Executive Summary
Low NOx Residential Pool Heater

1 – Gas Quality and LNG Study Objectives

This research study was designed to assess how residential and small commercial/industrial end-use equipment responded to changes in gas quality and to determine if Southern California Gas Company (SCG) needs to modify its current Gas Quality Standards (Rule 30). The major objectives of the study were as follows:

- Evaluate each selected unit to determine any issues relating to equipment safety and performance. Equipment safety includes changes in Carbon Monoxide (CO) levels, combustion stability and Lifting, Flashback, and Yellow Tipping.
- Compare measured and observed results against the major natural gas interchangeability indices, including Wobbe Number, Lifting, Flashback, Yellow Tipping and Incomplete Combustion.
- Collect NO_X emissions data during testing

2 – Selection Criteria

The residential pool heater with pre-mix burner was selected for this study as it represents modern technology, which may be sensitive to changes in gas composition and characteristics. Factors and concerns that led to selection of the pool heater for this study include:

- Narrow air/fuel ratio operating band
- Performance/safety may be dependent on flame characteristics
- Sophisticated heat exchanger/combustion system
- Technology entering southern California marketplace

5 – Results Summary and Findings

The residential pre-mix pool heater was tested over a wide range of operating conditions and gas compositions according to developed test protocols[1]. Emissions from the unit exhibited some sensitivity to differing gas blends.

---

[1] Testing protocols used in this program were derived from industry standards and regulatory test procedures. Note, however, that based on the needs of this program and the operating and design characteristics of equipment tested, adherence to the industry and regulatory testing standards was not literal. The reader is cautioned that no inference can nor should be drawn as

- CO Levels neared the Critical Point[2] with the 1150 HHV / 1437 Wobbe Number (Gas 3).
- NO_X and CO emissions concentrations peaked when the 1150 HHV / 1437 Wobbe Number (Gas 3) was combusted.
- Conversely, NO_X and CO emissions declined when the lowest Wobbe/ lowest heating value gas (Gas 2) was combusted.
- Using base gas, CO and NO_X emissions and stack temperatures increased when the unit was over fired as compared to when it was under fired.
- No specific ignition assessments were performed during the testing of this unit. Visual assessments conducted during the course of other testing (as found, rated, over fired, and under fired) showed no ignition issues. Additionally, prior to testing, the manufacturer determined that there were no issues with regard to ignitions as a function of heating value and/or Wobbe for this type of burner system.

4 – Pool Heater Specifications

- **Description:** Gas-fired residential pre-mix pool heater
- **Burner:** Pre-mix, multiple tubular punched-port burners operated by induced draft
- **Input rating:** 250,000 Btu/hr
- **Type of fuel:** Natural gas
- **Required gas supply pressure:** 5.0 – 10.5" W.C.
- **Required gas manifold pressure:** 3.0" W.C.

regards certification of these devices to the industry or regulatory requirements as a result of this program.

[2] For purposes of this study the Critical Point is assessed as a change in CO concentration of 75 ppmv between baseline gas and other gas mixtures.