-International Seminar on Nuclear Safety 2006-

Outline of the Plant Safety Course

Foreword

Although the official organizer of this seminar is RADA (Radiation Application Development Association) being sponsored by the MEXT, the "Plant Safety Course" among the total four courses is actually organized by JAEA.
JAEA is in charge of this course as a part of the activities concerning the Centralization of Energy R&D in Fukui prefecture.

1. Object

The purpose of this course is to promote and disseminate the reactor plant safety among Asian countries by offering lectures and exercises on the subject of safety technology of LWR and FBR practiced in Japan.

In order to better understand the nuclear energy status of Asian countries, each participant is expected to present and participate in the discussion on the present situation or the future program concerning the development of nuclear energy in his/her country.

2. Target

An engineer or a researcher engaged in operation, maintenance or development of nuclear plant.

3. Time

January 22 (Mon)-February 9 (Fri), 2007

4. Place

International Nuclear Information Training Center of JAEA(Japan Atomic Energy Agency), located in Tsuruga, Japan

5. Contents

(1) Lecture

Lecture-1: Configuration and Features of Reactor Plant

A basic knowledge concerning the reactor plant safety technology will be introduced by providing the main systems of LWR and FBR consisting of reactor core, fuel, heat

transfer system, etc, and their different features for comparison.

Lecture-2: Safety Concept of Reactor Plant

The concept of reactor plant safety applicable to both LWR and FBR will be introduced by providing reactor plant safety principle such as defense in depth, fail-safe, fool-proof, redundancy, system separation as well as criticality management and containment of radioactive materials, and also through the case study of Monju plant accidents.

Lecture-3: Safety Design Principle of Reactor Plant

By taking the Monju safety design policy, which is based on the safety design review guide for LWR, as an example, the safety design concept of reactor plant system will be introduced by providing the design considerations for natural and unnatural phenomena, sodium handling, loss of power, reactor safety protection system and decay heat removal system; containment of radioactive materials; engineering safety facilities; etc.

Lecture-4: Structural Design and Maintenance Criteria of Reactor Components

A fundamental knowledge on the types of loading, major failure modes, design considerations affecting the structure, etc. and the outline of Monju high temperature structural design will be introduced. Also introduced will be the maintenance criterion and inspection technique.

Lecture-5: Seismic Design of Reactor Plant

The fundamental knowledge on earthquake such as its mechanism, fault investigation, etc. will be introduced. Also introduced will be the seismic design procedure for reactor plant through setting standard earthquake motion and seismic wave, making analysis flow, drawing structural analysis model and floor response curve, executing seismic analysis for piping and components, evaluating resulting stresses, etc.

Lecture-6: Case Study of Reactor Plant Accidents and Human Factors

Examples of reactor plant accidents as well as research on human factors and the measures against it will be introduced in order to enhance the knowledge on reactor plant safety.

Lecture-7: Safety Measures for Reactor Plant

The defense in depth, a fundamental philosophy of reactor safety design, provides measures to prevent (1) disruption, (2) accidents from spreading and (3) emission of radioactive materials. To better understand this concept, the safety measures taken for the sodium leak accident at Monju will be introduced as a lesson learned.

Lecture-8: Safety Assessment of Reactor Plant

The concept of DBE (Design Basis Accident) and BDBE (Beyond Design Basis Accident) and the results of their analytical evaluation, both of which are required for the application of reactor plant installation license, will be introduced using the case of Monju as an example.

Lecture-9: Probabilistic Safety Assessment of Reactor Plant

The fundamental knowledge on PSA (Probabilistic Safety Assessment) and analytical evaluation technique will be introduced using the case of Monju as an example.

Lecture-10: Development of New Concept Plant Technology

As an example of innovative FBR plant safety technology, SASS (Self Actuated Shutdown System) will be introduced, R&D of which is under way at JOYO as a joint research program with JAEA and JAPC.

(2). Exercise

Exercise-1: Operation of Small Training Reactor

Participating in a critical approach operation and a reactivity measurement experiment using a small training reactor, participants will be provided with knowledge concerning the central part of the reactor.

Exercise-2: Property of Reactor Coolant (Sodium)

Participants will have an opportunity to learn the basic technique of handling sodium as well as the problem of flow-induced vibration which caused sodium leak accident at Monju.

Exercise-3: Non-Destructive Testing (NDT) Technique

Three representative NDT technique applied to the safety examination of reactor plant will be introduced; namely PT (Penetrant Testing), RT (Radiographic Testing) and UT (Ultrasonic Testing).

Exercise-4: ISI (In-Service Inspection) Technique for Monju

Two kinds of ISI technique for Monju will be introduced; one for the steam generator tubes and another for the reactor vessel and its periphery.

(3). Sight Tour

- Monju

The Japan's first prototype FBR, liquid sodium cooled type, developed by JAEA, located in Tsuruga, Fukui prefecture. 280 MWe (714MWth),
MOX fuel, 3 loops (760t sodium). Now under modification, re-criticality to be in early 2008.

- Mihama Power Station

PWR owned by KEPCO or Kansai Electric Power Co., Inc., located in Mihama town, Fukui prefecture, 3 units (No.1: 340MWe, initial criticality in 1970; No.2: 500MWe, initial criticality in 1972; No.3: 826MWe, initial criticality in 1976). ECCS-actuated accident occurred at No.2 unit on Feb. 1991 caused by SG tube failure.

- Nuclear Training Center

The exclusive training facility for PWR operators, located in Tsuruga, operated by NTC Co., Ltd., 3 training simulators, opened in April 1974.

- Ohi Power Station

PWR owned by KEPCO, located in Ohi town, Fukui prefecture, 4 units (No.1&2: 1,175MWe, initial criticality in 1979; No.3: 1,180MWe, initial criticality in 1991; No.4: 1,180MWe, initial criticality in 1993).

Nuclear Maintenance Technology Training Center