeatable results for high water content or heavy (low volatility) oils. Method 313L has been shown to have accurate and repeatable results for neat oil products. In addition, the test method has been utilized to test heavy oils, methyl ester and high water content products with satisfactory results in the AQMD's Clean Air Solvent and Clean Air Choices certification programs. The AQMD has identified several local and national labs that have extensive experience running GC/FID test methods. They can conduct several dozen tests per day at a cost between \$200 and \$500 per sample. Peer review and round-robin testing can take many years as demonstrated by ASTM 6886 and will present an unacceptable delay to the rule making process. The final test method has been released to the public.

Comment 5

A possible alternative to GC/FID analysis is the use of Thermo-Gravimetric Analysis (TGA) to determine VOC levels. This analysis methodology can accurately and efficiently determine the volatility characteristics of a sample, both neat oil samples and emulsion samples at any desired temperature.

Response

The TGA test method is very similar to EPA Method 24 with respect to its strengths and weaknesses. It would provide accurate and repeatable results for high-solvent or petroleum-based oil products but will not provide acceptable results for low-VOC products that contain high water content. It remains to be determined if TGA testing provides accurate and repeatable results for neat oil samples. Until TGA testing has shown to be repeatable and accurate for all fluids subject to the proposed rule, and a limit or endpoint has been determined that provides a comparable VOC measurement, Test Method 313L, and alternative test methods found to be equivalent to Method 313L and approved by SCAQMD, CARB and EPA, will remain the only applicable test method under Rule 1144. However, the District agrees to continue reviewing the merits of TGA testing with interested stakeholders and considering it as an approved test method if further data provides sufficient evidence.

Comment 6

It may be possible to mimic the test results of the SCAQMD GC/MS procedure using a capillary GC unit equipped with FID and could produce a comparable chromatograph to the GC/MS results. This form of VOC testing was documented by California Polytechnic State University in a progress report from 2006, under sponsorship of CARB and Cal EPA, in the development of a new VOC analysis method for architectural coatings. Results from the new headspace method were compared using the standard direct sample injection method (ASTM method 6886). Results reported seem to indicate the static headspace analysis method to provide results comparable to direct injection analysis method for compounds showing GC column elution times prior to an industry recognized reference standard.

Response

Test Method 313L utilizes a capillary GC unit equipped with FID as described in the comment. We agree that the results are comparable to other methods using methyl palmitate as the reference standard. Head space analysis would require very high temperatures to ensure that the sample would completely volatilize for the compete chromatograph to be analyzed. Lower temperatures would provide an incomplete chromatograph and potentially give an artificially low VOC result. In addition, numerous other factors in headspace analysis, such as liquid to vapor ratios and sample transfer, suggest that headspace analysis would be less reliable than direct injection.

Comment 7

Methyl palmitate is not normally classified as a volatile compound, but SCAQMD uses it to define what constitutes a VOC. What is the basis for this decision, and are any other regulatory agencies in agreement with the decision?

Response

Test Method 313L is a modified version of SCAQMD Method 313 – Determination of Volatile Organic Compounds (VOC) by Gas Chromatograph/Mass Spectrometry (GC/MS) which has been accepted by CARB and U.S. EPA for AQMD rule implementation and in air districts in California and Arizona since 1991. In this method, the total specified sampling period is 30 minutes. Previous testing has shown that methyl palmitate elutes at the 30 minute mark. The AQMD includes all compounds, besides water and exempt solvents, that elute prior to methyl palmitate, to be VOC. The modifications streamline the test significantly, reducing cost and labor as well as allowing the use of commercially available GC columns. In modifying the test,

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the compounds elute out in the same order and methyl palmitate remains the endpoint determining volatility.

Comment 8

The data reported by AQMD was calculated based on the manufacturer's recommended dilution of the product after testing of the neat product. Since in-use samples will be used to determine customer compliance, the results should correlate to actual dilutions and real world conditions versus calculated dilutions. The results varied by 100 percent for one sample and 33 percent for another. A validated test does not have such variability, especially when critical to both compliance and enforcement.

Response

Testing to verify that results from dilute samples correlate to earlier results from neat samples calculated based on the manufacturer's recommended dilution has been completed and shows that Method 313L results correlate very well when testing neat and diluted samples. These results have been shared with the public and included as Table IV – Dilute Sample Results in this document. While the commentor criticizes the results as having large percentile differences, these differences equate to less than 20 g/l. These are very small values and all samples tested would fall well within the VOC limits proposed. Additionally, it is routine enforcement policy to recognize a margin of error for sample results equal to +/- 20 percent for VOC limits of 50 g/l or less.

Table IV – Dilute Sample Results

Sample ID (Dilution ratio)	Neat	Predicted	Tested
Sample 001 (8%)	20 g/l	2 g/l	2 g/l
Sample 002 (10%)	140 g/l	14 g/l	10 g/l
Sample 003 (20%)	140 g/l	28 g/l	8 g/l

Comment 9

The high temperature (200°C) at the injection port for the FID is not reflective of real world conditions. Glycerin may break down at such a high temperature giving false results. A lower temperature, such as 40°C would be better.

Response

The temperature at the injection port is not intended to reflect real world conditions but to provide a complete chromatograph of the fluid for further analysis. While much of the fluid will elute at that high temperature, only the portion occurring before methyl palmitate is considered when determining VOC content. There has been no indication that glycerin or any other chemical compound breaks down giving false results. A lower injection port temperature could potentially leave some volatiles in the injection port giving an artificially low result.

Comment 10

The proposed test method utilizes direct injection. We believe head space analysis is more accurate than direct injection.

Response

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Head space analysis would require very high temperatures to ensure that the sample would completely volatilize for the compete chromatograph to be analyzed. Lower temperatures will provide an incomplete chromatograph and potentially give an artificially low VOC result. In addition, numerous other factors in headspace analysis, such as liquid to vapor ratios and sample transfer, suggest that headspace analysis would be less reliable than direct injection. Test Method 313L provides repeatable, accurate results.

Comment 11

The inventory figures, particularly from vanishing oil applications, are inaccurate and outdated. Many assumptions are based on census data from 1995 and 2002. Sales are down and there are fewer companies using these fluids when they were reported in 2006. The survey captured 95 percent of the sales at that time and the national sales estimates are far too high. A new inventory survey should be conducted before the rule is heard.

Response

The inventory figures were provided by surveying local manufacturers and suppliers. Those figures were for annual sales in the District for 2004, 2005 and part of 2006. The results are relatively consistent over the survey period, and national sales confirm relatively stable sales. In response to the comment, earlier survey respondents were contacted and invited to revise earlier annual sales or provide new sales data if they wished. None have provided any additional data. Census assumptions regarding national sales data confirm survey sales data, but only the 2006 survey sales data collected for the South Coast have been used for making emission estimates. Based on discussions with industry pertaining to solvents used as lubricants, metal working fluids, vanishing oils and rust inhibitors, the local survey may underestimate the volume and associated emissions. While the local survey and the national sales figures were used as reference points to establish the baseline inventory for rulemaking, staff is cognizant of the limitations of initial surveys and intends to refine them by periodically conducting future surveys.

Comment 12

There is known interference in the proposed test method from surfactants used in the suggested alternative metal working fluids. Will the proposed test method give accurate results?

Response

The proposed test method has been shown to give accurate, repeatable results for a wide range of products, including those that contain surfactants. Surfactants are commonly found in cleaning products. Cleaning products submitted for Clean Air Solvent and Clean Air Choices Cleaner certification are reliably tested using the proposed test method.

Comment 13

The costs for manufacturers and suppliers will have to test each and every product costing \$60,000 to \$150,000. They will also have costs for research and development and technical support staff. The projected emission reductions only represent 0.5 percent of the VOC emissions in the basin. Additional strain will be placed on small businesses hard pressed by severe economic conditions. Companies cannot afford to modify processes. Many companies are leaving the basin and additional costs will accelerate their departure. The proposed rule will have huge costs for little gain.

Response

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The sixteen million Southern Californians residing in the South Coast Air Basin experience the nation's worst air quality. Proposed Rule 1144 implements control measure CTS-01 of the 2007 AQMP, which reflects the South Coast Air Basin's comprehensive strategy to improve air quality and meet the state and federal air quality standards. CTS-01 is a vital component of the stationary source VOC control strategy. When fully implemented, Rule 1144 will reduce approximately 3.3 tons of VOC per day, a significant level of emission reductions. While staff acknowledges that there are costs associated with the implementation of Rule 1144, staff has attempted to craft a rule that minimizes such costs, while maximizing emission reduction benefits. The analysis included in this staff report shows that the revised staff proposal is technologically feasible and very cost-effective. The proposed rule requires manufacturers and suppliers to list the VOC content on the containers but does not require that each and every product be tested. Calculations of VOC content for formulations with compounds of known VOC contents are acceptable. Test Method 313L will be used to determine compliance. Analytical laboratories report that the cost to do GC/FID testing ranges from \$200 to \$500 per sample. The cost-effectiveness analysis conservatively includes the cost to test 10,000 samples. Costs for research and development and technical support staff are considered in the higher cost of low-VOC alternatives and included in the cost-effectiveness calculations in the Staff Report. Companies have the option to use alternative products that may not require process modification. However, the Staff Report includes a cost-effectiveness analysis using the most conservative assumptions. The analysis shows the proposed rule is cost-effective. Case studies of facilities that have used these alternative products and modified processes may even realize a cost savings. A SocioEconomic assessment of PR 1144 has been conducted to evaluate employment impacts.

Comment 14

Cost effectiveness and incremental cost effectiveness calculations have not been provided. The District is specifically required by statute to consider, and make available to the public, its findings related to the cost-effectiveness of a control measure it proposes to adopt. The District is also required to assess the availability and cost-effectiveness of alternatives to the proposed rule. Moreover, the District is also required to calculate the incremental cost-effectiveness of potential control options that achieve the emission reduction objectives of the proposed rule.

Response

Cost effectiveness calculations were provided in the Preliminary Draft Staff Report as well as the Draft Staff Report. Incremental cost-effectiveness of potential control options are included in the Draft Staff Report, and were discussed at working group meetings and presented at the Public Consultation Meeting.

Comment 15

VOC standards and test methods should be consistent statewide and nationwide.

Response

Nationally, EPA Method 24 is the default method to determine VOC content of fluids subject to regulation under the rule. However, EPA Method 24 has failed to show repeatable results for high water content and heavy (low volatility) oils. Using an inaccurate method would create unnecessary confusion and be detrimental to determining compliance. Statewide, the only applicable standard is for consumer product lubricants, CARB Method 310 – Determination of Volatile Organic Compounds (VOC) in Consumer Products and Reactive Organic Compounds in Aerosol Coating Products. CARB Method 310 is a GC/MS method that exempts solvents with a vapor pressure less than 0.1 mm Hg. While this may be a satisfactory standard for consumer

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products, the AQMD does not exempt low vapor pressure solvents, since VOCs are released over time and interact to form ozone and secondary organic aerosols.

Comment 16

The proposed limits are unachievable and there is no documentation supporting the conclusion that alternatives are available. The Institute for Research and Technical Assistance (IRTA) report referenced in not available to the public and neither is the survey data collected by the AQMD.

Response

Staff estimates, according to information provided by manufacturers and suppliers, that over 89 percent of the 4.2 million gallons of lubricants, metal working fluids and rust inhibitors sold in the AQMD already meet the proposed limits. The specific sales volume information is considered confidential and will not be provided to the public, but, the consolidated information is included in the Staff Report. Manufacturers and suppliers have provided hundreds of material safety data sheets for products that are used in nearly all machining applications. In the limited instances where high-VOC solvents uses were indentified, IRTA conducted a technical assessment of available alternatives that included case studies where alternatives were demonstrated to be successful in production settings. The IRTA report is referenced in this document and is available online at www.irta.us. Applications where light oils are used may require further time to implement alternatives and the effective date for those applications have been extended based on the requested time frame. Some exemptions have also been included where deemed appropriate.

Comment 17

A limit of 50 g/l should be considered in lieu of the 25 g/l proposed. Many tested products may meet the proposed limit in laboratory settings but routine evaporation and contamination may make the products non-compliant. Considerable labor would be necessary to constantly verify that the product remained below 25 g/l at all times.

Response

The revised staff proposal sets the VOC limits at 50 g/l to address commentor's concerns. While many of the products tested would meet the originally proposed 25 g/l limit, the added labor involved to monitor products in use to ensure that applicable fluids remain compliant would add considerable cost with minimal emission reductions.

Comment 18

Light oil use with high VOC content should be exempt for aluminum, stainless steel, copper, brass, and titanium cutting and high speed grinding, coolants, EDM, fast quenching, honing, lapping, milling, and rolling oils. Special consideration should be given to lubricants specified by machine manufacturers where deviation may cause the warranty and service contract to be voided.

Response

Light oils with viscosities less than 20 cSt (100 SUS) that have a VOC content greater than 50 g/l include lubricants for spindle machine oil, cutting fluids for aluminum, stainless steel, copper, brass, and titanium, lapping and sinker EDM applications. The other applications use heavier oils or aqueous-based metal working fluids that have VOC contents below the proposed limit. Due to their very low usage and lack of available alternatives, sinker EDM and lapping

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operations have been exempted. Slightly heavier, but low-VOC oils, are a viable alternative for cutting fluids. Because testing and possibly some equipment changes are necessary to use these products, the effective date for this operation has been extended until 2012. The high speed spindle oils specified by machine manufacturers do not come into direct contact with parts or products being manufactured or assembled, and therefore are not subject to the proposed rule. High speed spindle oils account for approximately 5,000 gallons used per year.

Comment 19

Assembled aircraft require specialized corrosion inhibitors and lubricants and should be exempted from the proposed rule.

Response

PR 1144 has been revised to exempt the specialized lubricants and corrosion inhibitors for assembled aircraft which represent less than 0.002 ton per day of VOC emissions.

Comment 20

Lubricants and metal working fluids used during the manufacture and use of aircraft fasteners should be exempted from the proposed rule.

Response

Lubricants and metal working fluids subject to Rule 1124, including barrier coatings, dry lubricative coatings and solid film lubricants are exempt from the provisions of this rule. Other lubricant, metal working fluid and rust preventative applications not subject to Rule 1124 will be subject to the proposed rule.

Comment 21

Straight oils are often used and provide valuable lubricating functions. Water-based fluids involve more maintenance, down time and tooling will wear out faster. They also cannot be skimmed from aqueous cleaning baths meaning additional waste generation and costs. Are there petroleum-based rust inhibitors that comply with the regulation?

Response

The proposed rule does not require the use of water-based alternatives. The majority of straight oils will comply with the proposed limits. Facilities where high-VOC solvents and light oils are utilized will generally have the option to choose between heavier straight oils or aqueous-based, soluble, semi-synthetic or synthetic metal working fluids. The AQMD has tested several petroleum-based rust inhibitors that comply with the proposed limits. Review of material safety data sheets provided by suppliers and manufacturers indicated that most carry a compliant petroleum-based rust inhibitor. The AQMD cannot recommend specific suppliers but can provide a list of suppliers.

Comment 22

A more precise applicability statement and definition of terms is necessary. It is not clear which, if any, maintenance and repair activities are exempt from the rule. Proposed Rule 1144 should be clarified to also exclude research and development.

Response

The applicability statement has been modified to further improve clarity. Additional definitions have been included to clarify the scope and intent of the proposed rule. The rule applies only to

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the manufacture and assembly of products and parts. Repair and maintenance activities are not applicable to the proposed rule. Neither are research and development activities that do not meet the definition of “manufacture” in the proposed rule.

Comment 23

We strongly believe that there is no “necessity” for the AQMD to regulate consumer and commercial products since CARB exercises continuous regulatory jurisdiction over these products. Dual regulation by CARB and AQMD is contrary to state Legislature’s intent to establish a uniform set of regulations for consumer products. Additionally, it is not clear which provisions of the rule apply to consumer products.

Response

Consumer products are exempt from the prohibition of sale and labeling provisions of the proposed rule. Use of consumer products by households, institutions and commercial operations, and consumer products used for maintenance and repair activities are also exempt. However, the use of consumer products during the manufacture and assembly of parts and products must meet the same limit as industrial products specifically formulated for those operations. Regulation of VOC content at stationary sources falls squarely within the long-established authority of air districts. According to CARB, “[I]t was certainly not the purpose of the ARB regulations to deprive districts of their long-standing authority to regulate pollution-generating activities occurring at stationary sources, just because these activities may involve the use of consumer products.” Walsh, Kathleen. CARB General Counsel. "Interpretation of Health and Safety Code Section 41712 (f)." Letter to William Wong, Senior Deputy District Counsel. February 20, 2001.

Comment 24

All aerosol product uses should be exempt from the proposed rule.

Response

Aerosol products are not normally used for most manufacture and assembly operations. There is no reason to encourage their use, with corresponding higher VOC content, by providing a blanket exempt status.

Comment 25

The AQMD should consider a small container (one quart or less) exemption.

Response

Small containers are not normally used for most manufacture and assembly operations. Providing an exemption would encourage wasteful packaging and provide a loophole for non-compliant products.

Comment 26

The AQMD should consider a small use exemption (i.e. 55 gallons per facility annually). Some parts require thread locking compounds, sealants, mask, hardeners, layout fluid, hand applied tapping compounds and other essential fluids that may contain VOC but should not be included in the proposed rule because of their small usage.

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Response

Applications such as sinker EDM, lapping, rust inhibition for avionics and assembled aircraft, where there is low usage and alternatives are unavailable have been included in the rule. Thread locking compounds, sealants, masks, hardeners, and layout fluids do not meet the definitions for lubricants, metal working fluids or rust inhibitor and the rule will not be applicable to those uses. Tapping fluids, applied by hand and by machine are metal working fluids and subject to the VOC limits in the rule. Low-VOC products are available for tapping applications and there are liquid, paste and aerosol versions of the low-VOC hand tapping fluids. A general small use exemption would require shops to maintain extensive records to verify if the small use exemption applied and is unnecessary when compliant alternatives are readily available.

Comment 27

A longer sell-through period is necessary to ensure that products in the supply chain at the effective date are able to be used in a timely manner.

Response

While consumer products may remain on the shelf for an extended period of time, most fluids used for industrial applications are consumed within six months after purchase. Extending the sell-through period would allow high-VOC products to be stockpiled for a longer than normal period.

Comment 28

Local labeling is a challenge for consumer products that are sold locally, nationally and internationally.

Response

Consumer products are specifically exempted from the labeling provisions of the proposed rule.

Comment 29

Language should be included in the rule describing the enforcement protocol for sampling products in use and directly from shipping containers.

Response

Enforcement procedures are normally not included in rules. Sampling of products in use is typically done at the application source. Verification of VOC content of fluids in shipping containers is normally done by testing the product from a sealed container. However, because of variations in circumstances the procedures may be altered as necessary.

Comment 30

The District has routinely regulated the aerospace industry separately due to its unique status and it should continue to do so. Rule 1124 is specifically designed to reduce VOC emissions from all aerospace manufacturing and assembly operations and other applications have been routinely exempted from multiple other District rules.

Response

Aerospace machining operations that have applicable limits in Rule 1124 have been specifically exempted in the proposed rule. Metal working operations at aerospace facilities that have no specific limits in Rule 1124 are subject to Rule 442 as an unregulated source of VOC emissions. It is possible that at some future date Rule 1124 will be amended to include general machining

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operations that would immediately exclude them from the provisions of this rule as provided by paragraph (h)(3) of the proposed rule. However, many operations at aerospace facilities, including solvent degreasing and plating, are subject to Reg. XI rules in addition to Rule 1124. Until Rule 1124 has specific limits for all lubricant, metal working fluid and rust inhibitors applications, proposed Rule 1144 will apply.

Comment 31

Isopropyl alcohol is necessary for cutting applications on critical space vehicle components where the cutting fluid may penetrate coatings, adhesives and substrates and be off-gassed when exposed to the vacuum of space.

Response

An exemption for space vehicle components is included in the revised staff proposal.

Comment 32

Denatured alcohol is used for a high speed precision CNC milling machine used for aluminum nameplates with graphics already printed upon them. Using an exempt solvent would be cost-prohibitive and using a heavier metal working fluid would require the parts to be cleaned afterwards. The manufacturer of the equipment has said that a recirculating flood coolant process cannot be used or retrofitted. An exemption is requested for this application.

Response

Staff does not believe that an exemption is warranted for this vanishing oil operation. A heavier oil fluid is available as a low-VOC alternative. We acknowledge that using a heavier metal working fluid would require additional cleaning and have included such costs in calculating the cost-effectiveness of the proposed rule. The heavier oil would not necessarily need to be a flooding system and can be applied in the same manner as the alcohol is applied.

Comment 33

Users of consumer products should not be required to keep records. CARB already gets sales data of consumer products directly from manufacturers and suppliers and this puts an additional and unnecessary burden on users of these products.

Response

While CARB has consumer products sales records for emission purposes, records of consumer products used at an individual facility is necessary to determine compliance with permit conditions, rule requirements and possible exemption status. Alternative record keeping is available for consumer products with a VOC content below 50 g/l pursuant to Rule 109.

Comment 34

CARB currently has a rule that regulates lubricants used by household, institutional and commercial establishments that do not manufacture products. The proposed rule has wording in the applicability statement which conflicts with the CARB rule. The wording “commercial” and “institutional” should be removed. The section should be reworded to accurately describe the intended target audience of this regulation

Response

Agreed. “Institutional” and “commercial” have been removed and the applicability section has been clarified.

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Comment 35

The AQMD relied on one study that is limited to 13 specialized shops. More in depth work should be done before one limit is proposed for all lubricant and rust inhibitor uses.

Response

While the AQMD used the IRTA study for some aspects of the cost-effectiveness calculations, the rule's limits are based primarily on testing that has been conducted on a wide range of fluids addressed in the rule. The results indicate that 89 percent of the fluids have a VOC content below the proposed limits. For the 11 percent of the fluids with higher VOC content, the AQMD has reviewed applicable operations to determine appropriate VOC content limits and effective dates, and has incorporated those changes into the proposed rule.

Comment 36

None of the tested alternative low-VOC rust inhibitors or lubricants discussed in the staff report are feasible for use in aerospace manufacturing and assembly. Even if replacement fluids were available, which is not likely, the process for identifying, qualifying and obtaining approvals is difficult and time consuming and could not occur within the Rule's compliance deadline.

Response

The aerospace industry has been using low-VOC lubricants, metal working fluids and rust inhibitors on the vast majority of their metal working applications. Many tens or even hundreds of thousands of gallons of these fluids used on aerospace products are the aqueous-based or heavy oils that the staff report identifies as low-VOC alternatives to high-VOC products. Many compliant products are specially designated to have aerospace approvals. In three site visits and several conversations with aerospace facility industry representatives, only minor uses of moderate to high-VOC fluids were identified. These minor uses have been provided extended rule effective dates or exemptions as appropriate to compensate for the difficult and time consuming process to obtain approvals.

Comment 37

Proposed Rule 1144 should include a vapor pressure limit as an alternative to a VOC concentration limit. Rule 219 exempts equipment from requiring a permit if the VOC content is below 50 g/l or the vapor pressure is less than 20 mm Hg at 20 °C.

Response

Nearly all lubricants, metal working fluids and rust inhibitors, including those with high VOC content, have a VOC composite of 5 mm Hg or less. Measurement of vapor pressure for complex chemical blends is very difficult for low vapor pressure materials. Additionally, the vapor pressure of fluids does not directly correlate with VOC content.

Comment 38

Small quantities of mineral spirits should be allowed for the sole and express purpose of quality control of machined parts. Metal working fluids need to be removed to precisely measure parts.

Response

Proposed Rule 1144 does not apply to cleaning applications. Those activities are subject to Rule 1171 – Solvent Cleaning Operations.

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Comment 39

The proposed rule allows lubricants, metal working fluids and rust inhibitors to be used in conjunction with a control device but prohibition of sales provision does not allow their sale. The prohibition of sale should include an exemption for products to be used in conjunction with a control device.

Response

The revised proposed rule exempts products to be used in conjunction with a control device, in terms of VOC content, as well as the sales prohibition.

Comment 40

A mechanism should be provided in the rule for variances or waivers for products and uses when substantial justification exists.

Response

Regulation V provides a procedure whereby a company can apply for a variance to allow it to continue temporarily operating without penalty while in violation of AQMD rules, while it takes appropriate steps to meet air pollution control requirements. Variances can only be granted by the AQMD Hearing Board.

Comment 41

Manufacturers of certain machine tooling require the use of specific brands of oil otherwise the warranty and service contract may be voided.

Response

The AQMD has received information regarding the manufacturer's recommended oils and lapping compounds. Furthermore, the rule applicability has been revised to specify that only direct-contact lubricants are under the purview of this rule, and other oils, including enclosed high speed spindle oil that do not come in contact with the product or part during manufacturing or assembly, are not impacted by the proposed rule. Furthermore, lapping compounds are exempted. No other data has been provided showing further need of special consideration for the manufacturer's recommended lubricants, metal working fluids or rust inhibitors.

Comment 42

CARB's regulations are predicated on an emission inventory of all consumer products sold in the state. If a CARB-regulated product (e.g., multi-purpose lubricant) is used in a permitted stationary source (e.g., automobile repair facility), the emission reduction from that particular product has already been included in CARB's calculation of necessary state-wide reductions required to attain state and federal ambient air quality standard. To impose additional restrictions on a CARB-regulated product would result further regulation of a product that has already been subject to a standard deemed to achieve maximum feasible reductions in VOCs. Moreover, any attempt to impose additional District regulation on such products would result in a double-counting of the emission reductions achieved by the statewide regulation.

Response

Emissions from consumer products were not included in the inventory or emission reduction analysis for PR 1144, so there is no double-counting. The purpose of including consumer products was to limit and restrict the use of consumer products at stationary sources. However,

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based on discussions with industry, these products are exempted until January 1, 2011 from the VOC limits.

Comment 43

Please accept a request that the time period for written comments be extended until March 1, 2009.

Response

Extending the comment period from two weeks to five months would unnecessary delay the rule making activity. Nevertheless, staff will continue accepting feedback from all stakeholders up until the Public Hearing that will be held by the AQMD Governing Board.

Comment 44

The machining industry has been actively involved in an effort to recycle oils in the Southern California basin for the past 12 years. They sometimes require a solvent additive to reduce the viscosity of the cutting oil so that it can continue to be used in the application. Leakage in the machines results in ever increasing volumes of oil in the sump and ever increasing viscosity. If left unchecked, the oil will become unusable for the application and will have to be disposed. We can use a higher viscosity additive but this would compound the increasing volume problem and significantly contribute to oil disposal. Even though the elimination of this solvent based additive would contribute to the reduction of VOCs, it would be minimal in comparison to the increased waste generation over the next 12 years. Please consider the allowance of high VOC solvent additives used to recycle oil.

Response

Staff agrees that recycling of oil should continue. A provision in the prohibition of sale has been added that will allow viscosity additives to be sold provided that they are reported to the AQMD prior to delivery. However, after addition of the viscosity additive, the fluid must still meet the applicable VOC content limit while in use. The limit for spindle machine oil, where light oil is added to adjust viscosity, has been increased to 200 g/l to facilitate oil recycling based on evaluation of current recycling practice.

Comment 45

The District should consider not regulating lubricants or only regulating lubricants that come into direct contact with parts or products during manufacturing or assembly. Lubricants have little VOC content and have widespread use in many applications not under consideration by the District.

Response

The intent of the rule was to regulate fluids that come into direct contact with parts or products during manufacture or assembly. In accordance with the recommendation, the proposed rule has been revised to only regulate lubricants that come into direct contact during manufacturing. Lubricants used in direct contact with parts during manufacturing will continue to be subject to VOC limits.

Comment 46

The lighter, volatile chain lubricants, for which the VOC limit would preclude, provide a number of great benefits to the end users. They are designed to penetrate to the inner parts of the chain links in small volumes and provide a film of solid lubrication to all moving surfaces. The only

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alternative fluids which would meet the proposed VOC limits would be higher viscosity lubricants. These fluids would have less penetration of the chain leading to overall poorer lubrication of the internal parts of the chain and ultimately a much shortened chain life. These are typically large conveyor chains (hundreds, if not thousands of feet long) which are critical to the manufacturing process for moving parts throughout a facility. The cost to replace a chain is typically 6 figures and this would not include any related downtime.

Response

The intent of the rule was to regulate fluids that come into direct contact with parts or products during manufacture or assembly. As the commentor points out, chain lubricants are used for conveyors that move the parts along during manufacturing but normally do not come into direct contact except for an incidental drip or splash that may occur. An incidental drip or splash would not be considered direct contact and chain lubricants would not be subject to the rule unless they came into direct contact with the part or product during manufacturing.

Comment 47

Some definitions could be clarified to eliminate confusion. “Lubricants” should apply to “machine tools” instead of just “tools”. “Metal Working Fluids” could be clarified by stating that metal working fluids function in the “tool and workpiece interface.” Finally, the types of metal working fluids; straight oil, semi-synthetic, synthetic and soluble; should be defined in the rule.

Response

Staff agrees with the recommendation for “Lubricants” and “Metal Working Fluids” and has revised the definitions accordingly. The types of metal working fluids are used in the staff report but not in the rule language. Those terms are defined in the staff report but are not necessary in the rule because they are not used there.

Comment 48

A higher VOC limit is necessary for water displacing/fingerprint suppressing and “Domestic and International” formulations. These cannot be reformulated at present, even using the best currently available technology and represent a small fraction of total RP usage.

Response

Low-VOC water-based and vegetable oil based alternatives have been identified for these applications. These alternatives have been available for several years and, in some cases, for several decades.

Comment 49

We suggest an annual technology review, including a joint ILMA/San Joaquin Refining/AQMD study of Test Method 313L, to determine technological feasibility of future rule limits and test methods.

Response

We recommend a regular meeting schedule of the working group to continue discussions regarding issues that arise during the implementation of the rule and the revision of specifications. The working group will be able to make recommendations for rule limits, test methods, definition clarifications, inventory review and other aspects of the rule as issues might arise. This recommendation will be included as a resolution in the rule package.

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Comment 50

Blending is necessary for viscosity ratings and new oil purchased could exceed VOC content limits.

Response

The AQMD has tested the straight oil products supplied by the refinery supplying straight oils in Southern California. The test result for oil with a viscosity of 100 SUS (20 cSt) had a VOC content less than the proposed limit. Occasionally the refinery needs to make adjustments to make viscosity corrections but these batches are blended in larger holding tanks minimizing the blending impact over time.

Comment 51

Members in attendance of the Public Consultation meeting requested a definition for light oils. The AQMD did little research on this evidently feeling replacement fluids were readily available. Further consideration of this could satisfy both sides.

Response

The AQMD's interest in fluids used as lubricants, metal working fluids or rust inhibitors is their VOC contribution. The AQMD is very much aware of the concerns regarding the use of light oils and has requested details regarding potentially impacted applications. While staff does conclude that alternative low-VOC products are available, staff has agreed that additional time may help industry to identify, test and implement the alternatives. Light oils are defined by their viscosity which does not always translate directly to VOC content and thus the AQMD has not tried to define "light oil" in a regulatory sense.

Comment 52

The latest draft of the rule exempts special interests such as aerospace, small canisters using propellants and consumers. We are requesting the same exemptions due to the negative economic consequences the proposed rule will have on the area economies.

Response

The proposed rule does include exemptions for some small applications where alternative products have not been identified. These uses include rust inhibitors for assemble aircraft and space vehicles, sinker EDM and lapping applications, fluids used in conjunction with control devices. Aerosol cans and other consumer products are exempt from labeling and prohibition of sales provisions, but the VOC limits still apply if used in a manufacturing application. Consumer uses are already subject to CARB consumer product regulations. While staff acknowledges that there are costs associated with the implementation of Rule 1144, staff has attempted to craft a rule that minimizes such costs, while maximizing emission reduction benefits. The analysis included in this staff report shows that the revised staff proposal is technologically feasible and very cost-effective.

Comment 53

San Joaquin Refining uses GC/FID routinely to monitor our refining process and consider GC/FID analysis to be an acceptable means to characterize petroleum hydrocarbons by carbon distribution and type. We agree with others the need for refinement of Method 313L, particularly the necessity of determining repeatability and reproducibility. It appears that methyl palmitate was selected as the marker from earlier research work to characterize a series of methyl esters as biofuels that are subject to much higher temperatures than metal working fluids.

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Consideration should be made for n-tetradecane (C₁₄H₃₀) as a marker for determining the volatility endpoint.

Response

Staff agrees that a GC/FID method such as Method 313L is an appropriate test method. Method 313L has been shown to have accurate and repeatable results for neat oil products. As discussed in Comment 7 above, methyl palmitate was the endpoint eluted during a related EPA-approved test method to determine VOC content using a GC/MS method. Staff is unaware of the association of the endpoint with biofuels. Currently there is no evidence suggesting that n-tetradecane would be a better endpoint for determining volatility, while SCAQMD Test Method 313-91 has been used for more than a decade to determine VOC content with methyl palmitate eluting at the endpoint of the test.

Comment 54

Quantitative aspects of Method 313L should be revised or made clearer, particularly in defining a non-arbitrary method of peak group integration when dealing with broad mineral oil “peak humps” that may bisect the methyl palmitate marker for the terminus of the chromatogram.

Response

The quantification method provided in the method summary sufficiently explains the technique to determine VOC content when “peak humps” bisect the relative response times of the marker compounds including methyl palmitate. Specifically, the portion of the peak hump eluting prior to methyl palmitate is calculated as VOC while the portion of the peak hump eluting after the methyl palmitate marker is not.

Comment 55

Coalition for Clean Air applauds AQMD’s efforts to reduce emissions of VOC in lubricants, metal working fluids and rust inhibitors. We encourage you to reject industry’s requests to halt and/or delay this important rule. In the process of developing this rule, AQMD has been very considerate of industry’s comments and concerns and we feel that the timeline established in this draft can be met by industry.

Response

The AQMD has made every effort to balance achieving needed emission reductions in a timely manner, while allowing sufficient time for industry to identify, test and implement low-VOC alternatives. Staff is committed to considering all interested stakeholders concerns when developing the provisions of this regulation.

Comment 56

The rule should be bifurcated into two parts. The first covering solvents and be effective January 1, 2010. The second, covering light oils, should be exempt or with an effective date of January 1, 2012 allowing further study and development of alternative low viscosity oils. This would allow the AQMD to realize most of the emission reductions (2.67 tons per day) and delay the more problematic and complex affected applications.

Response

Staff agrees and the proposed rule has been modified to delay the effective dates for metal working fluids, except vanishing oils. Vanishing oils will have a VOC limit of 50 g/l, effective

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January 1, 2010. The delay in the effective dates should allow adequate time for alternative low-VOC formulations to be further studied.

Comment 57

Several applications utilize lubricants, metal working fluids and/or rust inhibitors where there has been insufficient time to determine if they will meet the proposed rules. These operations include copper lubricants, bodymaking fluids/coolants, necker lubricants and can and end making press lubricants used in can manufacturing. It also includes wire bunching and stranding, tool grinding, cubic boron nitride grinding, aluminum fin stamping, wire drawing, screw and bar machines, magnesium machining, temper rolling, cold rolling, hot thread rolling oil, penetrating oils, coating or slushing oils used for rust inhibition, water displacing rust preventatives, salt spray rust inhibitors, long term rust inhibitors and marine shipment rust inhibitors. Given the uncertainty, we feel compelled to request exemptions for these operations before knowing if they are necessary to protect ourselves.

Response

The effective date for VOC limits on metal working fluids has been delayed until January 1, 2012, to allow adequate time for alternative low-VOC formulations to be identified, tested and implemented. The AQMD will continue discussions with interested stakeholders through working group meetings to receive data and information. Further evaluations will be made with respect to VOC limits and exemptions when evidence has been presented demonstrating necessity.

Comment 58

We recommend extending the deadline to 2013 for consumer products in conjunction with CARB's consumer product regulation. We have worked extensively and successfully with CARB but the District's current proposed regulation has provided no time for consumer products to reformulate.

Response

An exemption for consumer products has been added to the rule that will allow additional time, until 2011, for reformulation. The estimated annual usage is relatively minimal but the AQMD does not want to encourage users to switch to higher VOC consumer products because they are exempt. Additionally, industrial facilities present an opportunity to develop market share and customer acceptance for low-VOC consumer products.

Comment 59

We recommend an exemption for aerosol food grade silicone lubricants. While the silicone lubricant itself does not contain any VOC, the solvents used as diluent and/or propellants will makes these products non-compliant.

Response

It does appear that although there are no aerosol food grade silicone lubricants that would meet the proposed regulation, staff research indicates that there are aerosol non-silicone food grade lubricants that perform the same function and meet the proposed VOC limits. Additionally, there are non-aerosol food grade silicone lubricants that also meet the proposed VOC limits. Because there are compliant alternative technologies available to end-users, an exemption will not be included in the proposed rule.

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COMPARATIVE ANALYSIS

Health and Safety Code Section 40727.2 requires a written analysis comparing the proposed rule with existing federal and AQMD regulations. Federal regulations do not regulate VOC emissions from lubricant and rust inhibitor operations. Most lubricants and rust inhibitors are categorized by the AQMD under miscellaneous solvent operations. They are currently subject to Rule 442 - Usage of Solvents, which addresses VOC emissions from VOC-containing materials that are not subject to VOC limits in any Regulation XI rule. Material or equipment subject to Rule 442, such as lubricants and rust inhibitors, are allowed to emit up to 833 pounds per month (five tons per year) of VOC emissions per facility without restriction. Solid film lubricants, dry lubricative materials and barrier coatings are subject to Rule 1124 - Aerospace Assembly and Component Manufacturing Operations, and are not subject to this proposed rule. Similarly, paints and coatings intended to completely cure and leave a solid, permanent film to beautify and protect metal surfaces are subject to other coating rules in Regulation XI and are not subject to this rule. Examples include aerospace, architectural, auto body, and metal paints and coatings with applicable VOC limits in Rules 1113 – Architectural Coatings, Rule 1124, Rule 1151 - Motor Vehicle and Mobile Equipment Non-Assembly Line Coating Operations, and Rule 1107 – Coating of Metal Parts and Products respectively.

SOCIOECONOMIC ASSESSMENT

A socioeconomic analysis of Proposed Rule 1144 has been performed. A draft report will be released no later than 30 days prior to the AQMD Governing Board hearing.

CALIFORNIA ENVIRONMENTAL QUALITY ACT (CEQA)

Pursuant to the California Environmental Quality Act (CEQA) and AQMD Rule 110, appropriate documentation will be prepared to analyze any potential adverse environmental impacts associated with the Proposed Rule 1144. Comments received at the public workshop and CEQA scoping meeting will be considered when preparing the CEQA document.

DRAFT FINDINGS UNDER THE CALIFORNIA HEALTH AND SAFETY CODE

Health and Safety Code Section 40727 requires that prior to adopting, amending or repealing a rule or regulation, the AQMD Governing Board shall make findings of necessity, authority, clarity, consistency, non-duplication, and reference based on relevant information presented at the hearing. The draft findings are as follows:

Necessity – State and federal health-based ambient air quality standards for ozone are regularly and significantly exceeded in the AQMD. The reduction of VOC from Proposed Rule 1144 is part of a comprehensive strategy to meet federal and State air quality standards.

Authority - The AQMD Governing Board obtains its authority to adopt, amend, or repeal rules and regulations from Health and Safety Code Sections 39002, 40000, 40001, 40440, 40441, 40702 and 41508.

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Clarity - The AQMD Governing Board has determined that Proposed Rule 1144 – Lubricants, Metal Working Fluids and Rust Inhibitors, is written and displayed so that the meaning can be easily understood by persons directly affected by them.

Consistency - The AQMD Governing Board has determined that Proposed Rule 1144 – Lubricants, Metal Working Fluids and Rust Inhibitors, is in harmony with, and not in conflict with or contradictory to, existing statutes, court decisions, federal or state regulations.

Non-Duplication - The AQMD Governing Board has determined that Proposed Rule 1144 – Lubricants, Metal Working Fluids and Rust Inhibitors, does not impose the same requirement as any existing state or federal regulation, and the proposed amendments are necessary and proper to execute the powers and duties granted to, and imposed upon, the AQMD.

Reference - In adopting this regulation, the AQMD Governing Board references the following statutes which the AQMD hereby implements, interprets or makes specific: California Health and Safety Code sections 40001, 40440, and 40702.

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Preliminary Draft Staff Report - Appendix A

Appendix A – Lubricant, Metal Working Fluid and Rust Inhibitor VOC Content Test Results

Type	Application	Results
General Lubricants		
Vegetable	General Lubricant	30 g/l
Straight	General Lubricant	43 g/l
Straight	General Lubricant	78 g/l
Rust Inhibitors		
Water-based	Rust Inhibitor/Stamping	202 g/l*
Straight/Consumer	Consumer/General	530 g/l
Straight	Rust Inhibitor/Stamping	319 g/l
Synthetic	Corrosion Preventive	471 g/l
Mineral	Anti-Rust	275 g/l
Vegetable	Cleaner/Rust Inhibitor	<25 g/l
Unknown	Cleaner/Rust Inhibitor	732 g/l
Straight	Rust Inhibitor	170 g/l
Straight	Rust Inhibitor	441 g/l
Straight	Rust Inhibitor	22 g/l
Coolants		
Synthetic	Coolant/Grinding	144 g/l*
Emulsion	Coolant/Grinding	141 g/l*
Emulsion	Coolant	181 g/l*
Metal Working Fluids		
Water-based Metalworking Fluid	Machining/Grinding	112 g/l*
Semi-Synthetic	Machining/Grinding	179 g/l*
Synthetic	Cutting/Grinding	90 g/l*
Synthetic	Cutting/Grinding	99 g/l*
Straight	Metal Removal	12 g/l
Mineral	Cutting/Grinding	172 g/l
Straight	Cutting	60 g/l
Unknown	Machining/Grinding	136 g/l
Straight blend	Spindle Oil	185 g/l
Straight	General	444 g/l
Straight	General	744 g/l
Straight	General	203 g/l
Straight	General	180 g/l
Unknown	Milling	71 g/l
Polymer	Cold heading	29 g/l
Soluble	Soluble Oil	155 g/l*
Straight	Stamping	597 g/l
Straight	Stamping	686 g/l
Vanishing	Vanishing/Stamping	729 g/l
Other		
Unknown	Hydraulic Oil	51 g/l
Straight	EDM	750 g/l
Straight	EDM	802 g/l
Straight	Penetrant	360 g/l
Unknown	Unknown	726 g/l

* Before dilution