Executive Summary
Commercial Water Boiler

1 – Gas Quality and LNG Study Objective

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 Commercial Water Boiler was selected for this study as it is used extensively throughout the Southern California Gas Company service territory. The unit is equipped with a ceramic power burner that is adjusted to operate at a very high firing intensity rate for a surface burner. This type of burner generates a long flame that could lengthen, when supplied with higher Btu gas blends, and may be quenched improperly by the heat exchanger, resulting in increased CO emissions or heat exchanger damage. Supply air for the ceramic power burner is fixed, which could also result in increased emissions as gas blends that differ from that used to originally set the burner are supplied. Factors and concerns that led to the selection of the Water Boiler for this study include:

- Performance/safety may be dependent on flame characteristics
- Safety concerns related to flue gases
- Sophisticated heat exchanger/combustion system
- High density in southern California
- Recommendations from credible industry experts

3 – Test Results and Findings

It was concluded that there were no operational, ignition, flame stability or safety problems observed from operation of this unit during the test program. The Commercial Water Boiler was tested over a wide range of operating conditions and gas compositions according to developed test protocols[1].

- Hot and cold ignition and safety tests were conducted with the 1150 HHV / 1437 Wobbe Number (Gas 3) and the lowest 970 HHV / 1270 Wobbe Number (Gas 2). All ignitions were normal.
- Also during the hot ignition tests, the flame was more stable, but the length increased and some orange colored flame were observed when the appliance was supplied with 1150 HHV / 1437 Wobbe Number (Gas 3).
- It was noted that there was some flame puffing and the flame did not cover the entire burner surface when the appliance was supplied with 970 HHV / 1270 Wobbe Number (Gas 2). CO emissions from this unit remained were low.
- The flame temperature, flame length, partial orange tinting, NO_X and equivalence ratio trended with the Wobbe Number.
- CO and hydrocarbon emissions had an inverse relation to Wobbe Numbers.

4 – Commercial Water Boiler Specifications

- **Description:** Space heating commercial water boiler with tube type heat exchanger
- **Burner:** Gas fired premix surface burner operating on a blue flame mode
- **Maximum input rating:** 500,000 Btu/hr
- **Minimum input rating:** 250,000 Btu/hr
- **Type of fuel:** Natural Gas
- **Required gas supply pressure:** 5.0 – 14.0” W.C.

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