

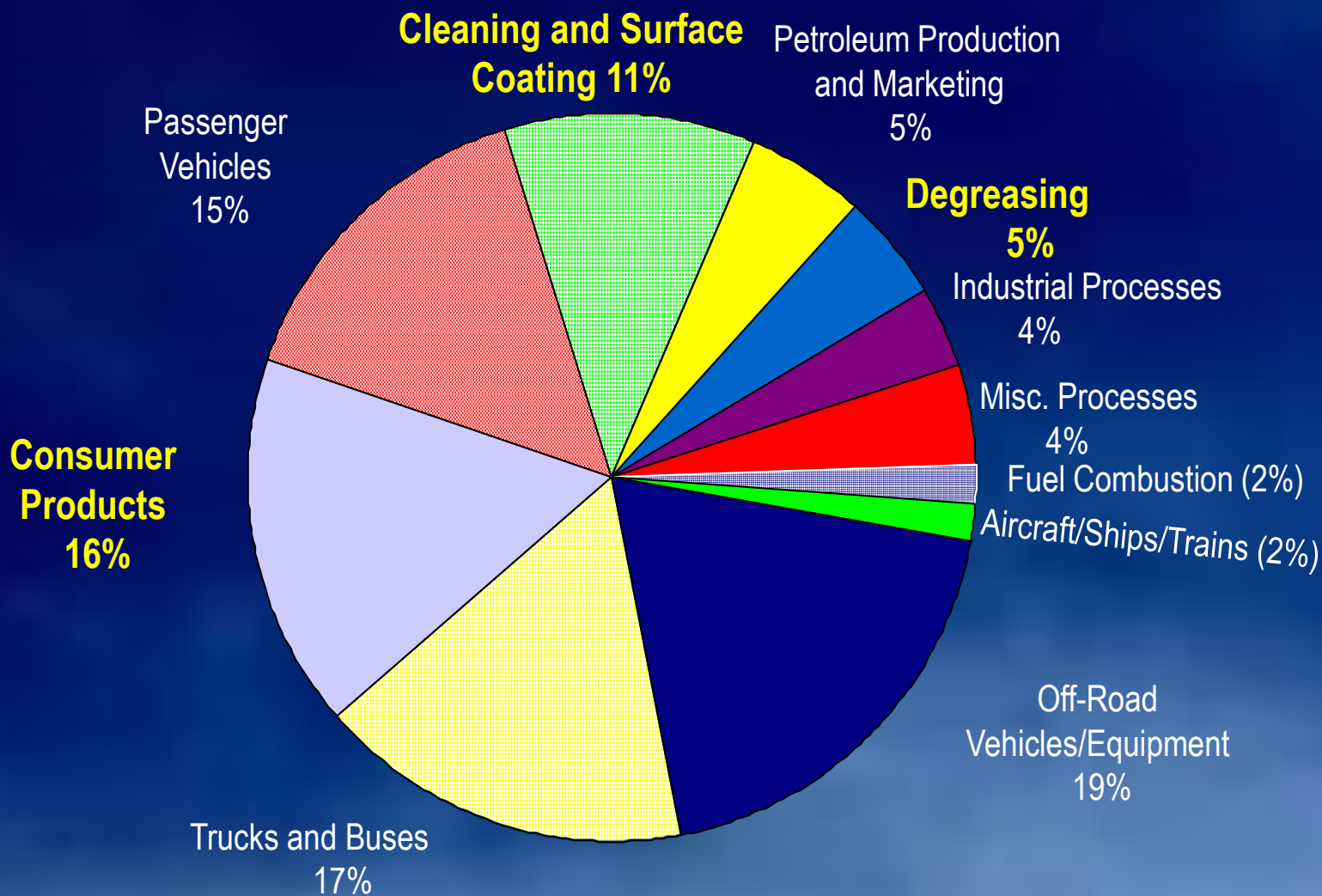
Reducing VOC Emissions from VOC-Containing Materials

Since 1950s

- **Population** -
 - 4.8 Million
 - 16.5 Million
- **Vehicles** -
 - 2.3 Million
 - 10.5 Million
- **Manufacturing**
 - \$10.5 Billion
 - \$203.8 Billion
- **Peak Ozone Levels** -
 - 0.68 ppm
 - 0.18 ppm*

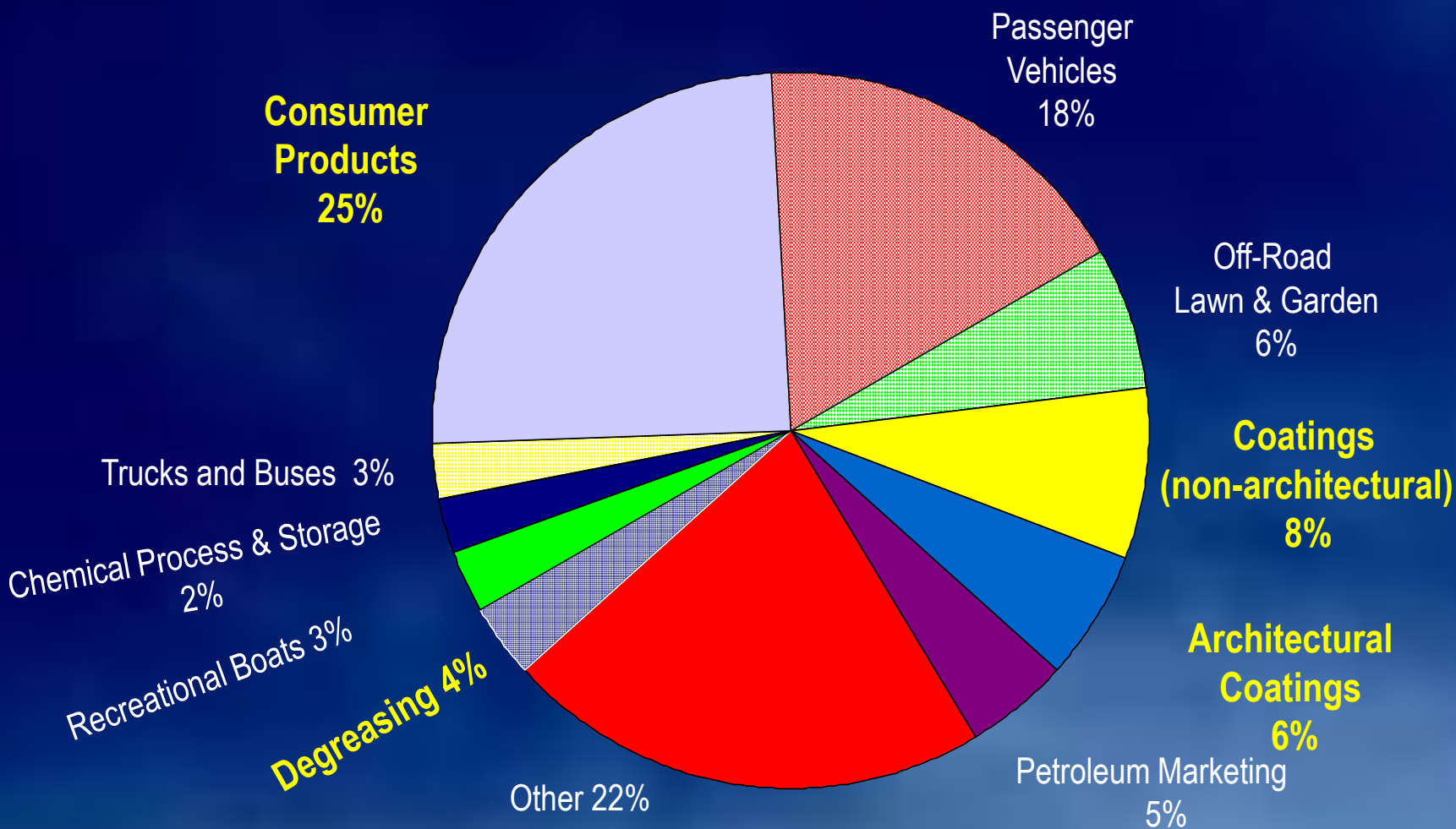
*Extreme Non-Attainment

Major Source Contribution To VOC (2010)



2010 VOC = 659 tons/day

Major Source Contribution To VOC (2020)



2020 VOC = 492 tons/day Source: ARB 2006 Almanac

VOC-Containing Material Rules

- Dry Cleaning (Rule 1102)
- Boats (Rules 1106 & 1106.1)
- Metal (Rule 1107)
- **Buildings (Rule 1113)**
- **Solvent Cleaning (Rules 1122 & 1171)**
- Aerospace (Rule 1124)
- Metal coil and containers (Rule 1125)
- Printing (Rules 1130 & 1130.1)
- Wood (Rule 1136)
- **Paint thinners (Rule 1143)**
- **Metalworking fluids (Rule 1144)**
- Plastic/Rubber/Glass (Rule 1145)
- **Auto refinishing (Rule 1151)**
- Polyester Resin (Rule 1162)
- Adhesives (Rule 1168)

Consumer products (regulated by California Air Resources Board)

Regulatory Requirements

- Applicability and Purpose
- Definitions
- Coating VOC content
 - Prohibits use of high VOC coatings
- Transfer Efficiency
 - HVLP
- Solvent Use
 - <25 g/l



General VOC Content Limits

<u>Product Type</u>	<u>VOC Content(g/L)</u>
Adhesive	50 - 150
Architectural Coating	50 -100
Industrial Coating	100 - 420
Inks	225 - 300
Cleaning	25 – 100
Metalworking Fluids	50 - 75

- Limits designed to encourage the use of low and non-solvent technologies
 - Co-benefits of reducing toxicity (removing aromatics)

Architectural Coatings

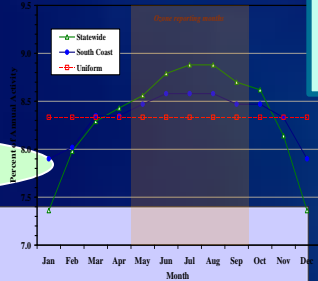


Rule Limits: VOC 50 – 100 g/l
 Numerous Commercial Coatings: VOC < 10g/l
 Colorants Limit: VOC 50 g/l – First in U.S.

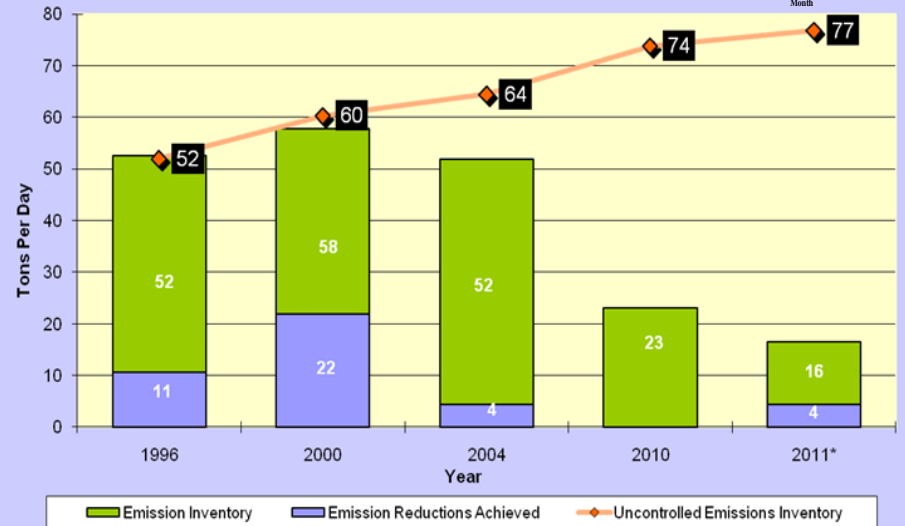
Solvent-based Alkyd,
 Epoxy, Urethanes

100% Solids
 Acrylics
 Alkyd Emulsions
 Waterborne Epoxy & Urethanes
 Exempt Solvent-based

Summer (Planning) Inventory about 30% higher



Annual Average Emissions



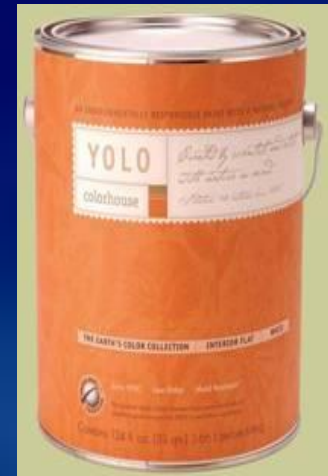
Basis for VOC Limits

- Feedback from Manufacturers
- CARB Coating Survey
- Rule 314 Data
- 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
- Private Standards Groups conducting paint testing



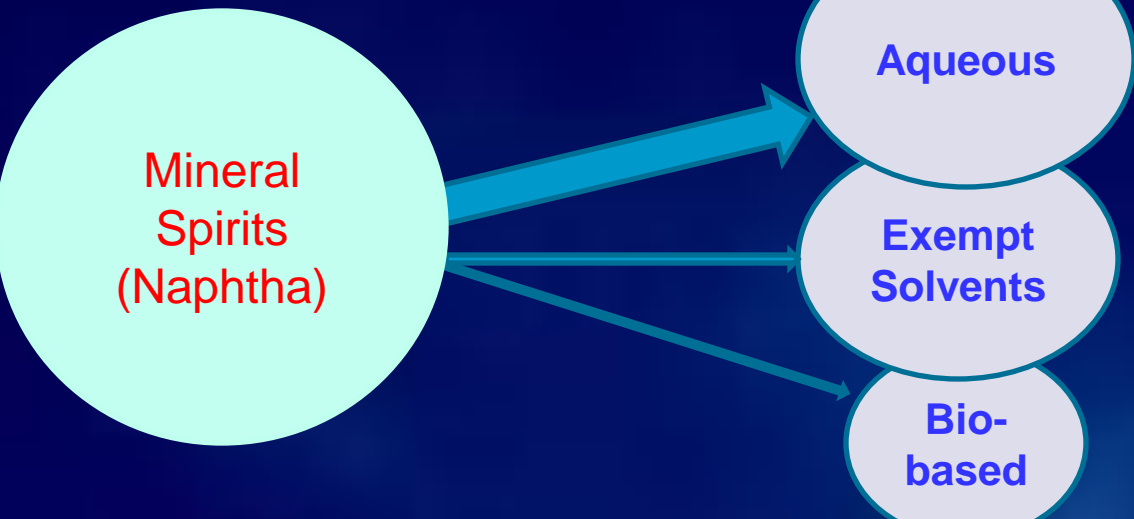


Clean Air Solvent Certification

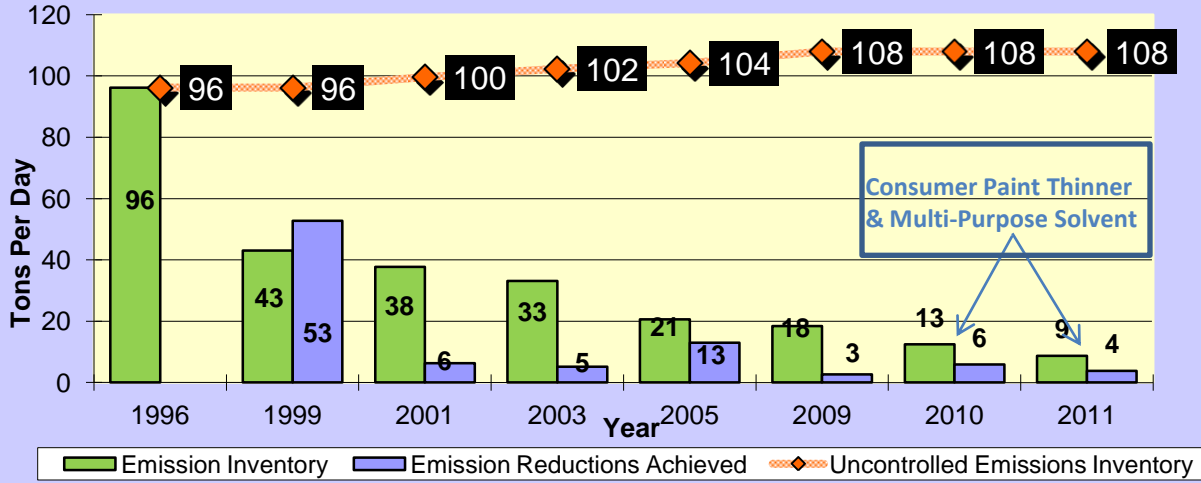
- Prohibition of
 - Volatile Organic Hazardous Air Pollutants (VOHAPs)
 - Ozone Depleting Compounds (ODCs)
 - Global Warming Compounds (GWCs)
 - Maximum Incremental Reactivity (MIR) value higher than toluene
- Product VOC must be no more than 25 g/L VOC
- Product VOC composite partial pressure (CPP) must be less than 5 mm Hg at 20°C
- 73 participating companies and over 140 certified products

Solvent Usage Industrial & Consumer

VOC < 25 g/l



Annual Average Emissions



Rule 1122 & 1171 – Applicability (All Things Cleaning)

- Solvent cleaning done during production, repair, maintenance or servicing
- Applicable to parts, products, tools, machinery, equipment, work areas

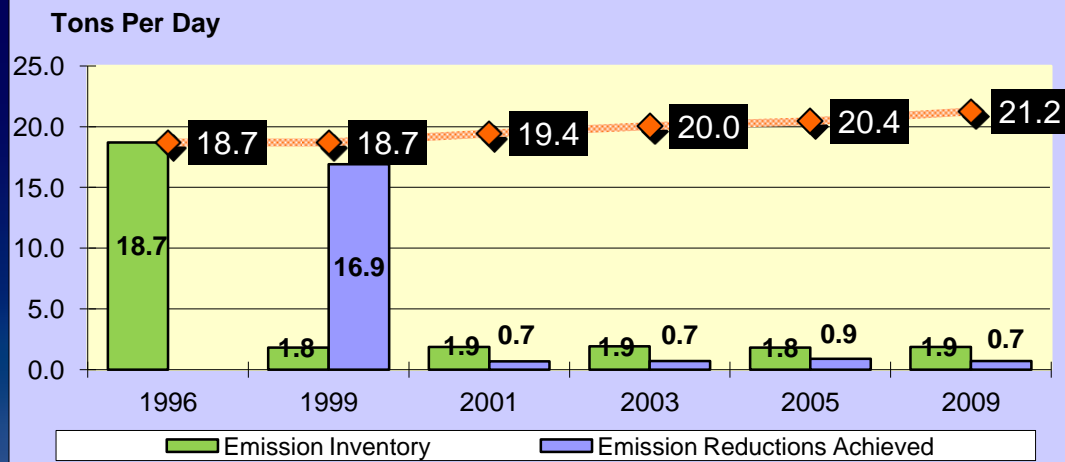


Automotive Parts Washers

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



Remote reservoir



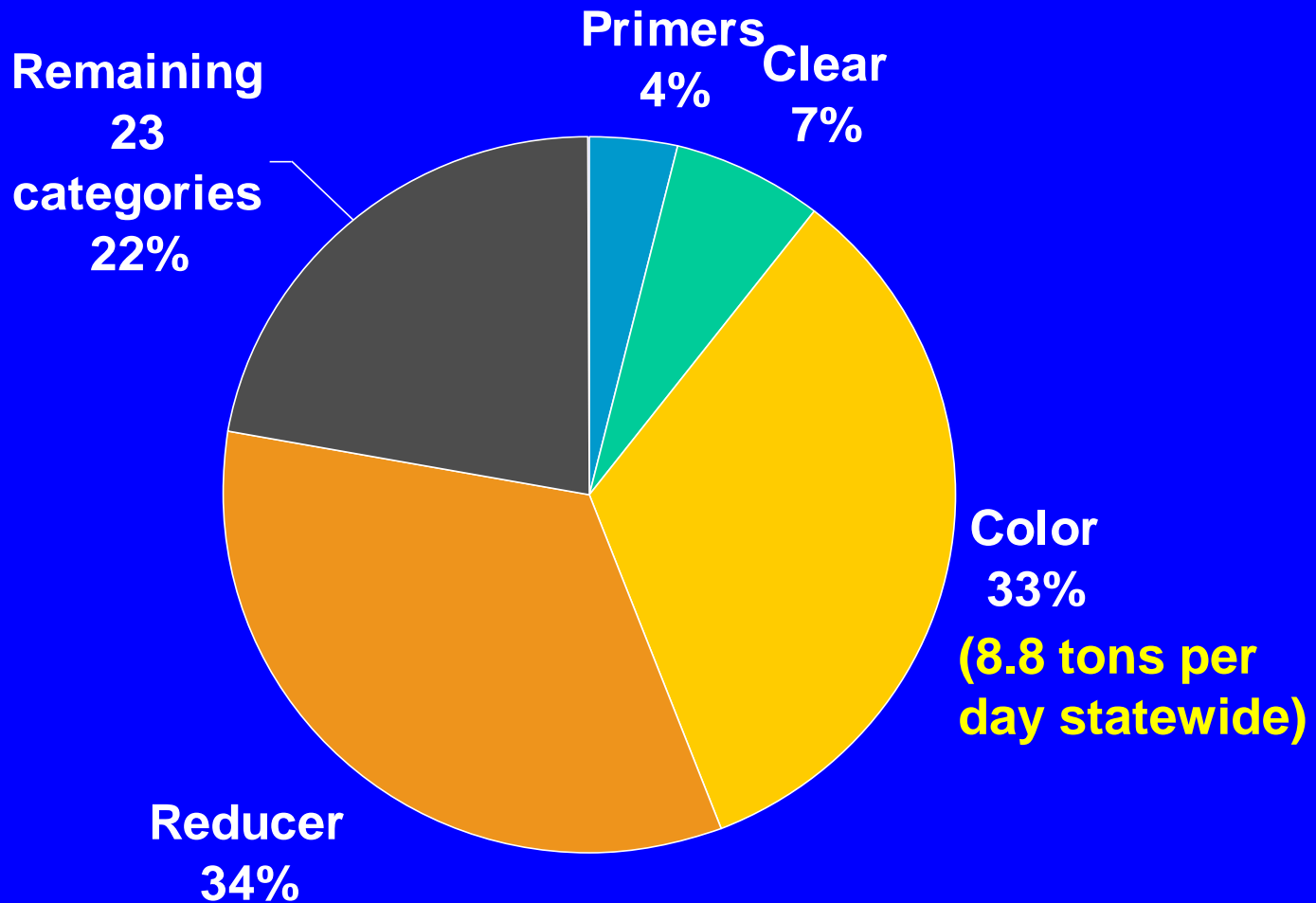
Spray cabinet

Auto Body Refinishing (2005)



- Auto body coatings were almost exclusively solvent-borne
- EU Directive 2004/42/EG
 - Requires 420 g/l for all automotive coating(s) in Europe
 - Effective 2007
- SCAQMD and SJVAPCD adopt regulations
 - Mirror the requirements of EU Directive and CARB SCM
 - Effective 2008/2009

Emission Categories



Auto Refinishing Regulatory Requirements

- **Coating VOC content**
 - Waterborne technology in use for refinishing
 - Prohibits sale and possession of high VOC coatings
- **Transfer Efficiency**
 - HVLP
- **Solvent Use**
 - <25 g/l
 - Closed Containers



Metalworking Fluids & Direct Contact Lubricants

- Over 12,000 machining shops
Mostly small businesses
- AQMD survey of local manufacturers and distributors
 - 4.2 million gallons of metalworking fluids sold in South Coast (2007)
 - Over 300,000 gallons are high VOC products
- No VOC information for semi-volatile oils



Test Method

- Cooperative process with industry
- Thermogravimetric Analyzer (TGA) Test Method
 - ASTM E 1868-10 & Work Instructions for QA/QC
- Acknowledges limited contribution by heavier metalworking fluids
- Reproducible method for semi-volatile metalworking fluids

Applicability

- Manufacturing and Assembly operations
- &
- Direct-contact with products made for sale



VOC Limits

Fluid	Effective 1/1/2010	Effective 1/1/2011	Effective 1/1/2012
(A) Vanishing Oil	50		
(B) Metalworking Fluid			
(i) Metal Forming			75
(ii) Metal Removal			
(a) General			75
(b) Precision Metal Removal			130
(iii) Metal Treating			75
(iv) Metal Protecting			
(a) General	300		50
(b) Military Specified Preservative		340	
(C) Direct-Contact Lubricant			50

Consumer Products

General Purpose Cleaners

- Over 600 million gallons sold annually in California
- Mostly water (97%)
- Disposal into sanitary sewer
- Traditionally formulated with IPA, 2-butoxyethanol, terpenes, and APEs
- Alternative products are formulated with ethoxylated alcohol, hydrogen peroxide and terpenes



Clean Air Choices Cleaner Certification Program

- Modeled after Clean Air Solvent Certification Program
 - 73 participating companies and over 140 certified products
- Ultra-low VOC (<10 g/l) janitorial products currently available and in use
- Prohibits toxics, heavy metals and other chemicals listed on Prop. 65



Objective



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



- Reduce VOC emissions and reduce human health and environmental impacts

Alternative Formulations for Consumer Products

- **Traditional product ingredients**
 - IPA, 2-butoxyethanol, terpenes, hydrochloric acid, mineral spirits, methylene chloride, alkylphenol and nonylphenol ethoxylates (APE)
- **Alternative product ingredients**
 - Water-based and highly dilutable
 - Bio-based (terpenes, methyl esters)
 - Low vapor pressure (<0.1 mm Hg)
 - Low toxicity/unknown toxicity
 - Hydrogen peroxide

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
 - Floor Wax alternatives have issues
- Nearly invisible transition for most uses



Example CARB VOC¹ limits

<u>Product Category</u>	<u>Aerosol</u> (wt. %)	<u>Non- Aerosol</u> (wt. %)	<u>Non- Aerosol</u> <u>2015</u> (wt. %)
Bath & Tile Cleaner	7	1	1
General Purpose Cleaner	8	4	0.5
General Purpose Degreaser	10	4	0.5
Glass Cleaner	8	4	3

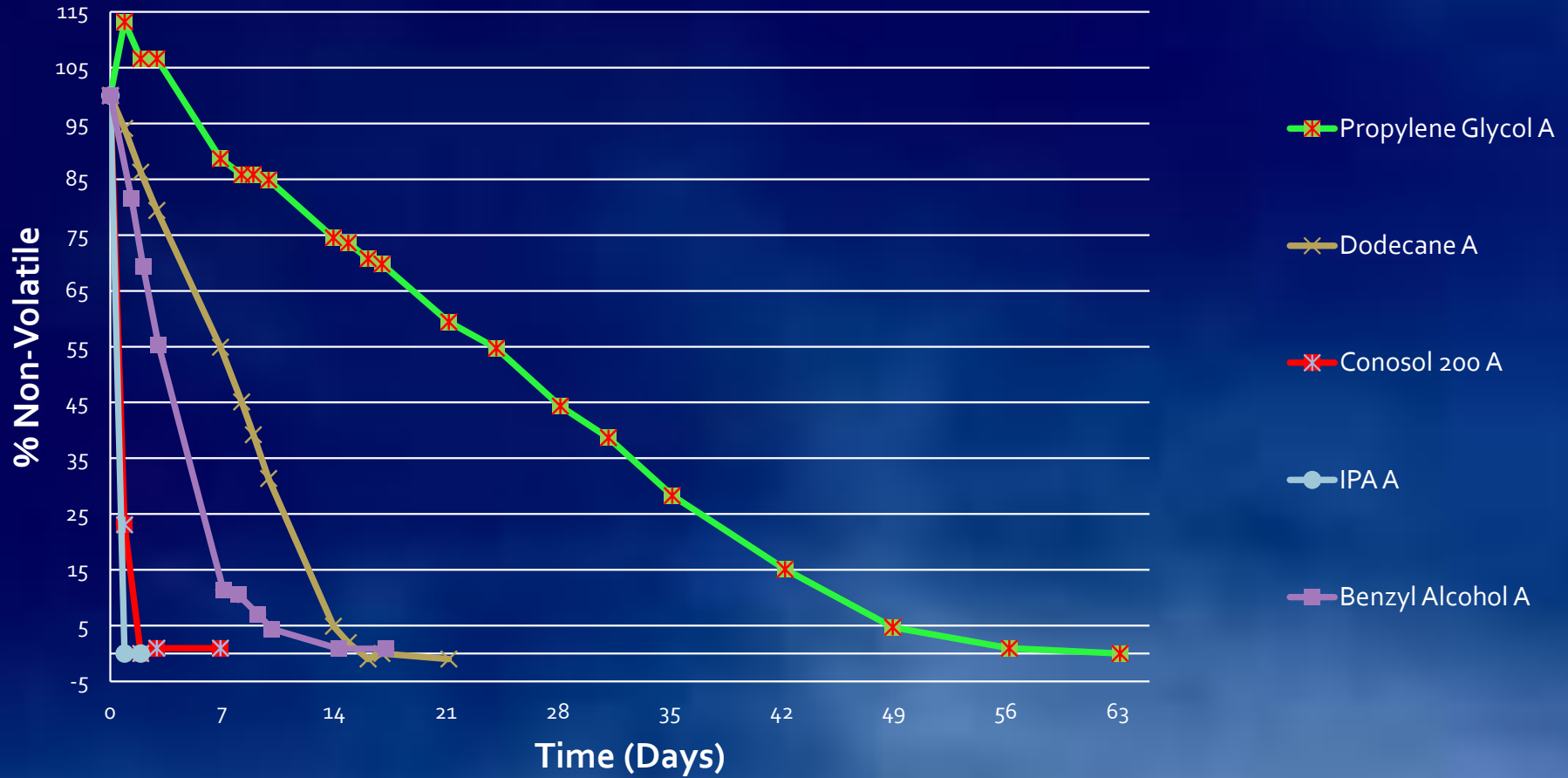
1. Exempts low vapor pressure solvents and fragrance

Volatilization of LVP Solvents

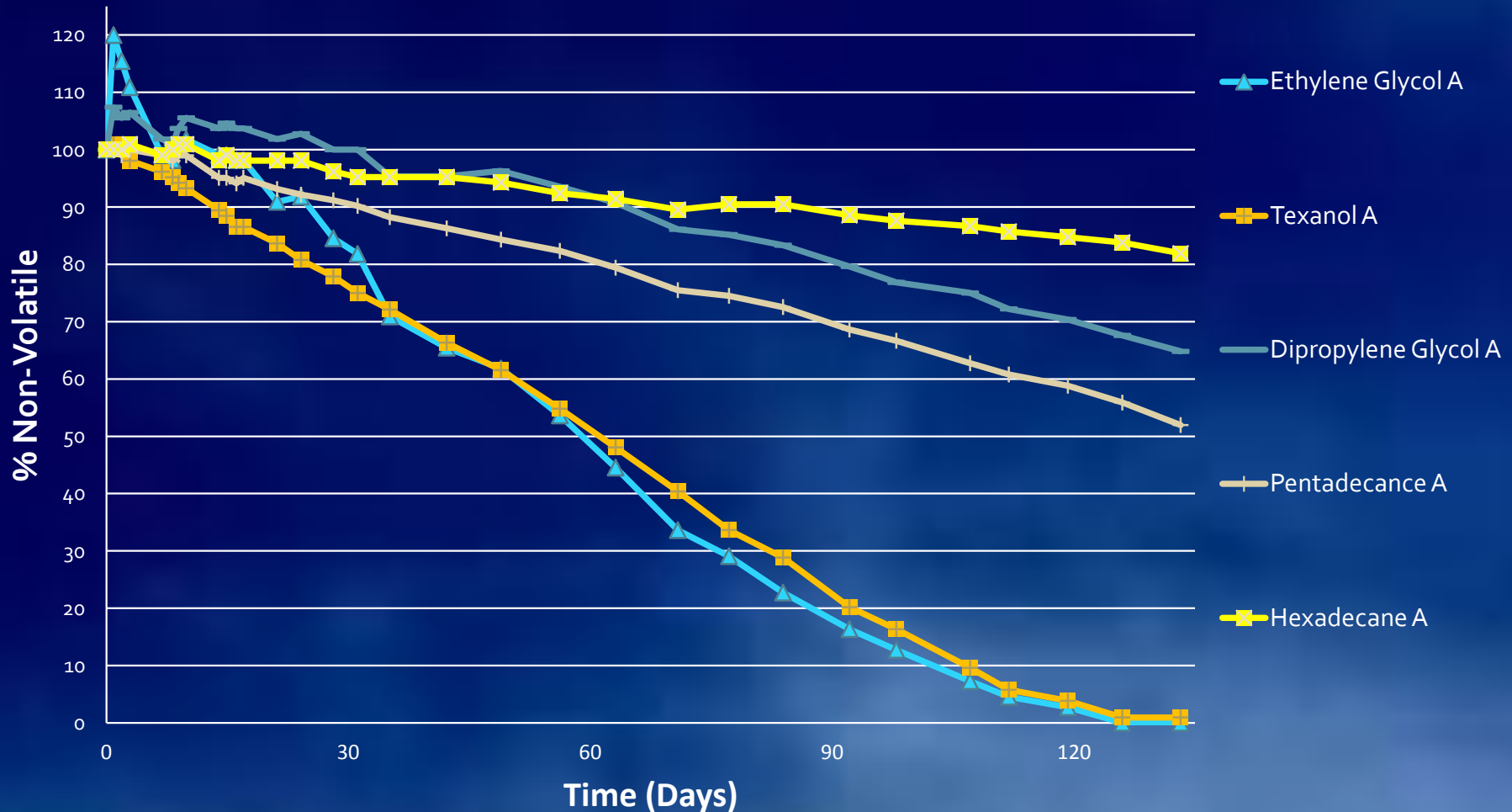
Background

- **VOC Content of Semi-Volatile Metalworking Fluids**
 - Method 24 provides inconsistent results
- **2008 Volatilization Study**
 - Six month test at low temperature (40°C)
 - Led to development of TGA test method (E 1868-10)
- **Similar extended low temperature testing shows common LVP solvents are volatilizing**
- **LVP parameters should be reconsidered**
 - Reflect latest scientific data
 - No consistency amongst parameters

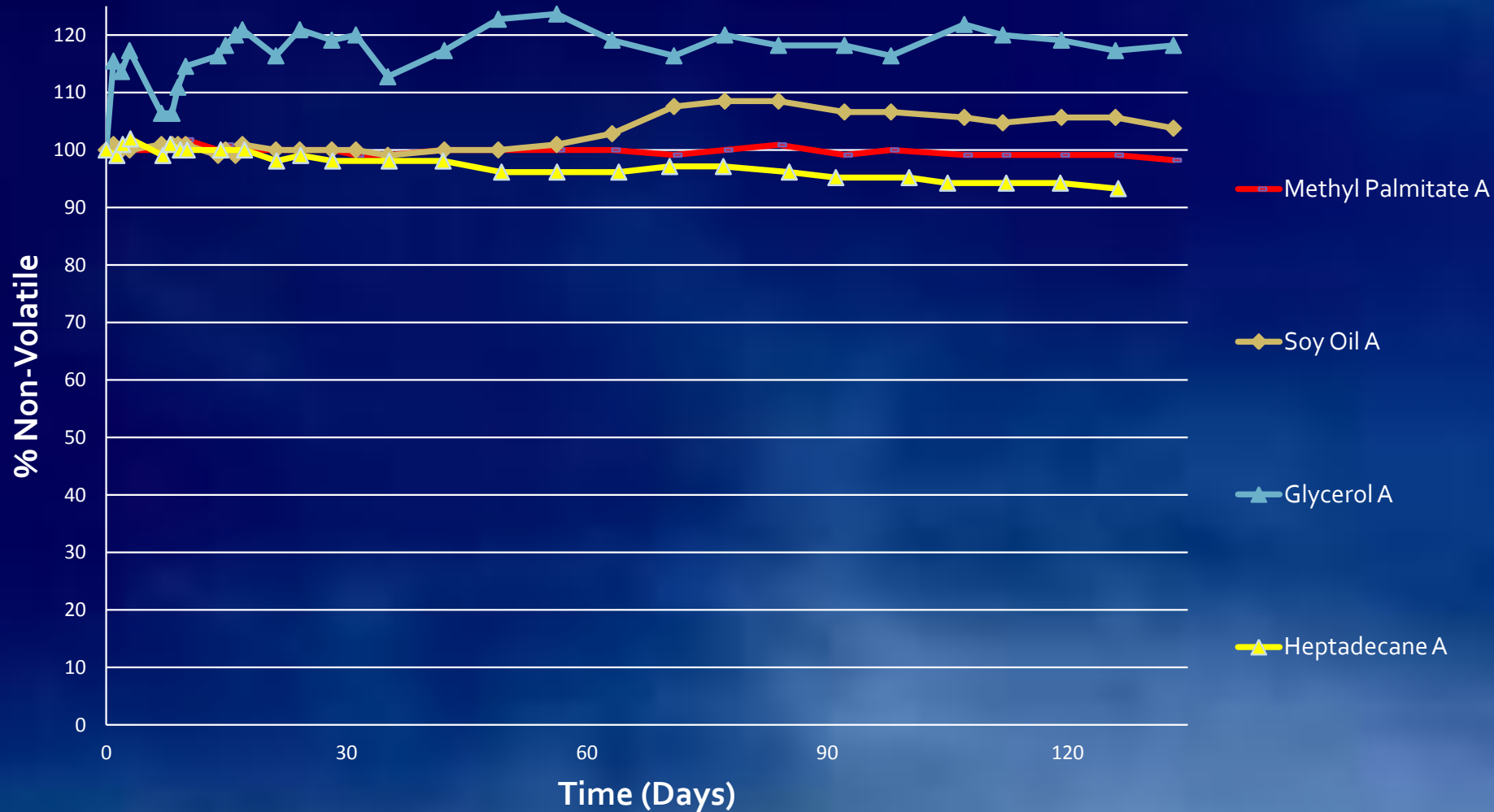
Volatiles - Isolated Ambient Evaporation Study



Semi-Volatiles – Isolated Ambient Evaporation Study (On-going)



Non-Volatiles - Isolated Ambient Evaporation Study (On-going)



Future Considerations

Potential AQMP Control Measures

- Additional Reductions from Architectural Coatings
 - Lowering VOC of certain categories to 25 g/l
 - Removing Small Container Exemption
 - Requiring minimal transfer efficiency
- Additional VOC Reductions from solvents, coatings, adhesives, and lubricants

PROPOSED CONTROL MEASURES – 2012 AQMP – OZONE

Number	Title	Adoption	Implementation Period	Reduction (tpd)
CTS-01	Further Emission Reduction from Architectural Coatings (R1113) [VOC]	2015/2016	2018/2020	4-5
CTS-02	Further Emission Reduction from Miscellaneous Coatings, Adhesives, Solvents and Lubricants [VOC]	2013/2015	2015/2018	1-2
CTS-03	Emission Reduction from Mold Release Products [VOC]	2014	2016	2
CTS-04	Further VOC Reductions from Consumer Products ([VOC]	N/A	N/A	N/A
FUG-01	Emission Reduction from Vacuum Truck Venting [VOC]	2014	2016	1-1.5
FUG-02	Emission Reduction from Propane Gas Refueling [VOC] – <i>Phase II</i>	2015	2017	1
FUG-03	Additional Emission Reductions from LDAR and Vapor Recovery Systems [VOC]	Mid-term (2016)	2018	1-2

Questions or Comments?

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