CASOM 9: AVAILABILITY IMPACT OF FLUE GAS DESULFURISATION SYSTEMS

In recent years many North American electric utilities have been faced with the likelihood of adding flue gas desulfurisation (FGD) systems to their coal-fired units. Of immediate concern was the impact that these systems might have on the unit's availability and reliability. Therefore the North American Electric Reliability Council's (NERC) Generating Availability Trend Evaluation (GATE) Working Group assembled a task force of electric utility experts familiar with the design and operation of FGD systems to perform an in-depth assessment using the detailed data base contained in NERC's Generating Availability Data System (GADS) as well as information available from federal agencies, industry organizations and internal data from the task force's companies. The results of this study are expected to help generating unit designers, utility planners and production staffs, and others considering FGD installations.

DATA AND ANALYSIS

Using the unit specific design, performance and availability/reliability data included in NERC's GADS database for 111 FGD systems (49,796 MW of scrubbed capacity) the task force was able to compare the impact on availability due to FGD systems for a wide variety of situations; e.g. included in initial design versus retrofitted later, early versus more recent vintage, inclusion of spare modules, etc. In addition the task force was able to examine the range of impacts on individual and not simply averages, leading to a much greater understanding of cost-effective ways to minimise the potential negative impact on performance.

EXECUTIVE SUMMARY OF FINDINGS

The overriding finding reached by the Task Force is that the performance of FGD systems has improved rapidly since the first FGD systems were installed. FGD system's impact on unit Equivalent Unavailability Factor (EUF) and unit Equivalent Forced Outage Rate (EFOR) was much less than previously believed. Many reasons were found to explain this improvement. Two primary reasons are that 1) FGD technology matured through the cooperation of manufactures and utilities, and 2) utilities gained experience and knowledge in the operation and maintenance of the FGD cycle. Several of the reports specific findings are described in the following:

- FGD systems had minimal effect on unit availability. In 70% of FGD installations, the FGD contributed 1 percentage point or less to the total EUF experienced by the unit. At an additional 12 %, FGD contributed between 1% and 2% of total EUF and at only 7 % (eight units) was EUF increased by more than 4 percentage points (the mean was 1.35% but the median was only 0.31%, indicating that a few bad actors skewed the average substantially). Similarly, the FGD systems contributed 0.25 percentage points or less to unit EFOR in over 67 % of the units, and only 7 % of the FGD systems increased EFOR

by more than 2 percentage points (again the mean was 0.45% while the median was only 0.06%);

- The reduced performance that occurred in FGD systems was primarily due to damage to the stacks, plugging of the mist eliminators, and repairs to the ductwork and absorber towers;
- No statistically significant performance difference was found in the unit EUFs or EFORs between units where the FGD system was part of the original design versus those where the FGD system was retrofit at a later date;
- The inclusion of a spare scrubber module was the only design characteristic that proved to be statistically significant in reducing availability losses. Approximately 30 % of the units equipped with spare modules experienced no change in unit EUF due to the FGD system;
- In most cases no difference was found in the current performance of the earliest and latest designs as most initial problems were eventually corrected. However, some problems with the earlier designs still exist and continue to degrade performance;
- No conclusive difference was found between units equipped with or without flue gas bypass systems;
- No statistically significant performance difference was found in the unit EUFs or EFORs between FGD systems equipped or not equipped with flue gas reheat capability. One anomaly was noted: the few FGD systems that had direct-combustion reheaters did have significant impacts on unit EUFs and EFORs;
- Capacity losses due to the operation of the FGD system at time of peak averaged 1.74% of total unit capacity; the median was 1.40%. At the time of peak just over 70% of the FGD systems used 2% or less of the unit's capacity;
- Station Service (house load or internal station electricity requirements) annual energy requirements for the FGD systems averaged 1.67% of the unit's capacity (median = 1.28%). Just over 70% of the FGD systems had requirements of 2% or less;
- Typical manpower requirements for the operation and maintenance of FGD systems were 4.3 persons per 100 MW of generating capacity, divided into 2.8 for operations and 1.5 for maintenance. Separate FGD engineering and chemical laboratory staffing was negligible;
- Units with reduced performance have higher operating and maintenance (O&M) costs. Where design or operating problems were corrected, O&M costs were reduced.

References:

Impact of FGD Systems, North American Electric Reliability Council publication, 1991.
Flue Gas Desulfurization System Impact on Availability – 1989-1991 Performance Update, International Joint Power Generation Conference, Atlanta, Georgia, October 18-22, 1992.