



**TECH ENVIRONMENTAL**

*Air Quality, Odor Control, and Noise Solutions*

***Outdoor Wood Boilers –  
New Emissions Test Data  
and Future Trends***

***Peter H. Guldberg, CCM  
Tech Environmental, Inc.  
Waltham, MA***



## ***Outdoor Wood Boilers (OWBs)***

***Heat output typ.  
50,000 Btu/hr,***

***5 x heat output  
of a woodstove***

# ***Objectives***

- ***Present new OWB test data***
- ***Compare PM and PAH emissions, OWB vs. Certified Woodstoves***
- ***Analyze OWB Mass Emissions with AERMOD for  $PM_{2.5}$***

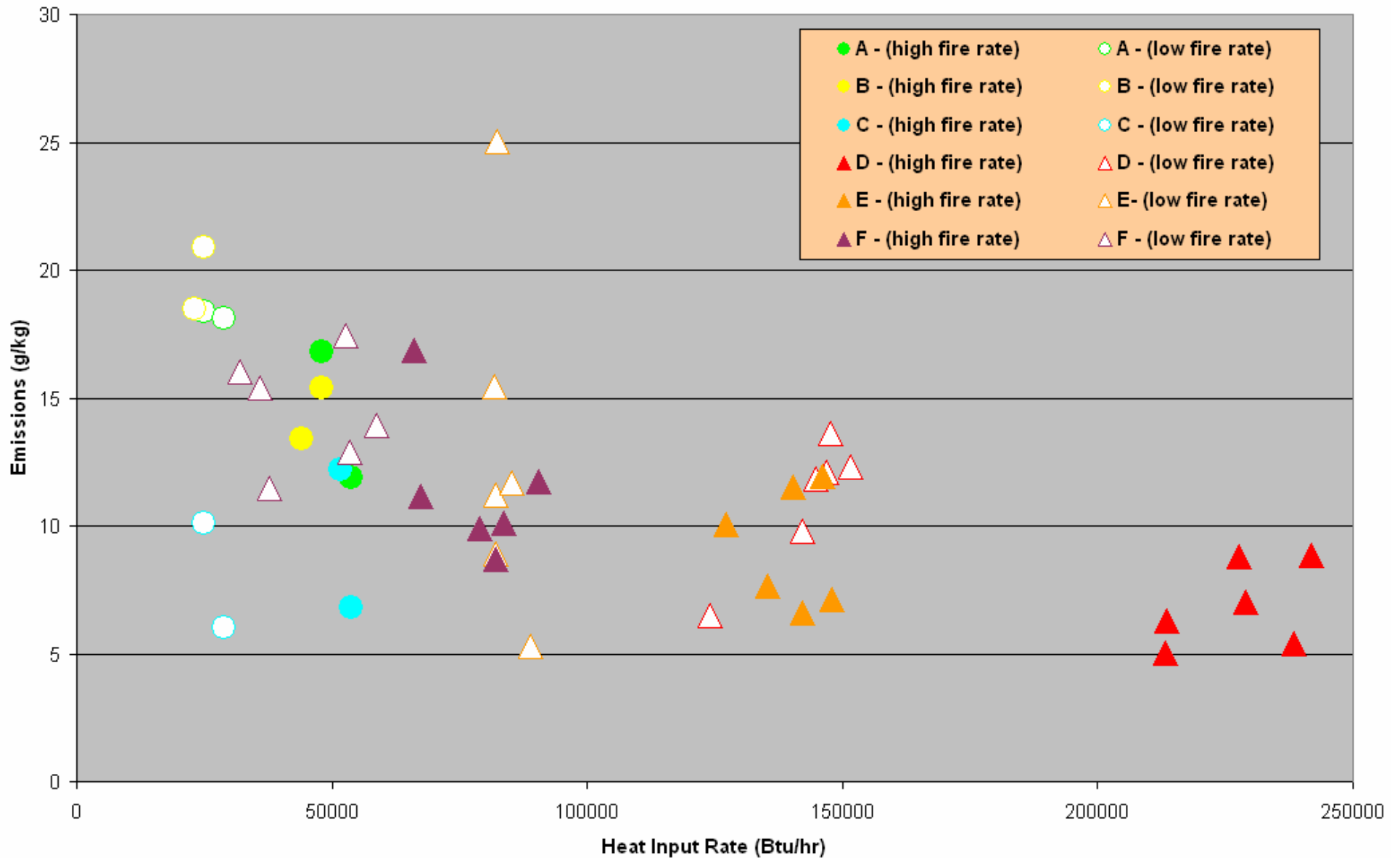
# ***Emission Units***

- ***Rate: g/kg-dry or lb/MMBtu input***
- ***Mass: g/hr***

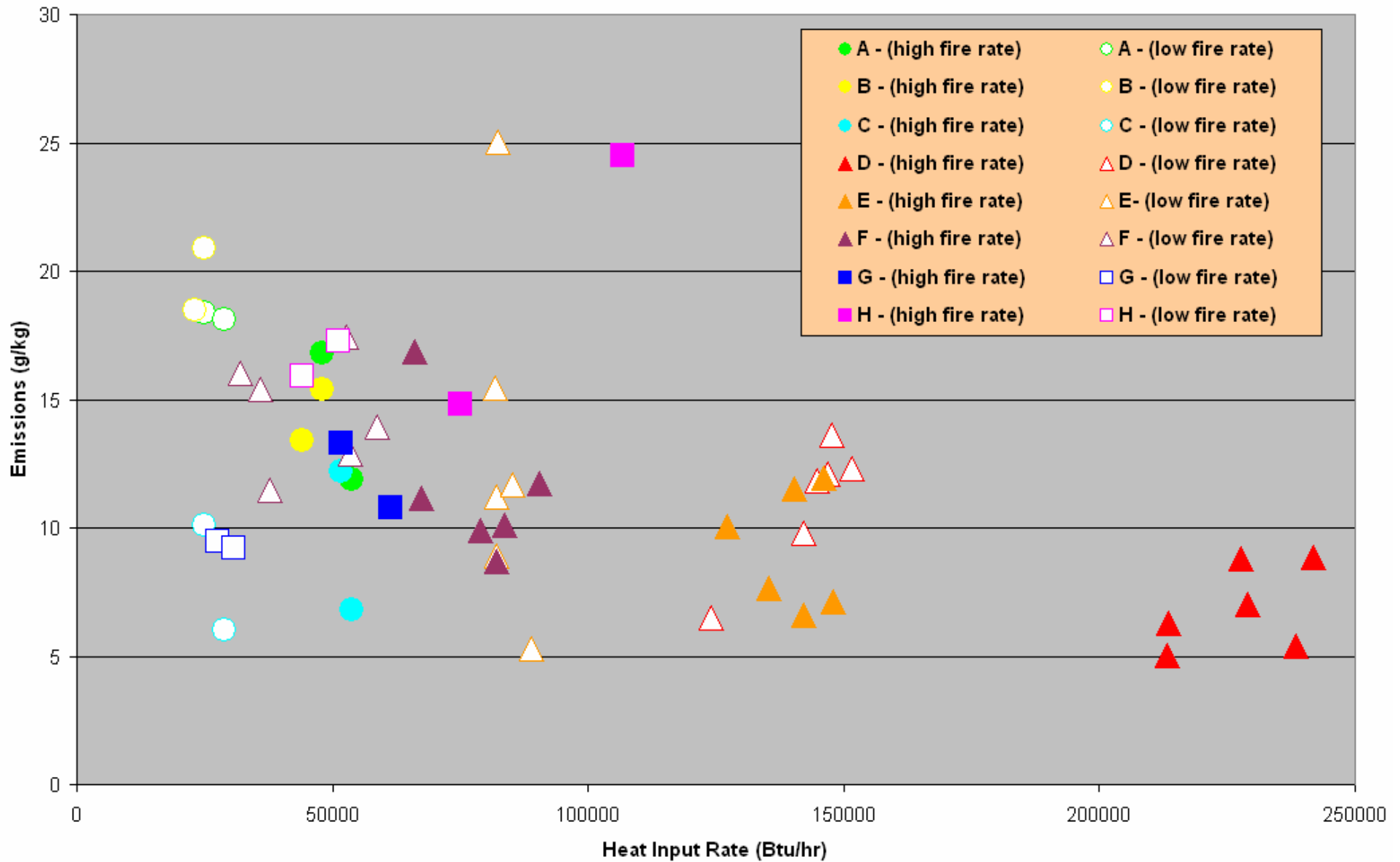
# ***New OWB Test Data (heat output)***

- ***A,B,C – 12 tests (11 & 22 kBtu/hr)***
- ***D – 12 tests (50 & 100 kBtu/hr)***
- ***E – 12 tests (25 & 50 kBtu/hr)***
- ***F – 12 tests (12 & 24 kBtu/hr)***

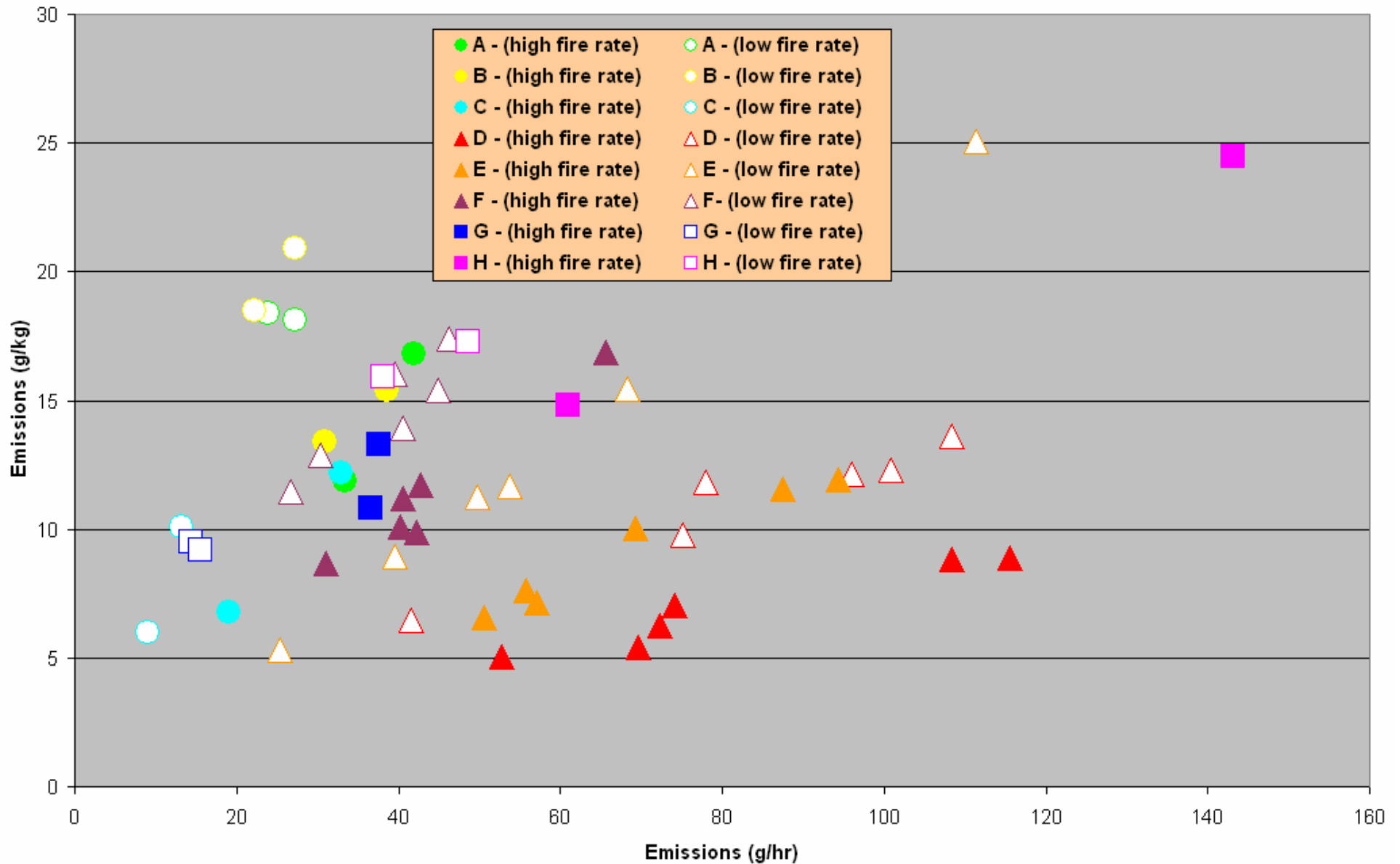
# PM Emission Rate (g/kg) vs. Heat Input Rate (lb/MMBtu)



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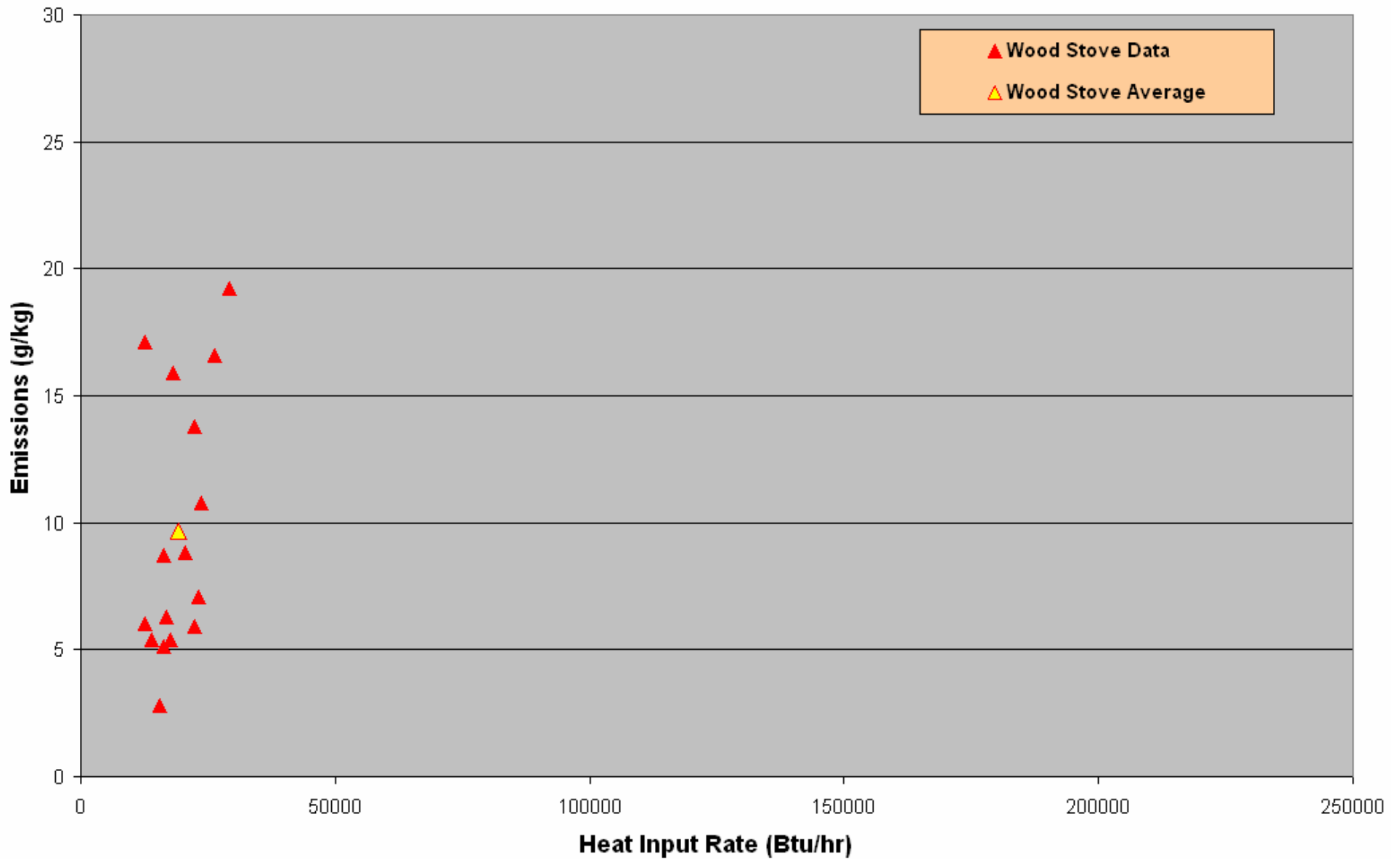


# PM Emission Rate (g/kg) vs. Emissions (g/hr)

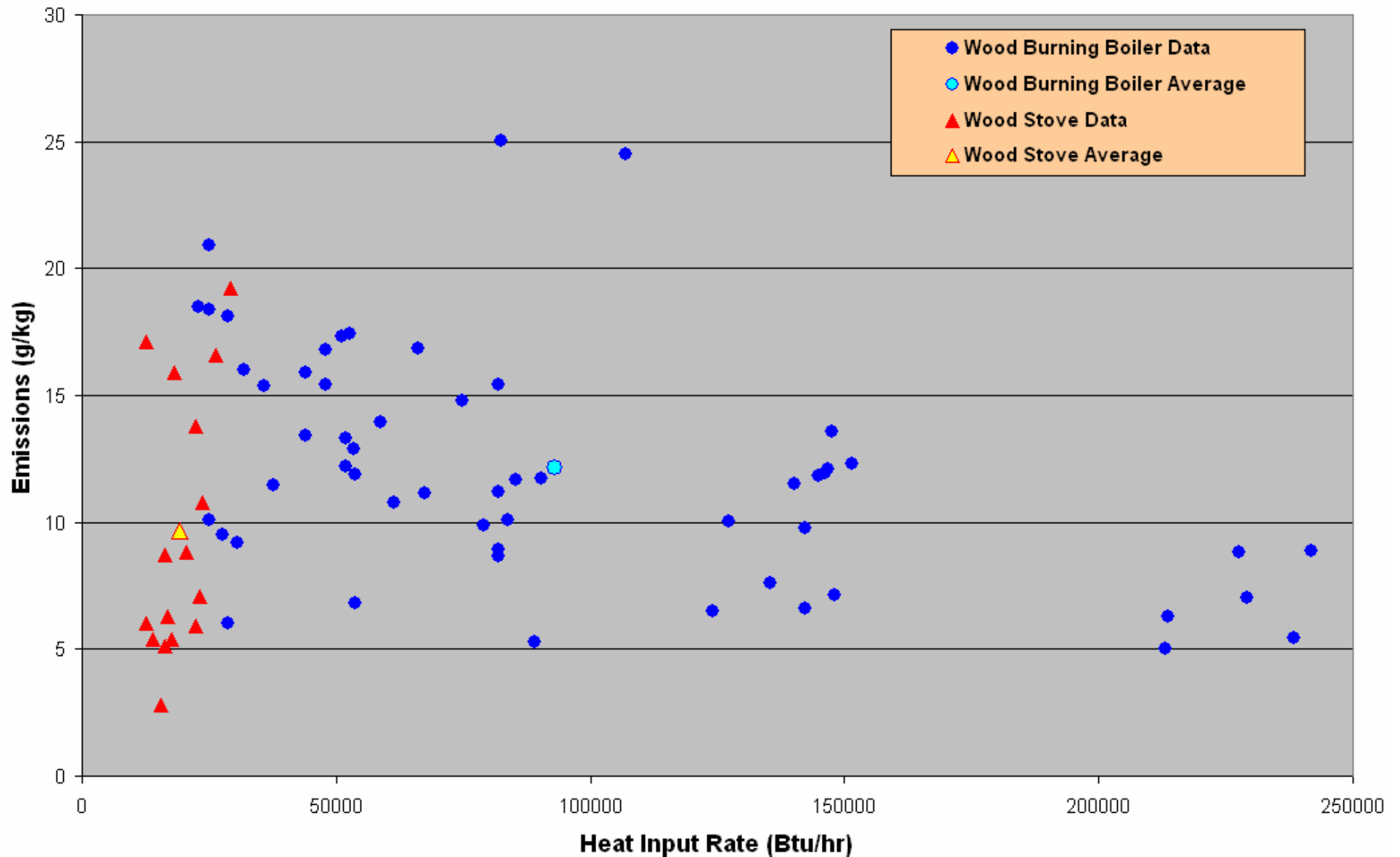




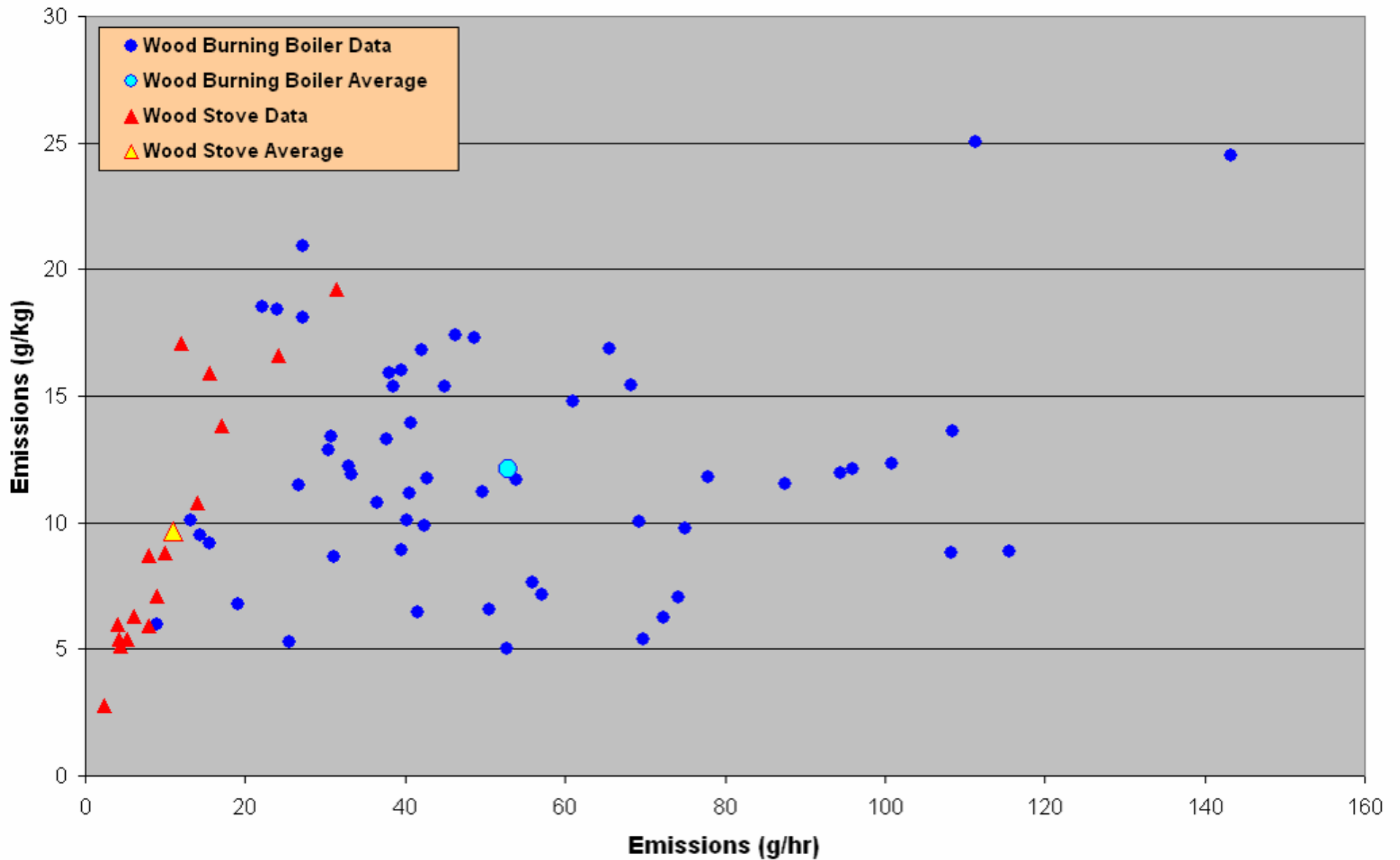
# Certified Woodstoves – g/kg vs. lb/MMBtu



# Certified Woodstoves – g/kg vs. lb/MMBtu



# Certified Woodstoves and OWBs – g/kg vs. g/hr.



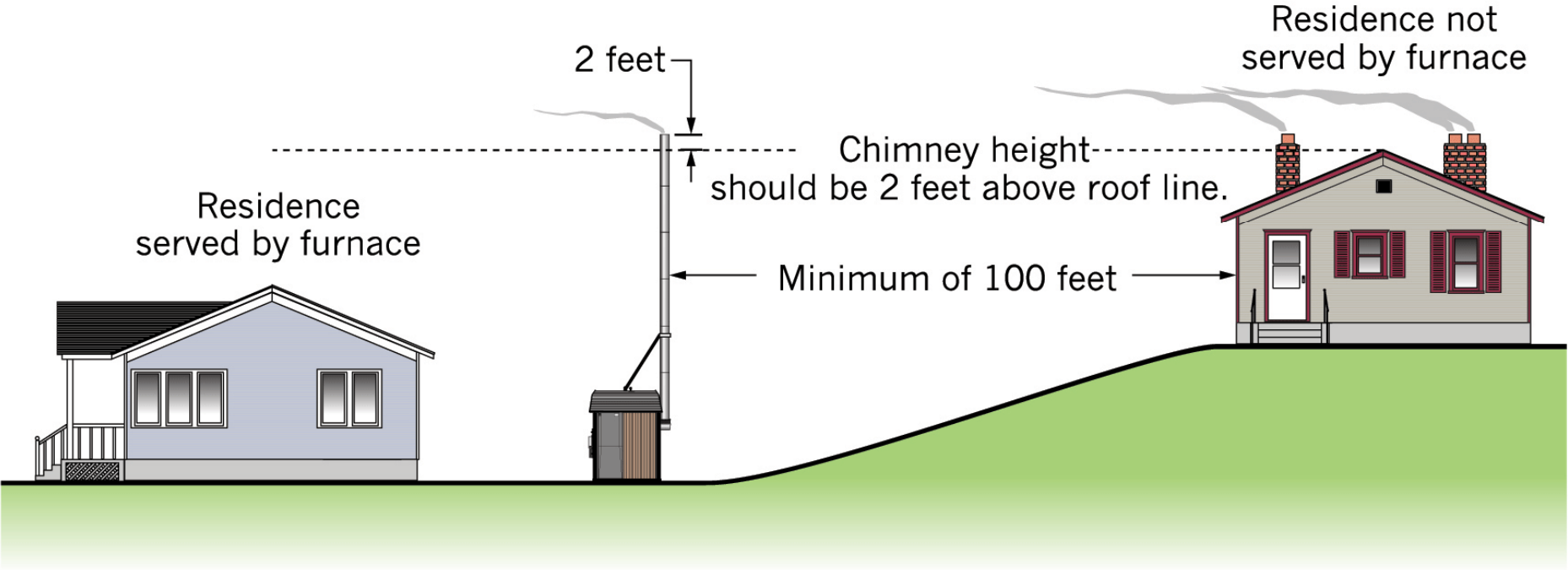
# ***EPA Test Results for PAH***

- ***OWB G*** ***16.1 mg/MJ***
- ***OWB H*** ***15.6 mg/MJ***
- ***Certified Stoves*** ***24-28 mg/MJ***

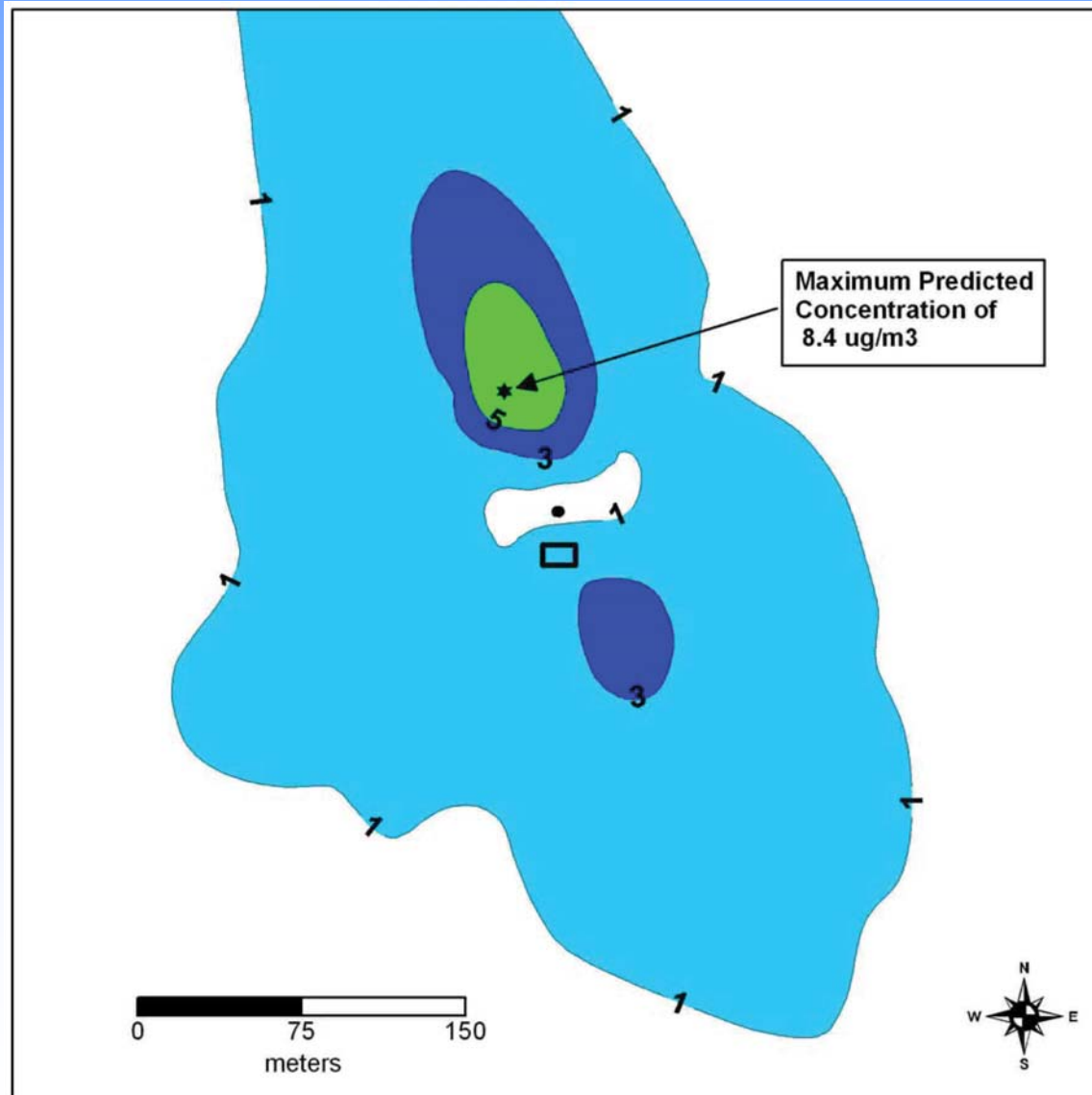
# ***AERMOD Dispersion Study***

- ***Emissions of 60 and 27 g/hr.***
- ***5 Years Burlington, VT  
Meteorological Data***
- ***Downwash From Residence***

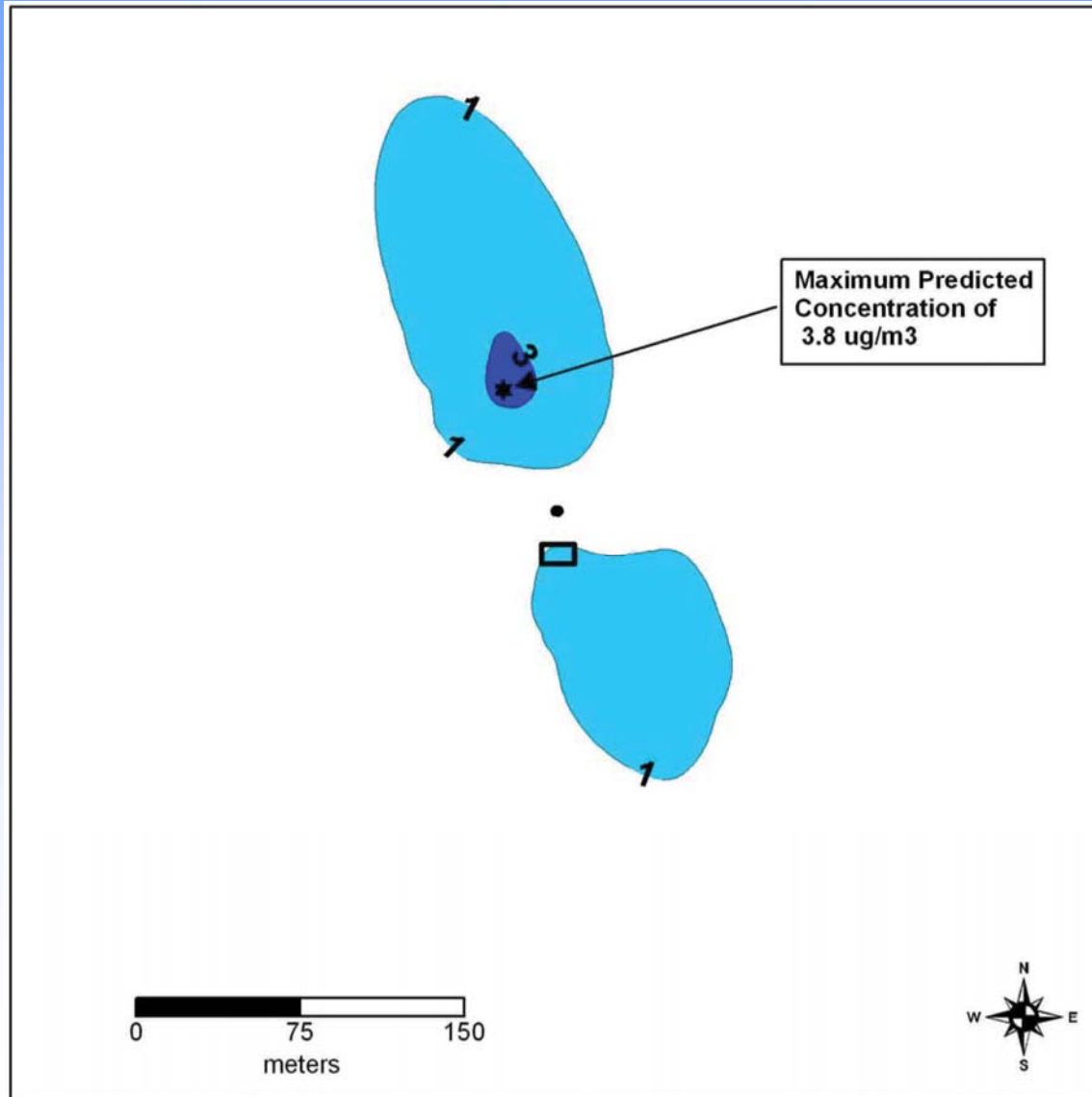
# Chimney Height Installation Scenario



# ***PM<sub>2.5</sub> H8H for Emissions 60 g/hr***



# ***PM<sub>2.5</sub> H8H for Emissions 27 g/hr***





# ***PM Emission Rates (lb/MMBtu)***

<b><i>Current OWB</i></b>	<b><i>1.44 Actual</i></b>
<b><i>Certified Stoves</i></b>	<b><i>1.18 Actual</i></b>
<b><i>Non-Catalytic Stoves</i></b>	<b><i>0.74 Compliance Test</i></b>
<b><i>EPA Phase 1 OWB Limit</i></b>	<b><i>0.60 Compliance Test</i></b>

# ***Conclusions***

- ***OWB PM Emission Rates Are Steady Over A Wide Range of Burn Rates***
- ***OWB PM Rates Are Similar to Certified Woodstoves; 20-25% Higher***

# ***Conclusions***

- ***OWB PAH Rates Are Similar to Woodstoves***
- ***A Properly Installed OWB Fully Complies with  $PM_{2.5}$  NAAQS***

# ***Conclusions***

- ***EPA Phase 1 Goal Represents 60% Reduction in PM***
- ***New Phase 1 Goal is More Stringent Than Current NSPS for Non-Catalytic Woodstoves***

