BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

Order Instituting Rulemaking to Establish Policies and Rules to Ensure Reliable, Long-Term Supplies of Natural Gas to California	R.04-01-025

PREWORKSHOP COMMENTS OF CHEVRON U.S.A. INC.

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February 11, 2005

PREWORKSHOP COMMENTS OF
CHEVRON U.S.A. INC.

Chevron U.S.A. Inc submits these 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.

ChevronTexaco is the fifth largest integrated energy company in the world and second largest in the United States. It can trace its history in California back over 125 years and has a major presence in this state with two large refineries, major cogeneration operations and one of ChevronTexaco's largest producing fields in the world. ChevronTexaco is a large producer, marketer and consumer of natural gas and ChevronTexaco and its affiliates use up to 500,000 MMBtu/D in California. In California ChevronTexaco uses natural gas to power cogeneration, produce heavy oil and refine oil products. Further, ChevronTexaco has major interests in natural gas fields located in other parts of the world that can potentially be used to provide natural gas to California. We have a definite interest in natural gas and natural gas transportation in California, including its availability, reliability, quality and price.

We are most pleased that the California Energy Commission and the California Public Utility Commission, in collaboration with the Air Resource Board and the California Department of Conservation, are holding these hearings. California needs to make the right decisions in a timely manner so that natural

gas from several sources can continue to fuel its economy. Delay in decision-making or implementation of unnecessarily restrictive gas standards could lead to future shortfall or unnecessary price increase that could harm the citizens and economy of California. We thank both Commissions for this opportunity to comment on this critical topic.

This submittal is divided into two portions. The first is an overview addressing the important issues in the workshop. The second portion (Attachment A) is a detailed response to a number of questions that will be of most interest to the staff. The data and information in the detailed responses support the position that is outlined at the beginning of this submittal.

ChevronTexaco is confident that the evidence will show:

- **Natural Gas Derived From LNG Is One Of The Safest And Cleanest Forms Of Energy Delivery**
- **Current CPUC Specifications Are Adequate To Maintain Safety And Gas Quality**
- **CARB Specifications Are Unnecesarily Restrictive And Need To Be Modified**
- **Such Modification Will Have No Affect On Safety Considerations And Air Quality**
- **LNG Will Help California Meet The Needs Of Its People And Its Future Economy**
- **Timely Decisions Need To Be Made So That LNG Suppliers Can Make The Long Term Commitments Necessary To Supply Gas To California**

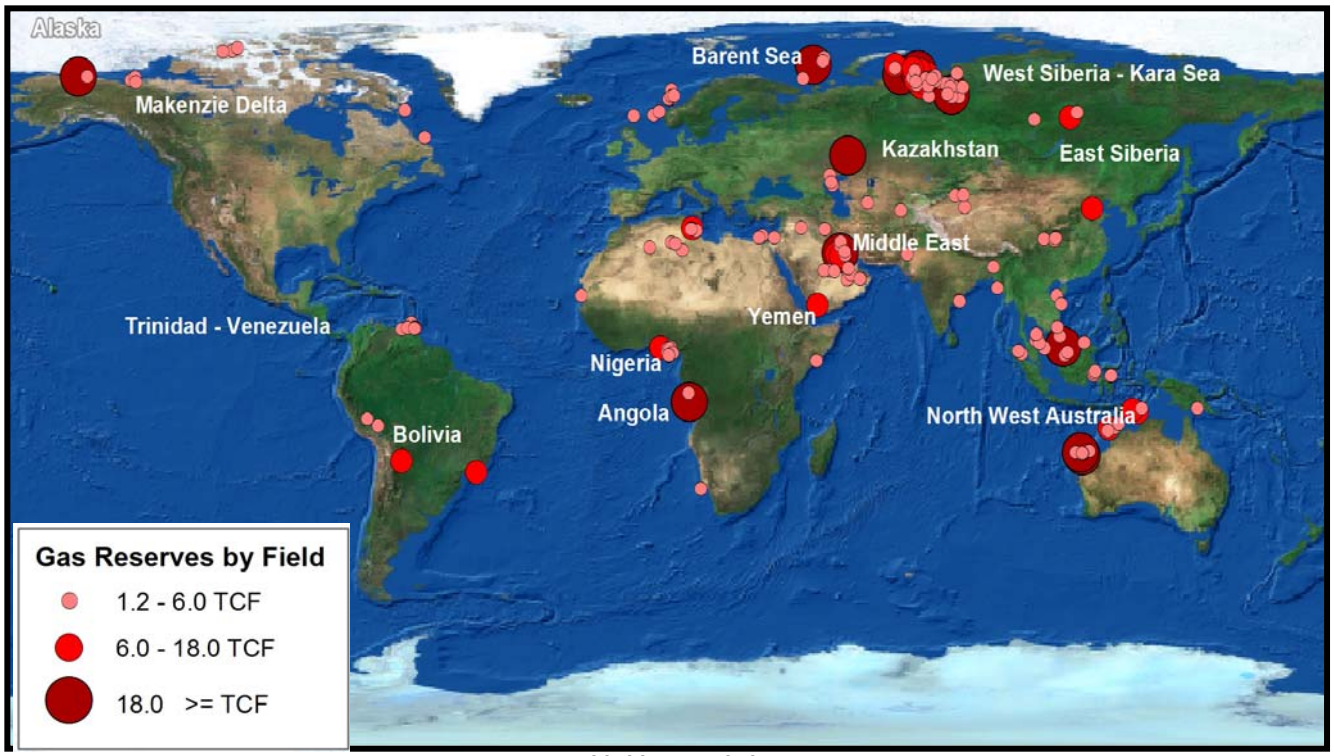
SAFETY

Safety is a top priority at ChevronTexaco and natural gas from LNG sources is one of the safest and cleanest forms of energy delivery. The quality of

natural gas from LNG sources will improve the quality and efficiency of our domestic pipeline gas systems. The gas is drier and has little to no impurities versus typical pipeline gas, resulting in a less corrosive and safer operation. The average BTU is slightly higher (~5%) which will allow the natural gas grid to operate more efficiently in delivering BTUs to the consumer.

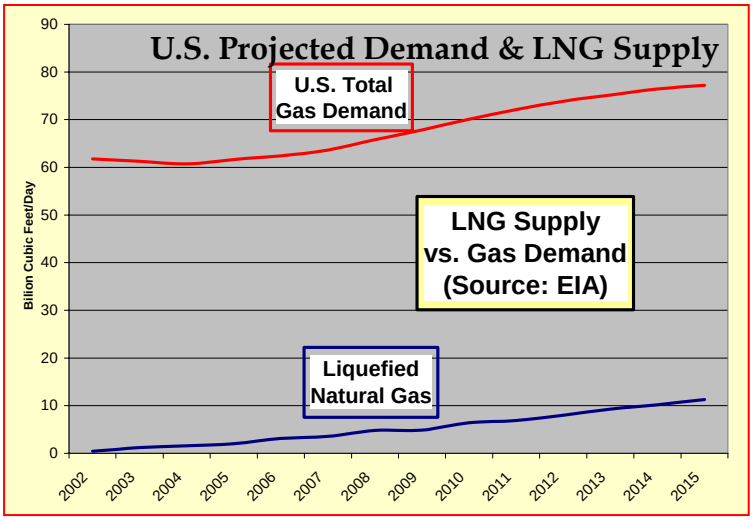
SUPPLY AND DEMAND

The need for natural gas from LNG imports is expected to double over the next decade. Pacific Basin sources from Australia, South America, and Asia are well suited for delivery to the West Coast. Natural gas from LNG sources is a good fit for California and will help ensure continued reliable and safe energy delivery. California is a net energy importer, and additional supply sources increase reliability and help meet future demand. In short, making LNG available to the state is very much like adding a new interstate pipeline from an abundant new production source.



Worldwide Stranded Gas
Figure 1

Potential Users
Figure 2



Pacific Basin LNG Supply
Figure 3

NEED FOR CHANGE IN EXISTING REGULATIONS

The CPUC, CEC, and California Utilities have done a good job of developing regulations and delivery systems to provide safe and clean natural gas for their consumers. The quality specifications of natural gas from most, if

not all, LNG sources are within the parameters of the utilities' current specifications. There is no need to alter these specifications, with the exception that SoCalGas' recent filing to add Rule 39 incorporating CARB specifications to its tariff is unnecessarily restrictive and not needed. We recommend not adopting Rule 39 as filed. SoCalGas Rule 30 and PG&E Rule 21 should also incorporate and designate the Wobbe Index (discussed below) as the primary interchangeability parameter.

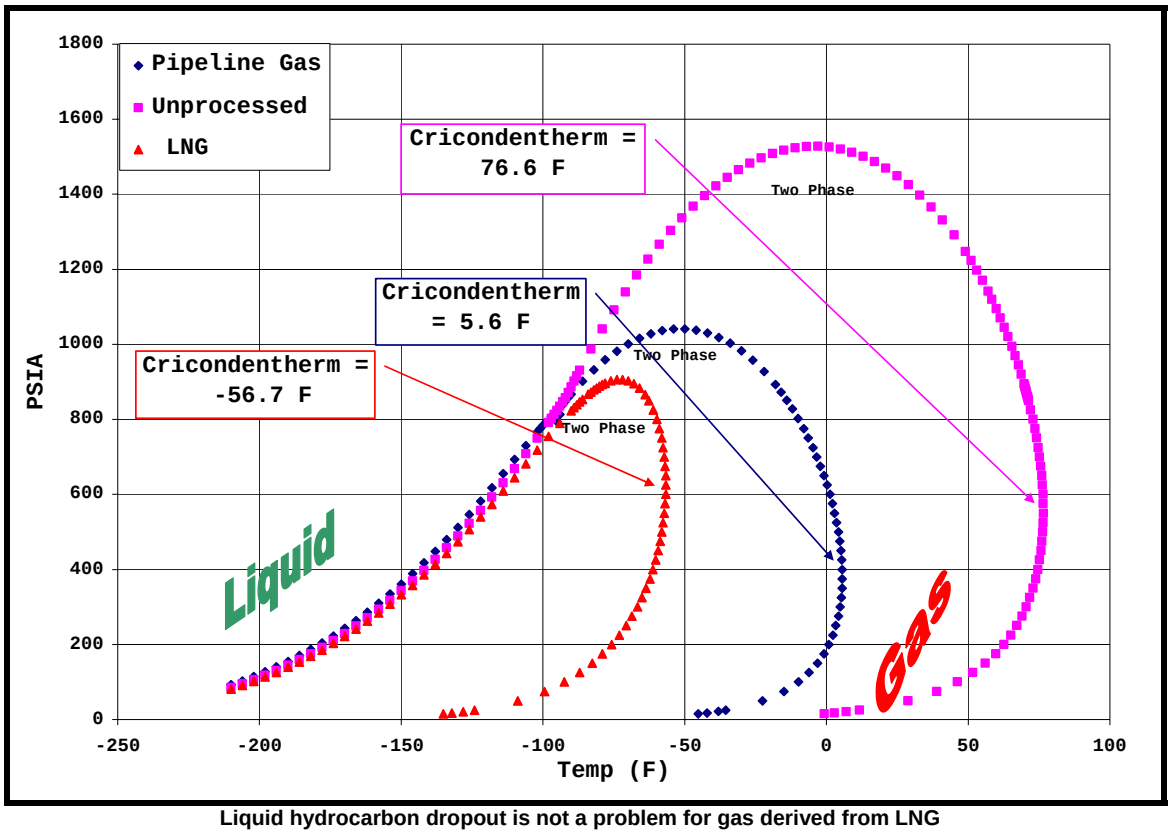
In regards to CARB Specification for CNG vehicles, many LNG supplies cannot comply with the requirement that natural gas have a minimum 1.5% total inerts, and ethane maximum limit of 6 mole%. The existing CARB Specification is the only known standard that requires a minimum concentration of inerts. Natural gas from LNG sources is a cleaner commodity than domestic pipeline gas (from domestic production) and its total inerts are routinely below 1.5%. The specification is compositional and not correlated directly to more traditional combustion-based indicators of gas quality such as Methane Number. Methane number does take into account the compositional quality of natural gas, including ethane levels and the combustion indicators. The CARB Specification should be replaced with a Methane Number Specification that correlates to CNG vehicle performance (typically MN>73).

INTERCHANGEABILITY WILL WORK WITH NEW STANDARDS

Interchangeability is simply defined as the ability for consumers of natural gas (Residential/Commercial, Industrial, and Electrical Generation, including

Utility, wholesale generation, and cogeneration), to use one fuel interchangeably with another. The key message is that natural gas sourced from LNG is very similar to domestic supply (86-96% methane). The BTU content of natural gas from LNG sources is typically higher, mainly due to less inerts and slightly higher ethane (C2) content.

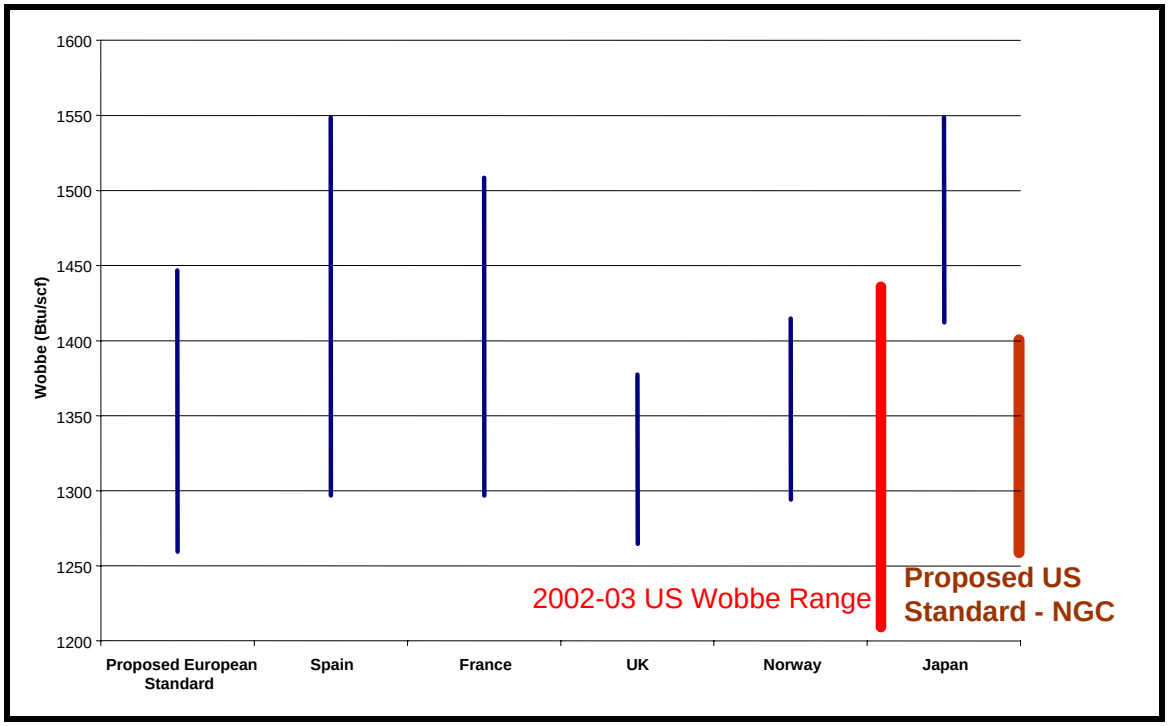
Nationally, the Natural Gas Council (NGC) has sponsored two industry wide (AGA, INGAA, NGSA, IPAA) task forces in 2004 that produced studies on gas quality. One addressed the liquid hydrocarbon drop out potential, the other addressed gas interchangeability. The hydrocarbon dewpoint of a gas mixture is the pressure and temperature at which hydrocarbon liquids will drop out of natural gas during pipeline delivery operations. All natural gas sourced from LNG has very low hydrocarbon dewpoints and will not drop any liquid hydrocarbons in pipelines or end user equipment (see Figure 4.) Liquid dropout is generally associated with domestic produced supply with a greater concentration of heavier liquid components (Butanes & Pentanes +). Generally, liquid dropout is not a problem with gas that has a hydrocarbon dewpoint below 15-25^{o}F. All natural gas sourced from LNG is well below this range.



Liquid hydrocarbon dropout is not a problem for gas derived from LNG
Figure 4

The NGC interchangeability study concluded through consensus that upper limits of 1400 Wobbe Index and a BTU maximum of 1110 are feasible interim interstate pipeline standards. Testing to date shows that residential and commercial appliances can safely use gases with a Wobbe Index that is ± 5% of the SoCalGas baseline gas Wobbe Index currently consumed. The Wobbe Index is a world standard and coupled with a BTU limit will correlate to typical gas interchangeability standards. World Wobbe Index standards are shown in the Figure 5 below. The proposed NGC US standard range is more conservative to assure gas from LNG sources is more readily interchangeable with existing pipeline gas. This proposed standard may exclude LNG from certain regions of the world from the US LNG market. California should not unnecessarily restrict

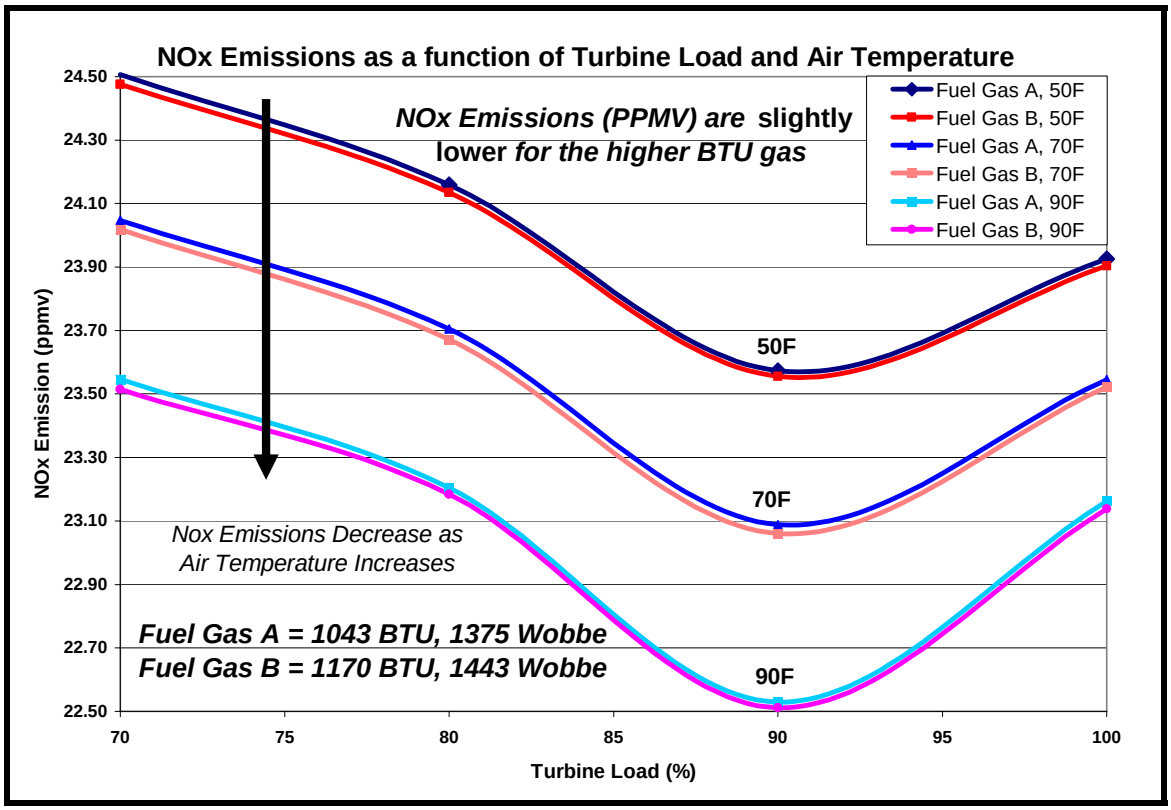
LNG suppliers from competing in the California market by adopting even more stringent standards than those proposed by NGC.



Other nations show greater flexibility in accepting LNG
Figure 5

The gas fired electric generation units have varying standards of interchangeability depending on the type of equipment. The older units using diffusion flame combustors can accept a fairly large range of gas quality ± 5-7% of the established Wobbe Index. The newer low emissions turbines generally allow a ± 5% Wobbe Index variation before retuning is necessary to meet NOx air emission limits. Some manufacturer specifications are set slightly tighter than this range. These low emission turbines can operate at a 1400 Wobbe Index, the upper end of the range (typical Wobbe Index of SoCalGas pipeline gas is 1339 Btu/scf). The NOx emissions impact at the upper levels is a minimal 1-2 ppm increase. Adjusting the turbine set point will reduce this increase to even

smaller levels (less than 1 ppm). Figure 6 illustrates two major points. First, there is an almost imperceptible difference in NOx ppm whether the fuel gas is pipeline gas or gas sourced from LNG. Second, other factors, such as ambient temperature, have a far greater effect on emissions than does the source of natural gas.

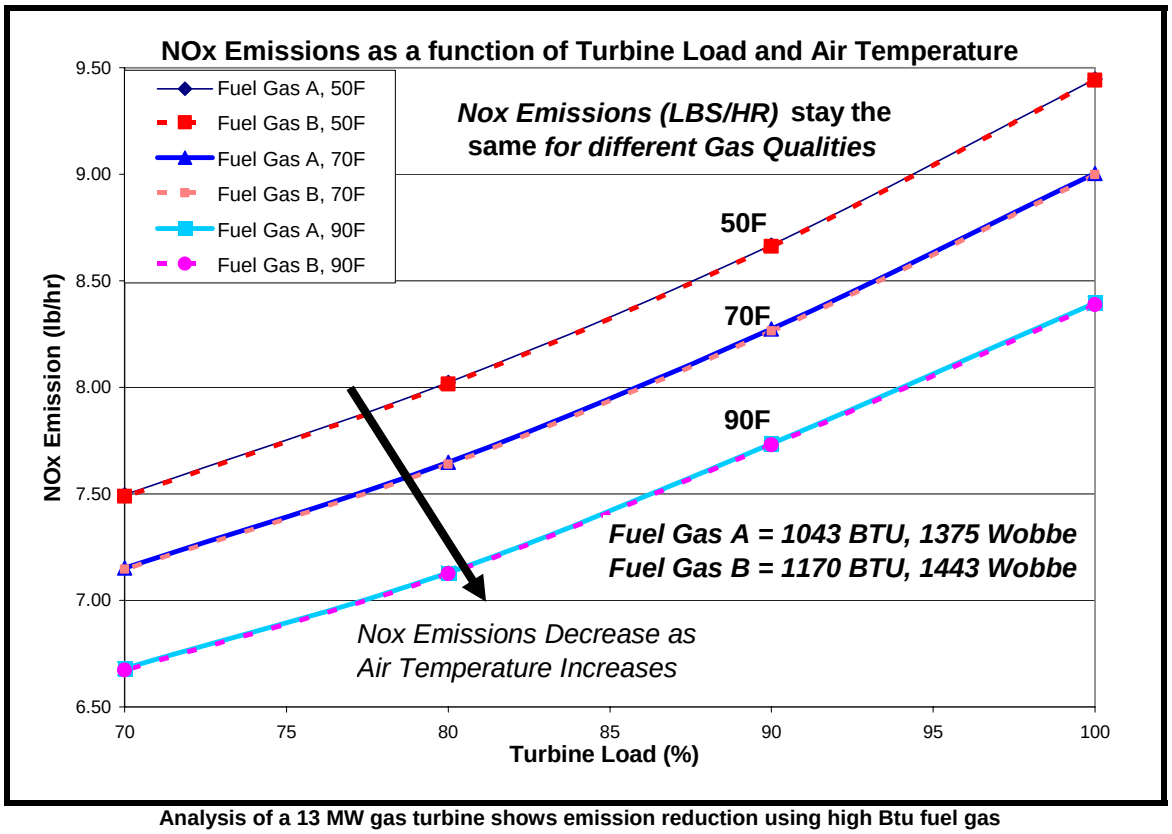


Imperceptible difference in NOx emission based on Btu content
Impact of ambient conditions far greater than Btu content
Figure 6

The Natural Gas Council has provided these studies and recommendations to the FERC. The FERC is planning its first hearing in first quarter 2005 to begin the process of establishing national interstate pipeline standards over the next year.

AIR QUALITY

Natural Gas sourced from LNG is a clean form of energy. It has been processed at the LNG Liquefaction plant to remove most of the impurities that are present in domestically produced natural gas. The generally higher BTU content associated with Natural Gas sourced from LNG is due to slightly higher Ethane (C_2H_6) content as compared to domestically produced natural gas. This higher BTU content allows for a more efficient transfer of heat content through the pipeline system to the burner tip. This efficiency can help the air quality. While the higher heat content of Natural Gas sourced from LNG may produce more Nitrogen Oxides (NOx) per cubic foot of gas burned than domestically produced natural gas, the efficiency of delivering more heat to the burner will result in burning a lower volume of gas. The end result of burning less volume of gas (because of its higher heat content) can offset any change in parts per million NOx emissions. One of our studies, as illustrated in Figure 7, shows that the pounds per hour NOx emissions for a nominal 13 MW gas turbine actually are reduced with higher BTU gas, primarily due to the lower gas fuel rate.



Analysis of a 13 MW gas turbine shows emission reduction using high Btu fuel gas
Figure 7

Additionally, the lack of impurities in Natural Gas sourced from LNG also helps result in a cleaner burning flame. Impurities can cause inefficient and/or incomplete combustion which results in higher Carbon Monoxide (CO) emissions. Certain impurities such as H_2S will form Sulfur Dioxide upon combustion. Natural Gas sourced from LNG will not have such emission components. Thus, we believe that Natural Gas sourced from LNG can also help in the fight to improve air quality.

CONCLUSION

Natural gas sourced from LNG can provide significant benefits for California. The current California utility natural gas quality specifications are

adequate. Natural gas from LNG sources can improve pipeline safety, is cleaner than domestic pipeline gas, and will enhance efficiency of the pipeline systems by allowing more BTUs to be delivered via the existing infrastructure. Potential LNG suppliers need reasonable gas quality specifications before they can make the long-term commitments needed to supply the California market. Decisions to serve California from LNG sources will require large scale funding for design, permitting and construction of facilities, both in the production and consumption areas, fabrication of LNG tankers and execution of long-term leases and transportation commitments. Other potential users of LNG such as China, India, South Korea and Japan are not only closer to most of the LNG sources, but also further along in their contractual and regulatory processes. California needs to complete this important phase so that gas from LNG can serve its people and economy.

February 11, 2005

Respectfully submitted,

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ATTACHMENT A

Response to Individual Questions
By
Chevron U.S.A. Inc.

Topics of the Workshop
Natural Gas Quality Standards
Workshop Sponsored by CPUC and CEC
February 17-18, 2005
CPUC Auditorium, San Francisco, California

I. Introduction

a) **What are different measurements of gas quality?** *The items below are the typical measurements of gas quality*

1. *Chemical Composition - mole composition derived from gas chromatograph is utilized to calculate the below values.*
2. *Heating value - BTU, a unit for measuring heat quantity in the customary system of English units of measurement, equal to the amount of heat required to raise the temperature of one pound of water 1 degree F.*
3. *Wobbe index - Wobbe index is the heating value of a natural gas divided by the square root of its specific gravity. This index is proportional to the heat input to a burner at constant pressure. Therefore, requiring two "interchangeable" gases to have the same Wobbe index would primarily require them to produce the same heat rate through the same burner orifices at the same pressure drop.*
4. *Methane number - methane number is a measure of the knock resistance of the fuel. Knock, or detonation, can be extremely damaging to an engine. Knock occurs when there is uncontrolled combustion proceeding along a flame front initiated at the spark plug. Knock can result from the heat produced by compression of the air/fuel gas mixture in the piston. The knock resistance of the fuel is a function of the fuel composition. Methane has a very high knock resistance. The heavier hydrocarbons in natural gas, such as ethane, propane, and butane have lower*

knock resistance and thus reduce the overall knock resistance of the fuel.

5. *Hydrocarbon dew point (HDP) - the series of matching pressure and temperature points at which hydrocarbons condense into liquid from a natural gas mixture. The hydrocarbon dew point pressure is the pressure at which hydrocarbons will begin to condense from a gas mixture at a given temperature. The hydrocarbon dew point temperature is the temperature at which hydrocarbons will begin to condense from a gas mixture at a given pressure, and it is usually more important for pipeline operations where the pressure is determined independently.*
6. *Weaver Index - Weaver index is a compilation of four indices. The four indices are: lifting, flashback, yellow tipping, and incomplete combustion. All four are relative indexes. For example, a lifting index of 1.0 shows that two gases are interchangeable. This index considers differences in the stoichiometric air/fuel ratio, heating value, specific gravity, and laminar flame speed (at stoichiometric conditions and was developed empirically from studies of partially premixed Bunsen-type burners. However, there has not been general agreement on what the baseline gas for comparison should be, and no work has been done to determine the applicability of this index to prediction of lean, premixed, low emissions combustion units.*

b) Why does gas quality matter?

1. *Commercial and residential burner tip performance*
2. *Safety and reliability issues*
3. *Emissions and air quality*

c) **What are the quality characteristics of the pipeline gas imported into California from other states and Canada?** *SoCalGas' gas quality is a good measure of the combined pipeline imports.*

d) **What are California natural gas producers' issues concerning gas quality standards?** *See Comments by Western States Petroleum Association and California Independent Petroleum Association.*

e) **What are the potential effects of the introduction of regasified LNG on quality of the natural gas flowing through California pipelines?** *It is anticipated that regasified LNG will improve the overall quality of natural gas flowing through California pipelines*

due to no water and less inerts inherent in LNG. Higher Btu gas will allow up to 5% pipeline grid capacity increase throughput without investing any capital. Furthermore, it is anticipated that overall NOx emissions and CO emissions may stay constant or slightly drop due to the nature of higher Btu and less volume needed to provide the energy to do the work.

f) **How fully interchangeable is regasified LNG with pipeline gas?** *Within certain Btu and Wobbe ranges, regasified LNG is interchangeable with domestic gas production. In certain appliances it produces lower CO and de minimus NOx increase.*

II. What are California's current standards?

a) Gas Quality Rules 30 (SoCalGas and SDG&E) and 21 (PG&E), CPUC General Order 58-A

1. What are the current standards?

Specifications from Rule No. 30 of Southern California Gas Company Tariff

I. Gas Quality

2. *All gas delivered into the Utility's system for the account of the customer for which there is no existing contract between the delivering pipeline and the Utility shall conform to the following minimum specifications:*

   a. *Heating Value: The minimum heating value is nine hundred and seventy (970) Btu (gross) per standard cubic foot on a dry basis. The maximum heating value is one thousand one hundred fifty (1150) Btu (gross) per standard cubic foot on a dry basis.*

   b. *Moisture Content or Water Content: For gas delivered at or below a pressure of eight hundred (800) psig, the gas shall have a water content not in excess of seven (7) pounds per million standard cubic feet. For gas delivered at a pressure exceeding of eight hundred (800) psig, the gas shall have a water dew point not exceeding 20F at delivery pressure.*

   c. *Hydrogen Sulfide: The gas shall not contain more than twenty-five hundredths (0.25) of one (1) grain of hydrogen sulfide per one hundred (100) standard cubic feet. The gas shall not contain any entrained hydrogen sulfide treatment chemical (solvent) or its by-products in the gas stream.*

   d. *Mercaptan Sulfur: The mercaptan sulfur is not to exceed three tenths (0.3) grains per hundred standard cubic feet.*

   e. *Total Sulfur: The gas shall not contain more than seventy-five hundredths (0.75) of a grain of total sulfur compounds per one hundred (100) standard cubic feet. This includes COS and CS2, hydrogen sulfide, mercaptans and mono, di and poly sulfides.*

f. *Carbon Dioxide: The gas shall not have a total carbon dioxide content in excess of three percent (3%) by volume.*

g. *Oxygen: The gas shall not at any time have an oxygen content in excess of two-tenths of one percent (0.2%) by volume, and customer will make every reasonable effort to keep the gas free of oxygen.*

h. *Inerts: The gas shall not at any time contain in excess of four percent (4%) total inerts (the total combined carbon dioxide, nitrogen, oxygen and any other inert compound) by volume.*

i. *Hydrocarbons: For gas delivered at a pressure of 800 psig or less, the gas hydrocarbon dew point is not to exceed 45F at 400 psig or at the delivery pressure if the delivery pressure is below 400 psig. For gas delivered at a pressure higher than 800 psig, the gas hydrocarbon dew point is not to exceed 20F at a pressure of 400 psig.*

j. *Dust, Gums and Other Objectionable Matter: The gas shall be commercially free from dust, gums and other foreign substances.*

k. *Hazardous Substances: The gas must not contain hazardous substances (including but not limited to toxic and/or carcinogenic substances and/or reproductive toxins) concentrations which would prevent or restrict the normal marketing of gas, be injurious to pipeline facilities, or which would present a health and/or safety hazard to Utility employees and/or the general public.*

m. *Interchangeability: The gas shall meet American Gas Association's Wobbe Number, Lifting Index, Flashback Index and Yellow Tip Index interchangeability indices for high methane gas relative to a typical composition of gas in the Utility system near the points of receipt. Acceptable specification ranges are:*

** Wobbe Number (W for receiving facility (WP for producer)*
0.9 W <= WP< = 1.1 W

** Lifting Index (IL)*
IL <= 1.06

** Flashback Index (IF)*
IF <= 1.2

** Yellow Tip Index (IY)*
IY >= 0.8

** Specifications are in relation to a typical composition of gas serving the area to be supplied by the new source.*

Specifications from Rule No. 21 of Pacific Gas & Electric Company Tariff

C. QUALITY OF GAS

Gas delivered to PG&E for transportation to the Delivery Point(s) shall meet the gas quality specifications stated in the service agreement between the delivering pipeline company and PG&E. If no gas-quality specifications agreement exists between the delivering pipeline company and PG&E for the Receipt Point(s), or if

the natural gas is not delivered by a pipeline, the gas received by PG&E shall meet the following specifications:

1. *Carbon dioxide: The gas shall contain no more than one percent by volume of carbon dioxide.*

2. *Oxygen: The gas shall contain no more than 0.1 percent by volume of oxygen.*

3. *Hydrogen sulfide: The gas shall contain no more than 0.25 grain of hydrogen sulfide per one hundred standard cubic feet.*

4. *Mercaptan sulfur: The gas shall contain no more than 0.5 grain of mercaptan sulfur per one hundred standard cubic feet.*

5. *Total sulfur: The gas shall contain no more than one grain of total sulfur per one hundred standard cubic feet.*

6. *Water vapor: The gas shall contain no more than seven pounds of water vapor per million standard cubic feet.*

7. *Hydrocarbon dewpoint: The gas shall not have a hydrocarbon dewpoint that will allow formation of liquids under the operating conditions of the receiving pipeline.*

8. *Liquids: The gas shall contain no liquids at the Receipt Point(s).*

9. *Objectionable matter: The gas shall not contain dust, sand, dirt, gums, oils, or other substances in an amount sufficient to be injurious to PG&E facilities or which shall cause the gas to be unmarketable.*

10. *Temperature: The gas shall not be delivered at less than 60 degrees Fahrenheit or more than 100 degrees Fahrenheit.*

11. *Gas from landfills: Gas from landfills will not be accepted or transported under the Agreement.*

12. *Gas interchangeability: The gas shall be interchangeable with the gas in the receiving pipeline. Interchangeability shall be determined in accordance with the methods and limits presented in Bulletin 36 of the American Gas Association.*

13. *Heating value: The gas shall have a heating value that is consistent with the standards established by PG&E for each Receipt Point(s).*

2. *Are there concerns regarding these standards? The SoCalGas Rule 30 has done a fine job historically providing safe clean natural gas. It's a proven standard that works. If the SoCalGas Interchangeability Study indicates changes are needed, they should be incorporated into Rule 30 in a timely manner.*

b) *California Air Resources Board Motor Vehicle Fuel Specifications: California Code of Regulations, Title 13, Section 2292.5, Specifications for Compressed Natural Gas*

1. *What are the current specifications?*

§2292.5. Specifications for Compressed Natural Gas.

The following standards apply to compressed natural gas (The identified test methods are incorporated herein by reference):

Specifications for Compressed Natural Gas

Specification	***Value***	***Test Method***
Hydrocarbons (expressed as mole percent)		
Methane	*88.0 % (min.)*	***ASTM D 1945-81***
Ethane	*6.0 % (max.)*	***ASTM D 1945-81***
C3 and higher HC	*3.0 % (max.)*	***ASTM D 1945-81***
C6 and higher HC	*0.2 % (max.)*	***ASTM D 1945-81***
Other Species (expressed as mole percent unless otherwise indicated)		
Hydrogen	*0.1 % (max.)*	***ASTM D 2650-88***
Carbon monoxide	*0.1 % (max.)*	***ASTM D 2650-88***
Oxygen	*1.0 % (max.)*	***ASTM D 1945-81***
Inert Gases		
Sum of CO2 and N2	*1.5-4.5 % (range)*	***ASTM D 1945-81***
Water	*a*	
Particulate matter	*b*	
Odorant	*c*	
Sulfur	*16 ppm by vol. (max.)*	*Title* ***17 CCR Section 94112***

[a]The dewpoint at vehicle fuel storage container pressure shall be at least 10^{0}F below the 99.0% winter design temperature listed in Chapter 24, Table 1, Climatic Conditions for the United States, in the American Society of Heating, Refrigerating and Air Conditioning Engineer's (ASHRAE) Handbook, 1989 fundamentals volume. Testing for water vapor shall be in accordance with ***ASTM D 1142-90****, utilizing the Bureau of Mines apparatus.*

[b]The compressed natural gas shall not contain dust, sand, dirt, gums, oils, or other substances in an amount sufficient to be injurious to the fueling station equipment or the vehicle being fueled.

[c]*The natural gas at ambient conditions must have a distinctive odor potent enough for its presence to be detected down to a concentration in air of not over 1/5 (one-fifth) of the lower limit of flammability.*

2. **What are the concerns regarding these specifications?**

There are two concerns with the existing specification. The first is that it is a compositional specification that is not relevant or correlated to any of the normal gas quality parameters (e.g. interchangeability, Wobbe Index, pipeline integrity, CNG performance, Methane Number etc). The second is the requirement that natural gas have a minimum 1.5% total inerts. This is the only known standard that requires imperfections. Regasified LNG is much cleaner commodity than domestic produced natural gas in that its Total inerts is routinely below 1.5%.

It would make more sense to replace this compositional specification with a Methane Number specification that is correlated to CNG performance (e.g. MN > 73) or combination Wobbe Index and Btu limit that is correlated to Interchangeability standards.

3. Should there be one statewide universal standard for pipeline gas?

- **All users** *no*
- **All locations** *no*
- **All seasons** *no*

Domestic gas producers and regasified LNG is not subject to seasonal effects. Any State standard should also be consistent with National standards to not inadvertently preclude the import of gas from out-of-state producers.

Pipeline and utilities have little flexibility to provide specific class of end users with differing quality of gas without endpoint gas conditioning. As an example of this, is natural gas delivered to CNG stations.

III. Should there be any changes to current standards in California?

a) **If yes, what kind of changes?** *Current CARB Specification is not a performance specification. It is a compositional specification based on historical gas pipeline component make-up. E.g. Inert requirements of minimum 1.5% mole percentage. Current efforts of SoCalGas heavy duty legacy NGV study indicate that*

legacy open-loop engines can handle natural gas with minimum 80 Methane Number. (Most can burn MN>73). Note: Closed-loop engines do not have these limitations. If the CARB specification is maintained, it should be changed to a Methane Number.

b) **Should these changes be specified in utility tariffs or operating agreements?** *CARB specifications should not be receipt based, but delivery based specifications. The demand of NGVs is relatively small and the nature of pipeline commingling precludes the effectiveness of tighter NGV specification on receipt points than pipeline specifications.*

c) **How much discretion should the utilities have in meeting natural gas quality standards adopted by CPUC and ARB?** *Utilities should have ability to make gas quality specification waivers on particular receipt points if it determines the aggregate commingled pipeline quality is not compromised.*

IV. What are the best solutions for addressing the problems of in-state producers to meet the current gas standards by ARB and the CPUC?

a) **In-state producers in southern California** – **SoCalGas Rule 30 and ARB standards** *See Comments by Western States Petroleum Association and California Independent Petroleum Association.*

b) **In-state producers in northern California-PG&E Rule 21 and ARB standards** *No comment.*

V. What is happening at the local, national and international level regarding natural gas quality studies?

a) **SoCalGas Air Emission Advisory Committee** – *The Air Emission Advisory Committee (AEAC) provides technical guidance to SoCalGas on air emission and testing issues in conjunction with SoCalGas' gas interchangeability study. This study was conducted in the second half of 2004. Fourteen different residential and small commercial appliances were studied firing typical pipeline and LNG gases. A final report will be released in the first quarter of 2005.*

b) **National studies** – *A number of national studies have been completed in the past 5 years on LNG interchangeability issues. The Gas Technology Institute conducted a study entitled "Gas Interchangeability Tests - Evaluating the Range of Interchangeability of Vaporized LNG and Natural Gas". Appliances tested included: two Water Heaters, two Ovens, two Range Tops, a Furnace, an Unvented Space Heater, a Radiant Space Heater, an Unvented Fireplace and a Dryer. These*

appliances were chosen based on being widely used in the domestic market. All appliances were brand new and properly adjusted in terms of air/fuel ratio for a typical pipeline domestic natural gas. Changes in an appliance's burner performance were generally very small over the entire range of gases tested. Local interchangeability studies have been done at LNG terminal locations such as Cove Point.

c) **FERC conference** – *FERC held a Natural Gas Interchangeability conference on February 18, 2004 to solicit input on liquid hydrocarbon dropout and gas interchangeability issues. A wide range of stakeholders participated in this conference. As a result of the conference, the National Gas Council initiated an effort to develop industry consensus positions on possible solutions to these issues. The NGC process has produced two white papers with suggested technical solutions developed through this stakeholder consensus process. These solutions will be presented to FERC in early March 2005.*

d) **European studies** – *European countries define acceptable gas quality limits based on the worst performing appliances in each country. Current limits are specified by a mix of national legislation and commercial contracts. A Marcogaz Working Group is now studying the feasibility of developing a single European gas quality standard based on the requirement for all appliances manufactured since 1993 to comply with the 1990 European Gas Appliance Directive.*

VI. What are potential quality issues related to regasified LNG? How should these issues be addressed?

a) **High Btu** *High Btu is not in itself a problem. It can lead to lower consumption of natural gas as it takes less volume of gas to provide the same energy required for work. But high Btu, all things remaining equal, will produce higher NOx emissions per volume of fuel burned because of higher average combustion temperatures. The net effect of less volume of fuel burned and higher NOx emissions per volume of fuel burned will result in at worst a diminimus net increase in emissions.*

b) **Different chemical composition for same Btu** *Regasified LNG relatively higher Btu has been mistaken for domestic gas LNG with high Btu. Domestic gas Btu is set by HCs in the C6+ range which can condense in pipeline operations. Regasified LNG does not have these heavy HCs. It does have a disproportionate share of Ethane, which can not condense in pipeline operations. Thus regasified LNG is better pipeline quality gas than domestic gas.*

c) **Higher proportion of heavy hydrocarbon** *See note above. Domestic gas that is not fully processed can have disproportionate share of C4+ that can condense in pipeline operations as opposed to Regasified LNG which lacks C4+ hydrocarbon.*

It should be noted also, that regasified LNG has no water vapor and reduced amount of inerts (CO2, N2, etc) due to the liquefaction process. This makes Regasified LNG better quality pipeline gas leading to longer life in the State's natural gas infrastructure.

d) **Quality variations in different LNG tanker-loads LNG sourced from different parts of the world do differ in their compositional make up**. *As long as the regasified LNG meets the current SoCalGas Rule 30 requirements, they will not present any problems.*

VII. Are there any cost impacts on end-users involved with implementing different natural gas quality standards in California?

a) **Residential** *Residential customers may see a reduction of their monthly bill if being billed on a volumetric basis. Residential customers' appliances have been shown to be interchangeable between domestic gas production and regasified LNG.*

b) **Commercial** *Again, studies have indicated that regasified LNG is interchangeable with domestic gas and most commercial users should see little to no effect of any change in gas composition.*

c) **Appliance manufactures** See Residential above.

d) **Gas-fired power plants** *Gas fired power plants have set their emission control equipment for specific wobbe index. As long at the gas quality remains within manufacturers specifications (typically +/- 5% of the baseline gas setting) gas fired power plants should see little to no effect of changing gas composition*

e) **Chemical feedstock** *Depending on their desired component, chemical feedstock may benefit or not. If using natural gas for methane production, regasified LNG generally has less methane than domestic gas. However, if natural gas is processed for Ethane/Propane, regasified LNG will have higher E/P mix than domestic pipeline quality gas. Typically, chemical feedstock is obtained by processing gas to remove the C2+. Thus, import of regasified LNG will not impact this balance of C2+ production.*

f) **Natural gas vehicle** *As modern compressed natural gas vehicles (CNG) are designed at closed-loop engines, their performance under regasified LNG will not differ as compared to domestic gas.*