AIRFLOW SCIENCES CORPORATION

The Airflow Update

Fall 2013

Improved Methods of Detecting Inleakage

Air inleakage at power plants is common and the source of adverse effects, including: operation limitations at high load due to fan capacity, combustion control system confusion due to inaccurate O_2 readings, heat rate degradation due to cold inleakage upstream of the air heater, pollution control equipment reduction in effectiveness due to increased gas flow rates, and general system inefficiency due to increased pressure losses.

With zero inleakage, the gas constituents would remain primarily unchanged from the boiler outlet to the stack breeching. Any weaknesses in the duct system (Figure 1), including casing leaks, aging expansion joints, poor air heater seals, or hopper and access door leaks, can result in the infiltration of ambient air into the flue gas stream. This results in a higher oxygen concentration, providing a metric to determine the overall inleakage.

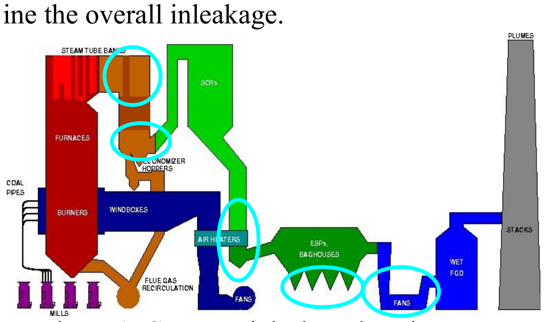

Figure 1: Common inleakage locations

Since the early 2000s, ASC has been conducting inleakage testing at plants throughout North America. As part of a holistic approach to quantify inleakage, ASC conducts HVT testing in the boiler and velocity, temperature, and O_2 traverses throughout the downstream ductwork.

In a recent comprehensive test program, ASC performed an inleakage audit for a 450 MW plant in the Midwest. Flow and O_2 traverse testing was conducted upstream and downstream of the air heater to quantify total inleakage. After initial testing, the plant made numerous repairs to the air heater and the associated seals. Follow-up testing verified an inleakage improvement from 18.7% to 14.5%.

Quantifying inleakage is a fairly standard test. Determining where the leakage is occurring can be difficult, especially with casing, door, and hopper leaks. We recently participated in a multi-year research project with the Electric Power Research Institute (EPRI) to aid in this. ASC performed qualitative inleakage analysis at numerous plants, investigating various methods of leak detection during both online and offline unit operation. Research assessed the technique's ability to locate the precise source of leaks, including visual, thermal, and auditory methods. While research is ongoing, a few select methods have been determined to be most effective and efficient at locating duct and boiler leaks.

The primary tool used in most of our audits was that of smoke visualization (Figure 2). The objective of this test program was to look beyond the low-hanging fruit of air heater inleakage and try to specifically locate leaks at other locations in the duct system.


Figure 2: Smoke wand testing method

One Eastern U.S. plant was able to make substantial reductions in their inleakage as a result of the ASC analysis. Since they had conducted numerous quantitative audits over the course of several years, they were able to immediately recognize the large reductions in inleakage that were achieved. Their total inleakage was reduced by over 10%, and they saw corresponding reductions in the CEMs flow rate reported at a given load.

An ideal inleakage testing program would utilize both quantitative and qualitative analyses. Plants that have used the information gathered during leak detection testing, exclusively, or in conjunction with O_2 auditing, have been able to reduce their boiler inleakage, improving plant efficiency.

ASC News

To help make sure we meet our customer's deadlines, we are pleased to welcome another 5 people to the Airflow family. Please welcome ***Eric D'Hondt****,* ***Hank Glancy****,* ***Gordon Palnau****,* ***Julie Pierce,*** *and* ***Colin McNally*** *to our staff.*

Since the last newsletter, our expanded family has grown. ***Walt*** *and* ***Amy Jambeck*** *welcomed* ***Nolan****,* ***Paul*** *and* ***Jen Harris*** *welcomed* ***Maxwell****,* ***Kanthan*** *and* ***Jennifer Rajendran*** *welcomed* ***Surya.*** *Congratulations to the proud parents, and older siblings too!*

Edited by Julie Pierce

"Fan Test" Helps Design Odor Control Facility

Sewer odor complaints are an increasing problem for large metropolitan areas. Sewer odor emissions are caused by the generation of positive air pressures within the sewer system and the resulting escape of odorous air through manholes and vents into the atmosphere.

An increasingly popular odor control technique is to depressurize the sewer system by withdrawing air with a suitably sized and located fan. The withdrawn air is scrubbed to remove odors and then released into the atmosphere. The location and size of the fan(s) are critical to implementing a successful and cost effective odor control facility.

Airflow Sciences recently conducted a fan test for the city of Vancouver, British Columbia. The City of Vancouver had received many odor complaints from the residents in a local neighborhood. Because the fan test was to be conducted in a residential neighborhood and immediately adjacent to a popular city park, the City of Vancouver was very concerned about odor and noise caused by the fan test. ASC was able to address these concerns by providing a portable activated carbon scrubber and noise control barriers for the test (Figure 1). No noise or odor complaints were received during the week-long test. We also provided a 14,000 CFM fan, fan drive, and generator for the test. ASC was able to have equipment on-site on short notice from its home office in Detroit, Michigan, 2000 miles away.

Figure 1: Portable Scrubber System

In addition to the fan and its support equipment, ASC also supplied data loggers to monitor the sewer pressure at eight locations upstream and downstream of the fan location. By varying the fan flow rate, and by cycling the fan on and off, the pressure data showed the zone of influence of the fan at various extraction rates. This made it possible to determine the most cost-effective fan flow rate, size, and location.

Figure 2 illustrates the effect of the fan on the sewer pressure at select locations. The fan was cycled on and off so that its effect at different times of the day could be clearly seen. Various fan flow rates were tried in order to determine the flow rate required to keep the desired locations at negative pressure and avoid odor release to the community.

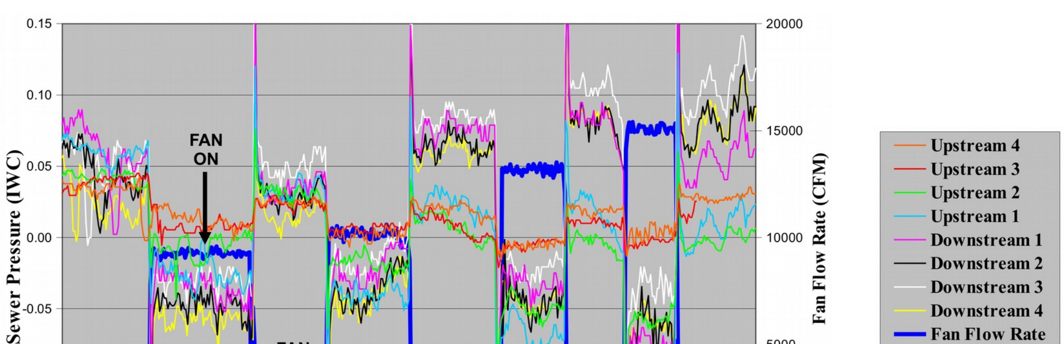

Figure 2: Sewer Pressure Monitor Data

Contacting ASC

www.airflowsciences.com
asc@airflowsciences.com

Headquarters:
12190 Hubbard Street
Livonia, MI 48150-1737
phone: (734) 525-0300

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

Southeastern Region Office:
1906 Arrowhead Dr NE
St. Petersburg, FL 33703
phone: (727) 526-9805

Airflow Trade Shows
Recently attended & future:

Coal to Gas Conference
Chattanooga, TN
Oct 29-30

Process Expo
Chicago, IL
Nov 3-6

Power-Gen
Orlando, FL
Nov 12-14

Energy Gen
Bismark, ND
Jan 28-30

NO_x Combustion
Charlotte, NC
Feb 10-11

HRSG Conference
Las Vegas, NV
Feb 24-26

EPRI CEMS
Denver, CO
May 14-15

Your Office
Looking to host a seminar on modeling, fluid flows, or heat transfer?
We make house calls!

Air Force Research Project Update

As part of our SBIR-sponsored research effort on quench modeling for heat treating operations, we have constructed a unique test facility to measure flow boiling heat fluxes for subcooled water and oil over a wide range of operating conditions. These data will be incorporated into new boiling methods for CFD-based simulations of quenching operations. Research results were presented at the 2013 ICME and Heat Treat conferences. The photo at the right shows film boiling at a surface temperature of around 1000ºF (550ºC) and a water velocity of 1.5 ft/s (0.5 m/s).