AIRFLOW SCIENCES CORPORATION

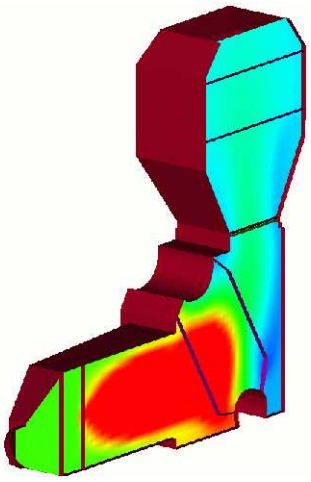
The Airflow Update

Spring 2004

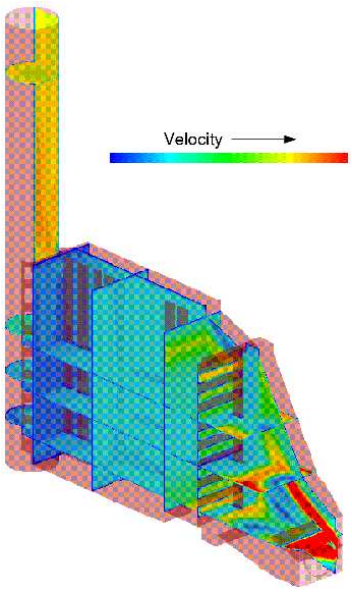
# Heat Recovery Steam Generators

Heat recovery steam generators (HRSGs) are often used downstream of gas turbines to efficiently utilize exhaust gas heat. The gas travels through steam tube banks to generate steam for a turbine or process equipment.

Flow and heat transfer characteristics within the HRSG are critical to its performance. ASC utilizes our flow modeling expertise to optimize the heat transfer to the tube banks, the velocity and temperature profiles through the NOx catalyst, the duct burner position and design, as well as the overall pressure loss.



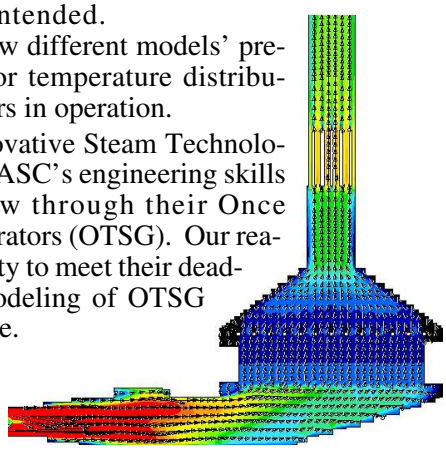
*Sample Temperature Profile*




*HRSG Sample Velocity Profile*

Utilizing our 3D Probe data acquisition system (detailed in our Fall 2003 newsletter) ASC can test the flow field downstream of the turbine or upstream of first row of tubes to ensure any flow control devices are working as intended. The three figures show different models' predicted velocity and/or temperature distributions with duct burners in operation.

Clients such as Innovative Steam Technologies have been using ASC's engineering skills to optimize the flow through their Once Through Steam Generators (OTSG). Our reasonable cost and ability to meet their deadlines makes CFD modeling of OTSG their method of choice.



*OTSG Sample Velocity Profile*

## Flow Modeling of Wet Scrubbers

**Brian Dumont P.E.**, gave a forty-five minute presentation on the flow modeling of wet scrubbers at the WPCA/Duke Energy Scrubber Seminar. This presentation features physical and CFD modeling methodologies and challenges. It takes a look at flow uniformity, droplet evaporation and impingement, and thermal predictions. It concludes that modeling wet scrubbers accurately is a difficult but achievable task.

The presentation is available on the Airflow web page at *www.airflowsciences.com*

Source: B&W

## From the Editor

*Things have been very busy these past six months. We've hired new technicians and engineers to help with our field testing, physical, and CFD modeling. Welcome aboard **Jim Phillips, Paul Maitre, Sneha Madhavan-Reese,** and **Matt Gentry**!*

*Speaking of welcomes, Project Manager **Brian Dumont, P.E.** has become a co-owner of Airflow Sciences, joining Bob, Rob, and Andy. Look for Brian to manage more power-plant projects in the immediate future.*

*More babies, another name in this section! Double congratulations to **Rob Mudry P.E.** on twins Adrienne Marie & Amanda Grace. Babies and mommy are all doing excellent!*

*If you have any flow, heat transfer, mixing, combustion, or mass transfer issues you're dealing with, feel free to give us a call at (734) 464-8900.*

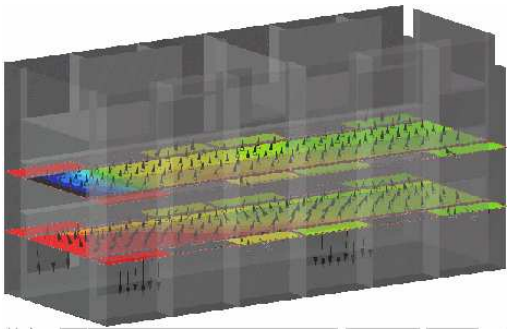
Edited by Kevin Linfield, P.E.

# CFD Coupled to Food Thermodynamics

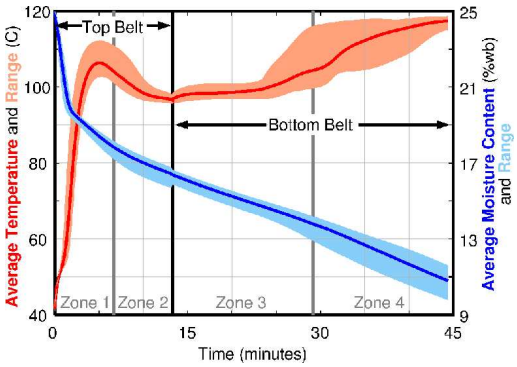
Many food processing operations involve the baking, drying, cooling, toasting, or cooking of many small food pieces within a much larger piece of processing equipment. While computational fluid dynamics (CFD) is effective at examining and improving such equipment, the difference in the length scales between the food pieces and the processing equipment has made it very difficult to include the food in these simulations. Since the food can have a significant effect on the process conditions, and the properties of the food itself are a desired output from the simulation, a different approach is required.

ASC has developed a simulation method that links a CFD model of the processing equipment with models of individual food pieces to provide a more comprehensive representation of the actual process. Moisture and temperature profiles are predicted within the food pieces, and the movement of the pieces through the equipment is included in the simulation. Temperature and moisture gradients within the food are predicted, and the simulation method includes water activity into the surface evaporation. The effects of thermal conductivity and moisture diffusivity that vary with local temperature and moisture content are also included.

As a result, the predicted food properties reflect the range of actual conditions seen by the product, and variations in food properties due to non-uniformities in the processing equipment are accurately reflected. This simulation method has been correlated against data for existing food processing operations and has also been used to develop new processing techniques.



*Nonsymmetric flow patterns within a dryer result in air temperature variations across the width of the dryer. Display planes pass through the two product beds.*




*The effect of non-uniform processing conditions are variations in product moisture content and temperature.*

## Contacting ASC:


General Info:
web: www.airflowsciences.com
email: asc@airflowsciences.com

Headquarters:
37501 Schoolcraft Road
Livonia, MI 48150-1009
phone: (734) 464-8900

Western Region Office:
P.O. Box 22637
Carmel, CA 93922-0637
phone: (831) 624-8700

Southeastern Region Office:
3709 Foster Hill Drive North
St. Petersburg, FL 33704-1140
phone: (727) 526-9805


## ASC Quote-of-the-Newsletter

*"In theory there is no difference between practice and theory. But in practice there is."*

## Airflow Events

We've participated in six conferences since our last newsletter, and hosted numerous seminars.

We hope to see you at future trade shows including:

- APC Roundtable & Expo (Aug 8-10, Snowbird, UT)
- Megasymposium (Aug 30 - Sept 2, Washington, DC)
- PowerGen (Nov 30-Dec 2, Orlando, FL)
- **Your Office**: Looking to host a seminar on modeling, fluid flows, or heat transfer?

**We make house calls!**




**Airflow Sciences Corporation**
37501 Schoolcraft Road
Livonia, MI 48150-1009

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**www.airflowsciences.com**