Moore's QUADLOG® Safety PLC Provides Didcot Power Plant Safe and Cost-Effective Control of Multi-fuel Burners

National Power's Didcot power plant conversion to gas and coal-fired burners included the implementation of QUADLOG for safe and cost-effective gas firing control and burner management systems.

Didcot power plant in Oxfordshire, England, was originally designed as a coal-fired power plant producing 2000 MW with four 500 MW sets. The design included a DEC PDP11 computer system interfaced to sensors and actuators via PLCs and data acquisition units. In 1996, the plant was upgraded by National Power to burn gas in addition to coal. New technology, multiple fuel, and low NOx burners were installed for this upgrade, and a small scale conversion of the control room was carried out with implementation of National Power's Advanced Process Management System (APMS).

For the gas firing control system (GFCS) and burner management system (BMS), the conversion team at Didcot wanted a control system that combined first class safety performance with exceptional availability to minimize false plant trips. It was also important to select a system that could be programmed and reprogrammed quickly and easily, since those features were identified as a very significant proportion of the control/safety system project cost. Moore was chosen to supply the hardware and carry out all system integration and installation based on the safety control architecture of QUADLOG.

The high availability and safety control architecture of QUADLOG allowed National Power to achieve a lower installation and maintenance cost. The architecture's availability results from the design of QUADLOG as an extension to Moore's process control system, APACS+™, rather than a safety system with some control capabilities. This design ensures efficient programming and low cost implementation.

Didcot power plant burns a mixture of gas and coal, the ratio selected daily based on price and availability of fuel.

At the core of this system is Moore's IEC 61131-3 compliant programming language, *4-mation*™, which lets users work with a mixture of function blocks, sequential function charts, ladder logic, or structured text according to their skill and experience and the parameters of their application. Mike Mills, National Power's computer systems team leader at Didcot commented, "We are particularly pleased with the *4-mation* configuration language. It has proved convenient to learn and yet offers great power and flexibility. For minor system changes, we now feel able to implement them ourselves, returning to Moore only for large scale projects that are too big for our in-house resources."

QUADLOG also allows National Power to meet safety requirements with its TÜV-compliant programmable electronic systems. QUADLOG achieves a high safety rating by employing a dedicated diagnostic channel that detects and overrides circuits failed to energized and provides fail-safe outputs. In its very high availabil-

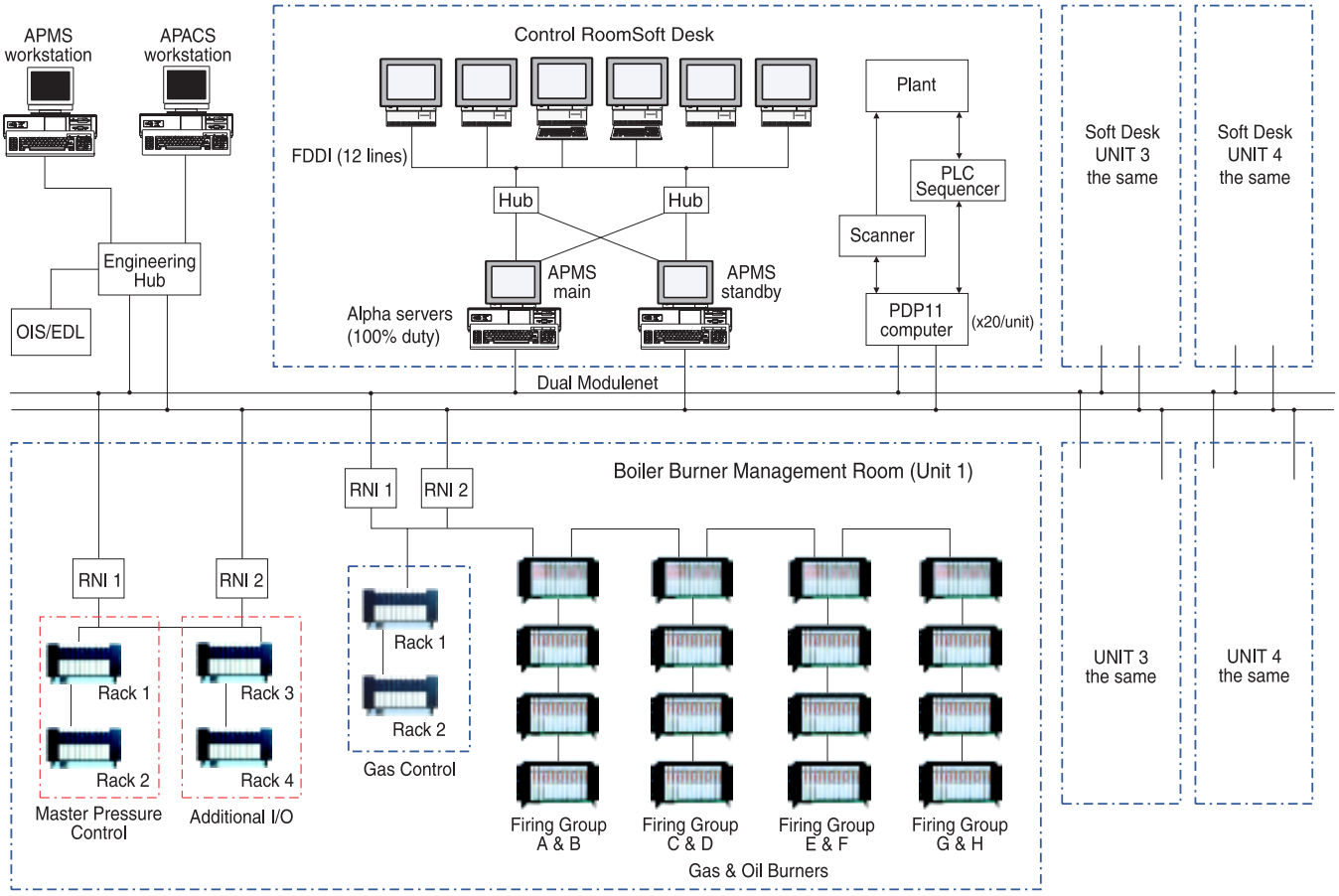
ity quad logic configuration, parallel combinations of fail-safe outputs are each controlled by duplicated processors. The duplicate system may even be located in a separate housing to avoid errors from common causes such as physical damage to a cabinet.

Because the new burners at Didcot were designed to permit not only gas or coal (PF-pulverized fuel) firing, but a mix of the two, the burner management systems had to provide start up and shut down sequences for more than one fuel and a system of sub-dividing the burners on each boiler into logical groups for fuel selection. QUADLOG allows operators to adjust the fuel use to any desired mix as dictated by cost and availability of coal or gas.

On each burner face, 16 sets of 3 burners each are controlled in 8 firing groups each of 6 burners with 8 coal mills per boiler for coal firing. Each group is assigned to a QUADLOG control node. Each burner has 6 gas spuds surrounding the annular PF burner. The burners are started and stopped by signals from the GFCS. The 4500 Input/Output (I/O) circuits for each system are housed in prefabricated local control equipment rooms located close to the burner face for each unit. The GFCS controls the burner firing pattern from signals received from the APMS manual input operator screen. The GFCS also controls the main gas burner header pressure based on burner demand. Connection to the APMS system is through a dual fiber optic Ethernet link. The gas control system has a dedicated engineering work station in each local equipment control room for system maintenance and a duplicate of these in the main control room.

The APMS implementation at Didcot required a number of signals that were only available on the traditional unit operator back panel to be securely interfaced to the new operator human machine interface (HMI). The signal types and level were varied and required the use of interposing relays for discrete signals and signal conditioning units for the analog signals. To accommodate these needs, Moore used APACS+ hardware fitted with dual redundant controllers, power supplies, and network interface cards that were connected to the HMI through a dual Ethernet. The APACS+ systems were also capable of supporting the dual redundancy essential to the critical power plant applications. Combined with the APACS+ ability to hot swap individual modules and even processors, APACS+ offered National Power unrivalled availability.

Despite its large scale, involving over 15,000 I/O channels with multiple control nodes, remarkably few difficulties were experienced during the QUADLOG installation and start-up. “We were well supported by Moore throughout the project and, looking back over the two years since commissioning the first phase, there has not been a single instance of control loss,” said Mr. Mills.



Didcot power plant’s control system architecture with local and remote control of burner management system.