

Next Generation Biomass Thermal Energy Grant Emission Testing Program

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4/10/2017

- Established in 1997
- Provide industry and government with technical expertise in automotive research and product development
- Provide students the opportunity to become directly involved in comprehensive research projects

Minnesota Center for Automotive Research



Big ideas. Real-world thinking.

Project Background

- Minnesota Department of Agriculture & The NexGen Bioenergy Board
 - Grants to promote Minnesota Timber and Bio-Technology Industries
- Purpose of the Biomass Thermal Energy Grant
 - Identify and assist in funding projects utilizing biomass for heating purposes
- Three demonstration projects were funded
- Minnesota Center for Automotive Research MnCAR was contracted to conduct emission testing of the systems.

Project Objectives

- Understand the EPA Test Methods
- Conduct a performance test for each wood heater system
- Provide the MDA with 3 emission reports
- Systems are currently not regulated in Minnesota

Uses of the Data

- To provide data for health risk assessments.
- To provide data for dispersion modeling.
- To provide data for determining appropriate emission limits.
- To provide data for determining compliance.

Viking Company – Albany, MN Poultry Farm

- EvenTemp Biomass - 1.65 MMBTU forced air furnace
- The unit is a bottom feed, top fire, and continuous flame wood chip furnace.
- 85% efficiency



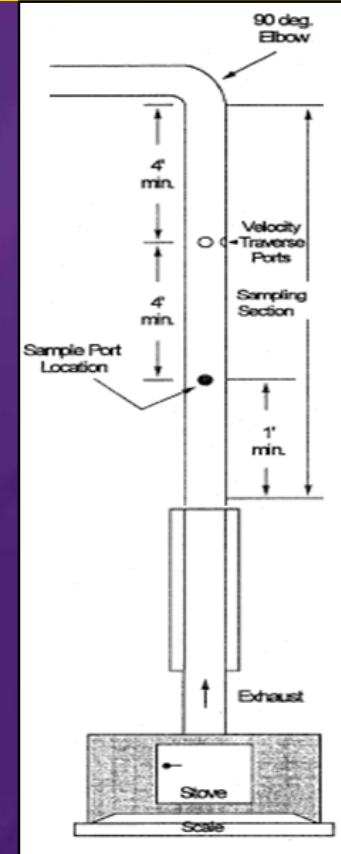
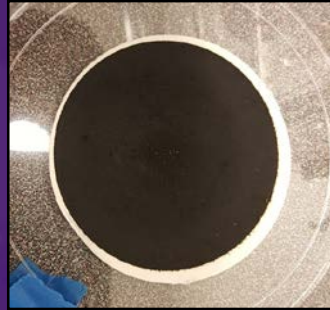
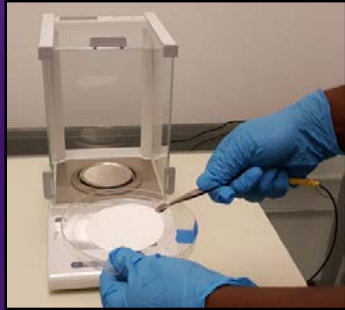
Whitewater Gardens Farm— Altura, MN Greenhouse

- TLB Inc. Log Boiler – 2.4 MMBTU hydronic boiler system
- The unit is a top load system designed to use 8” – 12” diameter, 8’ long logs



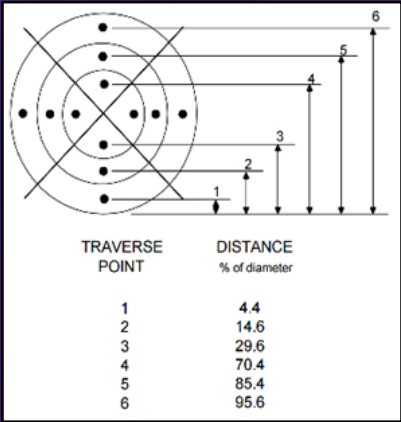
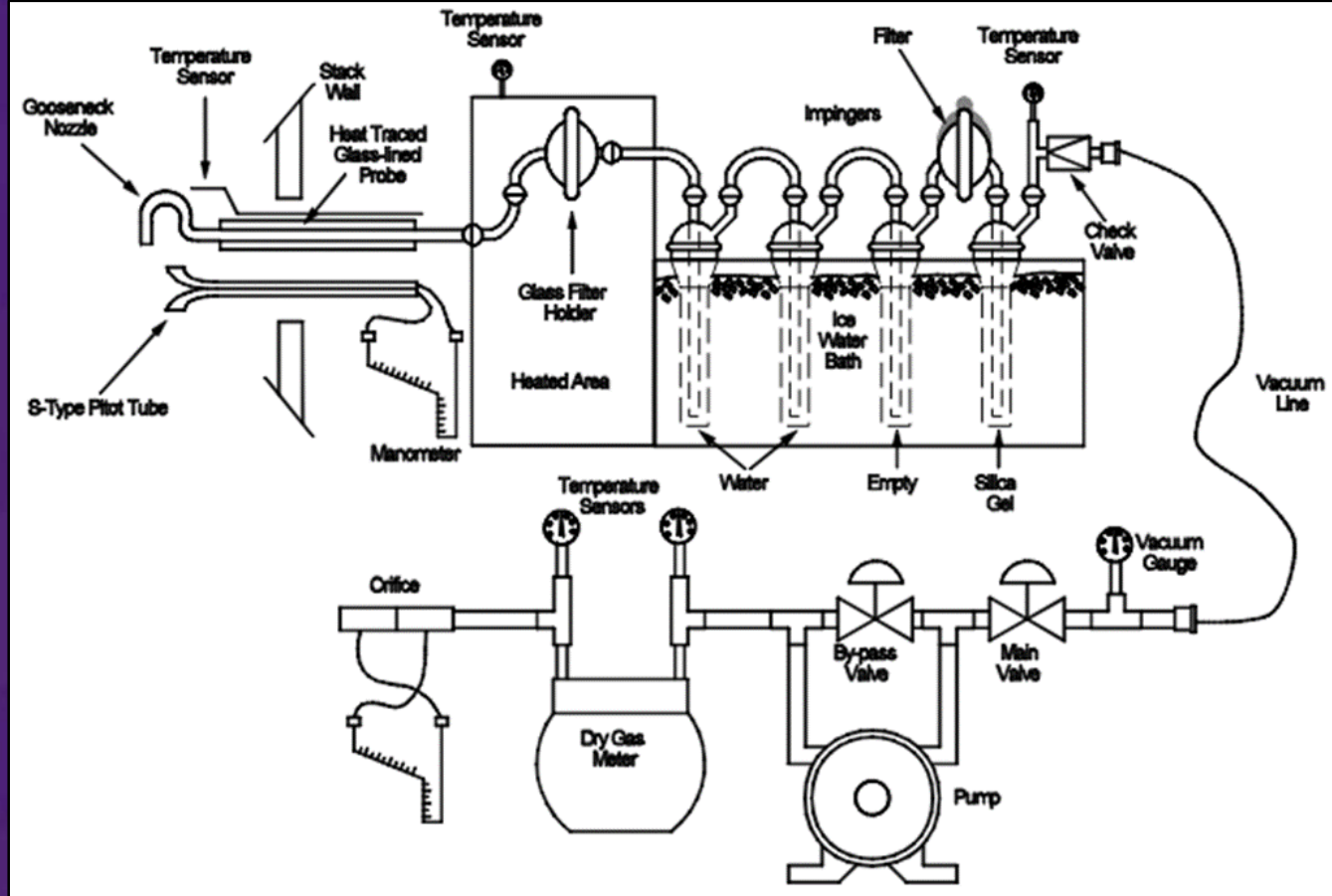
Emissions Testing Procedures – 1 Hour Sample

- All sampling followed USEPA protocols
- Methods 1-5 were used
- Emissions measured
 - Total Particulate Matter – Particulate filter paper
 - Gaseous emissions – FTIR analyzer



Sampling Procedures

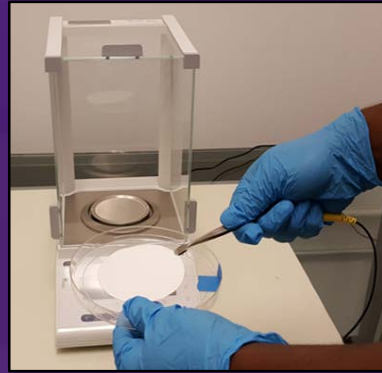
- Mass of exhaust flowing
- Remove and determine moisture content
- “Lbs. per hour”



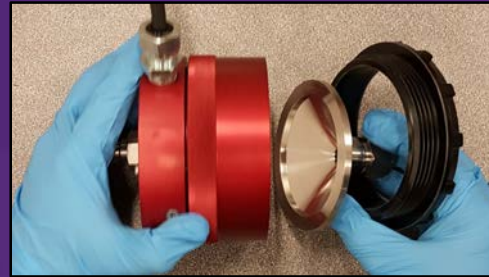
Particulate Sample Measurements



Dry Filter Paper



Weigh Filter Paper



Load Heated Filter Holder



Connect Sample Probe

Sample Chamber

Particulate Sampling Ports



Gaseous Emissions Sampling Port

Velocity Sampling Ports

Test Site Set-Up



Particulate Sampling



Gaseous Sampling

- Much easier to collect samples
 - CO
 - CO₂
 - VOC
 - NO_x
 - O₂
 - SO_x



Current Status

- Initial testing trip to Whitewater Gardens Farm
 - No alterations of test sampling procedures required.
 - Must have adequate supply of dry consistent fuel.
 - Could not remove enough heat from the boiler to operate in efficient range.
- Performed pre-site visit to Viking Company
 - Will be scheduling testing visit during time when barn is empty.

Summary

- Testing lessons learned
 - Significantly easier to test in a lab under controlled conditions!
 - Testing when greenhouse and poultry barns are full limits flexibility.
 - Fuel supply and qualities are critical.
- Biomass thermal energy system observations
 - “Learning curve” required for proper system operation
 - Fuel quality is critical

