UP&L Solves Problem at Gadsby Plant

Utah Power & Light's Gadsby Unit 3 is a 107 MW Combustion Engineering fossil (coal, pitch or gas) fired natural circulation drum boiler unit. A very serious operational problem existed because of the inability of the low pressure heater drain valves to maintain design level in the heaters.

Problem

The design level for the low pressure heaters is 3 inches, but the actual operating level was oscillating from 9 to 12 inches, which was keeping the heaters flooded. The normal drain control valves were oscillating between closed and fully open, with the level being controlled by the emergency drains. Because this is an older unit, there is no *automatic* Turbine Water Induction Protection (TWIP) system to prevent carryover of water into the turbine if the heaters filled up to the point of filling the steam extraction lines. This was a very serious potential problem which required constant monitoring.

The oscillations also caused the unit power output to swing by 5 MW. This was due to no extraction steam being supplied when the heaters were full. There was also a potential problem with tripping the boiler feed pumps due to low NPSH, since the deaerator level was oscillating significantly.

Modeling

The first step which was taken was to model the entire feedwater system. Because there is so much coupling between components and controls, it was very difficult to match design conditions. Therefore, the low pressure heaters and normal drains were modeled separately and the control parameters were adjusted until the model gave results similar to design. These values were put into the entire low pressure feedwater model and the emergency drain controls were adjusted until the steady-state model results were very close to design. The model transient results exhibited no oscillatory behavior and all levels were controlled satisfactorily.
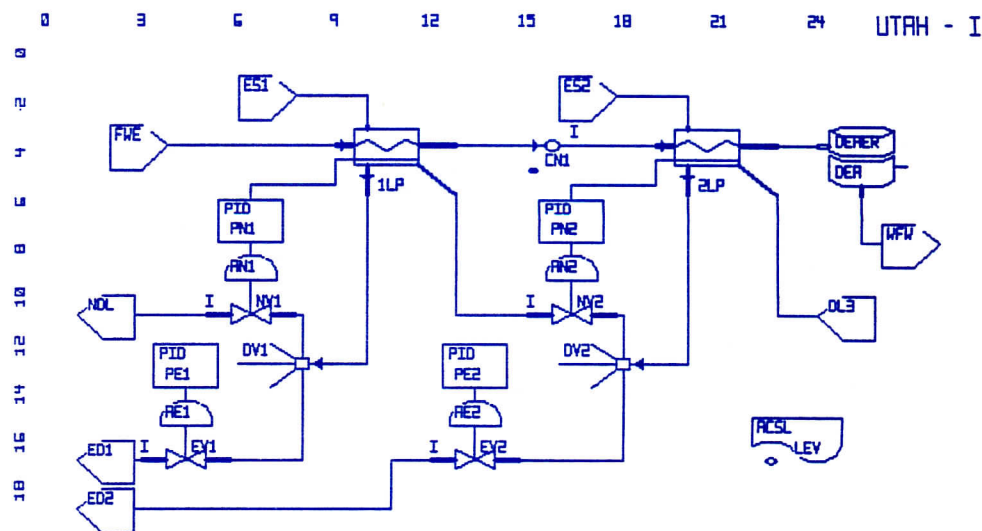
Low Pressure Heater Model of Gadsby Unit 3

Application

The Plant Instrumentation and Controls Department was advised of the model results. Upon investigation of the control settings in the plant it was determined that the values used in the model were nearly the same as used in the plant, except that the normal and emergency drain valve control settings were reversed. Because the gains and setpoints for the emergency drains had been used for the normal drains, the normal drain valves were stroking full open and closed and the emergency drains could not compensate since their gains and setpoints were too low (being intended for the normal drains). The settings were changed and the levels are now controlled by the normal drains. All oscillations ceased and levels are maintained at design.

Benefits

The benefits derived are many. The unit power output has stabilized and no longer swings 5 MW. The deaerator level oscillations no longer exist so the boiler feed pump trip problem has gone away. Since heater levels are now controlled to design, the potential for water induction to the turbine is very low. In addition, a 5 Btu/lbm savings has been noticed due to decreased extraction steam flow to the heaters. This represents a saving of $25,000 per year if the unit is operated at full capacity.

Conclusions

A very significant problem was solved because of the understanding of the system which resulted from the modeling effort.

Through modeling, the system dynamics and interactions between components and controls became clear and the results were used to convince others to investigate the problem. The results also pointed out the answer and gave confidence in applying it.

The effort also pointed out the need to start with small models and build on them to create full system models. It is also very helpful to build the model to match design data first (to verify accuracy) and then to modify it to the particular application.

As a result of this work, there is a high level of confidence in the model and it is now being used extensively to evaluate alternative operational strategies to maximize unit efficiency and availability.

**JEFF TUCKER
UTAH POWER & LIGHT**

MMS-B&W and MMS-EASE+ Updates Released

Release 2 of the B&W version of the MMS will be distributed to User Group members during June. This release will be the last semi-annual release. At the direction of the membership, future releases will be made annually, with release 3 currently scheduled to occur in June, 1987.

This release incorporates the following modifications and additions:

- **Error handling routines:** Water property errors will be detected and the user notified automatically.

- **Two-phase modules:** The two-phase modules and associated FORTRAN routines will be included.

- **Air/Gas dynamics modules:** This is a new addition to the fossil library that does a better job of modeling the air/gas side of a fossil boiler.

- **User modifications:** Dave Weber of Philadelphia Electric and Ken Jones of Detroit Edison contributed modifications to some of the MMS modules. These contributions have been incorporated into this release. The modules affected are: ACT, CONDEN, FLASH, LOGDT, VALVEC, VALVED and VALVEI. Also, a new controls module (TRIP) was contributed by Ken.

A new version of MMS-EASE+ will be released concurrently with the new release of the MMS-B&W. Updates from version 1.2 will be delivered free to all MMS-EASE+ users. This version corrects some user-reported problems as well as adding some new features. Some of the new features are:

- **Report generator:** The MMS-EASE+ report generator will print a detailed summary of your model development activities.

- **File format:** The model page and file names have been added to the header information in the MMS input file. Also, double quotes have been replaced by single quotes.

- **Error handling:** Support for the MMS error handling routines has been added.

Version 1.4 will incorporate some major improvements and is tentatively scheduled for Spring, 1987.

ROSS SCHAACK

The President's Corner

Our User Group meeting in Norfolk, Virginia was a success. Eleven of the member organizations were represented. This also became our first International MMS User Group meeting with attendance of Juan Carbajo of Empresarios Agrupados, a Spanish A&E firm.

I would like to thank Dave Weber of Philadelphia Electric for arranging this meeting. It was held in conjunction with the Eastern Simulation Conference. The meeting was held on the last afternoon of the formal sessions of the conferences and the following day.

As I saw the conferences they were primarily directed toward and attended by those in simulation software development. Those attending the B&W/MMS User Group meeting were in the minority as far as being simulation software users. We were also about the only attendees from utilities. The conferences started each day with a plenary session followed by morning and afternoon concurrent sessions. These latter were either presentation of papers or panel discussion. The latter tended to be more interesting. Speakers were more willing to express a controversial idea as a panel member than as the author of a paper. Dave Weber had arranged two afternoon sessions on MMS. This was the first part of the User Group meeting, and it was a chance to present MMS to those who were not fully aware of its potential. The next day, attendance at the User Group meeting was for members only. Most of the day was devoted to user reports. These reports were very helpful. Those presenting the reports were able to get some suggestions for some of the problems they were having and those hearing the reports were learning of some of the pitfalls to avoid. Due to the length of time spent discussing the user's report, the B&W team could not discuss their new developments as fully as they desired. Some of these developments are reported elsewhere in this newsletter.

I am told that the training session which was held at B&W the week of April 14-18 was judged successful by the session participants (12 total from 6 member organizations). The training format was structured around the use of the MMS/PC Workstation with an emphasis on control analysis. The next training session will be held on October 20-24, 1986.

In the area of membership I would like to welcome Pacific Gas and Electric as a new B&W User Group member. I would also like to welcome Pennsylvania State University as our first Educational Institution member. If any of you know of a college or university which might be interested in using the MMS for research or teaching, please contact Phil Bartells.

Plans have been made to hold the next meeting of the User Group in Knoxville, Tennessee. This meeting will be hosted by TVA on September 16 and 17, 1986. Mark your calendars now. At the last three User Group meetings I have heard suggestions that a meeting be held in southern California. Therefore I have reserved a meeting room here at Southern California Edison for a User Group meeting on March 10 and 11 of 1987. Have a happy and safe summer.

CHARLES SAYLES
PRESIDENT
April 25, 1986

Rapid Data Limited Named Sales Representative

Agreement was recently reached with Rapid Data Limited of Worthing, England for sales representation of MMS in Western Europe. As MMS marketing rep., RDL will serve as liason between B&W and potential members of the User Group. RDL currently has over 200 customers for ACSL, and also markets other software products such as SIMSCRIPT, SIMAN, and CAMP. Bill Havranek of RDL will team up with Phil Bartells in early June at the European Nuclear Conference in Geneva, Switzerland, after which several specific customer visits are planned. It is anticipated that the marketing arrangement will result in several new member organizations being added in the next year. The MMS/PC Workstation (see article elsewhere in this newsletter) is expected to provide an entry-level system which will be useful to introduce new users to the MMS technology.

PHIL BARTELLS

MMS/PC Workstation Now Available

Development of the mainframe version of the Modular Modeling System by the Electric Power Research Institute (EPRI) made power plant simulation available to utility engineers and others who previously had little experience in modeling and simulation. To expand availability of MMS technology, B&W has taken advantage of improvements in personal computer (PC) hardware and software to offer the commercial version of MMS for dedicated PC-based workstations.

Workstation software provides stand-alone capability to develop MMS models, debug them, perform transient analysis, review results, and evaluate control characteristics. It also enables models to be uploaded to a more powerful computer system, and permits communications with the B&W/MMS User Group Bulletin Board for file transfer or other communications.
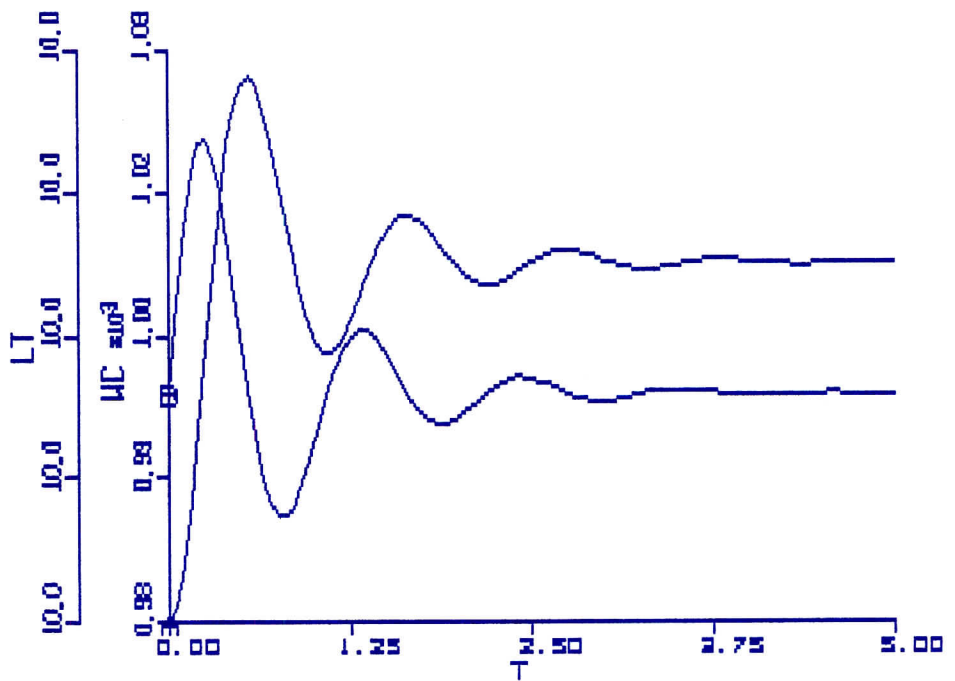
ACSL/PC Provides Interactive Capability

The Software

The MMS/PC workstation integrates a variety of capabilities that were previously only available separately:

- MMS LIBRARY — The MMS Macro and FORTRAN libraries are implemented fully; no simplifications are made because they are on a PC. As a result, models developed on the PC are transferable to more powerful computer systems without modification.

- ACSL/PC — Full implementation of the mainframe ACSL language provides capability to run MMS models in interactive or batch modes entirely on the PC — without the need to upload to a mainframe. ACSL has capability for linear analysis and utilizes a modified Gear algorithm for efficient integration of the differential equations that model the dynamics.

- MMS-EASE+ — The PC-based pre- and post-processor that was originally released in 1985, is implemented with its full capability. This software enables an MMS user to build models graphically and to readily review results.

- PC - MATLAB — An extremely versatile matrix library coupled with a controls analysis toolbox provides a flexible package for performing controls analysis and optimization. Included are capability for conventional control design and advanced techniques.

- STEAM/WATER PROPERTIES — The MMS steam/water properties routines are provided as a tool, eliminating the need for reference to manuals.

- COMMUNICATIONS — Several communications packages are available, or the user can supply his own preferred package.

The Hardware

MMS/PC is supported on IBM or compatible personal computer systems with a hard disk, arithmetic co-processor and suitable graphics card. Several options are available and assistance will be provided in defining a suitable system for application.

Availability

The MMS/PC Workstation is available to members of the B&W/MMS User Group once the applicable software licensing agreements have been completed. Pricing information and other details are available on request.

PHIL BARTELLS