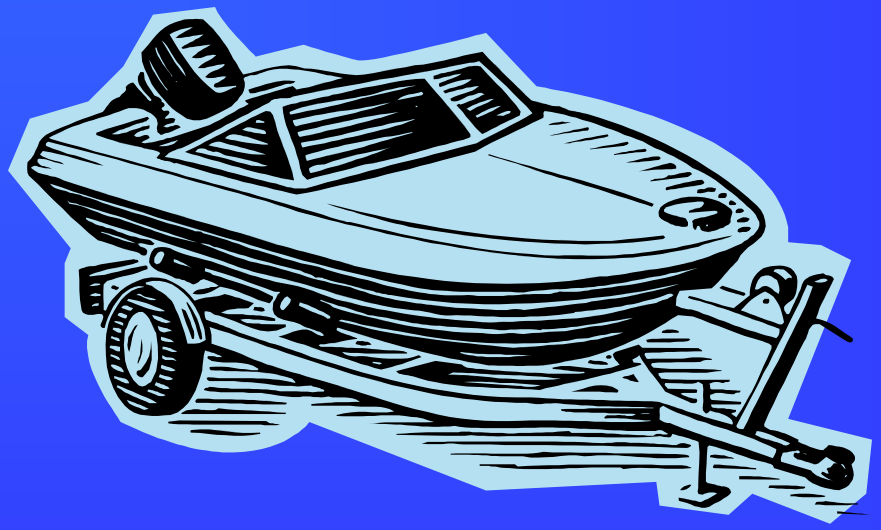
Setting Evaporative Emission Standards for Pleasure Craft



April 12, 2006

Presentation Outline

1. ARB approach
2. Potential U.S. EPA standards
3. Limitations of U.S. EPA potential standards
4. California emissions inventory
5. Existing test data
6. Emissions source breakdown
7. Need for regulation
8. Potential control technology
9. Potential benefit of U.S. EPA standard
10. Next steps
11. Comments and contact Information

ARB Approach

- ARB will cooperate with the U.S. EPA in developing nationwide evaporative emission standards
- ARB will evaluate U.S. EPA proposal before considering further action to achieve additional emission reductions
- If U.S. EPA does not adopt regulations in a reasonable time frame, ARB may consider proposing regulations

Presentation Outline

1. ARB approach
2. Potential U.S. EPA standards
3. Limitations of U.S. EPA potential standards
4. California emissions inventory
5. Existing test data
6. Emissions source breakdown
7. Need for regulation
8. Potential control technology
9. Potential benefit of U.S. EPA standard
10. Next steps
11. Comments and contact Information

Potential U.S. EPA Standards

- Permeation standards similar to those for recreational vehicles
  - Fuel hose
    - 15 g/m^2/day
    - Test temperature of 23℃, 10% ethanol
  - Fuel tank
    - 1.5 g/m^2/day
    - Test temperature of 28℃, 10% ethanol
- Diurnal venting control can be met with a passively purged canister

Presentation Outline

1. ARB approach
2. Potential U.S. EPA standards
3. Limitations of potential U.S. EPA standards
4. California emissions inventory
5. Existing test data
6. Emissions source breakdown
7. Need for regulation
8. Potential control technology
9. Potential benefit of U.S. EPA standard
10. Next steps
11. Comments and contact Information

Limitations of Potential U.S. EPA Regulation

- Current technology supports setting lower permeation standards
- Actively purged canisters could further reduce vented emissions
- Carburetor and connector emissions could be controlled by available technology

Presentation Outline

1. ARB approach
2. Potential U.S. EPA standards
3. Limitations of potential U.S. EPA standards
4. California emissions inventory
5. Existing test data
6. Emissions source breakdown
7. Need for regulation
8. Potential control technology
9. Potential benefit of U.S. EPA standard
10. Next steps
11. Comments and contact Information

California Emissions Inventory (Current Estimate)

Pleasure Craft Type	Population	Evaporative Emissions (Tons/Day Annual Avg.)
Personal Water Craft (2 cycle)	287,963	1.9
Vessels w/Outboard Eng. (2 cycle)	178,900	3.6
Vessels w/Inboard Eng.	85,882	3.8
Vessels w/Inboard Jet Eng.	30,983	1.5
Vessels w/Outboard Eng.	26,995	0.9
Vessels w/Stern drive Eng.	242,271	10.8
Totals	**851,446**	**22.5**

California Emissions Inventory Issues

- Population data does not agree with DMV records
- No running loss test conducted
- Pleasure craft tested not representative of the population

California Emissions Inventory Verification

- Concern
  - Population data does not agree with DMV records
- Resolution
  - Pleasure Craft population will be updated

California Emissions Inventory Verification

- Concern
  - No running loss test conducted
- Resolution
  - Running loss emissions will be measured

California Emissions Inventory Verification

- Concern
  - Pleasure craft tested not representative of the population
- Resolution
  - Test representative pleasure craft

Presentation Outline

1. ARB approach
2. Potential U.S. EPA standards
3. Limitations of potential U.S. EPA standards
4. California emissions inventory
5. Existing test data
6. Emissions source breakdown
7. Need for regulation
8. Potential control technology
9. Potential benefit of U.S. EPA standard
10. Next steps
11. Comments and contact Information

Testing Results for Pleasure Craft Tested by Automotive Testing Laboratories (ATL)

- ATL tested evaporative emissions for 3 personal water craft, 3 outboards, and 3 inboards
- Diurnal and hot soak emissions were measured for each vessel
- Data was generated using:
  - Summer fuel (7 RVP)
  - 65-105 F temperature profile
  - Tank Filled to 50%

Testing Results for Pleasure Craft Tested by ATL (Continued)

Personal Water Craft	Tank Vol. (gal)	Hot Soak Losses (g/3 hr)	Diurnal Losses (g/day)
92 yamaha wave runner II 2cyc	10.5	5.71	13.93
91 bombardier Sea-Doo XP 2 cyc	10	7.22	23.69
01 Yamaha Waverunner 2cyc	4.8	1.55	6.76
Average for PWC	**8.4**	**4.83**	**14.79**
Outboard Engines			
77 Evinrude 66054 2 cyc	6.6	6.14	19.63
01 Mercury Opti-Max 4 cyc	31	4.91	26.75
00 Johnson RJ90PLSSE 4 cyc	35	13.22	49.86
Average for Outboards	**24.2**	**8.09**	**32.08**
Inboards			
77 Schuster Jet Boat 4 cyc	11	29.56	48.00
98 Yamaha EXT 1200W 2 cyc	35	10.09	37.49
02 GM 4.3 GL 4 cyc	29	3.66	22.99
Average for Inboards	**25**	**14.44**	**36.01**

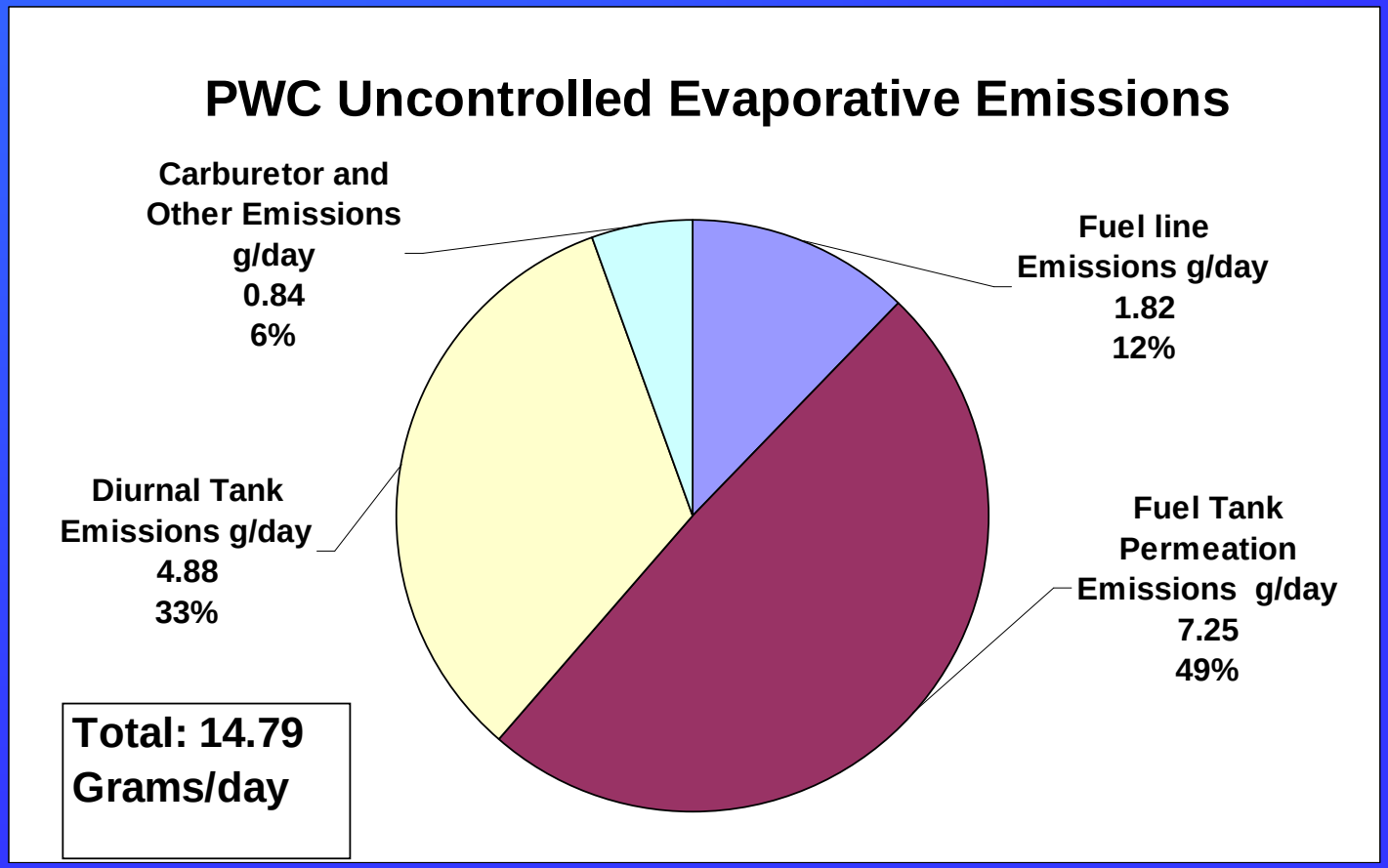
Presentation Outline

1. ARB approach
2. Potential U.S. EPA standards
3. Limitations of potential U.S. EPA standards
4. California emissions inventory
5. Existing test data
6. Emissions source breakdown
7. Need for regulation
8. Potential control technology
9. Potential benefit of U.S. EPA standard
10. Next steps
11. Comments and contact Information

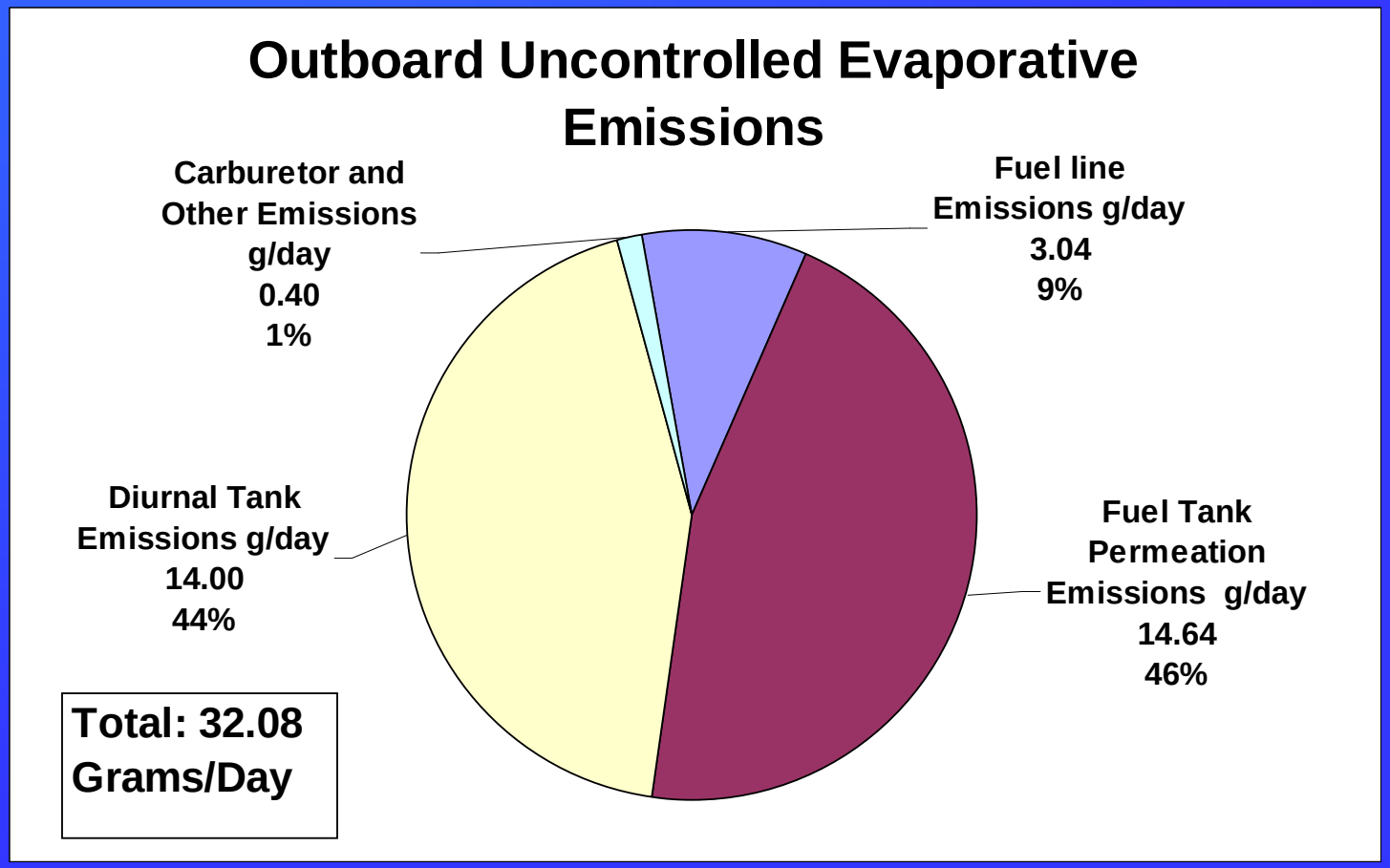
Emissions Source Breakdown

- Emissions by component are calculated from:
  - ATL data
  - Vented emissions calculated using
    - Reddy Equation
    - Summer fuel (7 RVP)
    - 65-105 F temperature profile, adjusted 50%
    - Tank filled to 50%
- Assumptions:
  - Estimated ¼-inch diameter fuel line lengths
  - A cubic fuel tank
  - Permeation equal to the standards
  - Uncontrolled permeation rates of:
    - 12 g/m^2/day for fuel tanks
    - 100 g/m^2/day for fuel hose

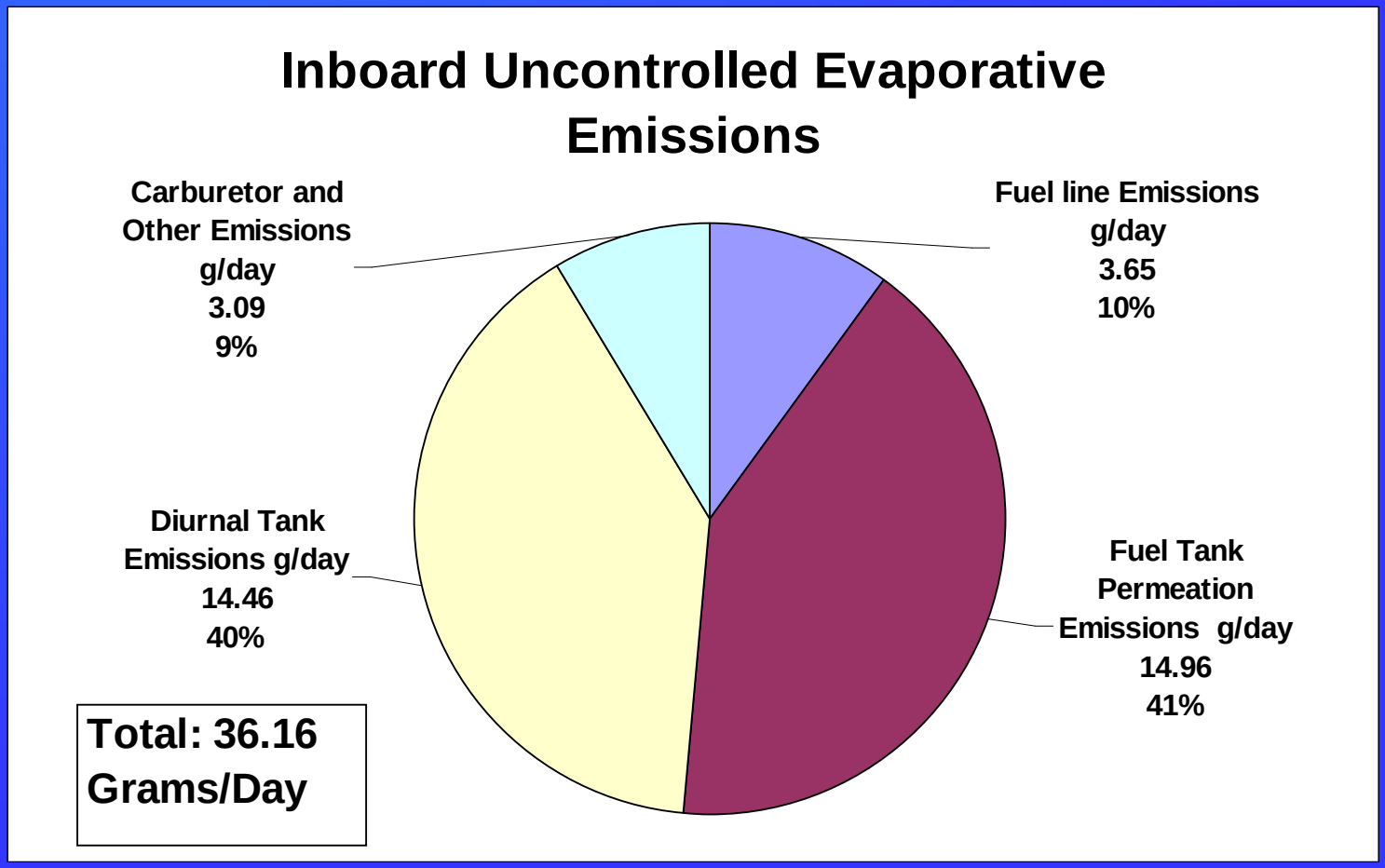
Breakdown of Uncontrolled Emissions Sources for a Personal Water Craft



Breakdown of Uncontrolled Emissions Sources for an Outboard Pleasure Craft



Breakdown of Uncontrolled Emissions Sources for an Inboard Pleasure Craft



Presentation Outline

1. ARB approach
2. Potential U.S. EPA standards
3. Limitations of potential U.S. EPA standards
4. California emissions inventory
5. Existing test data
6. Emissions source breakdown
7. Need for regulation
8. Potential control technology
9. Potential benefit of U.S. EPA standard
10. Next steps
11. Comments and contact Information

Need for Regulation

- ARB is assisting the U.S. EPA to develop a rule that is timely and appropriate for California
- If the U.S. EPA does not develop adequate regulations, ARB will consider a separate rulemaking effort
  - Significant additional reductions are needed for ozone attainment
  - Marine engines are a large uncontrolled category

Controllable Sources of Evaporative Emissions

- Permeation emissions
- Vented emissions
- Carburetor and connector emissions

SORE Permeation Technology Advancements Allow Setting Lower Standards

Company name	Product	Test Fuel	Temp C	Test Results ($g/m^2/day$)	Equivalent Results at 28 C for tanks and 23 C for hoses ($g/m^2/day$) *
Arkema	Tank	Indolene	40	0.80	0.35
Custom Pak	Tank	California Cert. fuel	40	0.30	0.13
Kelch	Tank	California Cert. fuel	40	0.26	0.11
Avon Automotive	Hose	California Cert. fuel	40	3.94	1.21
Dana	Hose	Indolene	40	7.40	2.28
DTR industries	Hose	Indolene	40	3.20	0.98
Gates	Hose	California Cert. fuel	40	8.20	2.52
Goodyear Tire	Hose	CE10	40	12.32	3.79
Mold-Ex	Hose	California Cert. fuel	40	4.63	1.43
Parker	Hose	CE10	40	12.60	3.88
Parker (Model # II)	Hose	CE10	40	3.75	1.15
Teleflex	Hose	CE10	60	11.13	.86

* Increase in test temp of 10 deg C leads to double the permeation

Need to Control Vented and Permeation Emissions

- Vented emissions account for ~40% of total emissions
- Permeation emissions account for ~55% of total emissions
- Carburetor and fitting losses account for ~5% of total emissions
- Controlling these emission sources will result in substantial reductions

Presentation Outline

1. ARB approach
2. Potential U.S. EPA standards
3. Limitations of potential U.S. EPA standards
4. California emissions inventory
5. Existing test data
6. Emissions source breakdown
7. Need for regulation
8. Potential control technology
9. Potential benefit of U.S. EPA standard
10. Next steps
11. Comments and contact Information

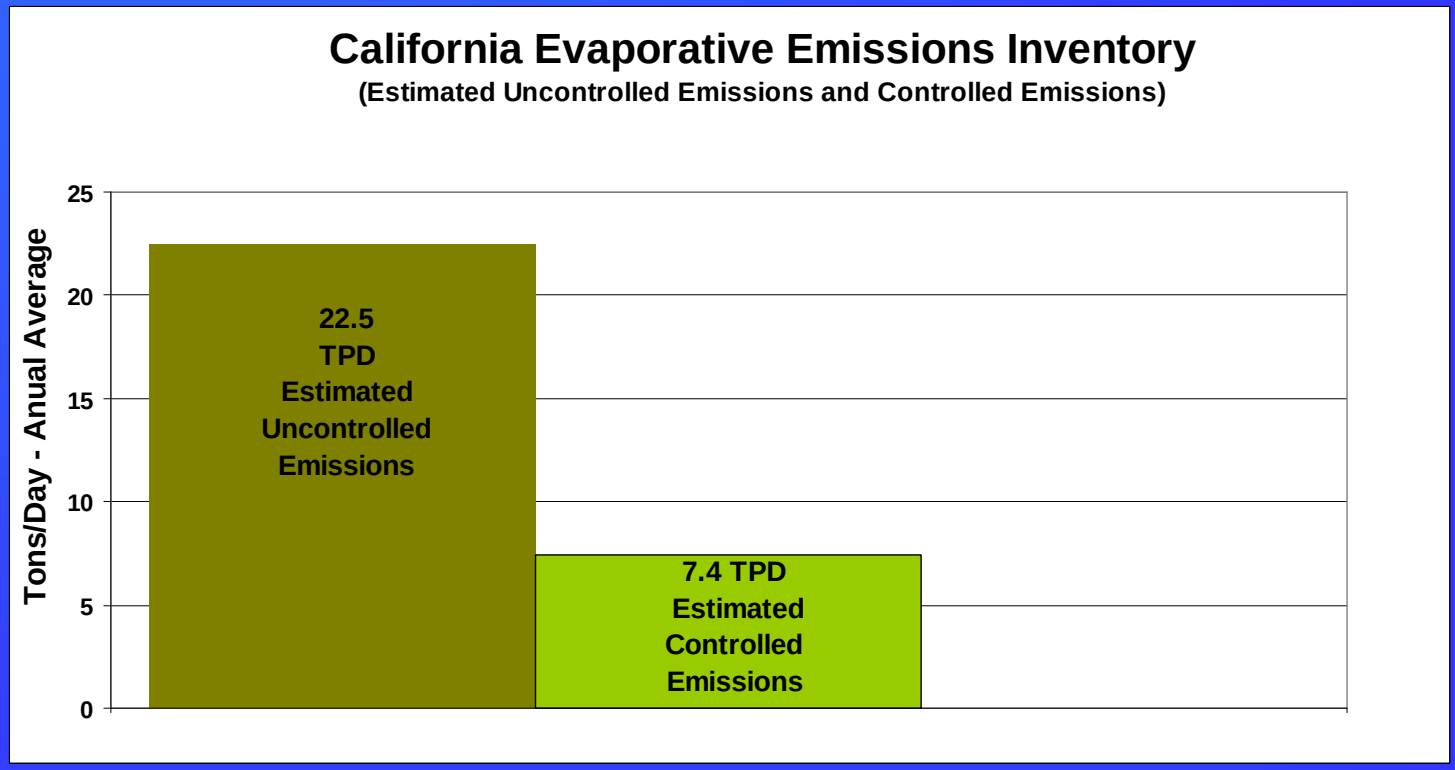
Potential Control Technologies to be Evaluated

- Active and passively purged carbon canisters
- Insulation
- Low permeation fuel hoses
- Low permeation fuel tanks
- Fuel injection
- Advanced fuel line connectors

Presentation Outline

1. ARB approach
2. Potential U.S. EPA standards
3. Limitations of potential U.S. EPA standards
4. California emissions inventory
5. Existing test data
6. Emissions source breakdown
7. Need for regulation
8. Potential control technology
9. Potential benefit of U.S. EPA standard
10. Next steps
11. Comments and contact Information

Potential Benefit of a U.S. EPA Evaporative Emission Standard



Presentation Outline

1. ARB approach
2. Potential U.S. EPA standards
3. Limitations of potential U.S. EPA standards
4. California emissions inventory
5. Existing test data
6. Emissions source breakdown
7. Need for regulation
8. Potential control technology
9. Potential benefit of U.S. EPA standard
10. Next steps
11. Comments and contact Information

Next Steps for Rule Development (Tentative)

- Allow Reasonable Time for U.S. EPA Proposal
  - Winter 2006
- Emissions Inventory Development
  - Spring 2006 – Spring 2007
- Control Technology Evaluation
  - Summer 2006 – Summer 2007

Presentation Outline

1. ARB approach
2. Potential U.S. EPA standards
3. Limitations of potential U.S. EPA standards
4. California emissions inventory
5. Existing test data
6. Emissions source breakdown
7. Need for regulation
8. Potential control technology
9. Potential benefit of U.S. EPA standard
10. Next steps
11. Comments and contact Information

Comments?

Contacts

Monitoring and Laboratory Division

(For Questions Concerning the Rule Development)

- Jim Watson
  - Manager, Engineering Development and Testing Section
    - (916) 327-1282, jwatson@arb.ca.gov
- Don Ridgley
  - Project Lead, Engineering Development and Testing Section
    - (916) 322-8913, dridgley@arb.ca.gov

Planning and Technical Support Division

(For Questions Concerning the Emissions Inventory)

- David Chou
  - Manager, Off-Road Modeling and Assessment Section
    - (626) 450-6136, cchou@arb.ca.gov