

The Impact of Using LNG-Derived Natural Gas in the South Coast Air Basin



Prepared by ENVIRON International for
Southern California Gas Company

March 2007



Background

- **Future natural gas demand in the United States will rise**
- **Traditional natural gas sources are increasing in cost and new supplies will not meet demand**
- **Regasification of LNG imports is commercially feasible and economically beneficial**
- **Imported LNG typically has higher heat content and Wobbe Index (WI) than current gas in the South Coast**
 - More ethane, propane, butane
 - Less N₂, CO₂, and O₂



Air Quality Background

- **South Coast is a severe-17 ozone non-attainment and serious PM_{2.5} non-attainment area**
 - Draft 2007 AQMP: “NO_x Heavy” strategy, extreme bump-up
 - reduce NO_x by 76% (2002 to 2024)
- **Combustion of higher WI gas may increase NO_x and CO from some types of equipment**
- **Draft 2007 AQMP control measure CMB-04 proposes upper limit of 1360 WI (CPUC WI limit is 1385)**
 - Import high-methane LNG,
 - Condensing (e.g. extracting) out higher hydrocarbons,
 - Adding inerts (e.g. N₂), and/or
 - Blending (so that end user gas is ≤ 1360 WI)
- **Question: What would be the impact of higher WI gas on South Coast emissions and air quality?**



Impact Analysis Approach

- **Review relevant emission inventories for SCAB natural gas combustion emission categories**
 - Compare to overall SCAB inventory
- **Review equipment test data that compare the combustion emissions from higher WI gas to those from base gas**
- **Apply emission ratio to appropriate SCAB stationary source natural gas combustion inventory categories and assess the inventory impact on the inventory**
- **Apply appropriate SCAQMD regulatory limits, where possible, and assess inventory impact**



High WI Gas Emission Impact Analyses (1Bcf per day replacement scenario)

- **Analysis 1: Natural Gas OIR (December 2005) Analysis**
 - Initial SoCalGas 2005 Test Report
 - Impact of WI 1400 to base gases: 1.2 tons/day
- **Analysis 2: WI 1385 – WI 1360 Analysis (December 2006)**
 - Interpolated previous test results for WI=1360 and 1385
 - WI 1385 - WI 1360: 0.34 tons/day
- **Analysis 3: New Test Data Analysis (February 2007)**
 - SCAB 2005 engine results replace Ventura 2003 results
 - Broiler test results were added
 - Additional boiler tests and boiler distribution data



Applicable Test Results

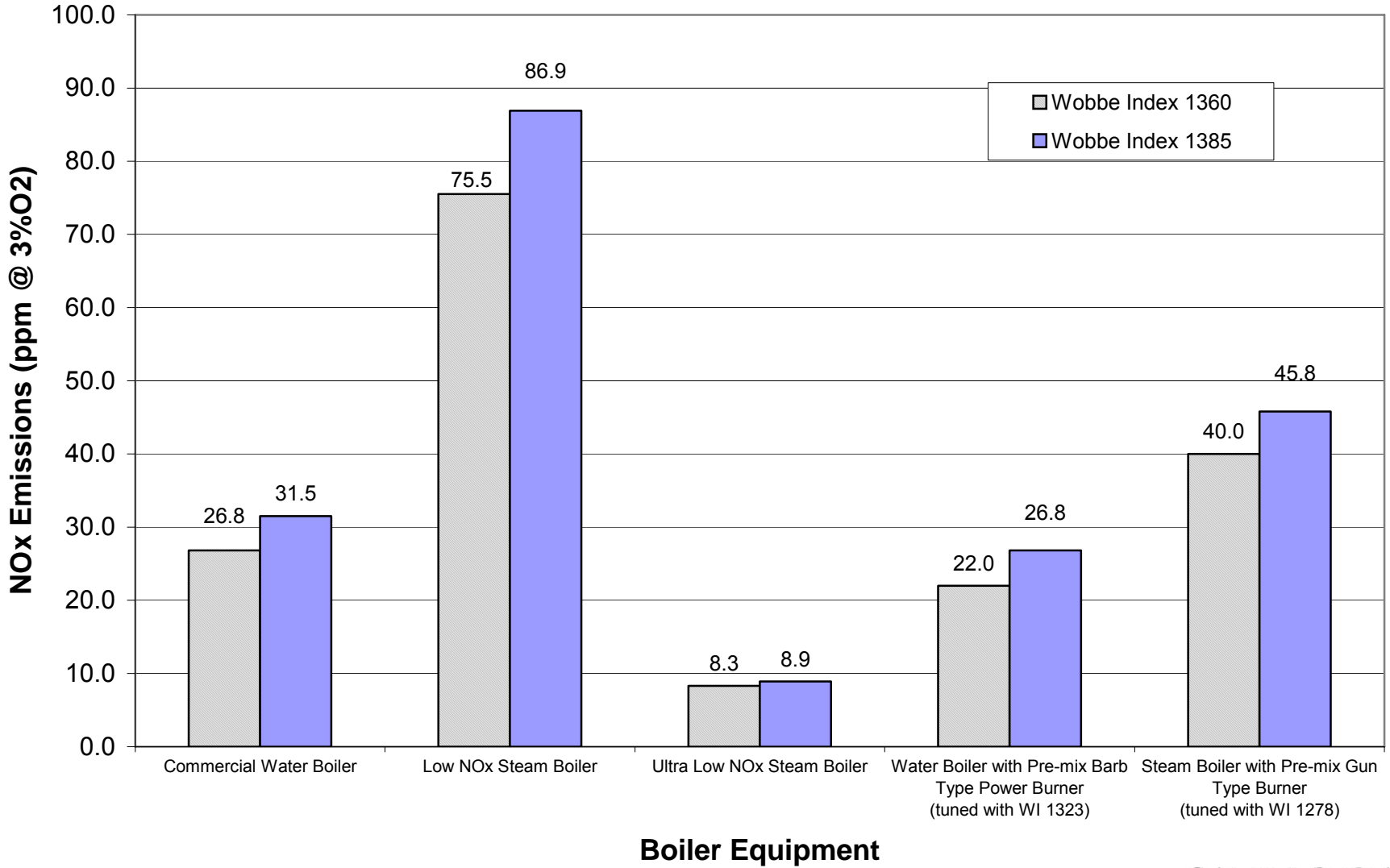
Emission Source Category	Tested Equipment ¹	2003 NO _x Emissions (tons/day)
All ICEs	Internal Combustion Engine ²	6.9
All boilers and process heater categories	Commercial water boiler for Analyses 1 and 2 Range of boilers for Analysis 3	7.8
Residential, service and commercial space heating	HCFAU ³	10.6
Residential, service and commercial water heating	Legacy water heater	10.7
Residential cooking	None in Analyses 1 and 2 Residential broiler for Analysis 3	2.0
gas turbines, oven heaters, in-process fuel, other	None available (no adjustment)	14.9*

* 3.8 tpd from residential (other)
and 3.3 tpd from gas turbine engines generally
in RECLAIM

1. LNG study April 2005, except as noted
2. 2003 Ventura engine for Analyses 1&2,
2005 SCAB engine for Analysis 3
3. Gas #3 results used



Boiler Test Data





Rule Adjustments

- **Almost all in-basin sources that emit over 4 tons/year of NO_x are in RECLAIM (Cap-and-Trade)**
 - Net Basin emissions change from those sources = zero
 - Sophisticated control equipment historically has managed variations in fuel quality
 - If emissions increase, there would be increased demand for RTCs and probably higher prices
- **RECLAIM applied to:**
 - All electric utilities, co-generation, oil / gas production, petroleum refining, and industrial / manufacturing categories
 - 2003 baseline emissions: 20.1 tons/day
(Actual 2005 RECLAIM emissions: 33.5 tons/day)
- **No rule or permit limits applied to any other categories:**
 - All combustion equipment under food & agriculture, service and commercial, and residential categories
 - 2003 baseline emissions: 32.8 tons/day



NO_x Impact of Higher WI Gas – Analysis 3 (1Bcf per day replacement scenario)

	Change in NOx Emissions
WI 1437 - 1385	0.61 tons/day
WI 1385 - 1360	0.29 tons/day

- **Sensitivity Analysis: If boiler emission changes eliminated due to appropriate tuning of all boilers:
Δ 0.11 tons/day NO_x (WI 1385-1360)**



Conclusions

- **Latest analysis (1Bcf per day replacement scenario):**
 - 0.34 ton/day NO_x difference between WI 1385 and 1360 if previous equipment test results used
 - 0.29 ton/day NO_x difference between WI 1385 and 1360 if additional equipment test results and boiler distribution information used
 - Does **not** account for reductions from proper tuning and/or sophisticated control equipment
 - Does **not** account for impact of non-RECLAIM rules or permit limits
- **Ozone and PM_{2.5} air quality impact expected to be negligible**