Southern California Gas Company
A Sempra Energy utility

Executive Summary
Flammable Vapor Ignition Resistant (FVIR) Water 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 Flammable Vapor Ignition Resistant (FVIR) Water Heater represents modern technology that is required in all new water heaters. This technology limits flammable vapor fires from water heaters. The FVIR system incorporates a mechanism that prevents flames from propagating outside the water heater in the event of vapor ignition. The combustion air openings on these units are smaller than found on previous water heaters. This led to a concern that there could be air/fuel ratio problems when rich Natural Gas fuel is supplied. Factors and concerns that led to selection of the FVIR for this study include:

- Performance/safety may be dependent on flame characteristics
- Safety concerns related to flue gases
- Recommendations from credible industry experts
- Information from background and industry research
- Technology entering Southern California marketplace

3 – Test Results and Findings

The FVIR demonstrated the capacity to satisfactorily operate with the range of gas properties and compositions currently supplied and anticipated to be

supplied in the southern California service area. The FVIR was tested over a wide range of operating conditions and gas compositions according to developed test protocols[1]. Test results and findings include:

- As tested, the unit did not exhibit significant safety, performance or emissions sensitivities to the range of gas blends and gas properties used in this program.
- Stack temperatures, while somewhat elevated with richer gas compositions remained below levels that would pose an operating concern.
- NO_X emissions were generally higher than anticipated with this unit, but CO emissions remained very low throughout the tests.
- Test results suggest that there are no issues related to ignition of the FVIR with the range of gas compositions used in this study.

4 – FVIR Specifications

- **Description:** 40-gallon gas-fired flammable vapor ignition resistant residential water heater
- **Burner:** 4.5" diameter atmospheric burner
- **Input rating:** 36,000 Btu/hr
- **Type of fuel:** Natural Gas
- **Required gas supply pressure:** 5.0 – 10.5" W.C.
- **Required gas manifold pressure:** 4.0" 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.