Instructor Training Course JFY2025

Course Prospectus

Nuclear/Radiological Emergency Preparedness

Nuclear Human Resource Development Center
JAPAN ATOMIC ENERGY AGENCY

1 COURSE INTRODUCTION

1.1 OBJECTIVES

The objective of this course is to educate future instructors in the field of nuclear and radiological emergency preparedness. Through a three-week program, participants are expected to acquire basic knowledge to be able to contribute as instructors in their countries. The course involves lectures on basic topics such as radiation protection for emergency workers, and also applied topics such as outline of Fukushima accident and its exposure situation. After going back to their home countries, **all participants are required to give a lecture in the future Follow-up Training Course (FTC).**

1.2 PARTICIPANTS

The course is open to those who work for nuclear-related organizations or academic institutions and are willing to contribute to human resource development in the field of nuclear and radiological emergency preparedness in their own countries. Please refer to the Application Guidance for further information.

1.3 NOTE

- Pre-course learning will be implemented in ITC 2025. Participants are required to use the Learning Management System provided by JAEA to watch lecture videos and submit a report in advance before the course begins. The pre-course learning topics are described in **2 COURSE SYLLABUS**.
- ITC on Nuclear/Radiological Emergency Preparedness will be held in parallel with ITC on Environmental Radioactivity Monitoring (ERM). Therefore, some of the lectures and other activities will be jointly conducted. The joint activities are described in **2 COURSE SYLLABUS** as Joint Class.
- This course will be conducted in person.

2 COURSE SYLLABUS (Tentative)

2.1 Lecture

(1) Basics of Radiation and Radiation Protection (Pre-course learning)
- Type of radiation (natural radiation and artificial radiation)
- Unit of radiation
- Feature of each radiation
- Interaction of radiation with matter
- Radiation exposure
- Basic radiation protection

(2) Biological Effects of Radiation on Human (Pre-course learning)
- Historical background
- DNA damage by radiation and repairing function of DNA
- Deterministic and stochastic effects
- Acute and late effects
- Somatic and genetic effects

(3) Introduction to Nuclear Reactor (Joint Class)
- History of various reactors
- Outline and utilization of research reactor
- Mechanisms and features of light water reactor (LWR): boiling water reactor (BWR) and pressurized water reactor (PWR)

(4) Simple Dose Calculation
- Calculation of decay of radioactivity based on half-life
- Calculation mixed radioactive caesium (Cs-134+Cs-137)
- Calculation of absorbed dose rate from point source

(5) Radiation Protection for Emergency Workers
- Basic radiation protection and safety management
- Basic matter of normal condition and accident condition
- Radiation protection for emergency workers
- Work safety around radioactive contamination area
- Protective clothes and respiratory protection equipment
- Emergency medical treatment for body contamination
- Calculation of effective dose rate considered shielding from point source

(6) Emergency Response and Environmental Monitoring at Nuclear Accident
- How to respond on environmental monitoring at nuclear accident
- Making of emergency sampling plan (Simplified calculation program)
- Calculation exercise of airborne radionuclide concentration and air dose rate

(7) Outline of Fukushima Daiichi Nuclear Power Station Accident and Exposure Situation (Joint Class)

- Outline of Fukushima Daiichi NPS accident
- The reason why Fukushima Daini and Onagawa NPS survived even attacked by mega tsunami
- Strengthening of safety measures after Fukushima Daiichi NPS accident based on new safety regulation standard
- Present ambient dose rate at Fukushima Daiichi NPS and Fukushima area
- Radiation exposure situation of radiation workers and residents in the accident
- Decommissioning of Fukushima Daiichi NPS

(8) Radioactivity Measurement by HP germanium Detector (Joint Class)

- Principle of HP germanium semiconductor detector
- Calibrations (energy calibration, efficiency calibration)
- Radioactivity analysis: how to assign a radionuclide and decide its radioactivity in samples

(9) Assessment of Internal Exposure (MONDAL-3)

- Feature of internal exposure dose
- Management of internal exposure dose
- Evaluation of internal exposure dose (calculation method)
- Sample of internal exposure dose by manual calculation
- Evaluation of internal exposure dose by simple calculation code (MONDAL-3)

(10) Evaluation of Uncertainty in Measurement (Joint Class)

- Concept of uncertainty
- Extraction of uncertainty factor
- Evaluation and expression of uncertainty

(11) Lecture Materials and Presentation Skills (Joint Class)

- Tips for material preparation
- Effective presentation

(12) Emergency Dose Assessment in Environment

- Atmospheric dispersion calculation formulas
- Meteorological observation
- Atmospheric dispersion calculation exercise by gaussian plume model

(13) Decontamination Technology

- Decontamination of hand (comparison of contaminated level in before and after)
- Decontamination of whole body (wearing protective gear)

(14) Emergency Response Roles, Responsibilities and Preparedness Program in Japan

- Japanese comprehensive legal framework
- Disaster countermeasures basic act in Japan
- Comprehensive three layers of disaster management system in Japan
- Nuclear emergency response acts and plans in Japan
- Structure of disaster management plans
- Relevant local governments develop local disaster management plans
- Emergency preparedness and response guideline in 2012

(15) ALPS Treated water (Joint Class)

- ALPS treated water
- Properties of Tritium
- Regulatory concentration limit

(16) Lectures by Guest lecturers (Joint Class)

- Guest lecturers from participating countries are sharing their experiences on FTC

2.2 Exercise

(1) Handling of Radiation Survey Meters (Joint Class)

- Usage of hand-held radiation survey meters (Ionizing chamber, Geiger-Müller counter, Scintillation counter)
- Radiation related to shielding materials
- Surface contamination survey

(2) Radiation Protective Gear and Physical Contamination Survey

- Safe handling of radiation protection and protective gear
- Practical exercise of wearing and desorption of protective gear
- Radiation survey of physical body
- Mask-man test

(3) Ambient Dose Rate Measurement (Joint Class)

- Ambient gamma dose rate measurement in outdoor environment

(4) Presentation Exercise (Joint Class)

- Delivering presentation related to environmental radiation monitoring by each participant
- Discussing presentation by participants with other participants

(5) Decontamination Technology

- Decontamination conducted in Fukushima area

- Decontamination of the Hand

(6) Discussion on Video of Nuclear Emergency Response Drill of Japan
- Watching at the video of nuclear emergency response drill of Japan
- Discussing about nuclear emergency response of Japan

(7) Table Top Exercise
- Explanation of IAEA TECDOC-1162 (Generic procedure for assessment and response during radiological emergency) as exercise guidance
  - ✓ Section-A: Response initiation
  - ✓ Section-B: Managing accident response
  - ✓ On-scene controller response
  - ✓ Managing radiological response
- Determination of accident case and making accident scenario by discussion
- Establishment of responding system (functional group) by discussion
- Determination of each person's mission and action plan including goal by discussion

(8) Integrated Drill for Nuclear/ Radiological Emergency Preparedness
- Implementation of integrated drill based on accident scenario made in table top exercise
- Holding of mass-media interview
- Evaluation by observer and discussion

(9) Final Presentation (Joint Class)
- Presentation on specified topic related to the course curriculum

2.3 Facility Visit

(1) The Great East Japan Earthquake and Nuclear Disaster Memorial Museum (Joint Class)

(2) Fukushima Daiichi Nuclear Power Station, Tokyo Electric Power Co. Holdings, Inc. (Joint Class)

(3) Nuclear Emergency Assistance and Training Center (NEAT), JAEA (Joint Class)

(4) Ibaraki Off-Site Center (Joint Class)

3 Assignment

(1) Reports on pre-course learning materials

(2) Pre-test and Post test

(3) Experimental Reports

(4) Final Presentation on a Specified Topic related to the Course Curriculum