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WPCA NEWS

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WORLDWIDE POLLUTION CONTROL ASSOCIATION

When size and adjustment matter

The Optimum Precipitator Current Limiting Reactor

By Peter Aa and Paul Ford, Redkoh Industries

The AVC (Automatic Voltage Controller) and the CLR (Current Limiting Reactor) work hand in hand to keep a precipitator powered to an optimum level. Without a properly sized CLR in the system, even the best of AVC's may not provide the collecting efficiency needed.

In the last newsletter, we discussed how to spot a failing CLR in an electrostatic precipitator control circuit. Numerous readers of that article have asked us how they can determine if a CLR is properly sized for a given precipitator application and how power output from a control cabinet can be optimized by "adjusting" a CLR.

The unit of measure for a CLR is Henries (Hy). It is a measure of impedance (resistance to current flow in an AC circuit). Properly sizing a CLR for a given rating of a transformer rectifier (TR) is straightforward. It is a calculated value based on the following formula: *See figure 1*

$$Hy = \left[\frac{\text{Primary Voltage Rating of the TR}}{2 \times Pi \times f \times \text{Primary Current Rating of TR}} \right] \times \%IMP$$

Figure 1: Formula for Properly Sizing a CLR for a Given Rating of a TR

Where: Pi = 3.14
f = the line frequency (typically 50 or 60 Hertz)
%IMP = the desired percent impedance of the total circuit (typically 50)

This Hy value of the CLR when inserted in a typical TR control circuit will allow the conduction angle of the SCR power devices to be greatest when the TR is operating at its primary current limit. (Usually somewhere between 155 and 165 degrees of conduction – depending on the control type.) *See figure 10 on page 8.*

Due to normal sparking and arcing that occur in a precipitator electrical section, TR controls reduce the conduction angle (and in turn the power levels) to keep these electrical interruptions at reasonable (site specific) values. *continued on page 8*

Don't let flue gas "sneak" up on you

Optimized Wet FGD Performance

By Amy Evans, Director of Technology, Marsulex Environmental Technologies

Limestone based wet flue gas desulfurization (WFGD) technology has been the FGD technology most frequently selected for sulfur dioxide (SO_2) reduction from coal-fired utility boilers. Common FGD absorber designs include open-type spray towers and perforated-tray type towers. In the past, towers with wetted-film contactors (e.g., packing) were also common. Over the last several years, advancements in the design of the limestone based WFGD have included:

- Operation at high flue gas velocities to improve mass transfer and reduce absorber capital investment costs.
- Reliability improvements enabling single module design (i.e., no standby spare(s)).
- Use of high capacity absorber recirculation (AR) pumps to reduce the number of spray levels and associated absorber tower materials.

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Is your wash system up to par?

Keeping a Mist Eliminator Clean

By Ron Richard, RE Consulting

Every flue gas desulfurization (FGD) system comes with a mist eliminator wash system. But several speakers at various conferences have pointed out that the term "mist eliminator wash system" is a misnomer. If you ever have the opportunity to watch a water blaster working at over 1000 psig pressure in an effort to remove scale deposits from mist eliminator blades, you will not be surprised that it is impossible for the nozzles and pressures used in mist eliminator wash systems to remove scale deposits from mist eliminator blades.

The way a mist eliminator wash system functions is to keep the slurry on the blades from reaching the saturation point of the calcium compounds. A thin film of slurry tends to stay on the surface of the blades. Some of the water in this film can evaporate over time, causing the calcium salts in the film to become more concentrated. If the concentration reaches the saturation point, calcium compounds will begin to precipitate out as crystals adhered to the blades. The addition of more liquid in a timely manner can prevent the slurry concentration from reaching this saturation point.

Once you realize this principle, two tenets of operation become apparent. The first is that the mist eliminator wash water should contain the lowest possible concentration of dissolved solids. Thus, it is better to use "fresh water" rather than "recycled water" for washing purposes. All FGD systems need a constant addition of water to replace the water evaporated up the chimney or lost in the byproduct stream. It is best to add as much of this fresh water as possible to the system through the mist eliminator wash system. If this flow is not sufficient, then a blend of this water and recycled water is still better than using only recycled water.

The second principle is that it is better to wash each blade more frequently rather than for a longer duration. It takes the same amount of water to wash a blade for four minutes every hour as it does to wash a blade for one minute every fifteen minutes. But getting wash water added to the slurry on the blade four times an hour is more effective than only once an hour, even though the total volume of wash water used is the same.

If a unit is operated with the mist eliminator wash system out of service for a period of time, the mist eliminator differential pressure will climb as deposits begin to form on the blades. If the wash system is put back in service using the freshest water available, and operating as frequently as possible, some of these deposits will dissolve and the differential pressure will improve. But the only way to completely remove the deposits will be to take the FGD system out of service and clean the mist eliminator blades mechanically or by high pressure water blasting.

For additional information, contact Ron Richard, RE Consulting, at ron.richard@reconsulting.info

Setting the record straight

Catalyst Bench Scale Testing: Guidelines and Round-Robin Testing

By Marilynn Martin and Hans Hartenstein, STEAG LLC

In 1983, legislation was passed in Europe requiring a flat rate NOx emission limit of 200 mg/Nm^3 (~100 ppm) for all units ≥ ~100 MW. During the mid to late 1980's, SCRs were installed to meet the new legal emission requirements.

Different types of catalyst (honeycomb, plate and corrugated) were developed by the various catalyst manufacturers to meet the needs of the SCR operators. However, each catalyst manufacturer used their own testing method and apparatus to determine activity levels and to track catalyst deactivation over the long-term. As SCR operators switched catalyst types for operating efficiency and economic reasons, it became increasingly difficult to compare test results from different catalyst manufacturers based on their particular testing method and type of testing equipment.

A coalition was formed in1986 to develop a standard catalyst testing procedure under the umbrella of the German Technical Association for Large Power Plant Operators (Vereinigung der Großkraftwerksbetreiber), commonly

referred to as VGB. This coalition consisted of:

- Catalyst manufacturers (KWH, Siemens)
- Power producers and independent catalyst testers (STEAG, VKR)
- SCR OEMs (AEE, Steinmüller)
- Testing institutions (KEMA, TÜV) (Formerly tested SCR catalyst)
- Insurance companies (Germanischer Lloyd)
- Technical Associations (VGB, FDBR)

Based on the input from the above mentioned participants, as well as established industry testing methods, codes, standards, guidelines, statuary requirements, and international references, VGB published a guideline for a standardized testing procedure first in 1988 and a second revision in 1998. This *Guideline for the Testing of DeNOx Catalyst VGB-R302He 2nd Edition* has since become the industry standard for SCR catalyst testing.

Since 2002, additional supplements have been published and other protocols are under review to update the testing procedures. The supplements are based on the experience and best practice of the operators of independent SCR catalyst testing labs in Europe, including STEAG, in order to eliminate the little remaining ambiguity of said standard. These additional supplements include:

- Supplement to VGB-R302He 2nd Edition – *Common Best Practices for Bench Scale Testing and Chemical Analysis of SCR DeNOx Catalyst* published by STEAG AG, Essen, Germany in 2002.

- Supplement to VGB-R302He 3rd Edition – *Common Best Practices for Bench Scale Testing and Chemical Analysis of SCR DeNOx Catalyst* published by STEAG AG, Essen, Germany in 2007.

EPRI is also working on a catalyst testing protocol with U.S. utilities (Consumers Energy, New York Power Authority, Southern Company), catalyst manufacturers (Argillon, Cormetech, Haldor Topsoe) and independent catalyst testing labs (E.ON Engineering, STEAG) to expand and develop recommended and uniform procedures for SCR catalyst sample testing. The first result of this work by EPRI was published in December, 2006, as a technical report titled: *Protocol for Laboratory Testing SCR Catalyst Samples.*

The VGB guidelines also set the standard for certifying catalyst testing labs through Round-Robin testing. The VGB Working Group on "Round-Robin Catalyst Experiments and Test Guidelines" developed a protocol for certification of the bench scale reactors of all participating labs against a known standard. The Round-Robin tests are held every three to five years and it can take up to nine months to complete the test depending on the number of participating labs.

The Round-Robin testing procedure consists of a rigorous number of repetitive tests on the same sample under the same specified operating parameters by each participating lab in a bench scale reactor.

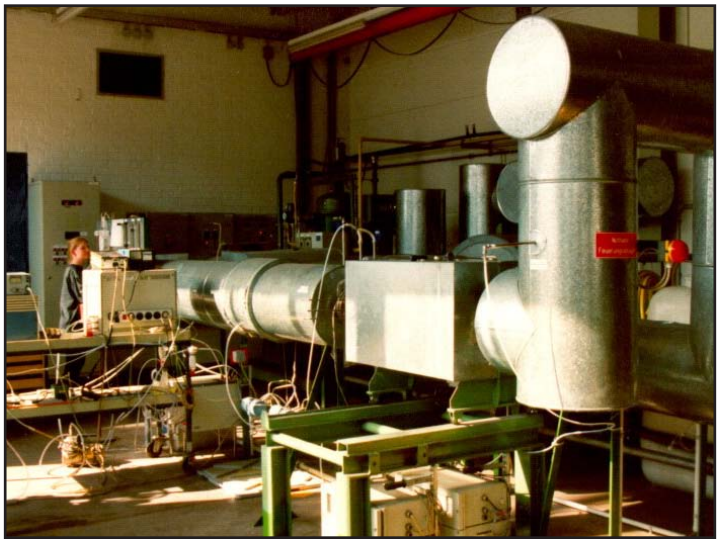

FIgure 2: Steag's VGB-R302He Round-Robin certified SCR catalyst bench scale test reactor

A bench scale reactor, such as STEAG's *(see figure 2),* in accordance with VGB-R302He, is designed specifically for the sole purpose of evaluating SCR catalyst under simulated, controlled plant conditions. It provides the only practical way of examining SCR DeNOx catalyst in a non-destructive manner while generating absolute values for catalyst activity, SO_2/SO_3 conversion rate and pressure drop.

The most important feature of a bench scale reactor designed and operated in accordance with VGB-R302He is its particular suitability for exactly replicating the actual operating conditions of a full-scale SCR reactor while still ensuring useful data. The only two deviations from the actual operation conditions of the full-scale SCR reactor are the lack of any fly ash in the bench scale flue gas and α, the molar ratio of ammonia to NOx, which is set equal to 1.

As each lab tests the designated sample, their test results are submitted to the VGB and the sample is sent to the next participating lab which conducts the same tests, under the same simulated operating parameters, on the same sample. When all participating labs have completed their test, the sample is sent back to the first testing lab to complete the circle and confirm accuracy of the initial test results. VGB reviews all the results and those which come within a plus or minus of

an acceptable variation (usually around +/-7.5%) of the results, are qualified as VGB certified. STEAG's independent catalyst testing lab has an allowable tolerance of only +/- 2.5% and, hence, always easily qualified during the past VGB Round-Robin tests.

The last Round-Robin tests were completed in the summer of 2005. Of the six participating labs, STEAG and E.ON Engineering in Germany were the only independent third-party testing labs which passed the test and are currently VGB certified.

It is important to note that the purpose of the catalyst testing guidelines, protocols, and supplements, as well as the Round-Robin testing, is to set a standard of testing methods and provide the SCR operator with an unbiased standard to compare catalyst testing results, chemical analysis data and mechanical strength information needed to determine the:

- Initial catalyst performance parameters, chemical composition and mechanical stability;
- Actual catalyst activity, SO_2/SO_3 conversion and catalyst deactivation rate;
- Change in chemical composition and identification of catalyst deactivation causes;
- Change in the catalyst's structural integrity and mechanical strength;
- Development and forecast of SCR system performance.

This information is essential to the SCR operator in making an educated decision to determine:

- The optimal time for a catalyst exchange;
- Whether to buy new catalyst, regenerate existing catalyst or to just move layers around within a reactor for optimal performance.

Frequent and correct catalyst testing performed preferably by an independent catalyst testing lab is the only way to attain long-term predictability of the performance of the SCR catalyst, as well as identify the root cause of potential SCR performance problems. Thus, all well experienced long-term SCR operators have their SCR catalyst tested at least once annually in order to track the development of the SCR's DeNOx potential, as well as accurately forecast it. This is considered good SCR maintenance practice, which has shown to pay for itself over a short period of time simply by avoiding catalyst related SCR performance problems.

Contact Marilynn Martin or Hans Hartenstein, Steag LLC, at mmartin@steagllc.com or hhartentein@steagllc.com for additional information.

Keeping up with year-round challenges

In Tune with your Catalyst Management Program

By Caleb Wiza, Clean Air Engineering

Roughly 105,000 MWe of operating power generation in the United States have Selective Catalytic Reduction (SCR) systems and about 10,000 MWe is expected to be added each year through 2009. Recently overshadowed by the installation of many flue gas desulfurization (FGD) units and a rush to install mercury continuous emissions monitoring (CEM) instruments, SCR systems have quickly become yesterday's challenge.

The operation and maintenance (O&M) challenges will increase as these systems move from ozone season to year-round operation under the Clean Air Interstate Rule (CAIR) and as the catalyst beds approach an end of life stage. The only way to achieve long-term optimal performance and reduced O&M costs is with a sound catalyst management plan that includes periodic ammonia injection grid (AIG) tuning.

The frequency of tuning is dictated by unit-specific conditions such as the AIG/mixer system design or air heater fouling as well as business drivers such as the value of NOx credits. For seasonal operation, the past practice has been to perform tuning at least once annually, but as we move into year-round operation, it might prove worthwhile to check the distribution and tune the AIG more frequently.

Tuning Approaches

The purpose of the ammonia injection grid tuning is to minimize ammonia slip by assuring an even NH_3 to NOx ratio distribution to the catalyst, which in most cases, won't necessarily be flat. This is best achieved by measuring the NOx/O_2 simultaneously at the inlet and outlet of the SCR reactor and adjusting the ammonia/air mixture flow into the AIG zones.

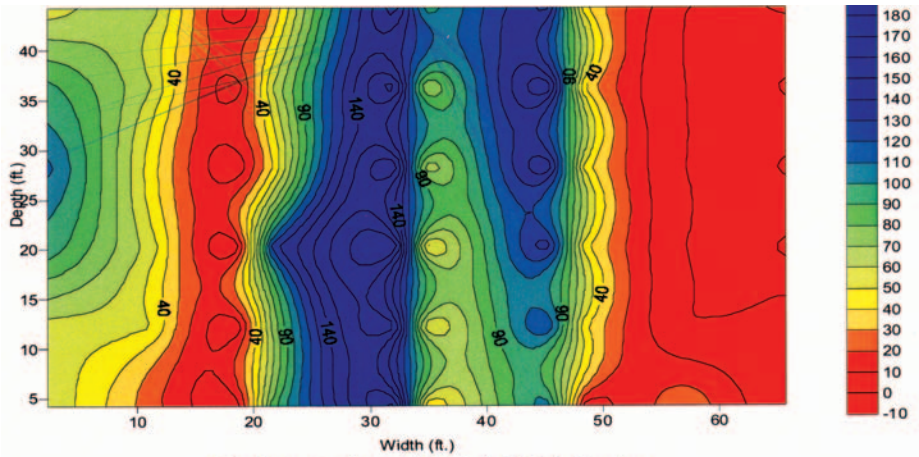

Figure 3: NOx Concentration at SCR Outlet Prior to Tuning

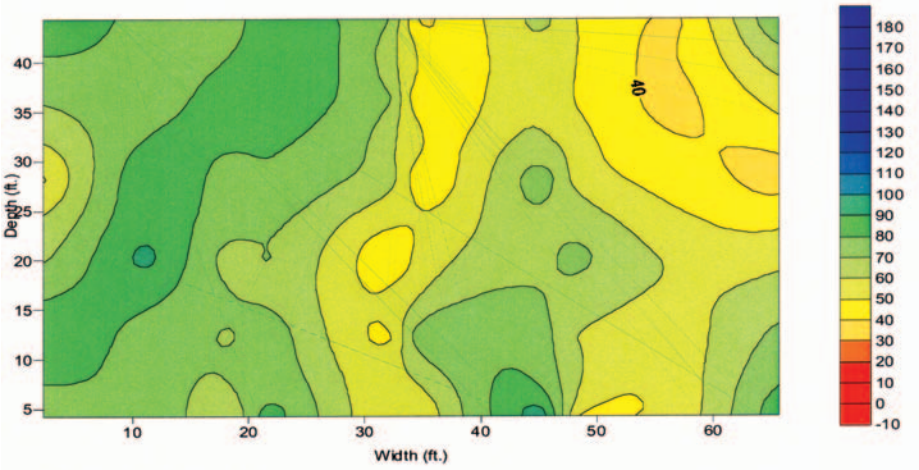

Figure 4: NOx Concentration at SCR Outlet after Tuning

Key elements of a solid tuning approach are pretty straightforward. The basics include verifying the NOx concentration profile into the SCR, balancing removal through the SCR by adjusting ammonia input, and verifying AIG performance under various load conditions.

If fixed sampling grids are available or can be temporarily installed at both the SCR inlet and outlet, the NH_3:NOx molar distribution is determined by simultaneous SCR inlet and outlet NOx/O_2 measurements.

If only SCR outlet sample grids are installed, the tuning begins with determining the baseline inlet NOx/O_2 profile by taking measurements at the outlet sample grids with no ammonia flow to the catalyst. The NH_3:NOx molar ratio distribution is calculated after each traverse using the baseline inlet profile data and the outlet data with ammonia flow and assuming the inlet NOx/O_2 distribution remains consistent.

Given that most SCR designs have no sample grids installed at the SCR inlet, the following is an outline of an acceptable tuning approach to determine the local NH_3 to NOx ratio by sampling only at the SCR outlet:

❶ AIG system is checked and previous tuned valve positions are verified.
❷ Boiler should be at a stable operating load condition.
❸ All instrument calibration checks have been completed.
❹ Conduct NOx traverse with no NH_3 flow (Baseline Test).
❺ Conduct NOx traverse with ammonia flow at desired reduction set point (Baseline Test).
❻ Evaluate data to determine NH_3:NOx distribution. If acceptable and within the RMS goal, adjustments to the valves are not required.
❼ If adjustments are required, AIG control valves should be adjusted to bring NOx emission data points closer to mean value. All valve positions are recorded.
❽ If a significant mal-distribution exists in NOx at the desired set point, all AIG valves may be set to a nominal 50% open position. Setting the AIG valves to 50% open allows upward and downward valve adjustment and minimizes areas of high localized slip during the early stages of tuning.
❾ Based on the calculated NH_3:NOx molar ratio distribution, new AIG valve set points will be calculated and Steps 5-6 of the process will be repeated until the target NOX removal is achieved and the profiles are balanced and statistically evaluated. Figures 3 and 4 show representative SCR outlet NOx distributions before and after AIG tuning.
❿ All final AIG valve positions are recorded and locked in position to protect against inadvertent adjustment.

As earlier mentioned, each SCR has its own unique aspects that require a well-designed unit-specific tuning program. Often overlooked is the measurement procedure - more specifically the instrumental accuracy and fast response time needed to minimize the effects of temporal variation both from boiler operation and SCR automated control function.

Figure 5 is a schematic of CleanAir's Multi-point Automated Sampling System (MASS) *(see figure 6)* which can be configured to sample 128 points in 12 minutes using 4 banks of analyzers.

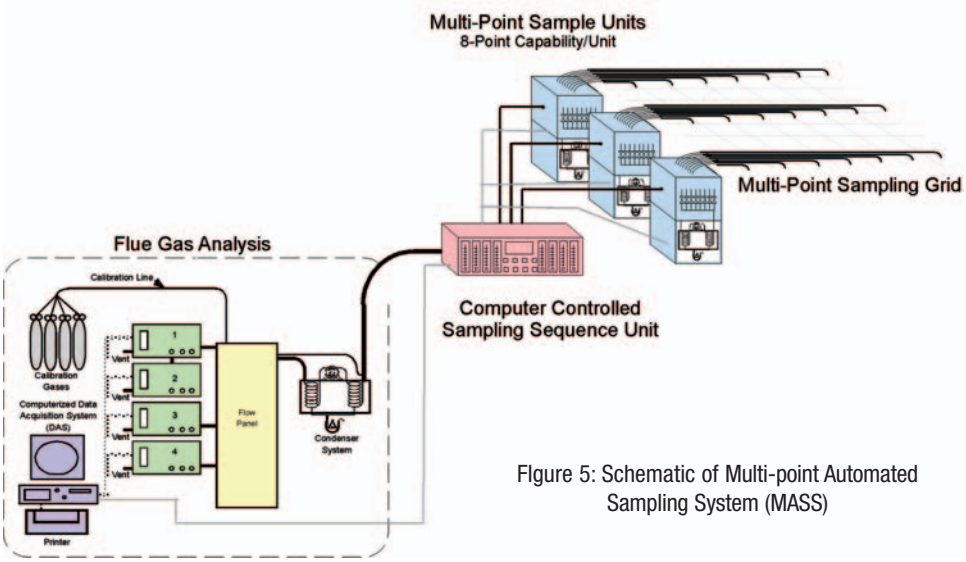

Figure 5: Schematic of Multi-point Automated Sampling System (MASS)

In this same manner, data quality, as usual, needs to be of the highest standard. Sound measurement and gas conditioning techniques must be followed. Analyzers based on analytical principles, such as chemiluminescence for NOx and paramagnetic for oxygen, need to be utilized and calibrated tightly to minimize measurement error. Instruments that are susceptible to short-term drift or were never designed for quick response or continuous use such as hand held analyzers should be avoided.

As the new regulations take effect, the demands on SCRs will continue to grow and the impacts of proper catalyst management will become more apparent. One of the simplest and most useful diagnostic and optimizing tools is a solid tuning program. Hopefully it will not take an expensive, unplanned outage to see the value of some front end maintenance.

For further information on this article, please contact Caleb Wiza at cwiza@cleanair.com

Figure 6: Multi-point Automated Sampling System (MASS)

Getting it just right

Temperature Mixing Enhances Performance of Pollution Control Equipment

by Rob Mudry, Airflow Sciences Corporation

Electrostatic precipitators (ESPs) are utilized at many industrial facilities to collect particulate so that it is not emitted to the atmosphere. Particle-laden flow passes through the ESP and the particles are captured through an electrostatic process. The particle capture efficiency of an ESP is dependent on many factors, including the flow characteristics of the gases and particulate passing through it. Ideally, the temperature distribution through an ESP should be uniform. If there is an imbalance in temperatures, particle capture performance could be affected. Also, low temperature zones may result in localized corrosion of metal parts, which further degrades system performance and adds to maintenance costs.

At the Tampa Electric Company Big Bend Station, *(see figure 7)* coal is burned to generate electricity, and an ESP is used to capture the ash residue from the coal combustion. As part of a recent upgrade of their ESP to enhance capture performance, Tampa Electric wanted to improve the temperature profile of the gases passing through the ESP. A

primary goal was to minimize the potential for corrosion of the new ash collection elements. Plant test data showed that the gas temperature entering the ESP varied by almost 75° F. This thermal gradient resulted in "cold zones" within the ESP where metal corrosion can be more prominent.

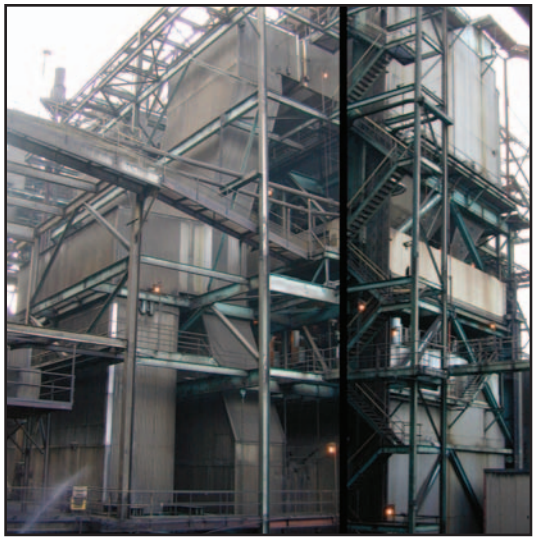

Figure 7: Tampa Electric Company Big Bend Station

To correct the situation, a flow modeling study was performed by Airflow Sciences Corporation of Livonia, Michigan. Airflow Sciences engineers constructed a computational fluid dynamics (CFD) model of the ESP inlet ductwork system. A CFD model is an engineering tool often used to simulate the flow in pollution control equipment. The model predicts flow characteristics such as velocity, temperature, pressure, and turbulence and is thus a useful design tool to optimize the flow within an ESP or similar equipment. By using the model, a variety of design ideas can be evaluated prior to actually installing them in a plant. The modeling goals were to assess the current temperature patterns and design a flow mixing device that reduced the temperature stratification.

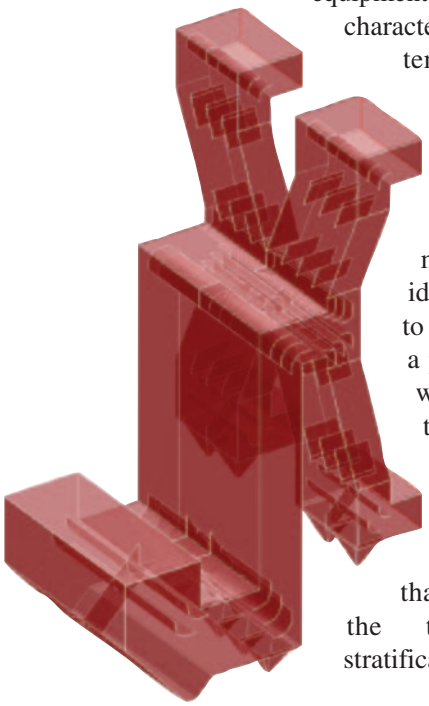

Figure 8: Duct Geometry Leading to ESP

The duct geometry leading to the ESP is shown in Figure 8. The flow exits a rotary air heater and splits to four separate ESP chambers. Many power plants utilize this type of air heater to improve combustion efficiency, but a downside of the design is that it typically causes a temperature gradient. Field testing at Big Bend indicated that the flow temperature varies by 75° F at the air heater outlet.

As the gas continues to the four ESPs, it does not mix much due to the ductwork geometry and short residence time. The left side of Figure 9 shows the CFD model results for the existing geometry. The gas temperature profile at select planes within the duct is shown in the color contours. At the ESP inlet (shown in pink), the temperature variation is 68° F. The CFD model was then used to develop a customized thermal mixer. A unique arrangement of baffles was developed to blend the hottest and coldest zones. The CFD results are shown in the right-side of Figure 9.

The temperature mixer was fabricated and installed at the Big Bend Power Station Unit 2, a 440 Megawatt plant. Data measured after the installation indicated that the temperature gradient was reduced to 24° F. The added pressure loss was 0.7 inches of water, well within the plant-specified maximum of 2.5 inches of water. Overall, Tampa Electric personnel are very pleased with the results and now consider the corrosion problem resolved.

Further details are available on the Airflow Sciences Corporation website, www.airflowsciences.com, by contacting Rob Mudry at rmudry@airflowsciences.com, or by contacting John Smolenski of Tampa Electric Company at jvsmolenski@tecoenergy.com

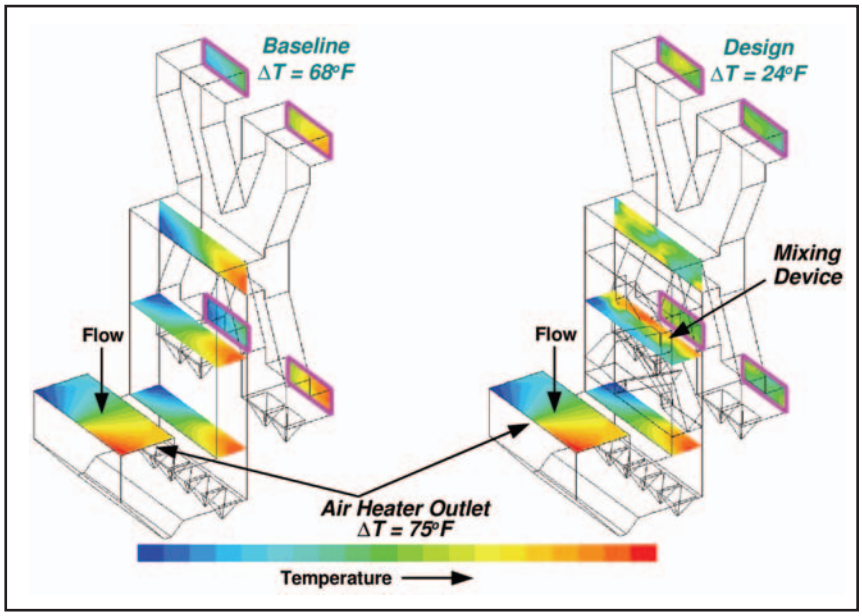

Figure 9: CFD Model Results

The Optimum Precipitator Current Limiting Reactor

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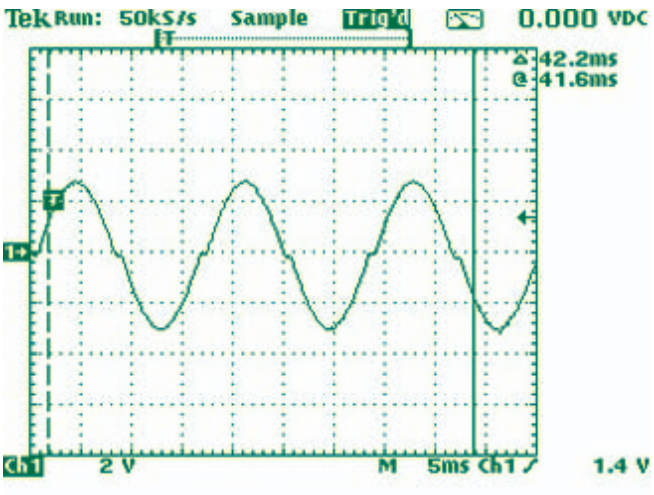


Figure 10: Current Waveform at "Full" Conduction Angle

It is very typical (especially of older precipitators) for the inlet half of a precipitator to operate at 50% or less of the rated value of the installed TRs.

With power levels this low, the SCR "on-time" of these controls become very small. That, in turn, means that the current flows into the precipitator for a short period of time per half cycle. *See figure 11.*

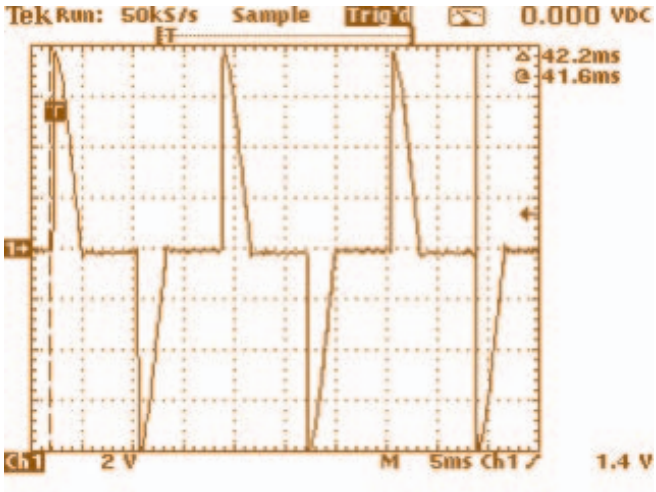


Figure 11: Reduced Conduction Angle Due to Operation Significantly Below TR Rated Current

If at this lower current level you were to recalculate the value of a CLR using the actual operating current, rather than the TR rated current, a very different value would be obtained.

If we were to replace the CLR originally installed with one that is now rated for the operating current we would see that the SCR on-time is increased and current would be flowing for a longer period of time per half cycle. This means that the precipitator is receiving current for a longer period of time and the particle charging is occurring for a longer period of time. This all equates to greater particulate collection and reduced outlet emissions. *See figure 12.*

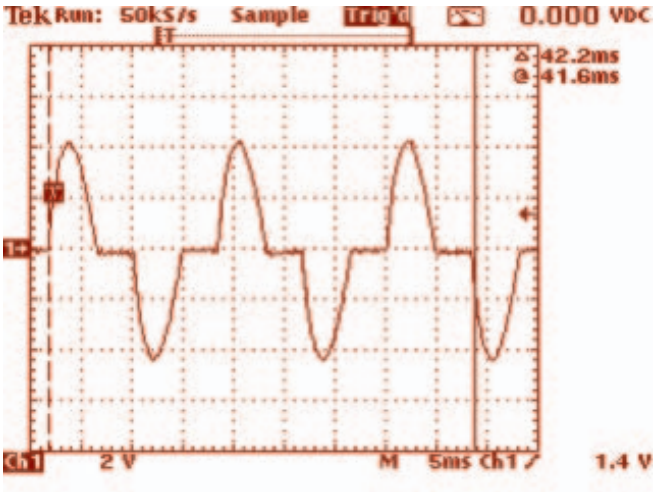
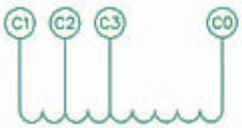


Figure 12: Increased Conduction Angle Due to Proper Resizing of the CLR

Since it is almost impossible to exactly pre-determine the operating current levels of all the TRs in every field, CLRs with multiple taps can be used. By multiple taps, we mean that there is more than one winding in the CLR, and that means there are multiple impedances in the CLR. Depending on the actual operating level of the TR, the most optimal tap can be selected. Tapped CLRs usually contain impedances of 30%, 40%, 50% and 60%. However, if the operating conditions are fairly stable, fewer taps can be used. *See figure 13.*



Tap	Hy	%IMP
C0 - C3	0.00637	30
C0 - C2	0.00424	40
C0 - C1	0.00531	50

Figure 13: CLRs with Multiple Taps

In conclusion:

While the electrical energization system was originally designed for a particular set of precipitator operating conditions, things change. Some characteristics, such as particulate loading, temperature, gas velocity, particle size, electrode alignment, and particle resistivity, can change yearly,

monthly, or even daily. Significant improvement in collection efficiency can be obtained by correctly matching the CLR value to actual operating conditions.

When seeking precipitator performance improvements, do not overlook this important investigation!

For additional information, contact Peter Aa or Paul Ford, Redkoh Industries, at either PeterAa@Redkoh.com or PaulFord@Redkoh.com

Optimized Wet FGD Performance

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The open spray tower absorber benefits the user with fewer internal components and much lower system pressure drop, as compared with the tray type absorber which carries with it more internal components and an inherently higher pressure drop.

One of the primary design criteria for achieving the desired level of SO_2 reduction is the liquid-to-gas (L/G) ratio or the quantity of liquid sprayed relative to the volume of flue gas. Increasing the L/G ratio improves SO_2 removal by exposing the gas to more absorbing liquor. Typically, however, this benefit comes at the expense of higher power consumption. A simple method of improving the gas/liquid contact and reducing the L/G requirements for an open spray tower is by the installation of Absorber Liquid Re-Distribution Devices (ALRD), either up-front in the OEM design or as a retrofitted upgrade to an existing system. The ALRD technology was developed and patented by General Electric Environmental Services, Inc. (GEESI, now Marsulex Environmental Technologies, or MET) in the 1990's and is reflected in MET's current OEM designs.

The ALRDs effectively offset the phenomena known as "sneakage" which represents the quantity of the flue gas that passes through the absorber partially untreated. Sneakage primarily occurs near the absorber wall due to the physical limitations in the arrangement of the spray headers and nozzles. This results in relatively low slurry liquor concentrations at the circumference of the absorber. In addition to the spray density mal-distribution, a flowing film of water/slurry running down the wall is created when the spray from the spray nozzles impacts the wall and cascades down the wall surface. The mass transfer efficiency at this gas liquid interface is very poor, thus the flowing film becomes a much less effective liquid contacting device. The effective surface area for gas-liquid contact is reduced by this phenomenon. The ALRDs offset sneakage without the imposition of excessive pressure drop (equating to additional energy consumption in terms of booster fans) that may be associated with a perforated tray approach.

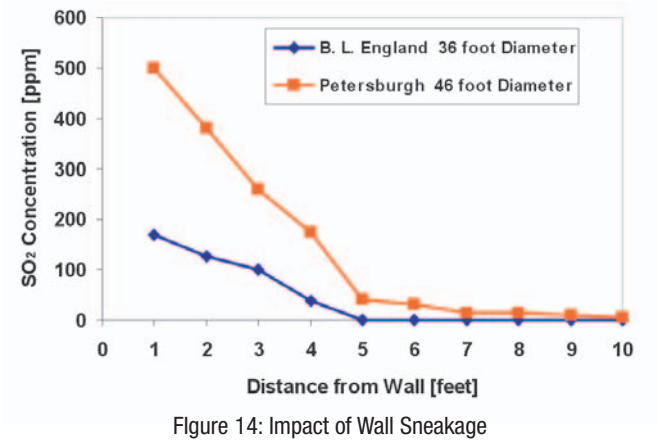

FIgure 14: Impact of Wall Sneakage

Impact of Wall Sneakage

The impact of sneakage was quantified by measuring the SO_2 concentration directly above the upper spray header as a function of distance from the absorber wall for several operating units. *See figure 14.*

The results of the field measurements summarized in Figure 14 illustrate that:

- The SO_2 concentration is the highest at or close to the wall.
- The SO_2 concentration decreases rapidly as the distance from the wall increases.
- Approximately 4 feet from the wall, the measured SO_2 concentration is at or less than the average SO_2 concentration in the stack.
- About 10 feet from the wall, the measured SO_2 concentration approaches zero (0) ppm.

The results described above clearly show that SO_2 penetration along the wall is significantly higher than away from the wall and a significant portion of the open tower cross section area operates at reduced SO_2 absorption performance. Therefore, re-directing the flow of the absorbent slurry away from the wall surface substantially improves the SO_2 capture efficiency.

ALRD Design

As a result of these findings, a concept was developed effectively re-introducing the liquid film back into the flue gas stream, maximizing the gas-liquid contact and improving the effective surface area for gas liquid contact and overall SO_2 reduction capability of the absorber. U.S. Patent 6,550,751 B1 was assigned to Marsulex for the ALRDS which are located between the absorber spray levels as shown in Figure 15.

The ALRD is a device designed to block an annular area of the absorber total cross-sectional area near the absorber wall and redirect the falling liquid film from the absorber wall back into the gas stream. This slight decrease in the cross-sectional area of the tower has a *minimal* effect on the flue gas pressure loss in the tower, but a major effect on gas-liquid contact.

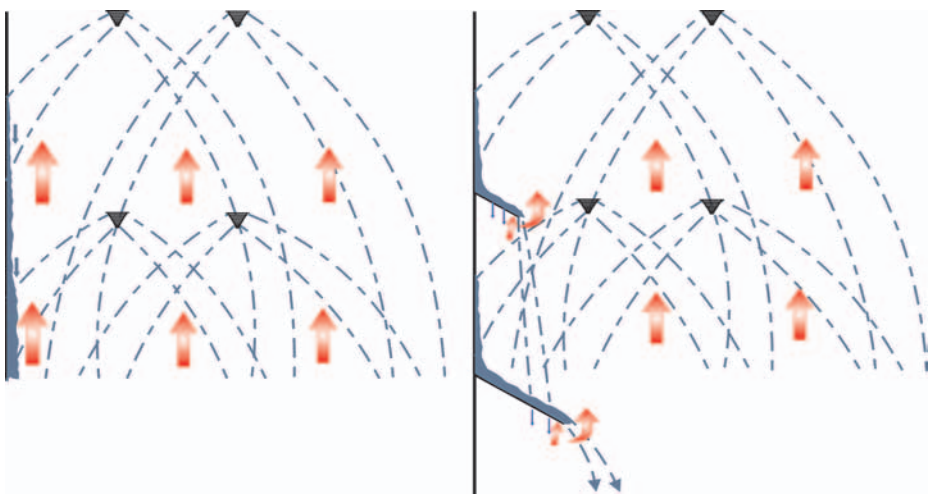

Figure 15: ALRD Improvement in Gas-Liquid Contact near Absorber Wall

ALRD Results

The improvement in the absorber performance due to the ALRDs is a function of the tower diameter and the number of ALRDs installed. The benefits of upgrading an existing system with the ALRDs include:

- Typically enables the removal of one AR pump from service while maintaining SO_2 removal efficiency
- Allows an increased level of SO_2 removal at no increase in power consumption
- Facilitates the burning of higher sulfur coals while maintaining SO_2 emission compliance

For an existing 40 foot diameter absorber, Figure 16 shows that the SO_2 removal efficiency can be increased from approximately 94% to 98% while maintaining three AR pumps in service. As an alternative, the ALRDs can improve the SO_2 removal efficiency relative to the baseline (95% versus 94%) when one of the three AR pumps/spray levels is taken out of service. The effective decrease in L/G will reduce the flue gas pressure drop across the absorber tower thereby reducing fan requirements as well as reducing the power required to operate the system AR pumps.

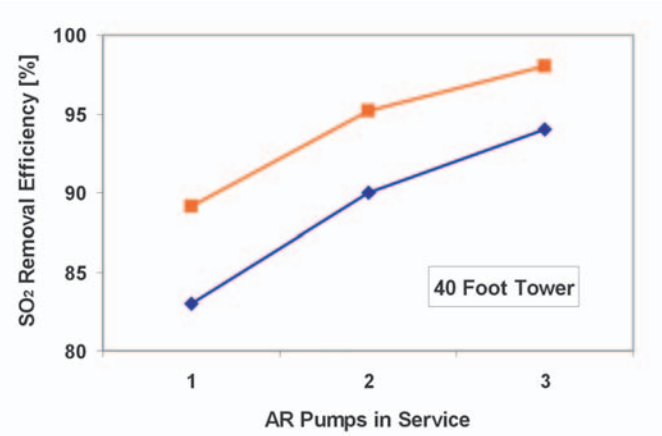

Figure 16: ALRD Impact on SO_2 Removal Efficiency

For new absorber tower designs, the ALRD enhancement allows for a decrease in the number of spray levels in service for a given sulfur loading when compared to a design without the ALRD. This translates to a savings in both power consumption and materials through the decrease in the overall tower height, elimination of a spray level, and the associated AR pump.

Conclusions

The ALRD technology serves to provide a remedy for the past gas sneakage effects in an open WFGD spray tower, thus allowing the user to derive the full operational and maintenance benefits of an open spray tower while benefiting from optimized SO_2 capture in an energy-efficient way. This technology is available either up-front, incorporated in a new OEM design, or as a retrofitted backfit to existing FGDs of most any type.

For further information, please contact David Murphy, Chief Technology Principal of Marsulex Environmental Technologies, at dmurphy@marsulex.com or by telephone at 330-256-3851.

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Alstom Environmental Control Systems
Philip Rader
1409 Centerpoint Blvd. Knoxville, TN 37932
Phone: +1.865-694-5233 Fax: +1.865-694-5213
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Babcock Power Environmental
Tony Licata
5 Neponset Street Worcester, MA 01606
Phone: +1.508.854.3853 Fax: +1.508.854.3800
Email: tlicata@babcockpower.com
Website: www.babcockpower.com

CleanAir Engineering
Allen Kephart
500 W. Wood St. Palatine, IL 60067
Phone: +1.847.991.3300 Fax: +1.847.991.3385
Email: akephart@cleanair.com
Website: www.cleanair.com

Fisher-Klosterman, Inc./Buell Division
Thomas Lugar
200 North Seventh Street, Suite 2 Lebanon, PA 17046
Phone: +1.717.274.7110 Fax: +1.717.274.7342
Email: twl@fkinc.com
Website: www.fkinc.com

GE Energy
Mike Sedler
8800 East 63rd. Street Kansas City, MO 64133
Phone: +1.816.356.8400 Fax: +1.816.353.1873
Email: michael.sedler@ge.com
Website: www.gepower.com

Haldor Topsoe
Nathan White
17629 El Camino Real Suite 300 Houston, TX 77058
Phone: +1.281.228.5127 Fax: +1.281.228.5019
Email: tnw@topsoe.com
Website: www.haldortopsoe.com

Korea Cottrell Co., Ltd.
Tae Young Lee
160-1 Dongkyo-dong, Mapo-gu, Seoul, Korea 121-817
Phone: +82-2-3206-103 Fax: +82-2-3206-100
Email: tylee@cottrell.co.kr
Website: www.koreacottrell.co.kr

Marsulex Environmental Technologies
Richard Staehle
200 North Seventh Street Lebanon, PA 17046
Phone: +1.717.274.7243 Fax: +1.717.274.7103
Email: rstaehle@marsulex.com
Website: www.marsulex.com

NIRO A/S
Niels Jacobsen
Gladsaxevej 305, Soeborg, Denmark DK-2860
Phone: +45.3954.5432 Fax: +45.3954.5871
Email: nj@niro.dk
Website: www.niro.com

REDKOH Industries
Paul Ford
125 Stryker Lane, Bldg. 29 Hillsborough, NJ 08844
Phone: +1.908.874.5588 Fax: +1.908.874.7994
Email: paulford@redkoh.com
Website: www.redkoh.com

Reinhold Environmental Ltd.
Susan Reinhold
420 Academy Dr. Northbrook, IL 60062
Phone: +1.847.291.7396 Fax: +1.847.498.1512
Email: sreinhold@reinholdenvironmental.com
Website: www.reinholdenvironmental.com

Steag LLC
Hans-Ulrich Hartenstein
203 Linwood Rd., Suite 102, Kings Mountain, NC 28086
Phone: +1.704.588.7657 Fax: +1.704.588.7644
Email: hhartenstein@steagllc.com
Website: www.steag.com

The Babcock & Wilcox Company
Greg Bielawski
20 S. Van Buren Ave. Barberton, OH 44203
Phone: +1.330.860.1591 Fax: +1.330.860.9901
Email: gtbielawski@babcock.com
Website: www.babcock.com

Wheelabrator Air Pollution Control
Buzz Reynolds
441 Smithfield Street, 5th floor Pittsburgh, PA 15222
Phone: +1.908.522.6616 Fax: +1.973-215-2557
Email: jamesreynolds@siemens.com
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Reinhold Environmental Ltd.
420 Academy Drive
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