

## Problem Solving Tools in Waste-To-Energy Systems

Mark White, Manager of Combustion Engineering

Greg Epelbaum, Principal Boiler Engineer

Covanta Energy Corp.

40 Lane Road

Fairfield, NJ 07007

[mWhite@CovantaEnergy.com](mailto:mWhite@CovantaEnergy.com) (973) 882-7145

[gEpelbau@CovantaEnergy.com](mailto:gEpelbau@CovantaEnergy.com) (973) 882-2448

### Abstract

Covanta is using a multifaceted approach to problem solving in Waste-to-Energy systems which combines several types of computer modeling with physical cold flow models, field testing, and engineering experience. This problem-solving approach is applied to boiler corrosion, gas and particulate flow patterns, reagent injection, and APC system issues. Our goals are to bring the most appropriate tools to each issue and incorporate results back into the engineering approach in order to continually improve our technical capabilities.

Several types of computer modeling are used. A commercially available energy balance program is used for steam cycle evaluations and boiler energy balance and heat transfer calculations. Computational Fluid Dynamics (CFD) models are developed to investigate temperature and flow patterns where local conditions must be understood in detail. We have made extensive use of cold flow models to improve performance of APC systems, and to evaluate overfire air mixing in furnaces, and flow distribution through tube banks in boilers. Field testing is used to investigate temperature fluctuations and distributions, flow stratification, corrosion rates, and to validate modeling or analytical results.

Each of these approaches has its own set of advantages, disadvantages, and limitations, and must always be combined with a healthy dose of operating and engineering experience. Analytical work is done by, or in close cooperation with, our operations and engineering staff with many years of experience operating, designing, and modifying boilers, APC systems, and related equipment. This integrated approach has yielded significant improvements in many cases and is being used in increasingly complex applications.

### Introduction

The Waste-to-Energy (WTE) industry shares many features with utility power generation, but many issues are unique to WTE. Approaches to solving problems which have been very successful in utility or other industrial applications may not be successful, or may not even be applicable, in the WTE industry. As a result, WTE operators often find it necessary to develop solutions to problems. This paper addresses some of the approaches and tools that Covanta Energy uses to understand and solve operational problems in our 31 domestic WTE facilities.

The approaches and tools discussed include:

Field testing – Direct measurement of actual conditions in the facility.

Process modeling – Use of computer models to calculate equipment performance, using various levels of sophistication. These models include boiler models with mass and energy balances and heat transfer rates, and models of steam cycle components.

Cold flow plastic scale models – These are physical scale models which allow visual indication and direct measurement of flow conditions. The models are relatively inexpensive, but cannot model heat transfer or combustion reactions.

CFD models – These programs are able to model all relevant phenomena, including flows, heat transfer, and chemical reactions. However, they are expensive, and require significant effort to develop and understand.