Public Meeting to discuss Motor Vehicle CNG Fuel Specifications

March 7, 2001

California Environmental Protection Agency



Air Resources Board

Overview

- ✦ Background
- ✦ Issues
- ✦ Impacts
- ✦ Fuel Quality
- ✦ Fleets
- Options

Alternative Fuels Regulations

- Title 13, CCR, sections 2290-2292 originally adopted in 1992
- Provides engine manufacturers with a known fuel quality for designing engines
- Ensures consistent fuel quality to prevent engine performance problems and excess emissions

Background

Motor Vehicle CNG Specifications

Hydrocarbons	Methane (min.)	88 mol%
	Ethane (max.)	6 mol%
	C3+higher (max.)	3 mol%
	C6+higher (max.)	0.2 mol%
Other Species	Hydrogen (max.)	0.1 mol%
	Carbon Monoxide (max.)	0.1 mol%
	Oxygen (max.)	1.0 mol%
	Inert Gases (CO_2 and N_2)	1.5 - 4.5 mol%
	Sulfur (max.)	16 ppmv
	Water, Particulates, Odorant	

Statewide CNG Supply

	Volume	Complying Fuel
Imports	85%	100%
California Production		
Associated gas	12%	~0%
Gas Wells	3%	100%
	100%	
Based on 1997 supply/production data		



Current Situation

- Limited availability of complying fuel in certain regions
 - San Joaquin Valley
 - South Central Coast
- Production- commercial vs. MV grade
 - Associated gas tied to oil production

Distribution- Not segregated to handle two fuels

Impacts of Off-Specification CNG

- Potential engine performance and durability issues
- ✦ Emissions
- Degree of Impact dependent on engine /vehicle technology
 - open loop vs. closed loop
 - heavy duty vs. light duty

Fuel Quality Variation in SJV

Component	Average	Range	Standard
Methane	86	79 - 97	88.0 min.
Ethane	9	0 - 12	6.0 max.
C3+	3	0 - 9	3.0 max.
Inerts	3		4.5 max.
CO_2	2	2 - 3	
N_2	1	0 - 1	
BTU	1100	990 - 1181	N/A

Fuel Quality Variation in SCC

Component	Average	Range	Standard
Methane	88	86 - 97	88.0 min.
Ethane	5	0 - 8	6.0 max.
C3+	4	0 - 6	3.0 max.
Inerts	3		4.5 max.
CO_2	2	2 - 3	
N_2	0	0 - 1	
BTU	1095	990 - 1141	N/A

Fuel Quality

Compliance with Existing Standard

11 % of SCC supply currently complies
<1 % of SJV supply currently complies

Fleet Information by Region

	SJV	SCC
HD Unknown	6	6
HD Closed Loop	35	60
MD	100	0
LD Dedicated	2	59
LD Bifuel	30	39
Total	173	164

Objectives

- Protect existing and future engines
- Minimize emission impact
- Provide adequate CNG availability

Improve Fuel Quality

✦ Blending

- Membrane Treatment Technologies
- LCNG Technology

Revise CNG Fuel Specifications

- Broaden Existing CNG Fuel Specifications
- New CNG Fuel Specifications based on Methane Number set for:
 - Existing heavy-duty vehicles
 - Advanced heavy-duty vehicles
 - Light-duty vehicles

Methane Number (MN)

- Experimentally derived relationship between fuel composition and engine performance (knock)
- ★ MN primarily dependent on content of methane, ethane, C_3 , and C_4 + in the fuel
 - Example: current specification approximately 81MN
- Engines require a minimum MN to prevent engine knocking
- Minimum MN dependent on engine technology

Minimum Methane Number

Engine
TechnologyMNExisting HD80Advanced HD73Light Duty65 (current minimum gas quality)

Options

Methane Number by Region

	Spec. Gas	SCC	SJV
Average	· ·	79	79
Range	81-108	72-107	67 - 108

Percent CNG Meeting Methane Number by Region

Methane Number SJV SCC

81	< 1 %	11 %
80	77 %	25 %
73	93 %	100 %
65	100 %	100 %