Executive Summary

EMWD Rich Burn Engine

1. Gas Quality and LNG Research Study Objectives

This research study was designed to assess how residential and small commercial/industrial end-use equipment responds 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 this test were as follows:

- Evaluate a rich burn engine to determine any issues relating to equipment safety and performance such as overheating, knocking or changes in CO and HC emissions levels.
- Collect NO_X emissions data during testing.

2. Selection Criteria

This engine was selected because:

- The engine made by this manufacturer and the emissions control equipment are commonly used in our service territory.
- Such equipment are subject to stringent air pollution requirements.
- Industry experts were concerned that this type of engine will have some operational or knocking problems when running on rich gases.

The engine used for this test was installed before the Best Available Control Technology (BACT) rule from the SCAQMD was approved, thus it has to meet a less stringent rule. This rule is the Best Available Replacement Control Technology requirement (BARCT) which has the following emissions requirements:

NO_X: 36, CO: 2,000, VOC: 250 (all in ppm @ 15% O_2)

By comparison, BACT requirements for a new, stationary, non-emergency natural gas-fueled IC engine, currently being permitted at a non-Major Source, are:

NO_X: 0.15, CO: 0.6, VOC: 0.15 (all in g/BHP-hr) or
NO_X: ~9.5, CO: ~64, VOC: ~28 (all in ppm @ 15% O_2)

3. Test Results and Findings

The engine was tested over a wide range of gas compositions according to developed test protocols[1]. Emissions and parameter measurements were conducted by Southern California Gas Company (SCG), Advanced Engine Technologies Corporation (AETC), Consultant, and the South Coast Air Quality Management District (SCAQMD).

Results obtained from all tests conducted reveal that (a) there were no operational, over heating, knocking, or safety problems during testing with the different test gases or during transitions; (b) the average CO, VOC and NO_X emissions increased with the richer gases but they were always below SCAQMD limits; (c) the air fuel controller adjusted the air fuel ratio promptly, thus maintaining a constant input rate and lambda with all the different gases; (d) none of the temperature measurements showed a significant increase and (e) there were some emissions spikes after switching with the different gases due to the variation in cylinder pressure of each gas.

After reviewing the test data and witnessing the test, both the engine consultant and the customer did not have any concerns related to the safety or performance of the engine while operating with any of the test gases. The SCAQMD was concerned with the increase in NOx, CO and VOC emissions with the richer gases because engines that have to meet more stringent requirements (BACT) could exceed their emission limits.

4. Equipment Specifications

- Description: Rich-Burn Engine
- Type: Reciprocating
- BHP: 225 @ 1200 RPM
- Emissions Control Equipment: NSCR catalyst, air/fuel ratio controller
- Type of fuel: Natural Gas
- Required Gas Supply Pressure: 7.5 psig
- Usage: Air Blower at a sewer plant

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[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.