

## **DCS Evaluation of a 150MW Gas Fired Power Plant**

At the request of plant management an evaluation of the condition of the unit was performed starting on January 28<sup>th</sup>, 2008 and concluding January 30<sup>th</sup>, 2008. The following are the findings of this evaluation.

### **DCS Hardware**

The unit is controlled by a Foxboro I/A DCS system installed in 1996. The hardware is in good operating condition and is stable. Wiring to the Field Bus Modules needs to be cleaned up and secured in order to prevent accidental damage to wiring or fiber optic cables. There was some evidence of ground loops in the system measurements. This was indicated by signal offsets and sporadic noise on some monitored signals. At the next unit outage it is recommended that the signal grounding system be examined carefully.

### **DCS Software**

Current version of the software is 7. Software is operating in a stable manner. AutoCAD, used for document management, is version 2000Mapi. An AIM historian is in place with a 2000 point limit, less than 900 points are presently in use.

### **HMI Interface**

The HMI is via flat touch screen panels. Operators are comfortable with the use of these screens. The graphics comply with ISA standards for functionality and controllability.

### **Document Control**

Management of system documentation is extremely poor. The set of working drawings in the engineering office is in chaos. There are hand written notes on most of the logic diagrams. Some modifications to the control logic are not documented at all. This poses a large risk exposure to the company. If the subject matter expert is lost for any reason there will be an even greater exposure for the company. It is imperative that these drawings and other documentation be organized and cleaned up as soon as practical.



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### **Unit Control**

The unit is limited in load due to an economizer leak, emissions constraints, and condenser issues. These will be addressed at the up coming outage. There are four major areas of control logic that need to be addressed. The fuel gas system, the throttle pressure control, drum level control, and the coordinated control between the turbine and the boiler. In addition the tuning of the system is in poor order and needs to be improved.

It is recommended that all five of the gas control valves be completely overhauled or replaced at the next outage. The 25 lb regulators and gas burner header regulator have a high amount of stiction which makes controllability problematic. There is also a high degree of coupling between these regulators that results in difficulty in controlling gas pressure at all times, especially during start up. Logic changes in the control of these valves in combination with there respective overhauls will improve controllability.

Drum level control is the traditional 3-Element system. Drum level has a higher than normal amount of variability during load changes. This contributes to restraining the ramp rate of the unit. Improvements in the drum level control logic can stabilize the level and allow the unit to ramp at a greater rate.

Throttle Pressure Control is widely variable due to two primary reasons. The first is the use of traditional throttle pressure measurement for control. With the addition of low NOx burners this control schema is no longer adequate. A direct energy balance schema for throttle pressure control will improve controllability and stability of the unit. The second major cause of throttle pressure instability is the poor coordination between the boiler controls and the turbine controls and is addressed in the next paragraph.

The coordinated control between the turbine and the boiler is not functioning properly. This is due primarily to tuning issues in the entire system. At present the turbine will ramp at 2 MW/min regardless of the boiler condition. Improvements in the tuning of the boiler will allow it to respond faster and retain controllability. If, after the tuning is completed, the coordination remains poor additional control changes may need to be made in order to improve the ramp rate.

Boiler tuning is in poor order. Some of the controllers have factory defaults in them while most of the controllers have been tuned using the 'seat of the pants' method. This results in a slow responding system.



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### **Training**

I&C Technicians are in need of additional training in three primary areas. The first is the understanding of the need to maintain calibration records on each instrument in the plant. At present, as revealed by the I&C supervisor, these records are not kept. No history of drift or error of the instruments can be visualized.

The second area of training is in general process control theory. There appears to be a lack of understanding of the fundamental concepts of control theory. This results in poorly conceived logic and inefficient use of system resources.

The third area of training needed to be addressed is in control system tuning. At present the tuning is performed without the aid of analytical data but rather is done by the 'seat of the pants' method. In order to maintain the highest efficiency from this unit and the highest ramping rates, the tuning must be kept up to standards.

Operations training in the theory of power plant operation seems to be lacking. While a route or mechanical step by step knowledge is present, there is little understanding of the 'why' behind what is being done. In a urgent or emergency situation this lack of understanding can prove to be hazardous.

A review of the training material being developed indicates that the forth coming training should, depending on accountability of the unit operators, provide detailed insight into the theory needed. The recently purchased system of online training provides a great deal of detailed knowledge. This being supplemented by the in house development of system specific information will be very effective. There are only a few in house systems presently developed. Addition systems are needed to complete the process. In reviewing the logs of operator participation in the online course some have yet to complete any courses.

This concludes the evaluation report.  
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