

# Public Consultation Meeting Regulatory and Non-Regulatory Fuels Activities

February 25, 2004

California Environmental Protection Agency



**Air Resources Board**

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## Agenda

- ◆ **Introductions**
- ◆ **Implementation Discussions**
  - Phase 3 RFG
  - Diesel Fuel Lubricity
- ◆ **Potential Regulatory Activities**
  - Phase 4 RFG
  - Diesel fuel for locomotive and marine diesel engines
  - Diesel fuel deposit control additives and diesel engine lubricating oils
  - Clean Fuels Outlets - Hydrogen
  - Biodiesel
- ◆ **Presentations by Others**
- ◆ **Open Discussion**
- ◆ **Closing Remarks**

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## **Implementation Issues**

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## **Implementation of Phase 3 RFG Regulation**

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## **Phase 3 RFG Implementation Issues**

- ◆ Documentation for transfer of denatured ethanol for use in California gasoline
- ◆ Blending small amounts of finished gasoline into CARBOB terminal tanks
- ◆ Blending small amounts of transmix into CARBOB terminal tanks
- ◆ Other issues may exist

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## **Documentation for Transfer of Denatured Ethanol**

- ◆ Importers and producers of ethanol must provide the following information with the product transfer documents:
  - Name, location and operator of the facilities at which the ethanol was produced or denatured
- ◆ Concerns about the practicality of this requirement
  - commingling of denatured ethanol
  - commingling of neat ethanol before it reaches a California production facility that adds the denaturant

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## **Blending Finished Gasoline into CARBOB Terminal Tank**

- ◆ Blending of CARBOB with California gasoline is prohibited except for specific situations that involve a changeover in service
- ◆ Address the blending of small amounts of finished gasoline into CARBOB terminal tanks
  - After calibration of ethanol meters
  - After pulling gasoline from service station tank
  - After aborted loading of ethanol and CARBOB to tanker truck

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## **Blending Transmix into CARBOB Terminal Tanks**

- ◆ CaRFG3 regulations include provisions for enforcement protocols for blending transmix with finished gasoline but none for blending transmix with CARBOB

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## **CaRFG3 Implementation Refinements**

- ◆ Plan proposed amendments for October 2004 hearing
  - Identify conditions under which returning small amounts of gasoline to CARBOB terminal tanks is allowed
  - Allow protocols for blending transmix into CARBOB terminal tank
  - Allow ethanol shipper to maintain all sources of ethanol instead of providing on each transfer document
- ◆ ARB staff to announce interim policy on website pending completing of rulemakings

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## **Implementation of Diesel Regulation**

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## **Diesel Fuel Lubricity**

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### **ARB Diesel Fuel Lubricity Standard Phase I: Protect Existing Equipment**

- ◆ 520 micron maximum WSD based on HFRR @60 deg C
- ◆ Time frame: 90 day phase-in commencing August 1, 2004

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## **ARB Diesel Fuel Lubricity Standard Phase 2: Protect Advanced Technology Fuel Injection Systems**

- ◆ Placeholder in regulation for 2006 lubricity standard
- ◆ Board resolution direction to staff:
  - Conduct technology assessment by 2005
  - Propose new lubricity standard to Board for 2006 if assessment determines:
    - HFRR maximum WSD of 460 microns, or more appropriate standard, should be implemented in 2006 with proposed 15 ppmw sulfur limit
- ◆ Time frame:
  - Technology assessment complete 2005
  - 2006 standard: 90 day phase-in commencing June 1, 2006

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## **Deference to ASTM Lubricity Standard**

- ◆ ARB lubricity standards will defer to ASTM standards if:
  - For 2004:
    - ASTM establishes a standard at least as protective as ARB adopted standard
  - For 2006:
    - ASTM establishes a standard that is protective of advanced technology fuel injection systems
  - Division of Measurement Standards adopts

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## **Status of ASTM Ballot**

- ◆ Current ballot is identical to ARB 2004 standard
  - Received negative votes
- ◆ Current plans:
  - Reballot prior to June meeting

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## **National Lubricity Standard for Diesel Fuel**

- ◆ EPA is considering pursuit of lubricity regulation to align with ARB standard

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## **Potential Regulatory Activities**

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## **Phase 4 RFG**

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## Suggested Measures for Further Evaluation

- ◆ SIP commitment includes examination of feasibility and scope of further gasoline specifications

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## Suggested Measures for Further Evaluation (cont.)

- |             |                            |
|-------------|----------------------------|
| ◆ Sulfur    | 5 ppm                      |
| ◆ Oxygen    | 0 %wt. <sup>a</sup>        |
| ◆ Aromatics | 25 %vol.                   |
| ◆ Olefins   | 6 %vol.                    |
| ◆ T50       | 200°                       |
| ◆ T90       | 300°                       |
| ◆ RVP       | 6.4 <sup>b</sup> - 6.5 psi |
| ◆ Benzene   | 0.1% vol.                  |

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## Comparison of Flat Limits

	Phase 2	Phase 3	Suggested Measure
Sulfur ppm	40	20	5
Oxygen %wt.	2 <sup>a</sup>	2 <sup>a</sup>	0
Aromatics	25	25	25
Olefins %vol.	6	6	6
T50 °F	210	213	200
T90 °F	300	305	300
RVP psi	7.0	7.0 <sup>b</sup>	6.5 <sup>c</sup>
Benzene %vol.	1.0	0.8	0.1

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## Estimated Potential Benefits

- ◆ The estimated potential benefits associated with suggested measure in 2010:

	<u>tons per day</u>
NOx	15
Hydrocarbons	35

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## Significant Issues

- ◆ Costs
- ◆ Supply

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## Significant Issues (cont.)

<u>Capital</u>	<u>cents per gallon</u>	<u>\$/lb. controlled</u>
Suggested Measure: 4 to 6 Billion dollars	10 - 20 <sup>a</sup>	45 - 90 <sup>b</sup>
CaRFG2: 4 Billion	10	6.3 <sup>b</sup>
CaRFG3: 1 Billion	3	NA <sup>c</sup>

a. Depends on costs of imports

b. Only HC and NOx emissions reductions used to calculate cost effectiveness

c. Intended to eliminate MTBE

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## Significant Issues (cont.)

- ◆ Production and Imports
  - Could further reduce in-state production by about 15%
  - Require more imports

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## Significant Issues (cont.)

- ◆ Availability of Imports
  - Limited due to specifications that are radically different from federal RFG for rest of the nation
    - Sulfur - 5 ppm cap vs 30 ppm average for federal RFG
    - Benzene - 0.1% by volume vs 1% by volume for federal RFG

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## **Other Significant Issues**

- ◆ Proposed 0% Oxygen Content
  - Federal CAA requires 2% oxygen content
  - Federal CAA oxygen requirement applies to 80% of all fuel sold in California
  - Would require a waiver of the federal oxygen requirement
  - Wintertime oxygen content requirement still in effect for the South Coast and parts of Imperial County

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## **Other Significant Issues (cont.)**

- ◆ Proposed 6.5 psi RFG limit makes production of complying fuel difficult if not impossible
  - Federal RVP minimum limit for fuel 6.4 psi
  - Leaves only 0.1 psi of flexibility
  - Reproducibility of test method is 0.2 psi

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## Conclusions

- ✦ Significant supply and production issues to be addressed
- ✦ Feasibility assessments require additional investigation
- ✦ Potential for emissions benefits for gasoline

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## CARB DIESEL FUEL USE WITH INTRASTATE



## **Why Evaluate Intrastate Marine and Locomotives?**

- ◆ ARB Public Hearing - July 24, 2003
- ◆ ARB Status Report - October 23, 2003
- ◆ ARB SIP Summit - January 13-14, 2004
  - ARB staff directed to prepare an evaluation of potential concepts to reduce emissions from intrastate marine and locomotives

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## **Line Haul Locomotive and Oceangoing Ship Fueling Patterns**

- ◆ Operate nationally and internationally.
- ◆ Low quality fuels with high sulfur content.
- ◆ Can fuel prior to arriving in California.
- ◆ Fuel storage capacity sufficient to avoid fueling in California.
- ◆ Most fuel dispensed in California consumed out-of-state.

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## Intrastate Harbor Craft and Locomotive Fueling Patterns

- ◆ Operate locally and regionally.
- ◆ Fueled primarily at California locations.
- ◆ Already some use of higher quality fuels.
- ◆ Opportunities for additional use of cleaner fuels.

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## In-Use Sulfur Levels of Transportation Fuels Consumed in California

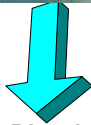
(ppmw)

Fuel Type	Current 2003	Anticipated 2006/2007
<b>CARB Diesel</b>	<b>140</b>	<b>10</b>
<b>EPA Diesel</b>		
<b>On-Road</b>	<b>360</b>	<b>10</b>
<b>Non-Road</b>	<b>3,200</b>	<b>340*</b>
<b>Marine Distillate</b>	<b>340-20,000</b>	<b>No Change</b>
<b>Marine Bunker Fuel</b>	<b>28,000</b>	<b>No Change</b>

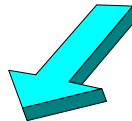
\* Currently unregulated. US EPA has proposed regulations.

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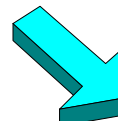
## Cleaner Fuel Opportunities Under Evaluation for Marine Vessels



- CARB Diesel:**  
**Harbor craft**
- ~25% PM Reduction
  - ~10% NOx Reduction
  - Greater use of add-on controls



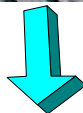
- Marine Distillate:**  
**Ships at Dockside**  
 (auxiliary engines)
- ~60% PM Reduction
  - ~10% NOx Reduction
  - ~90% SOx Reduction



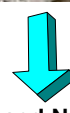
- Lower Sulfur Marine**  
**Bunker Fuel:**  
**Oceangoing ships at sea**  
 (main engines)
- ~20% PM Reduction
  - ~40% SOx Reduction

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## Cleaner Fuel Opportunities Under Evaluation for Locomotives



- Use of CARB Diesel:**  
**Short Haul and Switchers**
- ~5% NOx Reductions
  - ~20% PM Reductions
  - Greater use of add-on controls



- USEPA's Proposed Non-Road Diesel:**  
**Line Haul Locomotives**
- ~90% SOx reductions
  - ~5% NOx reductions
  - ~20% PM reductions

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## **ARB Evaluation Process**

- ◆ Gather information on intrastate marine and locomotives (e.g., engines, fuel use)
- ◆ ARB survey of marine and locomotives
- ◆ Conduct future workshops
- ◆ ARB Board Meeting (4th Quarter 2004)?

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## **ARB Webpages and List Serves**

- ◆ [Http://www.arb.ca.gov/offroad/](http://www.arb.ca.gov/offroad/)
- ◆ Locomotives - [loco/loco.htm](http://www.arb.ca.gov/offroad/loco/loco.htm)
- ◆ Marine Vessels - [marinevess/marinevess.htm](http://www.arb.ca.gov/offroad/marinevess/marinevess.htm)

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## **Diesel Fuel Deposit Control Additives**

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## **Diesel Deposit Control Additives**

- ✦ SIP keep clean measure
- ✦ No current deposit control additive requirement for diesel fuel
- ✦ Issue may gain significance for 2007 engine designs

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## **Deposit Control Additives Potential Benefits**

- ◆ Could reduce potential deposit formation in fuel systems and engines
- ◆ Keep engines closer to factory tolerances
- ◆ Minimize deterioration rate of engine-out emission levels

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## **Diesel Engine Lubricating Oils**

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## **Diesel Engine Lubricating Oils**

- ◆ Diesel engines consume (combust) lubrication oils as part of their normal operation
- ◆ Need to consider lubricating oil sulfur and ash content
  - Emissions
  - Impact on after treatment control technology

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## **Industry Efforts to Study Lubricant Effects on Aftertreatment Devices**

- ◆ Government/Industry workgroup
  - DOE Advanced Petroleum-Based Fuels - Diesel Emissions Control (APBF-DEC) Program
- ◆ Private consortium
  - Southwest Research Institute Diesel Aftertreatment Sensitivity to Lubricants (DASL) / Non-Thermal Catalyst Deactivation (N-TCD)

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## **ASTM Heavy Duty Engine Oil Classification Panel**

- ◆ Industry developing HD engine oil specifications for use with aftertreatment technology
  - Proposed Category 10 (PC-10)
  - Lower sulfur, phosphorous, and sulfated ash
  - Engine durability issues to be addressed
- ◆ Target API licensing: late 2005/early 2006
- ◆ Oils in market 3rd quarter 2006

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## **Summary of Potential Diesel Measures**

- ◆ Diesel deposit control additives
  - Need to investigate feasibility of deposit control additives - effectiveness and cost
  - Time frame: 2010+
- ◆ Diesel engine lubricating oils:
  - Industry efforts may preclude regulatory need
  - Licensing of new API engine oil category targeted for late 2005/early 2006

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## **Clean Fuels Outlets**

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## **Objective**

- ◆ To ensure that clean fuels are available for alternative fueled vehicles to operate and achieve the emissions benefits attributed from these vehicles

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## Key Points of Program

- ◆ Require certain owners/lessors of gasoline stations to install clean fuel outlets
- ◆ Requirement is triggered when 20,000 vehicles are certified to California LEV standards on a specific fuel

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## Considering Program Updates

- ◆ Current program does not consider:
  - New fuel/vehicle technologies
    - hydrogen fuel cells
    - hybrids
  - Infrastructure requirements
  - Lead time
  - Demand Needs
  - Mechanisms to adjust for market conditions

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## **Tentative Schedule**

- ◆ Board hearing September 2004

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## **Biodiesel**

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## Background

- ◆ Generally refers to methyl and ethyl esters of fatty acids that are derived from natural products
  - Vegetable, animal, and grease
- ◆ ASTM D6751 establishes fuel specification for biodiesel as a blending component.
  - Excludes fatty acids
  - Glycerol, moisture, cold flow, others
- ◆ US Production capacity: 150 million gallons/yr
- ◆ US Sales 2002: 20 million gallons/yr

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## Use of Biodiesel

- ◆ Pure Biodiesel B100
- ◆ Blends of Biodiesel
  - Common blends B2, B5, B20

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## Biodiesel Properties Compared to Diesel

	<b>Biodiesel</b>	<b>Average California Diesel</b>
<b>Energy Content btu/gal</b>	119,000 (Soy) 116,000 (Animal)	131,000
<b>Cetane No.</b>	53	50
<b>Sulfur ppm</b>	<1	≤15
<b>Aromatics %vol.</b>	Below detection limit	19 %vol.

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## Biodiesel Emissions Compared to Diesel (cont.)

- ◆ Lowers greenhouse gas emissions wells to wheel
  - 3.2 units of energy produced per unit of energy used to produce biodiesel as compared to 0.8 units energy produced per unit of energy used for diesel
- ◆ Generally reduces tail pipe emissions of PM, HC, CO
  - B100: reduces PM and CO 40%, THC 68%
  - B20 reduces PM and CO 12%, THC 20%

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## **Biodiesel Emissions Compared to Diesel (cont.)**

- ◆ Increase in NOx emissions
  - B100 10% increase
  - B20(soybean) 2-4% increase in NOx
  - Feedstock affect NOx (soybean highest)

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## **Issues with Biodiesel**

- Engine durability and impact on lubrication oil
- Fuel quality
- Fuel stability
- Cold flow characteristics
- Seal and material compatibility
- NOx

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## **Presentations by Others**

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## **Open Discussion**

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# Closing Remarks

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