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ISSUE 12

THE FOSSIL CONSULTING SERVICES TECHNOLOGY REPORT

FCS FOSSIL RECORD

We continue to grow to better serve our valued customers...

FOSSIL CONSULTING SERVICES (*FCS*) is a dynamic company dedicated to providing high-quality training, engineering, and technology transfer services to the fossil utility, independent power, district energy, industrial and process industries, as well as the U.S. Government.

We have an impeccable and proven track record in the power utility business. Our service to the industry over the past 15 years has been second-to-none. However, we continue to grow and improve our value to our customers by hiring industry professionals with various and vital areas of expertise in all phases of plant training and engineering.

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Hoosier DCS Upgrade Project: Preparing Control Room Operators

BY VICTOR MADISON

As part of their strategic initiative associated with purchasing a new control system to improve plant reliability and performance, Hoosier Energy contracted Fossil Consulting Services, Inc. (FCS) to develop a training program and conduct operator training using the new Merom Generating Station, Unit 2 control room simulator. The purpose of this training program was to ensure that the Merom operations personnel could smoothly transition from their benchboard control to a DCS system.

The Merom Unit 2 controls were upgraded from bench-board type controls to a new Emerson Ovation Distributed Controls System (DCS) in 2007. As part of this significant controls upgrade, the plant simulator was purchased. One of the preliminary steps in our project was the preparation of a Training Plan detailing the course learning objectives, and providing outlines of the simulator training courses. This training plan was developed based an assessment

of the station's training needs conducted by FCS, a review of the Merom Generating Station Simulator Design Plan, a review of the Merom Generating Station documentation, DCS Screens and logic, observations during provisional simulator factory testing sessions, and FCS' experience developing simulator training programs for many other fossil power plants.

TRAINING PLAN

The Training Plan was based on the five steps in the performance-based simulator training program design, development, and implementation process, and included the following:

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Preferred Work Methods: Alternatives to Training

BY SCOTT HOMMEL

Sacramento Municipal Utility District's (SMUD) Distribution Services Department operates and maintains a large electrical system for the City of Sacramento, California. They recognize the need to establish and maintain management-approved procedures for their workforce. The procedures are needed to ensure safe performance of each task and to ensure continued reliable operation of the Department's Distribution System infrastructure.

Given the nature of the Distribution System work, a question that was asked throughout the Department was "are procedures really needed, do they really work in a work environment where every time a task is performed the methods necessary to perform that task vary due to the wide variety of possible conditions and required equipment to ensure the work is done most safely and effectively?" This was the question that the Department management wrestled with: how to write procedures that would cover all possible scenarios, and at the same time ensure safe performance of the riskiest tasks so that injuries will be reduced and system reliability maintained. The answers to this dilemma and the resulting concept of "preferred work methods" in lieu of procedures are described in this article.

WHAT IS A PREFERRED WORK METHOD?

A Preferred Work Method (PWM) is a high level "description" of the elements of work processes that should never vary while performing a high risk task, including safety equipment requirements and the basic steps to take. The focus of the PWM is on consistency and safety. Due to variances in real-world application of each PWM, the Foreman has the authority to apply and/or adapt the PWM as necessary to fit the circumstance. A PWM is structured enough to satisfy management that safety is never compromised, but flexible enough to meet the needs of the workforce so they are not "handcuffed."

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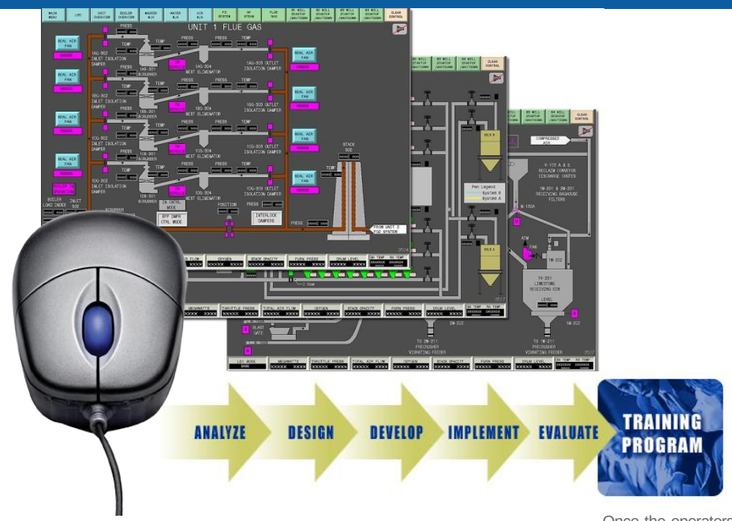

DCS Upgrade Project

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TRAINING MANUAL

The training manual described the systems from a control operator's perspective, described the analog and digital logic, and covered typical malfunctions that could occur during system operations. A detailed integrated operating procedure for cold, warm and hot startup and unit shutdown and efficient operations was also included. The manual was graphic intensive to improve trainee retention.

LESSON PLANS

The instructor lesson plans were used by the instructor in presenting both the classroom and simulator portions of the training program. The lesson plans detailed the objectives to be covered each day, and provided an outline for the instructor to follow ensuring that the training was presented in a consistent manner to all trainees. The lesson plans also provided guidance to the instructor in presenting the simulator operational scenarios, including providing guidance on when to use the various simulator training features.

SIMULATOR INSTRUCTION

FCS instructors conducted 10 weeks of simulator training for each of the four operating shifts at Merom. Trainees included Control Room Operators, Shift Supervisors, and Auxiliary Operators and included classroom and simulator sessions. The sessions covered details on the new Emerson Ovation DCS including equipment controls, DCS navigation, and control system logic. They provided extensive reviews of plant operations from cold conditions through full load operation and included control room fundamentals, advanced control room operation, unit trip, safe shutdown and hot restart, efficiency improvement, malfunction training, and plant-specific boiler, turbine, and control system training.

Plant operational scenarios (startup from cold, hot startup, unit shutdown, etc.) were practiced until the operators could efficiently perform routine plant operations using the DCS. Once the operators were familiar with the DCS controls and the Human Machine Interface (HMI) control screens, abnormal plant conditions were inserted into the simulation in the form of equipment malfunctions and trips that resulted in plant runbacks, rundowns and unit trips. The operators were also challenged with simulated plant problems that required troubleshooting using operational parameters from the DCS and control logic diagrams.

DCS OPERATIONAL SKILLS AND KNOWLEDGE

The results of the training were manifested in the operators' ability to startup and operate the actual plant when the controls upgrade project was completed. The operators were able to operate all plant systems efficiently during the initial unit startup and subsequent escalation to full load. Knowledge gained and skills developed during the simulator training were demonstrated to be invaluable as the operators transitioned from the old benchboard controls to the new DCS, given that very few plant upsets were caused by operators during the startup and during initial plant operations

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Alternatives to Training

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Before the start of each job, the Foreman uses the PWMs in a tailboard session to discuss the job requirements and work methods with the crew. The Foreman assesses the field conditions and adapts the PWM as necessary to maximize safety. This adaptation is formally documented as part of the tailboard minutes. The Foreman ensures that the crewmembers understand the PWM and any adaptations made. If the PWM cannot be followed due to unacceptable risk, the Foreman defers action on the task.

DEFINING AND DEVELOPING PREFERRED WORK METHODS

The basis for development of the PWMs was a definition of job. Each job was defined in three major phases:

- Skill and Knowledge Assessment to identify all tasks performed by each job position
- Risk Assessment to prioritize the tasks so that the PWM development process focused on the most critical risks with regards to job safety
- Gap Analysis to further prioritize the tasks in order to focus on those that had the largest gaps in existing workforce knowledge or ability

The Skill and Knowledge Assessment involved developing a customized task list for each job position, as well as a list of Skills & Knowledge required for each task. After the task list was developed, it was reviewed by a group of subject matter experts (SME's) that rated each task as to its the likely frequency of the occurrence of injury, and the likely severity of such an injury. The rating of each task considered three factors: Consequences, Exposure and Probability.

In addition to rating tasks for frequency and severity of injury, a Gap Analysis was done based on the Skill and Knowledge Assessment using a methodical method to process the specific gaps.

ACHIEVING WORKER BUY-IN

It was well understood that for this process to be effective, the PWM's required worker "buy-in." To achieve the buy-in, the workforce was included in every step of the process, including: initial informational meetings, interviews, job observations, and tabletop work groups. The workers also participated in the development of the PWMs. Finally, all PWMs were incorporated into the SMUD training program, ensuring that future Apprentices all receive standard training that is consistent with the PWMs. It is expected that making the PWMs part of training will continue to gain worker buy-in, and will change the work culture.

DEVELOPING AND INTEGRATING PWM'S

The PWM development process started with a list of the highest risk tasks for each position, as described earlier. A PWM Oversight Committee was established to oversee the process and to approve tasks from the assessment recommendations for PWM development. Individual sessions were held with several groups of 5-7 SMEs per group. Each group also had a recorder and a facilitator who worked with the SMEs. The groups worked in half-day increments, covering 1-to-2 tasks at a time. Work sessions were followed by group presentations and critique. Lunch was provided to make it fun. All participants demonstrated a positive attitude, which helped to ensure quality output and helped develop the all-important worker buy-in.

IMPLEMENTING THE PWM'S

The PWMs are made available to personnel in the field by having hard copies in all work vehicles. There is also access to electronic versions via the SMUD Intranet and via the Mobile Data Terminal (MDT - a mobile computer system) in the work vehicles. Finally, the PWMs are integrated into the SMUD culture by making them a part of the Apprentice training, ensuring that newly-trained personal learn the "preferred" and safest methods of performing each task.

The benefits that SMUD expects from the PWMs include:

- Reduced risk of workforce injury by documenting safe and consistent ways to work
- Capture of expertise of highly experienced, most respected SME's
- Provides guidance to Foremen in the field
- Integrated into all facets of field training for consistency with actual practice in the field
- Provides a methodology to capture technical expertise that is applicable elsewhere at SMUD, where many retirements are expected
- Field ownership is "built in" to the PWM development process through participation; this assures understanding and buy-in
- Improved system reliability by having a workforce that has work safety and consistency embedded into their culture

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Preparing for Operating Newly Installed Flue Gas Desulfurization Systems

BY PAUL HELGESON

When existing plants are retrofitted with flue gas desulfurization (FGD) systems, operations personnel must be in place to support startup, and those personnel must have the knowledge to safely, effectively, and efficiently operate, monitor, and control the FGD System. FCS supports installation of new FGD systems by developing an effective training system, which includes:

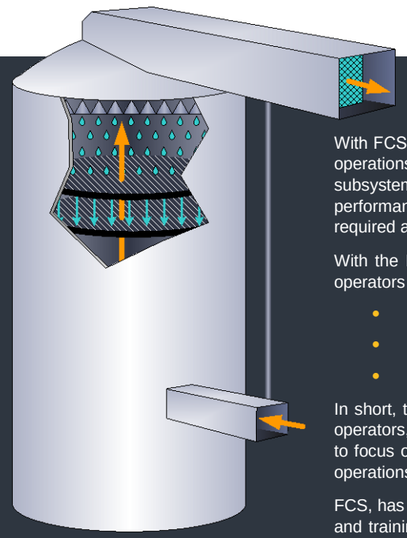
- Experienced Classroom Training for both Operations & Maintenance Personnel
- Standard System Operating Procedures
- Critical Alarm/Abnormal Operating Procedures.

On a recent project at a midwest facility, procedures and training were initially planned to be provided by the design engineer. After a detailed evaluation of the plans, the client determined that the mere listing of tasks supplied by the design engineer were inadequate. The client realized that their personnel needed operating procedures that would provide more detail and specific instructions.

As a result of these concerns, the facility owner contracted FCS to produce System Operating Procedures (SOP) Manuals and to present site-specific and job-specific training for operations personnel.

FCS worked with the client early in the construction phase to acquire the information and resources necessary to develop an effective FGD System Operating Procedures (SOP) Manual that was used in training and eventually in plant operations. The SOPs were liberally illustrated with vendor drawings, photos, and FCS simplified drawings to ensure effective comprehension of the materials. FCS maintained a close working relationship with the client during construction to ensure that engineering changes to the system were addressed, and to allow FCS personnel to make site visits that allowed FCS to take photos to support the written information in the SOP Manual.

The training plan was developed considering both the capabilities and needs of the target trainee audience, and in close coordination with the client, and focused on the needs of each job identified for the FGD System. The training was supplemented with FGD facility tours of the new facilities under construction, and practical exercises. The training for the operators also included use of the client's DCS-based simulator.



With FCS' training system, the client's plant personnel were able to startup the FGD System for the first time without any operations errors. Additionally, they were very effective during the process of testing and adjustment of FGD System subsystems and components. This effectiveness included not only above-average operational understanding and performance, but also sufficient system knowledge to assist vendor personnel in the identification of problems that required adjustment of system conditions and parameters.

With the FGD System fully operational, the client now has a working set of operating procedures that are used by all operators on all shifts. This benefits the client in three significant ways.

- Safe, effective, and efficient operation of the FGD System
- Cost-effectively operation.
- Quick response and resolution to anomalies and unexpected operating transients.

In short, the availability and use of the SOP Manual, together with the nature and quality of the training provided to the operators, facilitated a smooth startup of the new FGD System that was free of operational errors, which allowed the staff to focus on design issues. The SOP Manual and associated training was appreciated by management, supervision, and operations and maintenance department personnel

FCS, has the knowledgeable, experienced, and talented professionals to evaluate your project and develop the operations and training materials required. We can deliver operator training needed to ensure that your FGD System startup and operation proceeds as safely, effectively, and efficiently as possible.

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