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Saudi Aramco Rabigh Refinery Control System Replacement (Hot Cutover)

Location: Rabigh, Kingdom of Saudi Arabia
Order Date: October 2003
Completion Date: May 2006
Industry: Refining



أرامكو السعودية
Saudi Aramco

About Saudi Aramco and the Rabigh Refinery

Saudi Aramco's operations span the globe and the energy industry. The world leader in crude oil production, Saudi Aramco also owns and operates an extensive network of refining and distribution facilities, and is responsible for gas processing and transportation installations that fuel Saudi Arabia's industrial sector. An array of international subsidiaries and joint ventures deliver crude oil and refined products to customers worldwide.

World-class refineries located across the country, from the Arabian Gulf to the Red Sea, reliably supply more than a million barrels of products each day to meet the needs of the Saudi Arabian and international markets. The Rabigh Refinery, located 160 kilometers north of Jeddah on the Red Sea coast, is one such refinery operated by Saudi Aramco.

The Rabigh refinery has a 400,000 BPD crude topping facility. Crude is delivered by tankers through the Saudi Aramco Rabigh port. The main products are fuel oil, naphtha, and jet fuel. LPG and oil are used as fuel for the refinery while recovered sulphur is bagged and shipped.

Background of This Project

As part of an upgrade project to reap the benefits of the latest technology, Saudi Aramco Rabigh Refinery awarded Yokogawa this project to replace the existing control system with a state-of-the-art distributed control system (DCS). The entire complex was previously controlled by single loop controllers and a Foxboro IA system.

The decision to introduce the new system was motivated by the need to reduce the high maintenance costs of the single loop controllers and to obtain improved functionality. The selection criteria emphasized system reliability and the ability to replace the system while the plant was operational (hot cutover).



With SNC Lavalin Inc. as the design contractor and Carlo Gavazzi as the construction contractor, Yokogawa delivered the control system with the engineering assistance of its Middle East office in Bahrain.

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In addition to the DCS, the project scope included the implementation of an oil blending system (OBS), multi-variable control (MVC), and heater pass balance control by Yokogawa Middle East. The OBS implementation is in progress while the MVC implementation was successfully completed in March 2007. Twenty existing and ten newly installed subsystem interfaces increased the complexity of the hot cutover and function test.

Team Effort Always Pays

According to the Saudi Aramco Project Management Team Lead Engineer, "One of the key factors leading to the smooth hot cutover was the team effort. Every activity was meticulously planned to ensure a safe change over. This was possible because everyone adhered to the procedures stipulated before the hot cutover was started by all the groups involved."

The major challenge was the integration of the subsystem interfaces. "We never felt the complexity of the integration work", said the Control System Engineer, "and this was possible since the integrated site acceptance test (ISAT) was so comprehensive."

Hot Cutover Challenges

The major challenges were winning the operators' acceptance of the new system, scheduling and coordinating the ISAT with all the sub-vendors, and quickly troubleshooting the problems encountered during the hot cutover.

Pre and post hot cutover planning was done in several meetings between Saudi Aramco, SNC Lavalin, Carlo Gavazzi, and Yokogawa Middle East. Various check sheets and procedures were in place for the tuning of loops and the final handover.

What This Project Achieved

- 1) A smooth and safe switchover to the new system
- 2) An easy-to-use, easy-to-engineer system, plus various post-installation enhancements
- 3) Tuned controllers for smooth plant operation and better traceability of process upsets
- 4) Various other improvements thanks to advanced process control and MVC implementation

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What's Next?

Having successfully completed the control system replacement project, Yokogawa was awarded the Saudi Aramco – Sumitomo Joint Venture, PETRORabigh project to engineer and install the CS 3000 DCS for a huge petrochemical complex that is being built next to the refinery.

<System Details>

Control system	: CENTUM CS 3000 R3
Number of I/O points	: 5000
System configuration	
• No. of domains	: 06
• Engineering stations (ENG)	: 02
• Human Interface Stations (HIS)	: 14
• Field Control Stations (FCS)	: 12
• EXAOPC	: 01
• Plant Resource Manager (PRM)	: 01