**KNF-
SW-03**

3D Operation Support System(OASIS)

REACTOR CORE TECHNOLOGY DEPT.   YoonDeuk Nam
T. 042-868-1076   **E.** ydnam@knfc.co.kr

OASIS is an operational support system that is based on 3D code system. It can monitor the core status in real-time, the monitoring data can analyze and predict the core condition accurately. The code can confidently perform core follow calculation using technology such as 3D power correction factor. Finally, simple input and user interfaces enable user to confidently analyze the results.

Description

● **Background**

- In order to achieve efficient nuclear power operation, an operational support system is mandatory. However, all of OPR1000 and APR1400 type plants use COLSS for conservative monitoring and ACEONED for limited reactor analysis. As for COLSS, power distribution is calculated using the in-core detector signals and pre-designed Fxy and it ultimately yields conservative monitoring. As for ACEONED, 3D power distribution is corrected using the ACEONED's 1D calculation data. Consequently, the confidence level of the analysis can dramatically drop if the core condition is too different from the designed condition. Therefore, it is essential to have a code system that can perform accurate core monitoring(which is based on the 3D core design code that uses in-core detector signal) and core prediction(based on the accurate monitored data along with 3D core analysis).

● **Purpose and Necessity**

- Accurate Monitoring System for Highly Confident Core Prediction

  - Using 3D design code, 3D power distribution is calculated by synthesizing monitoring data with output conversion constant(W') and 3D-PCF
  - Using real-time 3D power distribution, DNBR, LHR POL Margin, Tile and ASI can be calculated
- Highly Confident Core Prediction System based on Accurate Monitoring System
  - 3D power correction is applied to the monitoring data for highly confident core prediction
  - GUI system that has simple input and user interface for easy analysis of the results
- OASIS Installation and Users' Needs
  - Real-time, confident response to long-term, low power and load follow conditions
  - Real-time, confident response to highly abnormal conditions such as CIPS or RPCS

● **Technological Configuration**

• **System Environment Configuration**

  - Plant data registration : input design requirements to set acceptance criteria for core prediction results
  - Snap shot file management and analysis GUI : initialization, sensitivity data collection and management of AsCORE
  - Plant Data DB Management: management of in-core detector signal data, power, detector position, and etc. for core monitoring calculation

• **Core Monitoring System**

  - Accurate 3D power distribution using periodic 3D-PCF : Using a 3D design code, 3D power distribution is calculated by synthesizing monitoring data with W' and 3D-PCF and ultimately produce accurate monitoring of DNBR, LHR, Tilt and ASI values
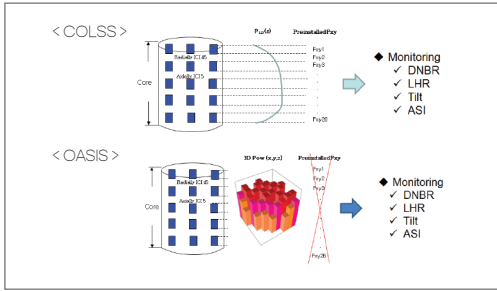
- **Core Prediction System**
  - Shut Down Margin(SDM) Calculation: For operation Mode 1 and 2, calculation of satisfaction of the shutdown margin required by the operational procedure For operation Mode 3 or higher, calculation of boron concentration that satisfies the required shutdown margin
  - Expected Critical Position(ECP) : For mode 2(HZP), calculation of expected critical boron concentration or control rod position at restart after shutdown
  - Axial Shape Index(ASI) : Calculation to check if ASI comes between the specified operation range during power increase or decrease operation
  - Cycle Prediction : Simulation of core after EOC with fixed ASI or control rod position
  - Load Swing : Simulation of load swing during several operational scenarios
  - General 3D Calculation: Calculation of core reactivity parameters and general core monitoring

- **Enhanced accuracy using shape matching factor**
  - Correction with core follow history and prediction/measurement shape matching factor
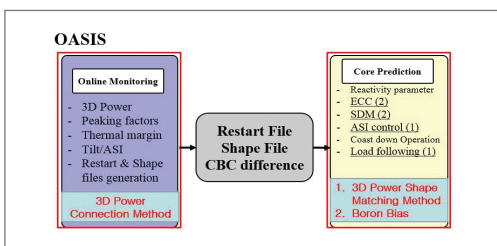
- **Establishment of easy–to-use GUI system**

Distinctiveness

● Characteristics
- Capability of precise monitoring and analysis with 3D-PCF and 3D Shape Matching method
- Offers various calculation options with plant operation procedure
- GUI environment with simple input and user interface for easy result analysis
- Integration with KNF code system

● Benefits
- Easily establish the operation strategy by immediate core prediction calculation for the urgent occurrence of the emergent core trip or power reduction
- Resolve problems in validity of the nuclear design report and the operation support constants in consequence of changing the core depletion condition like long-term low power operation
- Secure operation margin in case core monitoring system is to replace COLSS in the future

Experience

- Monitoring and prediction calculation of two domestic OPR1000 type plants
- Validation calculation on ECP and ASI control
- Application consultation of domestic power plant
- Application consultation of UAE BNPP

Deliverables

- OASIS execution file
- OASIS user manual and Education
- OASIS system and model update

**Technology
Readiness
Level (TRL)**

Actual system completed through demon.

**Business
Model**

Technology Transfer

Licensing

Joint Search

Service Execution

Others