

# Measuring Carbon Dioxide In Bulk Tobacco Barns Procedure and Guidelines

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## Introduction

This test measures the carbon dioxide level inside a curing barn as an indication of exhaust gases are being released into the curing chamber. One by-product of fuel combustion is carbon dioxide(CO<sub>2</sub>). Under normal ambient air conditions CO<sub>2</sub> readings should be approximately 350 to 500 parts per million (ppm). Although there may be elevated levels of CO<sub>2</sub>, and other combustion by-products present inside the curing chamber, the relationship between CO<sub>2</sub> readings and TSNA levels is not known at this time. However, the presence of certain combustion by-products are responsible for TSNA formation in flue-cured tobacco.

The procedure developed is to be used with the Vaisala GMT220 CO<sub>2</sub> electronic meter and probe. It could be used for other units with similar operating characteristics.

## Meter Probe Positioning

The probe can be inserted into most barns through the front exhaust vent. If the barns have some type of access door or viewing port in the back wall of the barn, the probe can be inserted at this location instead of the exhaust vent. If the probe is inserted through the exhaust vent, place the probe into the air stream by either placing it onto the perforated floor beneath the curing containers or suspending the probe a few inches above the floor. If the probe is inserted through the back wall viewing port, simply place the probe onto the floor and loosely close the door against the probe cord. In barns without a floor it may be easier to suspend the probe, which will keep the probe off the ground. On downdraft barns (BulkTobac), the sensing probe can be placed directly on top of an empty box or rack.

## Testing Procedure

1. Connect the CO<sub>2</sub> meter to a 120 volt source and allow a 10 minute warm up period. After warm up, position the probe inside the curing barn as mentioned above.
2. Close the fan intake dampers completely and turn the barn fan on only and monitor the readings for 5 to 10 minutes. The carbon dioxide level should read approximately 350 to 500 ppm. This will be a base reading for comparison. Record the information on the form provided.
3. Keep the fan on and advance the thermostat 30 to 40 degrees above the ambient air temperature. The burner will ignite and run continuously until the barn reaches the thermostat set point temperature. The maximum temperature setting during this test should not exceed 140°F. Record the maximum value on the form provided.

4. Continue to monitor the levels for 10 to 20 minutes after the burner initially ignites. If the CO<sub>2</sub> levels increase significantly above the initial background levels during this time, then the heat exchanger should be inspected closely for cracks. Also check the exhaust flue pipe connections located inside the curing barn as a potential source of leaking gases. The CO<sub>2</sub> level may change very rapidly, increasing by a factor of 2 or more above the ambient level in only a few minutes. Others may only increase by 200 or 300 parts per million in ten minutes or longer, but an inspection for cracks is still recommended. You may notice the CO<sub>2</sub> level fluctuating up and down as the burner cycles on and off during this time. After checking barns with elevated levels, allow the meter time to decrease and reach a stabilized ambient level before proceeding to the next barn.

If the CO<sub>2</sub> level remains constant or changes a small amount (< 100 ppm) during the entire procedure, then the heat exchanger probably has not developed cracks.

**Note:**

1. When checking a group of barns at one location, plug your meter into a centrally located power outlet so you can check all the barns without turning the meter power off and on. If power to the meter is interrupted, then time must be allowed for the meter to run through the warm-up period again before proceeding (10 min.).
2. Insure that electrical power and fuel are present and all barns are operating properly before starting CO<sub>2</sub> evaluations. This will minimize down time at individual barn sites.

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