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

Motor Vehicle CNG Specifications

Background

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

Issues

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

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

Options

Objectives

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

Improve Fuel Quality

- Blending
- Membrane Treatment Technologies
- LCNG Technology

Options

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

Options

Minimum Methane Number

Engine Technology	MN
Existing HD	80
Advanced HD	73
Light Duty	65 (current minimum gas quality)

Options

Methane Number by Region

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

Options

Percent CNG Meeting Methane Number by Region

Methane Number	SJV	SCC
81	< 1 %	11 %
80	77 %	25 %
73	93 %	100 %
65	100 %	100 %