



Expectation for USNRC-JAEA Cooperation in Nuclear Safety Research

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**Sector of Nuclear Safety Research and
Emergency Preparedness**

Japan Atomic Energy Agency (JAEA)

- Introduction of the Sector of Nuclear Safety Research and Emergency Preparedness in JAEA
- Prioritized pillars of research activities of the Sector
- Main facilities for nuclear safety research in JAEA
- Research areas for continuous and future cooperation between USNRC-JAEA

- The Sector of Nuclear Safety Research and Emergency Preparedness in JAEA has technically supported the Japanese regulatory body by implementing nuclear safety research.
- In the third medium- to long-term target period (2015-2021), the sector has strengthened its research on severe accidents in various nuclear facilities, reflecting the lessons learned from the TEPCO's Fukushima Daiichi Nuclear Power Station (1F) accident.
- The sector has set the following pillars of research activities prioritized in the fourth medium- to long-term target period (2022-):
 - the application of risk information,
 - the optimization of emergency preparedness and responses,
 - long-term operation of nuclear power plants (NPPs), and
 - environmental safety for further continuous safety improvement.

Long-term operation of NPP

See slide No.4

Application of risk information

See slide No.4

Optimization of emergency preparedness and responses

Research on emergency preparedness for application of plant information

Development of monitoring technique and preparation of the system

Training for specialists

Environmental safety

Preparation of evaluation methods for nuclide transfer due to degradation of artificial barriers and underground water

Contribution to

- Scientifically sound regulation and improvements of safety corresponding to risks
- Strengthening human and technical support system for nuclear accidents
- Realization of certain safety and scientifically sound inspection
- Judgement of long-term safety in disposal of wastes without review experience

Application of Risk Information

- ✓ Establishment of risk-informed regulation framework using PRA results
- ✓ Contribution to development of codes and standards in academic societies
- ✓ Support of plant owners to understand overall behavior of plants
- ✓ Support of local governments to establish scientifically sound emergency response program for decision-making

Long-term Operation of NPP

- ✓ Studies on structural integrity assessment of reactor pressure vessel (RPV) and piping system
- ✓ Improvement of applicability of probabilistic fracture mechanics (PFM) codes to RPVs and piping system

Fuel Safety

NSRR



Nuclear Safety Research Reactor

RFEF



Reactor Fuel Examination Facility

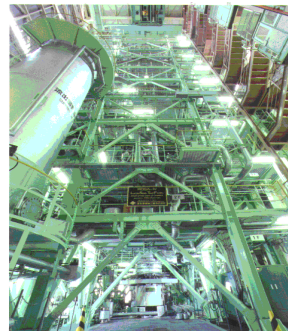
Thermal-hydraulic Safety

CIGMA



Containment Integral Measurement Apparatus

LSTF



Large Scale Test Facility

Fuel Cycle Safety

ACUA



Apparatus for Evaluating Clogging Effect of HEPA Filter on Confinement Capability Under Fire Accident

Nuclear Safeguards

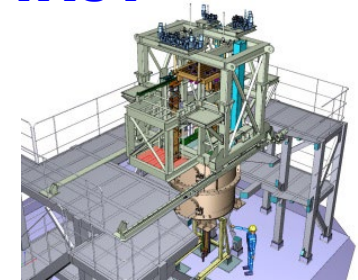
CLEAR



Clean Laboratory for Environmental Analysis and Research

Criticality Safety

STACY



Static Experiment Critical Facility (under modification)

Emergency Preparedness

NEAT



Nuclear Emergency Assistance & Training Center

Memorandum of Cooperation (MOC) between USNRC and JAEA

- ✓ The MOC which was signed in the field of nuclear safety research in 2017 is to be renewed shortly.

(Black item: expected for continuous cooperation)
(Blue item: expected for future cooperation)

Materials and Structural Integrity Research

- ✓ Benchmark studies on structural integrity assessment using PFM codes, such as the xLPR and PASCAL-SP2 for piping system, and **the FAVOR and PASCAL5 for RPV.**
- ✓ Safety research on irradiation embrittlement of RPV for long-term operational readiness.

Fuel Safety Research

- ✓ Cooperation under OECD/NEA FIDES-II/HERA project on behaviors of high-burnup LWR fuel under reactivity-initiated accident conditions.

(Black item: expected for continuous cooperation)
(Blue item: expected for future cooperation)

Severe Accident Research

- ✓ Research on source term evaluation in severe accidents using computational codes such as MELCOR.
- ✓ Relevant to 1F accident;
 - Refinement of analysis for 1F accident scenarios based on findings derived from 1F investigation, including analyses of samples collected in 1F, evaluation of data and observations, etc.,
 - Share of technical information through the OECD/NEA FACE* (Fukushima Daiichi Nuclear Power Station Accident Information Collection and Evaluation) project,
 - Improvement of severe accident analysis techniques by utilizing insights obtained from the 1F accident related activities,
 - Development of experimental and analytical techniques which could contribute to the decommissioning of 1F site, with regard to e.g. the criticality safety of debris handling.

* Participation of 23 organizations from 12 countries and EC including DOE, NRC and EPRI

(Blue item: expected for future cooperation)

Application of Risk Information

- ✓ Research on rational safety assurance using risk information especially on external events such as earthquake.
- ✓ Study on technology-inclusive optimum protection measures against external hazards

Others

- ✓ Collaborative research using facilities in JAEA (NSRR, STACY, etc.) and in national laboratories under USDOE.
- ✓ Dispatch of personnel
- ✓ Periodic meetings to review the cooperative activities under MOC.

A photograph of a modern, multi-story building with a mix of grey brickwork and large glass windows. The building is set against a blue sky with scattered white clouds. A white text box with a black border is superimposed over the upper part of the image, containing the text 'Thank you for your kind attention'. In the foreground, there is a paved area, a small landscaped area with dry grass, and a black lamppost. A white car is partially visible on the left side.

Thank you for your kind attention

Nuclear Safety Research Building in JAEA

(References)



Organization chart of JAEA

[Headquarters]

Decommissioning and Radioactive Waste Management Head Office, etc.

[Research and Development Sector]

Sector of Fukushima Research and Development

Sector of Nuclear Safety Research and Emergency Preparedness

This Sector is a TSO for the Nuclear Regulation Authority of Japan

Sector of Nuclear Science Research

Sector of Fast Reactor and Advanced Reactor Research and Development

Sector of Nuclear Fuel, Decommissioning and Waste Management Technology Development

Sector of Tsuruga Decommissioning Demonstration

Planning and Co-ordination Office

Office for Analysis of Regulatory and International Information

Office for Promotion of Risk-Informed Applications

Nuclear Safety Research Center (NSRC)

Research Planning and Co-ordination Office

Reactor Safety Research Division

Materials and Structural Integrity Research Division

Fuel Cycle Safety Research Division

Nuclear Emergency Assistance and Training Center (NEAT)

Planning and Co-ordination Office

Nuclear Emergency Preparedness Research and Development Division

Nuclear Emergency Human Resource Development Division



USNRC-JAEA Cooperation

Memorandum of Cooperation between the USNRC and the JAEA in the Field of Nuclear Safety Research (Dec. 26, 2017 – Dec. 25, 2022)

Areas of Cooperation

- ✓ Thermal-hydraulic safety of LWR (Light Water Reactor)
- ✓ LWR severe accident research
- ✓ LWR fuel safety
- ✓ Structural integrity assessment and materials degradation
- ✓ Offsite consequence assessment and its application for emergency planning
- ✓ Criticality safety/accident evaluation

Activities until now

- Benchmark studies on PFM (Probabilistic Fracture Mechanics)
- Participation to CSARP (Cooperative Severe Accident Program)
- Cooperation under OEDC/NEA framework (ARC-F, FIDES, etc.)

International Cooperation

Criticality safety

IRSN (France)

- Technical exchange, JAEA staff hosting at IRSN

OECD/NEA

- **ICSBEP** (Int. Criticality Safety Benchmark Evaluation Project)



Nuclear safeguards

IAEA

- **NWAL** (Network of Analytical Labs.)



Fuel safety

OECD/NEA

- **CIP** (Cabri International Project)
- **FIDES/HERA** (High burn-up Exp. in Reactivity Initiated Accident)



Thermal-hydraulic safety

OECD/NEA

- **THEMIS Project**
- EU NUGENIA**
- **IPRESCA**

Multilateral collaboration

OECD / NEA

- WGs of CSNI (WGFS, WGFCs, WGAMA, WGIAGE, WGRISK, WGEV)
- WPNCs of NSC
- CSNI SESAR/SFEAR2
- Joint Projects (CIP, Halden, SCIP, ICSBEP, FIDES, FACE etc.)

IAEA

- NWAL, RANET, ANSN, EESS

NUGENIA

- IPRESCA

EU

- MITHYGENE (ETSON)
- APAL
- Coop. Arrangement (JRC)

Canada (McMaster Univ.)

France

- Coop. Agreement (IRSN)
- Framework Agreement (CEA)
- VERDON5 (CEA)

Germany

- Framework Arrangement (KIT)

Korea

- Arrangement for coop. (KAERI)

Bilateral collaboration

U.S.A.

- Memorandum of Coop. (NRC)

Sweden (KTH)