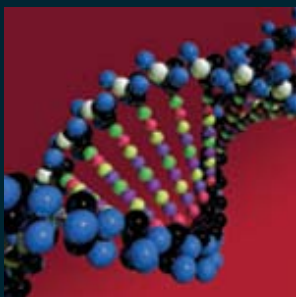


# Utilization of New Gas Supplies

## Filling Key Information Gaps



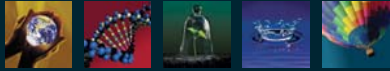
Gas Interchangeability and Quality Forum

November 19-20, 2008

Washington, DC

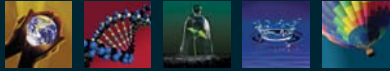
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ENVIRON



Valid interchangeability indices and relevant equipment performance data are needed to apply sound gas quality guidelines.

Screening	Workshop	Assessment	Monitoring
<ul style="list-style-type: none"><li>➤ Conduct screening assessment of interchangeability issues.<ul style="list-style-type: none"><li>• Characterize current and historical gas supplies.</li><li>• Identify potentially sensitive end-use applications.</li><li>• <b>Conduct interchangeability index analyses.</b></li></ul></li></ul>	<ul style="list-style-type: none"><li>➤ Hold workshop with stakeholders.</li><li>➤ Provide common understanding of interchangeability issues.</li><li>➤ Collect historical information on LDC operations.</li><li>➤ Gather inputs from end-users.</li></ul>	<ul style="list-style-type: none"><li>➤ Conduct assessment of interchangeability requirements and accommodation strategies.<ul style="list-style-type: none"><li>➤ <b>Test sensitive equipment, in the laboratory or in the field.</b></li><li>➤ <b>Define gas composition guidelines</b> and any necessary equipment adjustments.</li></ul></li></ul>	<ul style="list-style-type: none"><li>➤ <b>Monitor performance of representative equipment during initial introduction of new gas supply.</b></li></ul>



## Topics for Discussion

1

**Interchangeability Indices**

2

**Residential Appliance Performance**

3

**Commercial & Industrial NO<sub>x</sub> Emissions**



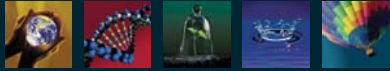
The introduction of new gas supplies may impact the performance of certain combustion equipment.

- Higher Wobbe number gas may have the following impacts:
  - Energy input (firing rate) may increase.
  - Excess air level may decrease.
  - Carbon monoxide (CO) emissions may increase.
  - Yellow tipping (soot generation in flame) may increase.
  - NO<sub>x</sub> emissions may change.
  - Heat exchanger temperatures may rise.
- Lower Wobbe number gases generally have the opposite effect. However...
  - Flame lifting may increase.
  - Carbon monoxide emissions may increase.
- Interchangeability indices (equations based on gas properties and compositions) have been developed to characterize many of these impacts.
  - Wobbe number
  - AGA indices
  - Weaver indices



An AGA Task Group is currently addressing gas interchangeability analysis methods.

- The Task Group, led by Rosemarie Halchuk of Xcel Energy, includes 47 members representing,,,
  - LDCs
  - Pipelines
  - Trade organizations/Consultants
  - Manufacturers
  - LNG suppliers
- This group is addressing technical aspects of interchangeability.
- It's mission is to coordinate and conduct research related to gas interchangeability and end-use applications.
- The group's initial activities are focusing on possible revisions to the AGA Bulletin 36 and Weaver interchangeability calculation methods for residential appliances.
  - Consider new appliance burner designs.
  - Incorporate latest combustion science.



## Topics for Discussion

1

**Interchangeability Indices**

2

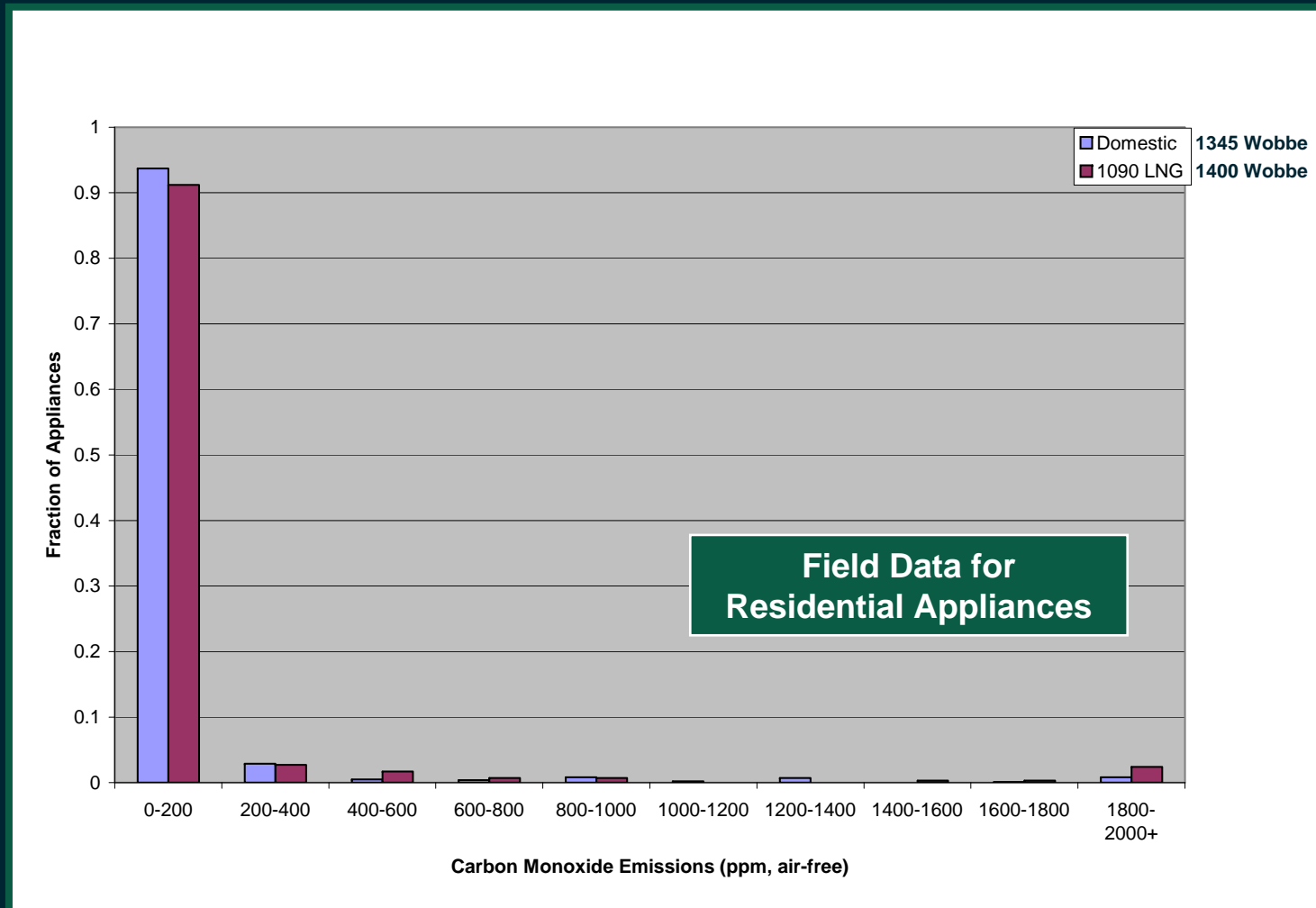
**Residential Appliance Performance**

3

**Commercial & Industrial NO<sub>x</sub> Emissions**

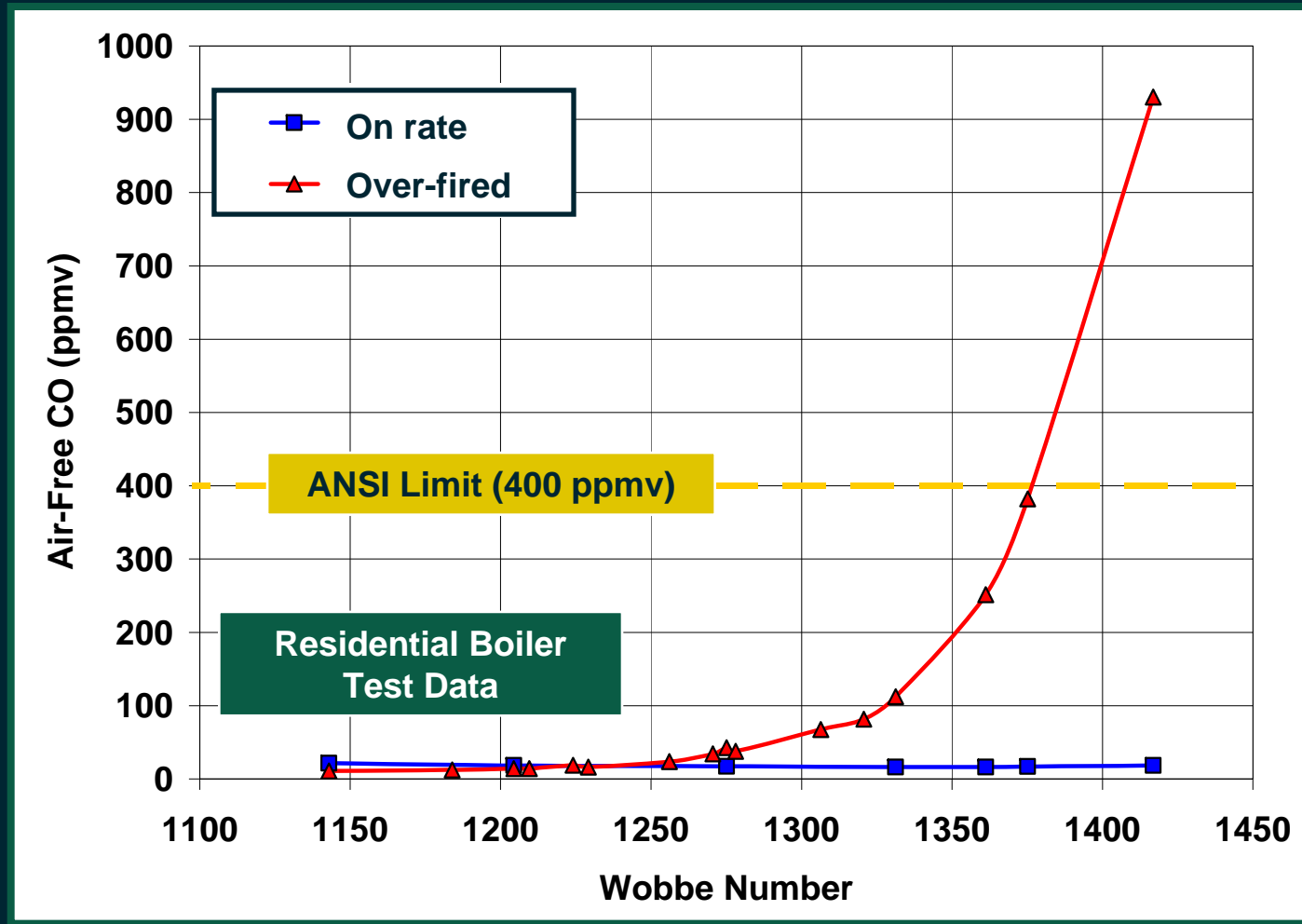


Residential appliance field testing can characterize the sensitivity of an entire population to gas composition changes.

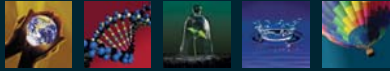




Laboratory testing can provide detailed information on gas composition impacts as well as equipment adjustment options.







Laboratory testing can quantify the impact of gas composition changes on flame lifting and soot production (yellow tipping).

Increasing Wobbe



-4

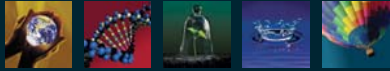


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+4





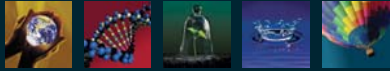
In a NYSEARCH/NGA project, we are evaluating the impact of changing gas supplies on the performance of in-service residential appliances.

- The ability of in-place appliances to operate properly with gas supply changes is not sufficiently understood.
  - very wide range of appliance types and ages.
  - installation and adjustment variability.
- In the project, we are...
  - documenting information and defining testing procedures that will fill information gaps regarding natural gas interchangeability for in-place appliances.
  - conducting field testing to determine the performance of in-place appliances and the potential sensitivity of the population to gas composition changes.
- The project team includes NYSEARCH, ENVIRON, GTI, and fifteen local natural gas distribution (LDC) and pipeline companies.



The project is being carried out in field assessment and laboratory testing phases.

- In Phase 1 (2008-2009) we are..
  - Developing a database of appliance types.
  - Identifying potentially sensitive appliance types.
  - Conducting field testing of 3200 - 3600 appliances located in four LDC service areas.
  - Evaluating the performance of the appliance population.
  - Planning Phase 2 activities.
  
- In Phase 2 we may...
  - Conduct laboratory test of new and used appliances, focusing on sensitive models and common maladjustments.
  - Develop guidelines for accommodating changing gas compositions.
  - Determine the most effective interchangeability indices for in-service appliances.



## Topics for Discussion

1

**Interchangeability Indices**

2

**Residential Appliance Performance**

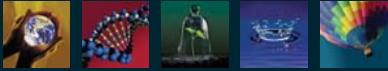
3

**Commercial & Industrial NO<sub>x</sub> Emissions**

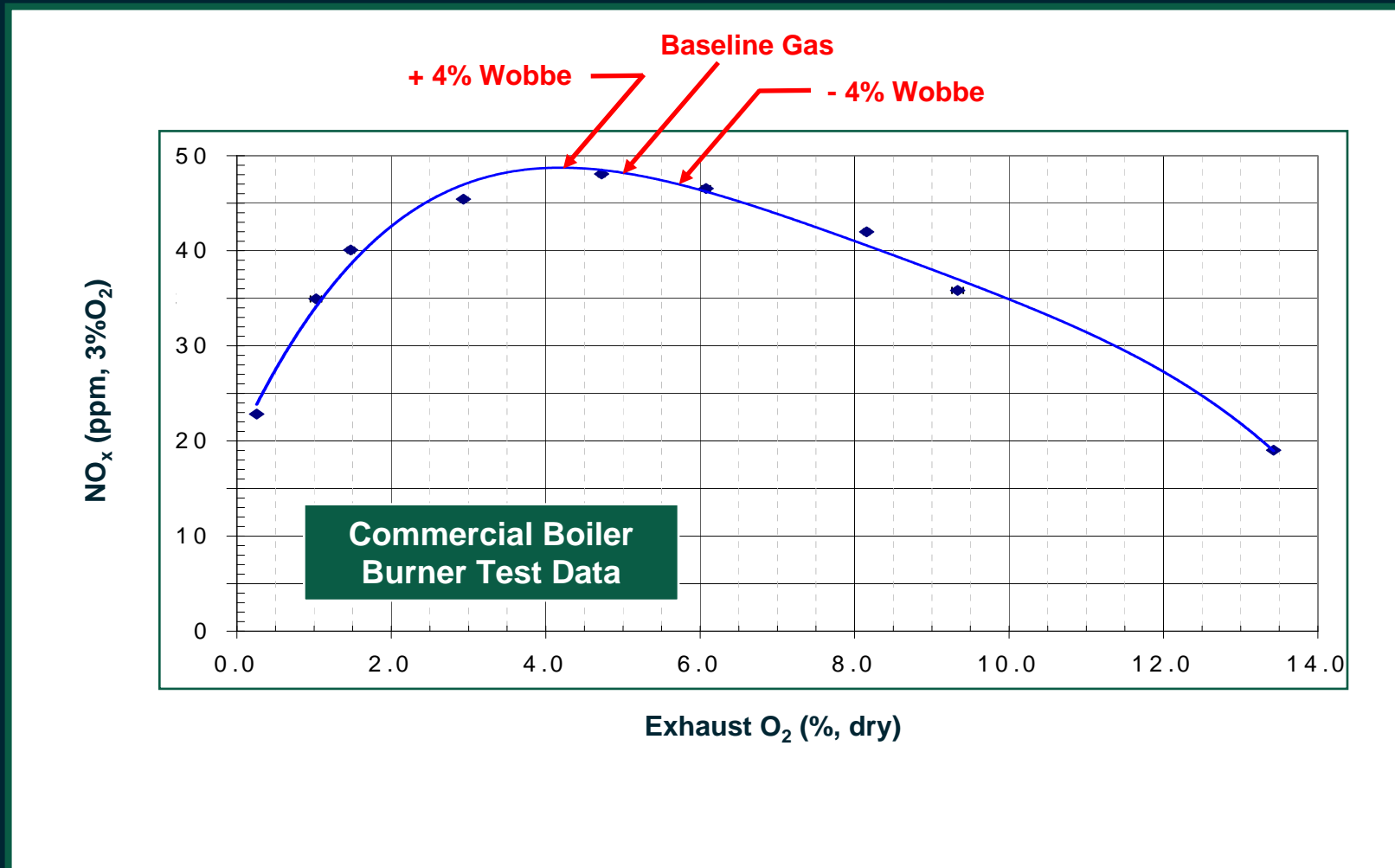


The introduction of imported LNG into California has focused recent industry efforts on the characterization of NO<sub>x</sub> emissions changes.

- For combustion of natural gas, NO<sub>x</sub> emissions (NO + NO<sub>2</sub>) are formed primarily through the “thermal” mechanism.
  - NO<sub>x</sub> levels increase exponentially with flame temperature.
- The adiabatic flame temperature for combustion of imported LNG is only very slightly higher than that for domestic natural gas.
  - 1332 Wobbe domestic natural gas = 3533 F
  - 1385 Wobbe imported LNG = 3542 F
- Combustion kinetic calculations show that similar NO<sub>x</sub> emissions will be produced if equipment is operated at the same level of excess air.
  - 1332 Wobbe domestic natural gas = 20 ppm NO<sub>x</sub>
  - 1385 Wobbe imported LNG = 21 ppm NO<sub>x</sub>
- The level of increase or decrease in NO<sub>x</sub> emissions is expected to be small and will depend primarily upon the burner type and any changes in excess air level.



Commercial and industrial equipment can be tuned to offset any increases in NO<sub>x</sub> emissions.





## Conclusions

Information developed through these projects will facilitate the successful distribution of new and changing gas supplies.

- Laboratory and field performance data will enable LDCs to work more effectively with their customers to successfully accommodate a wider range of gas compositions.
- Equipment tuning strategies will reduce or eliminate environmental impacts associated with gas composition changes.
- Improved interchangeability analysis methods could...
  - reduce or eliminate the need for equipment testing.
  - provide a higher level of confidence in proposed gas quality guidelines.