Carbon Dioxide Measurement for Detecting Heat Exchanger Leaks in Retrofitted Barns

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Flue-Cured Tobacco Barn Conversion Program

STATE	02/09/01 (Barns)	11/02/01 (Barns)
VA	631	2,505
NC	5,826	24,373
SC	1,486	3,885
GA	751	4,079
FL	127	644
Total	8,821	35,486

Does not include barns not covered by Barn Conversion Program

TSNA Results from 2000

- 375 Total Samples

  (273 Indirect-Fired, 102 Direct-Fired)

  Indirect-Fired Average - 0.30 ppm

  Direct-Fired Average - 4.35 ppm

Average TSNA Reduction - 93%

Nitrogen Oxide Levels

- ***Direct-Fired***

NO_x – 630 ppb (315 – 1225)

- ***Indirect-Fired***

NO_x – 35 ppb (12-75)

630 / 35 ~ 20x Increase in NO_x

* Typical Ambient NO_x 20 to 40 ppb

Reasons for measuring CO_2?

- By-product of combustion (>1ppm)
- Equipment cost and complexity
- Many existing commercially available meters
- Simple and direct process
- Portable instrumentation

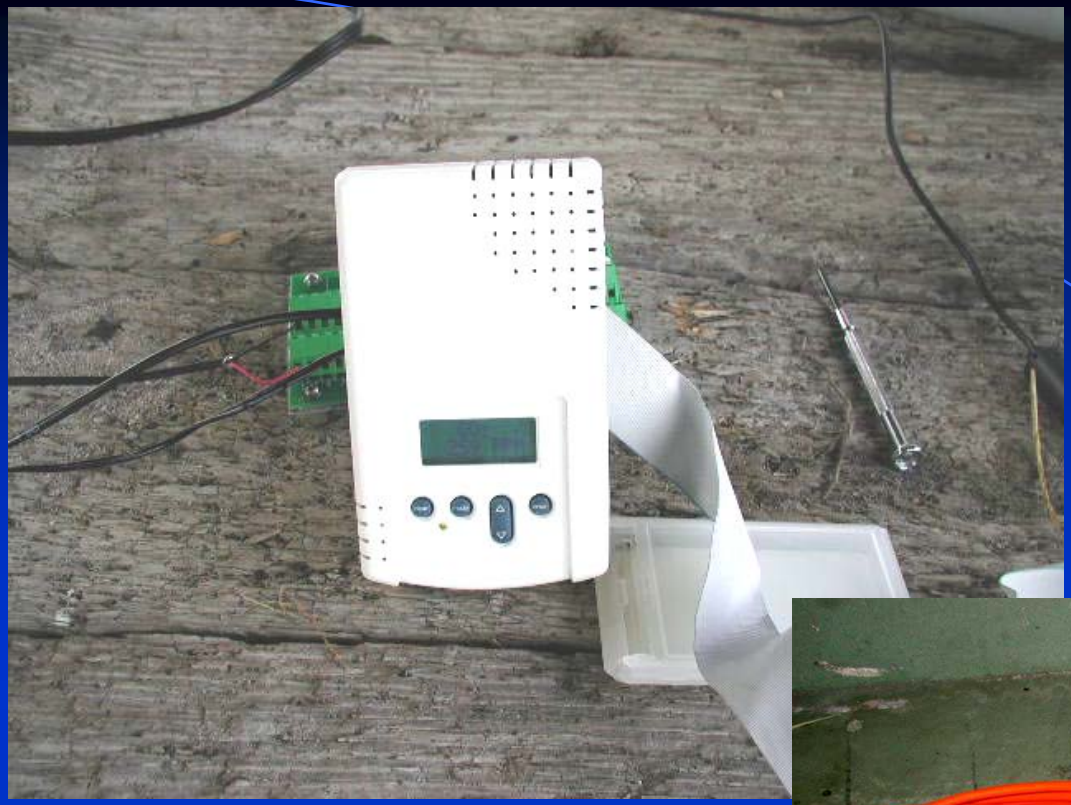
Typical CO_2 Levels in Flue Gas Produced

Fuel Oil	LPG	Natural Gas
CO_2 Max. - 15.7%	CO_2 Max. – 13.8%	CO_2 Max. – 12.1%
13.5% to 12.0%	12.5% to 11.0%	11.5% to 10.0%

Typical Ambient CO_2 Levels
300 – 450 ppm

CO_2 Measurements

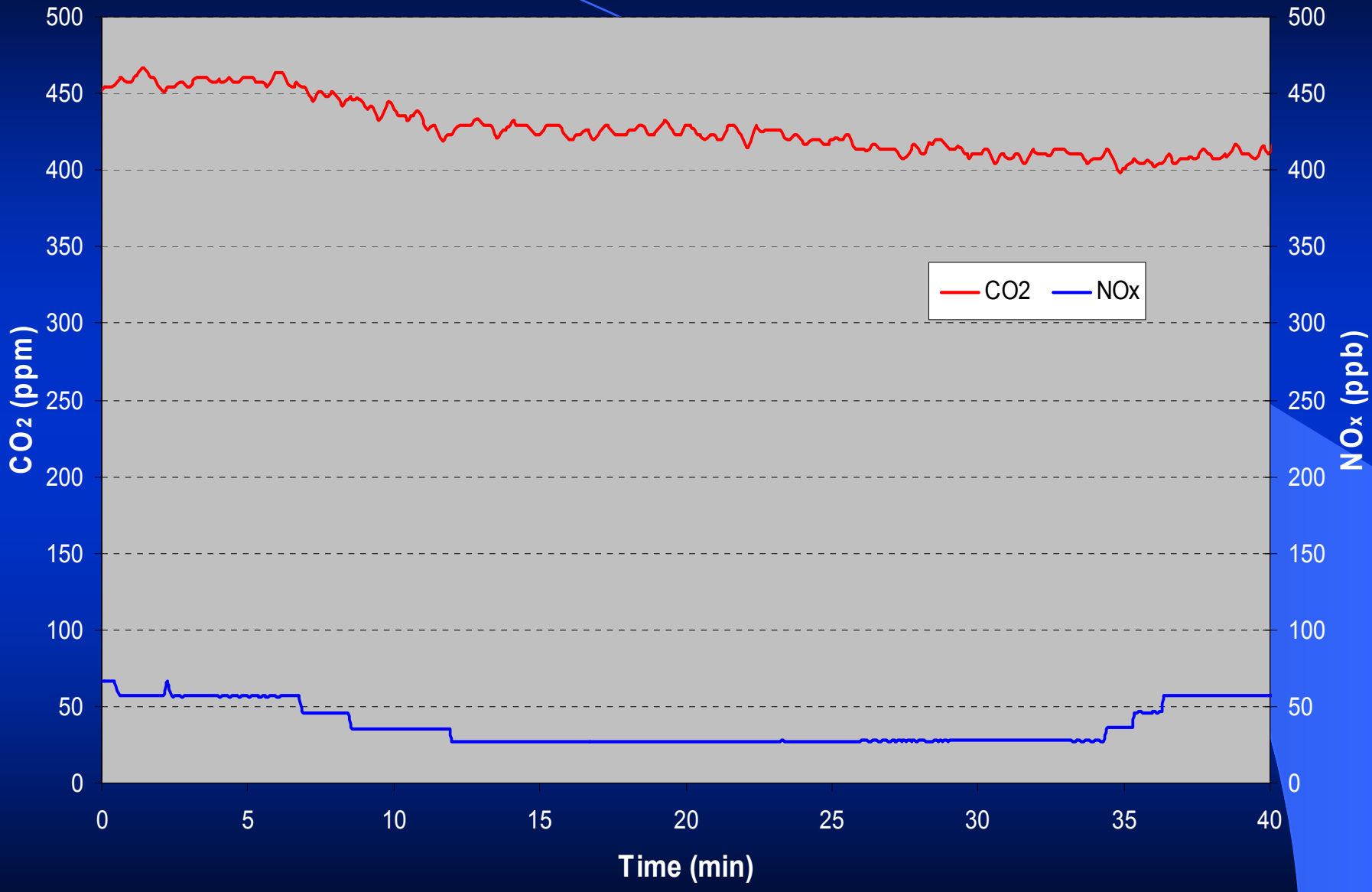
CO_2 Meters



Direct-Fired Barn Levels

2002

Indirect-Fired Barn Levels



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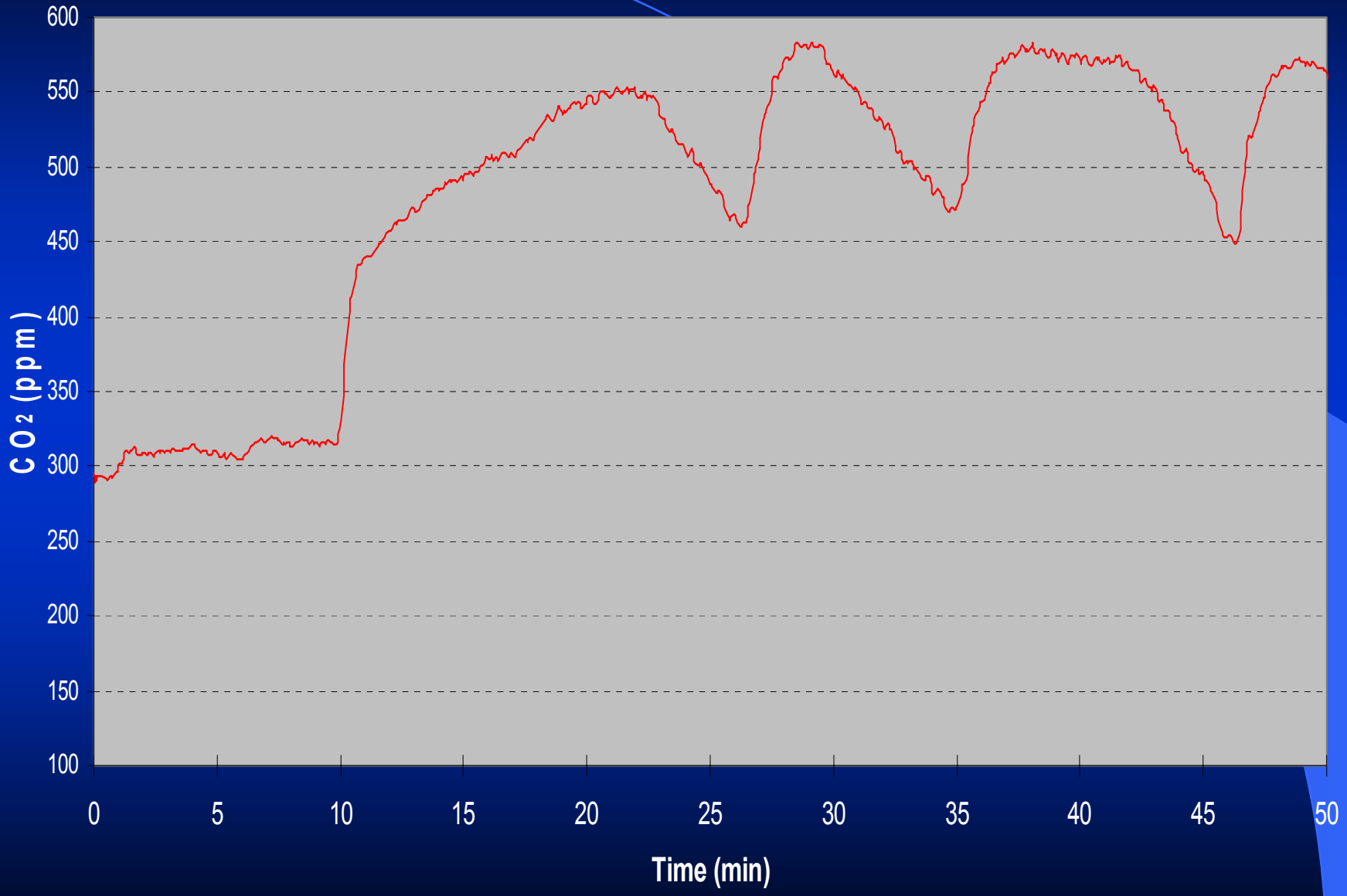
Indirect-Fired Barn Levels (Fuel Oil)

2002

Indirect-Fired Barn Levels (105 °F)



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Summary

- Elevated CO_2 levels (> ambient) may indicate cracked heating units
- Very portable and simple measuring process
- Barns tested prior to each curing season
- *Diagnostic tool to assist with maintaining low TSNA levels in Flue-Cured Tobacco*