Handling of fuel and core components

Blayais, France

During reactor core loading, the plant uses a simple mechanical device which ensures the safe positioning of fuel assemblies in the core. This device aims to make fuel assembly reloading operations easier. It is controlled by the fuel loading machine, which positions it on the core support plate as same as fuel assembly. It guides the fuel assembly during its landing on the plate and more specifically, adjusts the orientation of the bottom nozzle so as to facilitate positioning on the core support plate’s alignment pins. This device offers the following benefits:

- Increased safety during fuel handling
- Reduced number of modifications to reloading sequences: the tool bypasses the need for 180 degree turns or for temporary storage due to deformation of the handled fuel assembly or adjacent assemblies in the core.
  - The loading method used limits friction damage between assemblies and any consequences in terms of the integrity of the first barrier.
  - Each loading sequence is therefore unique and valid, whether the fuel assembly’s specific deformations.
- Increased availability
  - The length of time required for loading each assembly becomes disassociated from the assembly’s geometrical characteristics.

Doel, Belgium

The fuel department has compiled a pocket size book that is easy to use and provides a short and easy to read description of tools, equipment and installations used for handling of fuel and core components. The pocket-size book is called the “Fuel Bible”.

The book is easy to carry and is used by the fuel handling operators and maintenance teams. It is also used as an aid in training. The short descriptions of tools and equipment are complemented with graphics and pictures to support the text. The book is not a substitute for procedures, but provides comprehensive descriptions to help the operators, and gives answers to frequently asked questions.
Remote video surveillance of fuel handling, enhancing technical support.

A remote surveillance system for fuel handling and physical inventory activities has been put in place to enhance technical support and improved use of the video system. The fuel condition recording equipment includes 2 cameras, a video rack and a connected external hard drive providing 8000 hours of continuous recording. The equipment is connected to the plant IT network for real or differed time recording on remote computers.

The system put in place is not expensive and allows for increased and faster use of technical support from reactor engineering, both from site level or corporate level. It allows real time tracking of recordings from a remote office with a view to early detection and analysis of defects, and early transmission of the pictures to corporate entities for further expert appraisal and confirmation of plant analysis. In addition, the system allows immediate strong improvement of the sharpness and the level of details of the fuel assembly pictures. This facilitates the diagnostic to be performed by reactor engineering.

The system can be used for shipment of used fuel, yearly physical inventory, verification of assemblies before refueling (search for foreign materials underneath the debris filter on the bottom end, search for impacts or foreign material on the fuel assemblies) and classification of damaged fuel assemblies (visual examination of the grids, rods and ends, classification of foreign material type).

This device is used each time fuel assemblies are subjected to a camera inspection by plant staff. For example, in May 2010, thanks to this device during the examination of the lower parts of the fuel assemblies inside the spent fuel pool, the plant identified the presence of small-sized foreign materials on 2 fuel assemblies.

Since small defects are hard to interpret on pictures, the fuel building operators can directly transfer the picture to work planning for further analysis.

Direct communication between fuel work planning and fuel building technicians has made it possible to optimize the camera shots and to detect small-size foreign materials.
Equipping fuel casks with shock indicators.
Fuel casks are equipped with non-restorable shock indicators with the actuation threshold of 5g. These shock indicators enhance the following safety related aspects:

- To improve quality of fuel casks treatment.
- To increase personnel responsibility while handling them.
- To detect weak points of transport, loading and unloading operations.
- To trace conditions of fuel casks transportation along the whole way from the manufacturer to the user.

A shock indicator comprises of two sensitive elements in the form of two steel balls fixed by two springs in their sockets. The axes led through the centers of the ball couples are perpendicular to each other. If the indicator's load exceeds its actuation threshold (5g), the sensitive elements fall out of their sockets. The elements fallen out are perpendicular to the shock direction (in case of an axial shock, both elements fall out). It allows to register a shock exceeding the actuation threshold in three directions (in vertical, axial and perpendicular). The sensitive elements are placed in the transparent casing that allows visual identification of the indicator state (position of balls).

After indicators have been actuated, a value and direction of loads having affected the fuel casks and elements are analyzed.