KNF-
SW-04

Non-LOCA Safety Analysis Methodology based on 3-Dimensional Core Simulation (CHASER)

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Non-LOCA safety analysis methodology based on 3-dimensional core simulation has been developed to alleviate the excessive conservatism in the current methodology using point-kinetics model and to prepare for the application to stricter regulatory requirements.

Description

● Background

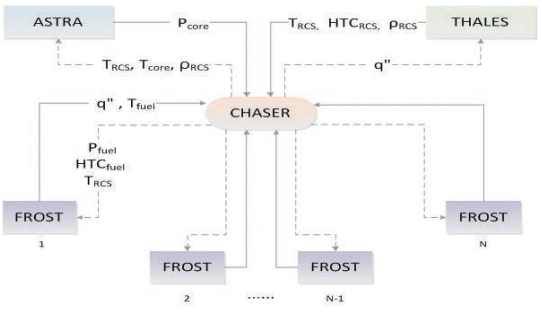
- Current Non-LOCA safety analysis methodology uses point kinetics model or 1-dimensional core model therefore, additional conservative assumptions should be applied and it results in excessively conservative consequence.
- The regulatory requirements are becoming more strict after the Fukushima disaster. The current methodology is not good enough to meet all the regulatory requirements.

● Purpose

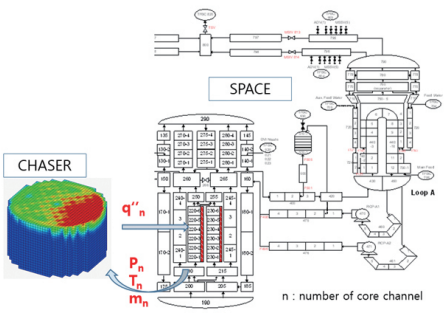
- Developing Non-LOCA safety analysis methodology based on 3-dimensional core simulation to prepare for the stricter regulatory requirements and to narrow the technology gap against oversea organizations.

● Non-LOCA safety analysis methodology based on 3-dimensional core simulation

- **Code system**
  - ASTRA, THALES and FROST codes which were developed by KNF have been



< CHASER code system >



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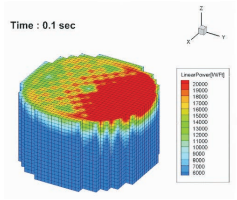
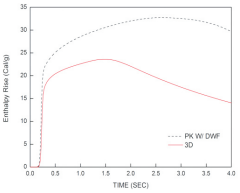
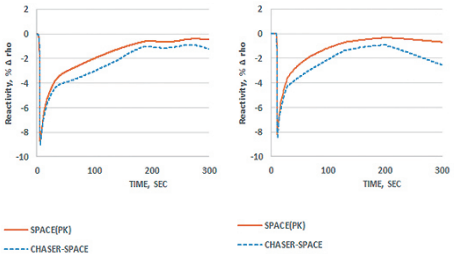




< Analysis results or rod ejection >



< Analysis results of main steam-line break >

coupled with CHASER code, which is for 3-dimensional core analysis.
- To develop the transient analysis code system based on 3-dimensional core simulation, SPACE, nuclear plant system T/H analysis code, was additionally linked to CHASER code system.
- The validation of code system has been performed by benchmarking international standard problems such as rod ejection, rod withdrawal and main steam-line failure.

- **Methodology**
  - 3-dimensional core simulation alleviates the excessive conservatism of current methodology(point-kinetic or 1-dimensional model).
  - The non-conservatism of best-estimate methodology has been covered through the deterministic approach using conservative kinetic parameters(moderator temperature coefficient, Doppler temperature coefficient, shutdown reactivity, delayed neutron fraction, prompt neutron life-time).

- **Analysis results**
  - The analysis results of rod ejection and main steam-line break accident using 3-dimensional methodology show that the excessive conservatism of the current analysis results is alleviated.

- **Conclusion**
  - The transient safety analysis methodology based on 3-dimensional core simulation can enhance the nuclear power plant's safety margin and contribute to resolving safety-regarding issues.

Distinctiveness

● Characteristic

- The 3-dimensional methodology uses ASTRA, THALES, FROST developed by KNF and SPACE developed by other domestic company which means it lowers the dependency on the analysis codes developed by overseas companies.

● Benefits

- It can help to increase safety margin and solve the safety issues of nuclear power plants.
- It can be used to solve safety analysis issues such as high-burnup fuel damage.

Experience

- The licensing process of the rod ejection methodology based on 3-dimensional core simulation is completed.

Deliverables

- Safety analysis results using 3-dimensional methodology

Technology Readiness Level (TRL)

Prototype validation in operational environment

Business Model

Technology Transfer
Licensing
Joint Search
Service Execution
Others