

**BEFORE THE ENERGY RESOURCES CONSERVATION
AND DEVELOPMENT COMMISSION
AND THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA**

In the Matter of:
Informational Proceeding and Preparation of the
California Energy Commission 2005
Integrated Energy Policy Report and

California Public Utilities Commission
Natural Gas Order Instituting Rulemaking 04-01-
025

Energy Commission
Docket No. 04-IEP-01

CPUC Docket No. R.04-01-
025
Notice of Workshop on
Natural Gas Quality Issues

**POST WORKSHOP COMMENTS OF
OCCIDENTAL OF ELK HILLS, INC.**

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POST WORKSHOP COMMENTS OF OCCIDENTAL OF ELK HILLS, INC.

Occidental of Elk Hills, Inc. (OEHI) submits these Post Workshop comments to the California Energy Commission and the California Public Utilities Commission pursuant to the Administrative Law Judges' Ruling Regarding Notice of New Workshop Dates dated December 23, 2004.

OEHI again would like to thank the commissions and staff for hosting the California Energy Commission (CEC) and California Public Utility Commission (CPUC) joint workshop on natural gas issues conducted on February 17-18, 2005 in San Francisco, and for providing an opportunity to present factual data and background information concerning natural gas quality from a producer's perspective. OEHI respectfully submits the following observations, comments and recommendations from the workshop.

Key Considerations in Reviewing Existing Standards

- 1. Maintaining a broad and flexible gas quality specification, consistent with the State's concerns for safety and the environment, will afford California the best future access to natural gas supplies, whether in-state, interstate or regasified LNG supplies.*** The result should be efficient pricing for natural gas.¹ Mr. Roger Johnson, one of the audience participants at the workshop in the open discussion period following the "Producer Perspective" panel presentation on February 17, cautioned that having a distinctly unique gas specification for California compared to all other states would have a negative economic impact on end users in California. A similar sentiment was expressed in Mr. Jim Campion's closing comments on the second day of the workshop.² A directly related benefit of maximizing the allowable gas quality specification is that this approach will also maximize the opportunity to bring in-state produced gas to the market.
- 2. The workshop brought consensus around the need to revise the 1992 CARB NGV specification.***³ Many of the presenters highlighted concerns and issues with the present NGV specification, and there appeared to be fairly widespread support for changes to that specification – even from the CARB agency itself.
- 3. CARB concerns regarding the specifications for gas delivered by NGV fueling stations can be met most cost-effectively and practically by continuing current pipeline and truck blending practices.*** The

¹ [Comments of Roger Johnson at TR 216, 217; Comments of Dave Maul, CEC at TR 6, 32, 215; Comments of Bill Liss, GTI at TR 56, 57; Comments of Joe Sparano, WSPA at TR 41, 42]

² [TR 444, 445]

³ [Comments of Lee Stewart, SoCalGas at TR20; Joe Sparano, WSPA at TR 43, 44; John Martini, CIPA at TR 45; Dean Simmeroth, CARB at TR67, 68, 70; Bill Liss, GTI at TR 60,61]

workshop did not reveal material problems with existing NGV engines.⁴ Application of a gas quality specification suited narrowly to NGVs across the full natural gas consuming and producing market in California was aptly described by Commissioner Jim Boyd as "the tail wagging the dog", since NGV gas consumption is less than 1% of the California natural gas market.⁵

- Pipeline blending remains a viable option. SoCalGas has engaged in pipeline blending of California produced gas with other system gas.⁶ In fact, data produced in A.04-08-018 suggest that the need for and cost of pipeline blending has been limited. This practice should be continued as an interim measure pending changes in the NGV fleet that will accommodate a broader gas specification.
- Truck blending. SoCalGas has also engaged in blending of natural gas for NGV deliveries at the point of fuel delivery over the years. Indeed, the Commission noted this practice and the cost support by producers in Resolution G-3295. The only cost data related to blending that was presented by SoCal / SDG&E was in Mr. Rick Morrow's comments on February 18, where he described CNG truck blending, and he stated that the cost was approximately \$300,000/ year.⁷ As was mentioned on February 17 in Mr. Bill Boyer's (OEHI) comments, OEHI and other producers have been reimbursing SoCal for a significant portion of that truck blending cost for several years. Moreover, the need for truck blending may be reduced to the extent that the present CARB NGV specification is revised to a Methane Number specification, as the comments from Mr. Lee Stewart of SoCal on February 17 indicated.⁸

From the comments offered by Mr. Morrow, the gas blending issue is complicated by the introduction of **LNG** - not by existing in-state production.⁹ Those complications could be reduced if the 1992 CARB NGV standard is revised; the problems likely would be eliminated entirely if, as several parties proposed, the standard were ultimately revised to MN 73.¹⁰ Consequently, the Commission

⁴ OEHI asked our expert, Mr. Steve Sokolsky of Bevilacqua Knight Inc. to investigate bus engine fuel problems, and his findings are attached as the last page of this submittal. He has not been able to find any details to date concerning a specific fuel related engine failure. Several early NGV engine problems associated with mechanical performance issues were, however, identified.

Also see TR 68, 70 -72 Dean Simmeroth, CARB comments regarding lack of problems observed at refueling stations which have been operating with temporary CARB NGV exceptions to use MN80⁵ [TR 59].

⁶ [TR 74 Dean Simmeroth, CARB; TR 82 John Martini, CIPA; TR 21 Lee Stewart, SoCalGas; TR423-424 Rick Morrow, Sempra]

⁷ See Morrow/Sempra at Tr. 423.

⁸ Stewart/Sempra at Tr. [TR 21].

⁹ See Morrow/Sempra at Tr. 423-24.

¹⁰ Rick Morrow, Sempra at TR 426; Also refer to presentation by Steve Sokolsky, BKI regarding test results on "legacy" fleet vehicles with MN73 fuel. MN73 recommendation was also incorporated in a 2001 CARB Staff Report, "Initial Statement of Reasons Proposed Amendments to the Alternative Fuels for Motor Vehicle Regulations"

should direct SoCalGas to continue its current practices for in-state gas and address the LNG impact once the CARB NGV standard has been reconsidered.

4. Gas Processing Alternatives Require Cautious Consideration.

Modifying existing practices to require further producer processing is not the most reasonable approach in light of alternatives. Requiring producers to construct new processing plants would far exceed the current costs of pipeline and truck blending. Moreover, with specifications in flux, it is not clear that processing ultimately will be required. Finally, a "full cycle analysis" of the impact of new plants would need to be considered – both with respect to energy consumption and emissions. In other words, if additional processing of gas is required in order to reduce its ethane or propane content, what additional energy is consumed to do so, and what are the incremental air emissions from that additional processing? As part of this analysis, the disposition of the hydrocarbons (ethane and propane) should be considered. For example, hauling significant new volumes of propane by truck to market locations (in-state or otherwise) will generate new emissions from the trucks used to make the deliveries.¹¹

There is no simple, easy, or inexpensive change to existing California gas processing plants which would significantly impact propane or ethane removal from processed gas. In response to expressed interest by the ARB staff and CEC staff regarding propane recovery capabilities of existing gas processing facilities in California, OEHI examined a recent industry survey by the Oil & Gas Journal which lists 30 operating plants in California, all of which are in the Southern part of the state; primarily in Kern, Los Angeles, and Santa Barbara counties. 22 of the 30 plants, representing 69% of the total processing capacity, are identified in the survey as "straight refrigeration" processing facilities of the type described in Bill Boyer's presentation to the Workshop on February 17. Capacities of the straight refrigeration plants range from 0.6 to 175 MMCF/ day, with an average of 36.4 MMCF/ day. Most of these plants have similar operating characteristics:

- (1) 400 – 600 psig inlet pressure, (2) cold separator temperature of -10 to -40 °F, (3) Butane+ recoveries typically 90 - 95% or higher, (4) Propane recoveries generally in the range of 60 – 70%.

Some slight increases in propane recoveries may be possible at some of the plants, but this generally would require purchase and installation of additional compression and heat exchange equipment, and possibly additional gas treatment equipment. In order to identify specific changes to improve propane recoveries and the cost to implement the changes at each plant, capacities of each part of each plant would need to be carefully evaluated. Potential increases in air emissions from the new processing should also be assessed. For older, smaller facilities, or those that are operating at low capacity, it is possible

¹¹ [TR 182-184 Bill Boyer, OEHI. Also see Boyer presentation slides which highlight additional sources of emissions associated with new equipment required for ethane removal.]

that the operator would opt to shut down the plant rather than spend additional capital to recover additional propane.

Comments on Other Workshop Presentations

Listed below are OEHI's comments regarding presentations by others at the 2-day gas quality workshop. We have also attached input from one of our experts, Mr. Bill Liss, of the Gas Technology Institute (GTI), dated March 2, 2005. Of particular interest are Mr. Liss' comments concerning the SWRI report and presentations related to the "legacy" vehicles, and suitable Methane Number fuels for engines in those vehicles.

1. With respect to the presentation by Mr. Roger Gault of the Engine Manufacturers Association, there are two points we would like to make:
 - The vehicle testing conducted in 2000 by the CAVT, which was presented by Mr. Steve Sokolsky of BKI at the Gas Quality Workshop on February 18, illustrated that a variety of both open and closed loop heavy duty engines did not, in fact, generate increased levels of NOx or Total hydrocarbons using fuels with MN values as low as MN73
 - The statement that "Any relaxation of the standard will adversely affect emissions, durability and engine performance" is an overstatement, conclusionary, and was not adequately supported with any laboratory or field test data. Unless supporting test data is presented by the Engine Manufacturers, this statement should be ignored.
2. The SWRI study upon which the SWRI Gas Workshop presentation was based was listed as a "paper study", meaning that no field testing or laboratory testing was performed to substantiate the findings and conclusions. SDG&E / SoCal Gas characterized the SWRI study in their pre-workshop written submittal as "theoretical", and the SWRI report itself includes the statement that "Determination of knock is only an estimate based on a correlation. The actual knock can be determined by knock testing of the engine." The low MN fuel figure of approximately 70 which SWRI selected as the lower range of fuel MN number for their study is actually below the calculated MN number for most producers' gas in the San Joaquin Valley. A better low end MN number would have been 73, as was discussed in the December 21, 2001 CARB staff report "Initial Statement of Reasons Proposed Amendments to the Alternative Fuels for Motor Vehicle Regulations". In that report, based on a review of data supplied by Southern California Gas to the ARB staff in 2001, the ARB concluded that "the proposed MN 73 specification would increase the local supply of complying CNG to about 88 percent in the South Central Coast and 99 percent in the Southern San Joaquin Valley."

Recommendation for "Next Steps"

OEHI supports the approach suggested by Commissioners Geesman and Boyd, that a series of meetings involving the primary stakeholders should take place over the next several months for the purpose of reaching consensus on future gas quality specifications within the existing framework of the CPUC approved Rules 30 and 21. It is expected that certain provisions of the NGC+ council recommendations on gas interchangeability will be considered, along with other confirmed, widely accepted test data concerning performance of fuel burning equipment and appliances. The NGC+ interim guidelines described in the "White Paper on Natural Gas Interchangeability and Non- Combustion End Use, dated February 28, 2005", which were submitted to the FERC on March 2, include some specific recommendations such as the Wobbe index which was discussed at length by a number of the Gas Quality Workshop presenters, but the guideline document also includes important guidance on how the recommendations should be applied:

"Exception: Service territories with demonstrated experience with supplies exceeding these Wobbe, Heating Value and/ or Composition Limits may continue to use supplies conforming to this experience as long as it does not unduly contribute to safety and utilization problems of end use equipment." (page 26).

In other words, there is significant consideration to be given to present operating conditions of existing utility systems, including the gas that is presently flowing to end users (including, in California, the existing associated gas from Producers).

March 4, 2005

Respectfully submitted,



William Boyer
Occidental Elk Hills Inc.

March 2, 2005

EMA PRESENTATION COMMENTARY

Mr. Gault's presentation contained both accurate and potentially misleading statements. The slide on "Engine Design and Fuel Specification" makes a statement that "engines are designed to operate on the fuel specified by the manufacturer." Engine manufacturers do not develop engines in a vacuum or necessarily to simply comply with specific government regulations. They must develop engines to meet the needs of their customers, the available fuels in the market, that avoid warranty concerns, and that satisfy government regulations.

More appropriately, a bullet could be added to this slide stating "Fuels available in the market." Engines are designed with recognition of the partnership between fuel providers and engine manufacturers. Representatives of these firms are actively involved in Society of Automotive Engineers Fuels Committee Fuels and Lubricants Technical Committee 7 – Fuels and with the American Society of Testing and Materials (ASTM) Committee D03 – Petroleum Products and Lubricants and Committee D04 – Gaseous Fuels. There is a long history of interactive work among fuel suppliers and engine manufacturers. The ASTM D02 (liquid fuels) committee was formed in 1904 and the D03 committee (gaseous fuels) was formed in 1934. The ASTM D02 Committee has nearly 900 members, including fuel and engine/vehicle manufacturers as well as other stakeholders. Engine manufacturers understand the real-world complexity of the liquid and gaseous fuels market.

The final slide on Mr. Gault's presentation states:

"Any relaxation of the standard will adversely affect emissions, durability, and engine performance."

There is no factual evidence provided by Mr. Gault to support this claim. In recent years, even statements from the California Air Resources Board (CARB) technical staff – whom presumably are amongst the most difficult to convince – have supported a position that gas composition impacts are modest on today's modern engines¹². The following is an excerpt from a CARB staff report on proposed changes to the 1992 natural gas vehicle fuel specification (this CARB staff document was developed in 2002). This position from a government agency who is most likely to have a heightened concern over emissions is in clear contrast to Mr. Gault's assertion that "any relaxation of the standard" would have adverse effects.

¹² URL location: <http://www.arb.ca.gov/regact/cng-lpg/isor.PDF>

5. Impacts of the Proposed CNG Amendments

a. Emission Impacts

1) How will the proposed amendments affect exhaust emissions?

Test results show that for dedicated light-duty NGVs, large variations in fuel composition produced only slight variations, both increases and decreases, in emissions and driveability. Also, bi-fuel vehicles had only modest changes in emissions and performance with changes in CNG quality.^{5, 6} Heavy-duty vehicle test data shows that fueling advanced generation engine technologies with MN73 fuel produces no discernible impact on the particulate matter (PM) and oxides of nitrogen (NOx) emissions when compared to emissions from higher quality fuels with MN greater than 80. There were very small increases in carbon dioxide (CO₂) and non-methane hydrocarbon (NMHC) emissions.

Mr. Gault also understates the potential for electronic controls to address fuel variability. Today's modern light-duty vehicles, for example, are designed to operate on liquid fuels that span from conventional gasoline, to gasohol (10% ethanol mixed with gasoline), and even E-85 (which can contain 75-85% ethanol in gasoline). These are obviously widely varying fuels, yet many of today's vehicles are certified by the US Environmental Protection Agency (EPA) and CARB to operate on all of these fuels.

Finally, Mr. Gault makes a final statement which is appropriate: "fuel in the field must meet the required minimum fuel specification." A current problem exists because the early development of the CARB fuel specification (during a nascent market condition) did not fully account for the range of fuels available in the California market and the evolution of technology. An effective solution is to modify, in an appropriate manner, the CARB fuel specification to more effectively align it with commercial practice as well as air quality needs. A change to the CARB natural gas vehicle fuel specification requirement will allow cost-effective, domestically produced natural gas fuels to be in compliance – ensuring the desired goal that fuels in the field meet required minimum fuel specifications as desired by Mr. Gault and others.

MEDIUM/HEAVY DUTY NATURAL GAS VEHICLES

Information provided by Southern California Gas and their contractor, Southwest Research Institute (SwRI), provides a valuable starting point for understanding the population of medium and heavy-duty natural gas vehicle engines in the marketplace. We applaud their efforts to bring quantitative data and technical expertise to understanding the problem. This is a key step to finding effective solutions – a goal of all the parties involved in this matter.

In the Attachment B titled “Heavy-Duty CNG Vehicle Natural Gas Quality Study” there is what we consider to be an error that vastly overstates the magnitude of concern over so-called “hot gases” from in-state California natural gas producers. On page 2 the report states that “...only 17.8% of the engine makes and models in the inventory can operate on natural gas that is less than MN 80.”

This is not an accurate statement. This resulted from what we believe to be a misinterpretation of the Detroit Diesel Corporation (DDC) fuel specification requirement for engines produced during 1998-2002. The DDC fuel specification clearly states the engines are manufactured to operate on fuels with a minimum Motor Octane Number (MON) of 115. GTI’s estimate, which was confirmed in subsequent communications with SwRI, indicates a MON value of 115 is about equal to a Methane Number (MN) of 68. Yet, the report indicates that SwRI independently stated the minimum MN capability of these engines is only 83.7 (see table in Exhibit 2).

Subsequent discussions with SwRI indicate they made their own calculations of the minimum Methane Number using abstract fuel specification assumptions. This is wholly unnecessary because the engine manufacturer’s fuel specification clearly states the engine was developed for a minimum Motor Octane Number of 115 (which translates to a Methane Number of 68). There is no need to have gone through any separate analyses because the engine manufacturer has already specified the minimum antiknock number.

Due to this, the largest population of DDC engines made between 1998 and 2002 are – by the manufacturer’s own fuel specification – permitted to operate on fuels with a Methane Number as low as 68. This study estimates there are 1,695 engines that were designed to a minimum Methane Number of 68. These were excluded, we believe inadvertently by SwRI, from the inventory of engines that can operate at a MN of less than 80.

Our estimates are that rather than on 17.8% of the population being able to run on fuels with a MN less than 80, the **actual estimate is over 68% of the medium/heavy-duty engines are capable of running on fuels with a Methane Number as low as 68.**

Currently, the actual potential impact of in-state “hot gases” is even less dramatic given the relatively proscribed region of the state where these fuels are being dispensed into vehicles. For example, the majority of natural gas engines operate within the metropolitan Los Angeles area that will compressed natural gas fuels -- due to mixing with other pipeline resources – that are in full compliance with existing CARB standards and manufacturer fuel specifications.

Based on this, we believe the number of potentially impacted medium/heavy duty vehicles that currently represent a concern from “hot gases” is small and regionally concentrated. This

population will continue to decrease with time due to retirements. Steps may be taken to address the capability of these engines to operate properly on “hot gases”, including engine upfits and retrofits (as noted in the SoCal Gas/SwRI study). It would appear, pending more data to the contrary, that the current magnitude of engines impacted by this issue (i.e., attributable to in-state natural gas production) is a manageable subset and should not be an impediment to modifying the CARB fuel specification.

CARB FUEL SPECIFICATION MODIFICATIONS

During the past five years, a serious attempt was made to modify the CARB natural gas vehicle fuel specification. This included staff recommendations supporting a shift away from prescriptive composition-based limits to broader natural gas property-based metrics (for example, Methane Number which is a measure of fuel knock resistance or perhaps Wobbe Number).

As noted during the workshop, the CARB fuel specification was well-intended when developed in 1992 during the very early years of the natural gas vehicle market. However, more information and technology developments have taken place that warrant revising this specification.

We recommend an effort to modify the CARB fuel specification be brought back on-track and made consistent with efforts by the CPUC and the regulations and recommended practices of other organizations and entities.

One note of caution is regarding the specification of Fuel Knock Resistance. This likely **should not** be used in developing the CARB fuel specification. There has been some momentum in this direction to use Methane Number, for example. We would recommend steering away from using Methane Number in the CARB natural gas vehicle fuel specification. This recommendation is based on these considerations:

1. Knock resistance is not correlated or associated with emission limits or controls – thereby should not be relied upon to set vehicle air quality requirements.
2. The jurisdiction in setting regulations and requirements for vehicle fuel knock resistance typically resides at:
 - a. Federal. Authority resides within the National Institute of Standards and Technology (NIST) and specifically the National Conference on Weights and Measures as well as within Federal Code 16CFR306 – Automotive Fuel Ratings, Certification, and Posting.
 - b. California. Authority should generally reside within Department of Food and Agriculture. Specifically, the California Business and Professional Code, Division 5 (Weights and Measures) is the appropriate area to establish minimum requirements for motor vehicle octane rating (or “antiknock index”). Minimum requirements for gasoline, for example, reside in this section of the California Code.

We would recommend that CARB address natural gas vehicle fuel specifications that look at Wobbe Number as a primary measure that has a linkage to combustion and emissions. Motor Octane Number or Methane Number is primarily a consumer protection and labeling issue that should be the responsibility of Weights and Measures authorities. Focusing on Wobbe Number will also enable the CARB specifications to more closely align with possible changes being formulated by the CPUC.



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March 2, 2005

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Dear Bill:

As per your request, I have conducted additional research on CNG school bus performance in the South Central Coast region. Here are my findings.

Investigations have yet to uncover a fuel quality-caused incident but we are continuing the investigation and will include any findings in our final comments.

Parties contacted include:

- Santa Maria USD
- Student Transportation of America (contractor for Santa Maria USD)
- Santa Maria Area Transit
- PG&E
- Santa Barbara APCD
- Lompoc USD
- California Natural Gas Vehicle Coalition (Mike Eaves)
- SoCal Gas (Steve Anthony)

The main issue is that the early school bus demonstration projects (1990-95) run by the California Energy Commission used Tecogen buses powered by Chevrolet 427 engines. These engines have experienced ongoing performance and maintenance problems and have permanently soured everyone's opinion of CNG vehicles. In particular, there was consistent damage to manifolds and poor fuel economy.

Performance issues have not been as obvious with the newer John Deere engines (introduced starting in 1995) but users complain of high operating costs. No one contacted can confirm a major engine failure that can be attributed to gas quality. In the worst incident, problems were caused by the installation of the wrong camshaft. This happened in about 1998. Otherwise, all engine problems were traced to mechanical problems, not fuel. In fact, SoCal Gas investigated each complaint and tested the fuel quality to make sure it wasn't the cause."

Sincerely,

Steven Sokolsky
Project Manager