Spanish utility Iberdrola has developed an in-house core management methodology – the Giralda methodology – which has been approved by the Spanish Nuclear Regulatory Authority (CSN) for reload design and licensing of Cofrentes BWR. As a result, Iberdrola has acquired the capability of promoting competition between fuel vendors, therefore getting improved fuel designs and lower fuel costs, which are the key to remaining competitive in an increasingly deregulated electricity market.

Furthermore, the connection between licensing activities and operation experiences is generating synergies with benefits in plant knowledge and safety.

Fuel diversification
Cofrentes is a BWR with a rated power of 2 894 MWt, which is currently running its cycle 13 at 104.2% power. Before reload 11 (cycle 12), two fuel vendors participated for the first time in a bid evaluation process for the next three reloads. Iberdrola performed neutronics analyses with the Casmo-Simulate codes to evaluate the proposed bundles. The technical results along with economics and other considerations led to the inclusion of fuel from the two suppliers in the same reload.

The evolution in bundle geometrical design together with the vendors’ diversification program has resulted in mixed cores with bundles from the same supplier up to cycle 11, and from different suppliers thereafter.

Experiences
Since Iberdrola got full responsibility in licensing and design, its goals and tasks have broadened and the fuel team has striven for granting accurate core modeling and calculations. In this way:

- Quality procedures and guidelines are followed, adhering to the documents of the Giralda methodology, from general reports such as the reference safety report to specific procedures for calculations. These quality practices are essential to avoid errors and contribute to provide a high level of confidence in results.

- Information exchanged with vendors and documentation supporting calculations are reviewed and filed according to quality procedures. As a result, not only are documents ready for auditing but also results can be traced backwards to the original data and calculations.

- Thorough benchmarking processes have been undertaken before accommodation of new code versions. The results from old and new versions have been compared to evaluate the improvements and impacts in design.

- Core tracking is continuously compared to predictions. Actual values are incorporated into statistics so that the reference eigenvalue, design margins and others are updated each cycle.

The results of this methodology are satisfactory. Predicted and actual values have been very close for cold criticalities in cycles 12 and 13, and for core operation. The fuel team is now acquiring a deep understanding of bundle and core behavior, stability, or neutronics and thermohydraulics coupling.

Auxiliary tools based on the design codes have been developed, such as Evacom, a program for multicycle analyses. These are Piscis, which is a graphical interface for results processing, and Capricore – a core monitoring system that runs in parallel with the plant official monitoring system.

The future
The fuel team is facing new challenges:

- Plant power will be increased up to 110% of its rated value at the beginning of next cycle, in the first quarter of 2002.

- Three vendors are involved in the new fuel bid that will determine the fuel loading for years 2002–2006.

Conclusions
The application of the Giralda methodology to the design and licensing of Cofrentes fuel loadings is giving satisfactory results. First, quality culture is present throughout the design process and there is a strong commitment with accuracy in calculations and continuous improvement. Second, the core predictions are in good agreement with the observed performance. The experience acquired is invaluable to understand the core behavior and to undertake new tasks. Giralda is the main axis of Iberdrola’s nuclear fuel management and represents a continuous challenge for its fuel design team.

Reference