Reducing VOC and Toxic Emissions
Sources of Ozone*

VOC Emissions: 433 tons/day

- Off-road Mobile: 25%
- On-road Vehicles: 16%
- Architectural Ctgts/Consumer Products: 26%
- Area Sources: 24%

NOx Emissions: 313 tons/day

- Off-road Mobile: 43%
- On-road Vehicles: 37%
- Area Sources: 10%

* Year 2023 baseline emissions – Summer Planning Inventory
ROG Emission Trends
(tons/day, annual average)

Stationary Sources
Area-wide Sources
On-Road Mobile
Other Mobile
Major Source Contribution To VOC (2023)

- Consumer Products: 22%
  - Off-Road Equipment: 10%
  - Coatings and Related Processes: 6%
  - Other (60 categories): 29%
- Recreational Boats: 5%
- Light Duty Trucks: 4%
- Passenger Auto: 4%
- Medium Duty Trucks: 4%
- Degreasing: 4%
- Architectural Coatings and Related Solvent: 4%
- Petroleum Marketing: 8%
- Coatings and Related Processes: 6%

2023 VOC = 530 tons/day Source: 2012 AQMP
VOC Source Specific Rules
Industrial Coatings and Solvents

- Boats (Rules 1106 & 1106.1)
- Metal (Rule 1107)
- Batch Cleaning (Rule 1122)
- Solvent Cleaning
- Aerospace (Rule 1124)
- Metal coil and containers (Rule 1125)
- Printing (Rules 1130 & 1130.1)
- Wood (Rule 1136)
- Metalworking fluids (Rule 1144)
- Plastic/Rubber/Glass (Rule 1145)
- Auto refinishing (Rule 1151)
- Polyester Resin (Rule 1162)
- Adhesives (Rule 1168)
- Hand-wipe Cleaning (Rule 1171)
VOC Source Specific Rules
Fugitive Emissions

- Fuel Dispensing (Rule 461)
- Liquid Loading (Rule 462)
- Liquid Storage (Rule 463)
- Refinery Process Turnarounds (Rule 1123)
- Oil Wells (Rules 1148, 1148.1, 1148.2)
- Storage Tank Degassing (Rule 1149)

- Landfills (Rule 1150, 1150.1, 1150.2)
- Leaks from Refineries (Rule 1173)
- Sumps and Wastewater Separators (Rule 1176)
- LPG Transfer and Dispensing (Rule 1177)
- Storage at Refineries (Rule 1178)
VOC Source Specific Rules
Consumer Related

- Dry Cleaning (Rule 1102)
- Architectural Coatings (Rule 1113)
- Paint Thinners and Multi-purpose Solvents (Rule 1143)
- Aerosol Coatings (CARB)
- Household and Institutional Products (CARB)
Coating Regulatory Requirements

- Applicability and Purpose
- Definitions
- Coating VOC content
  - Prohibits use of high VOC coatings
- Transfer Efficiency
  - HVLP
- Solvent Use
  - <25 g/l
- Control Equipment (optional)
### General VOC Content Limits

<table>
<thead>
<tr>
<th>Product Type</th>
<th>VOC Content (g/L)</th>
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<tbody>
<tr>
<td>Adhesive</td>
<td>50 - 150</td>
</tr>
<tr>
<td>Architectural Coating</td>
<td>50 - 100</td>
</tr>
<tr>
<td>Industrial Coating</td>
<td>100 - 420</td>
</tr>
<tr>
<td>Inks</td>
<td>225 - 300</td>
</tr>
<tr>
<td>Cleaning</td>
<td>25 - 100</td>
</tr>
</tbody>
</table>

- Limits designed to encourage the use of low and non-solvent technologies.
Architectural Coatings

Solvent-based Alkyd, Epoxy, Urethanes

Summer (Planning) Inventory about 30% higher

Rule Limits: VOC 50 – 100 g/l
Numerous Commercial Coatings: VOC < 10g/l
Colorants Limit: VOC 50 g/l – First in U.S.

100% Solids
Acrylics
Alkyd Emulsions
Waterborne Epoxy & Urethanes
Exempt Solvent-based
Basis for VOC Limits

- Feedback from manufacturers
- CARB Coating Survey
- Commercial volume reporting
- Data search for compliant materials
- Technical Advisory Committee and Working Groups
- Technical Assessments
  - Laboratory Evaluation
  - Field Evaluation
  - Accelerated Weathering
Staff Findings

- Greater number of compliant or super-compliant products virtually in all coating categories
- Courts have upheld technical feasibility
- Private Standards Groups conducting paint testing
- Significant reduction in VOCs with toxic and health concerns
  - Xylene, toluene, ethylbenzene
**Bio-based Exempt Solvents**

- Aqueous
- Exempt Solvents
- Bio-based

**PERC, TCE, MEK, Xylene, Toluene, Glycol Ethers, Mineral Spirits (Naphtha)**

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**Solvent Usage**

- Industrial & Consumer

**Annual Average Emissions**

<table>
<thead>
<tr>
<th>Year</th>
<th>1996</th>
<th>1999</th>
<th>2001</th>
<th>2003</th>
<th>2005</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
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</thead>
<tbody>
<tr>
<td>Tons Per Day</td>
<td>96</td>
<td>43</td>
<td>53</td>
<td>38</td>
<td>33</td>
<td>5</td>
<td>9</td>
<td>4</td>
</tr>
<tr>
<td>VOC &lt; 25 g/l</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

**Emission Inventory**

**Emission Reductions Achieved**

**Uncontrolled Emissions Inventory**

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**VOC < 25 g/l**
Vapor Degreasers

- Open Top
- Drag Out Losses
- PERC, TCE emissions

1995

- Airless/Airtight
- Reduced solvent use and waste
- Virtually no emissions

2001
Automotive Parts Washers

Rule 1171 - Repair and Maintenance Cleaning

- Previously used mineral spirits in parts washers (remote reservoir)
- Replaced by aqueous parts washers and spray cabinets
  - VOC 50 g/l in 1999
  - VOC 25 g/l in 2005

![Annual Average Emissions Graph]

Remote reservoir

Spray cabinet
Clean Air Solvents & Clean Air Choices Cleaner Certification Program

- Multi-media certification programs
  - More than 80 participating companies and over 180 certified products

- Ultra-low VOC

- Prohibits toxics
  - PERC
  - TCE
  - Methylene Chloride
  - Xylene
  - Toluene
  - Methanol
  - Glycol ethers
  - Ethylene glycol
  - Diethanolamine
  - Alkylphenol and nonlyphenol ethoxylates
Objective

- Certify ultra-low VOC cleaning products
  - Recognize availability
  - Encourage marketing and use

- Reduce VOC emissions and reduce human health and environmental impacts
Cost and Performance

- Tested products with City of Santa Monica, major school district, office buildings
- Chemical prices are the same
- Adequate performance with only minor increase in labor
- Nearly invisible transition for most uses
- Significant reduction in VOCs and toxics
Fuel Dispensing

- 16 billion gal/yr gasoline sales in California
  - Estimated 8.4 lbs/1,000 gal of VOC emissions from uncontrolled fuel dispensing
  - Concurrent reductions in BTEX
  - 56 tons/day emission reductions from Phase I controls
  - 11 tons/day from Phase II controls
Vapor Recovery at Service Stations

Phase I

Phase II

Source: CARB
Vapor Recovery Controls

- **Phase I – Fuel deliveries**
  - Trucks unload fuel using submerged drop tube
  - Vapors displaced returned to fuel truck

- **Phase II – Fueling vehicles**
  - Nozzle boot captures vapors displaced during fueling
  - Vapors returned to fuel storage tank
  - Phase I controls return vapors to truck during delivery
Enhanced Inspection and Repair at Refineries and Chemical Plants

- Applies to valves, flanges, pumps, etc.
- Requirements for atmospheric pressure relief devices (PRDs)
  - Monitor to detect any release
  - Notify and report significant releases
- Periodically report PRD release statistics
- Approx. 14 tons/day emission reductions
Refinery Flaring Reduction

SOx Trends as Surrogate

Tons/Year
Enforcement

- Critical aspect of rule process
  - Major impetus for compliance with rules
  - Provides feedback for further rule development and improvements

- Compliance components
  - Prohibition of sales
    - Including labeling of product containers and technical data sheets
  - Visual inspection of equipment
  - Review of permit conditions
  - Examine daily recordkeeping
Challenges

- **Reactivity vs. Mass-based reductions**
  - Much more regulatory complexity with Reactivity

- **Test methods**
  - Low VOC limits in rules challenging methodologies
    - Particularly high water content coatings

- **Reactivity vs. Toxicity**
  - Added flexibility may increase use of toxic compounds

- **Low Vapor Pressure**
  - Physiochemical properties may provide options
    - Establishing appropriate parameters under study
Conclusions

- Industry can thrive under “smart” regulations
- Inclusive rule development process key to industry acceptance
- Research and development (R&D) funds going towards development of low and non-solvent technologies
- VOC reductions lead directly to toxics reductions
Questions or Comments?

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