Proceedings of 17th Annual North American Waste-to-Energy Conference
NAWTEC17
May 18-20, 2009, Chantilly, Virginia, USA

NAWTEC17-2344

EMISSIONS PERFORMANCE OF A NOVEL COMBUSTOR BURNING SHREDDED WOOD

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ABSTRACT[1,2]

The Air Force Research Laboratory, Airbase Technologies Division (AFRL/RXQ) is engineering and evaluating the Transportable Waste-to-Energy System (TWES). This trailer mounted system will convert military base waste and biomass waste streams to useful heat and power. The Department of Energy (DOE) Federal Energy Management Program (FEMP) is a TWES funding partner. The first stage of the project is a suspension-type combustor (furnace). The furnace has been built and tested. A key feature of the furnace system is its unique patented combustion coil design. The design is intended to maximize ablative heat transfer by increasing particle residence time near a radiant ignition source. The innovative features of the design are targeted at ensuring that the system can be highly fuel-flexible to convert a variety of biomass and other waste streams to energy while demonstrating very low emissions.

In 2008, the unit underwent two days of emissions stack testing using established Environmental Protection Agency (EPA) testing protocols. During the testing, extensive real-time data were also collected. This paper presents the data and corresponding analysis of the recent emissions testing performed while utilizing dry wood chips as a control fuel. Detailed emission comparisons are presented using publicly available information from commercial units and from a similarly sized experimental system for small biomass combustion. Key combustion efficiency factors, such as carbon monoxide emissions and nitrogen oxide emissions are presented. The authors also provide commentary on the results for next generation units and the use of this mode of energy conversion for small scale systems.

INTRODUCTION

The Air Force Research Laboratory, Airbase Technologies Division (AFRL/RXQ) is engineering and evaluating the Transportable Waste-to-Energy System (TWES). This trailer mounted system will convert military base waste and biomass waste streams to useful heat and power. The innovative features of the design are targeted at ensuring that the system is fuel-flexible with the ability to convert a variety of biomass and other waste streams, including plastics, to energy while demonstrating very low emissions. In 2008, the unit underwent two days of emissions stack testing using established EPA testing protocols. During the testing, extensive real-time data were also collected.

NOMENCLATURE

A/F	air/fuel ratio, mass basis
Est	estimate
FGR	flue gas recirculation
HHV	higher heating value of fuel (Btu/lb)
kg/GJ	kilogram of pollutant per gigajoule of fuel burned
kWt	kilowatts of thermal energy

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[2] This document includes color graphs and photos. It is best viewed and printed in color.