

- ✓ Improvement of thermal-hydraulic safety analysis
- ✓ Development of reliable safety system
- ✓ Optimization of accident management

Prevention and mitigation of nuclear disaster and severe accidents, and safety evaluation

## 1. Research Outline and Objectives

Thermal-hydraulic safety analysis methods are improved for plant transients, accidents, and severe accidents, and reliable safety system and optimum accident management (AM) method are developed for prevention and mitigation of nuclear disaster and for safety evaluation,

## 2. Research Results

### Thermal-hydraulic system behavior and operator action (AM) during accidents]Fig.1

The large-scale test facility and safety analysis codes are used to study the thermal-hydraulic phenomena and the efficiency of operator action during accidents. For the accident at Fukushima Daiichi power plant Unit 2, the core damage was found to be avoided if the sea water would have been injected four hours earlier.

### Reactor-specific two-phase flow phenomena and numerical simulation method]Fig.2

Reactor-specific two-phase flow phenomena and prediction methods are studied ranging from fundamental flows to complicated accident flows for evaluation of reliable safety systems. For emergency coolant injection, cold water was shown by numerical simulation to spread from the primary piping along the pressure vessel wall.

### Measurement technique for material properties related to severe accident evaluation]Fig.3

Measurement technique for properties of high temperature molten material is studied for severe accident evaluation. For surface tension measurement using levitated droplets, the relation between droplet shape and frequency shift was made clear and the best control parameters were found.

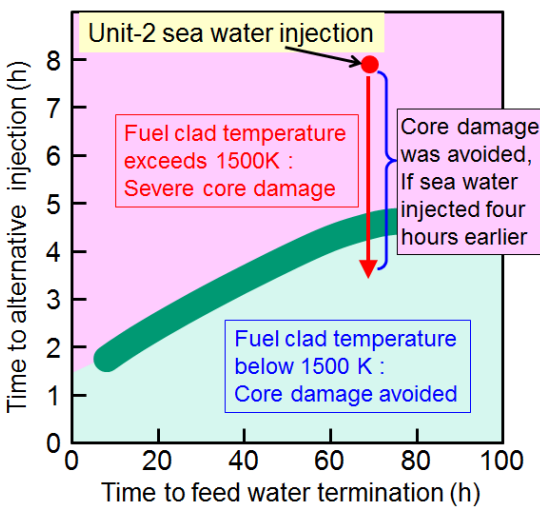


Fig.1 Efficiency of alternative injection

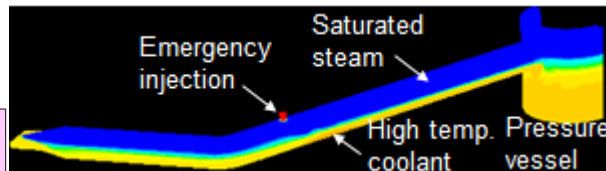


Fig.2 Thermal shock by emergency injection

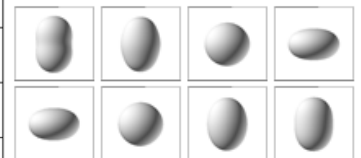
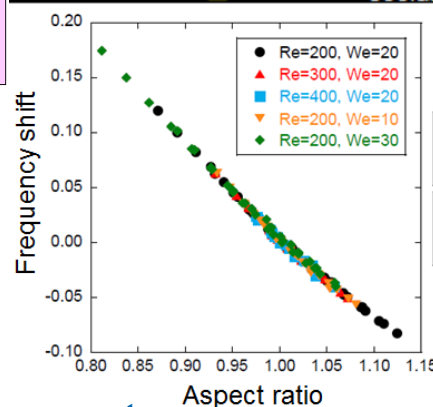


Fig.3 Development of measurement method using levitated droplet

## 3. Specific research points and prospect

Reactor thermal hydraulics from fundamental to applied and from micro to macroscopic phenomena.

Reliable safety system and optimum accident management are developed by studying thermal-hydraulic system and analysis methods

Progress of studies on nuclear disaster, severe accidents, and safety evaluation

## Message for students

Research and education are performed mainly by using computer simulations as well as using experimental facilities and data at Japan Atomic Energy Agency and other organizations.