

PROJECT ARRANGEMENT NE-05

**between
The Japan Atomic Energy Agency
and
The Department of Energy of the United States of America
under the
Implementing Arrangement between the Ministry of Education, Culture, Sports, Science
and Technology of Japan and the Department of Energy of the United States of America
Concerning Cooperation in the Field of Nuclear Energy-Related Research and
Development
for
Cooperation on Advanced Reactor Research and Development
(High Temperature Reactor)**

1. Objective

The Japan Atomic Energy Agency (JAEA) and the Department of Energy of the United States of America (DOE), referred to collectively herein as “Participants”,

Acting in accordance with Sections 4 and 5 of the “Implementing Arrangement between the Ministry of Education, Culture, Sports, Science and Technology of Japan and the Department of Energy of the United States of America Concerning Cooperation in the Field of Nuclear Energy-Related Research and Development” of January 7, 2013 (hereinafter referred to as the “Implementing Arrangement”),

Have decided to undertake a cooperative effort under this Project Arrangement to perform advanced reactor research and development.

2. Scope of Work

The scope of work under this Project Arrangement is as follows:

Validation of High Temperature Reactor Simulation Methods and Models

3. Project Management

Each Participant will designate a Project Coordinator and a Principal Technical Contact. The Project Coordinators will be responsible for detailed management, including technical progress reviews, of the cooperation under this Project Arrangement. The Principal Technical Contacts will serve as the points of contact concerning technical details.

JAEA is to be responsible for Japanese activity under this Project Arrangement.

DOE through Idaho National Laboratory (INL) is to be responsible for United States activity

under this Project Arrangement.

The specific tasks to be conducted are identified in Appendix I and key personnel are identified in Appendix II of this Project Arrangement. Both Appendix I and Appendix II will be updated as appropriate.

4. Financial Management

The ability of the Participants to carry out their specific tasks is subject to the availability of appropriated funds. Unless the Participants determine otherwise, all costs resulting from the work carried out under this Project Arrangement will be the responsibility of the Participant that incurs them. Any cost sharing for tests in the High Temperature Engineering Test Reactor to be performed under this Project Arrangement will be subject of further discussions between the Participants.

5. Intellectual Property

With respect to the protection and distribution of intellectual property rights and other rights of a proprietary nature created or furnished in the course of the cooperative activities under this Project Arrangement and the protection of business-confidential information exchanged under this Project Arrangement, the following paragraphs will apply in addition to the paragraphs of the Intellectual Property Annex to the Implementing Arrangement:

5.1 Inventions

For the purpose of this Project Arrangement, "Invention" means any invention made in the course of the cooperative activities under this Project Arrangement which is or may be patentable or otherwise protectable under the laws of Japan, the United States of America, or any third country.

In accordance with paragraph 3.B.(iii)(a) of the Intellectual Property Annex to the Implementing Arrangement, rights to an Invention made as a result of joint research conducted under this Project Arrangement, and allocation of benefits derived therefrom, are provided as follows:

- If an Invention is made solely by a Participant or a contractor, the Participant will obtain all right, title and interest in and to such Invention in all countries.
- If an Invention is made jointly by (a) the Participants, or (b) contractors of both Participants, or (c) a Participant and a contractor of the other Participant, each Participant will obtain all right, title and interest in and to such Invention in its own country. In third countries where both Participants intend to obtain the right to the Invention, the Participants will be joint owners of such rights. The Participants may jointly apply to obtain and/or maintain the relevant rights. The Participants should decide on appropriate cost sharing associated with obtaining and/or maintaining such rights.
- In any country where the Participant which is entitled to obtain the rights therein decides not to obtain such rights and interests, the other Participant has the right to do so.
- Each Participant will have, in its own country, for its own research and development activities within the scope of work of this Project Arrangement, during the term of this Project Arrangement, a free right of use of Inventions, whether protected or not by

intellectual property rights, solely owned by the other Participant and resulting from the joint research performed under this Project Arrangement.

5.2 Copyright

Allocation of rights to an Invention and benefits derived therefrom stipulated in paragraph 5.1 above will be applied *mutatis mutandis* to disposition of rights to copyrighted works created in the course of the cooperative activities conducted under this Project Arrangement.

6. General Consideration

This Project Arrangement is pursuant to and subject to the Implementing Arrangement, which is, in turn, pursuant to and subject to the agreement between the Government of Japan and the Government of the United States of America concerning cooperation in the field of nuclear-related research and development, effected by the Exchange of Notes of March 9, 2012.

7. Commencement, Modification, and Discontinuation

1. This Project Arrangement will enter into effect upon signature by both Participants, continue for a three (3) year period, unless earlier discontinued in accordance with paragraph 7.2, and may be extended or modified by the Participants' mutual written consent, provided that the Implementing Arrangement remains in effect.

2. This Project Arrangement may be discontinued at any time by the Participants' mutual consent in writing. Alternatively, a Participant that wishes to discontinue its participation in this Project Arrangement should endeavor to provide at least sixty (60) days advance notification in writing to the other Participant.

Signed in duplicate.

FOR THE JAPAN ATOMIC ENERGY
AGENCY:

Signature: 及川 邦

Tetsukuni Oikawa

Title: Director, International Affairs
Department

Date: June 4, 2014

FOR THE DEPARTMENT OF ENERGY OF
THE UNITED STATES OF AMERICA:

Signature: John E. Kelly

John E. Kelly

Title: Deputy Assistant Secretary for Nuclear
Reactor Technologies

Date: June 12, 2014

PROJECT ARRANGEMENT NE-05

APPENDIX I-1

Description of Tasks for Validation of High Temperature Reactor Simulation Methods and Models

1. Outline and Responsibility of Tasks

The High Temperature engineering Test Reactor (HTTR) is the only prismatic core High Temperature Reactor (HTR) operating in the world today. As such, it is a unique and valuable tool and can be a tremendous asset for the international HTR research and development community. In concert with other experiments and facilities, the tools exist to validate HTR simulation methods and models for design and regulatory purposes. If experiments and modeling efforts are planned and conducted to reproduce common operating conditions, the results can be applied more broadly and with less uncertainty than independent data sets.

The objective of High Temperature Reactor Methods Validation activity is to coordinate experiments among, and modeling of, HTR test facilities with the HTTR as the key element. Power operation of the HTTR will provide valuable data on coupled neutronic/thermal fluid transients that can be used for code validation. Testing conditions in other non-critical facilities can be modified to re-create HTTR conditions and thus provide a stronger linkage between integral and separate effects test data.

The scope of work under High Temperature Reactor Methods Validation activity is as follows:

Task 1: Data, model, and code exchange

Task 2: Complementary HTTR-HTTF Experiments

Task 3: Validation of Reactor Dynamics Models

Task 4: Studies of Transients involving Enhanced Decay Heat Generation

Task 5: Preparation for Reactor Instrumentation Testing

Task 1: Data, Model, and Code Exchange

Subject to the Participants' joint consent and compliance with applicable export control laws:

(a) INL and JAEA will exchange facility design data and RELAP models of the HTTR and High Temperature Test Facility (Oregon State University); and (b) INL will provide HTR 3D simulation codes with which HTTR and High Temperature Test Facility (HTTF) can be modeled.

Task 2: Complementary HTTR-HTTF Experiments

DOE, through INL, will join with JAEA to devise a set of coordinated and scaled experiments for the HTTR and the HTTF. The HTTR has been used to conduct pressurized loss of forced cooling (PLOFC) tests and more experiments are planned under an OECD Project. The HTTF is being used by DOE and the U.S. Nuclear Regulatory Commission to

simulate Depressurized Loss of Forced Cooling accidents and subsequent air ingress phenomena. New experiments can be designed to reproduce common thermal fluid conditions to provide data to validate a wider range of plant behavior than either facility can simulate alone. The accumulated data would fill in gaps in the validation data matrix for HTR severe accident behavior.

Subtasks include:

- Subtask 2.1 Experiment planning and scaling analyses
- Subtask 2.2 Conduct pre-experiment analyses
- Subtask 2.3 Experiment execution (or use of test data in the past)
- Subtask 2.4 Conduct post-experiment analyses

Task 3: Validation of Reactor Dynamics Models

INL will join with JAEA to devise a set of controlled power transients for the HTTR, the data from which would be used to validate core simulation and safety analysis codes used for HTRs. Examples of transients may include, but are not limited to: load following with control rod movement, helium flow rate ramps, and xenon transients. In addition, INL will join with JAEA to plan a set of temperature transient tests simulating postulated abnormal events in the hydrogen production plant to be coupled to the HTTR. In the first phase of this campaign, and as jointly decided by the Participants, JAEA may provide to INL a RELAP model of the HTTR. INL may provide to JAEA high performance HTR simulation codes.

Subtasks include:

- Subtask 3.1 Experiment planning
- Subtask 3.2 Conduct pre-experiment analyses
- Subtask 3.3 Experiment execution (or use of test data in the past)
- Subtask 3.4 Conduct post-experiment analyses

Task 4: Studies of Transients involving Enhanced Decay Heat Generation

Burnup in HTTR first core may not be high enough to generate decay heat high enough to simulate end-of-cycle conditions in larger HTRs. High decay heat, however, can be simulated using fission power. A series of reactor “scram” events with different simulated decay heat rates may bound the range of decay heat-driven transients expected in HTRs. Such data would be helpful in proving reactor safety to the regulator. INL and JAEA will investigate the possibility of using the HTTR control system to simulate a high rate of decay heat generation using fission power. In the first phase of this campaign, JAEA and INL would discuss what types of experiments may be acceptable and, if feasible, commence planning of such experiments.

Subtasks include:

- Subtask 4.1 Assess feasibility of fission-simulated decay heat generation in HTTR

- Subtask 4.2 Experiment planning

Task 5: Preparation for Reactor Instrumentation Testing

Although instrumentation research is not currently conducted under the Next Generation Nuclear Plant program, DOE supports such research through other programs. INL and JAEA will discuss the feasibility of using the HTTR for testing advanced HTR core instrumentation. In the first phase of this campaign, INL and JAEA will discuss and define the process to be followed for the installation and testing such hardware in HTTR.

Tasks include:

- Subtask 5.1 Assess the feasibility of installing experimental instrumentation in the HTTR
- Subtask 5.2 Define and document the process for the approval and installation of instrumentation

2. Sites

The tasks will be conducted at:

1. INL, Idaho Falls, Idaho, USA
2. Oarai Research and Development Center, Japan Atomic Energy Agency, Ibaraki, Japan

3. Schedule

		2014CY				2015CY				2016CY			
Activity		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Task 1	Data exchange		X	X	X	X							
Task 2	Experiment Planning		X	X	X	X							
	Pre-experiment Analyses				X	X	X	X	X				
	Experiments							X	X	X	X	X	X
	Post-experiment analysis										X	X	X
Task 3	Experiment Planning		X	X	X	X							
	Pre-experiment Analyses				X	X	X	X	X				
	Experiments							X	X	X	X	X	X
	Post-experiment analysis										X	X	X

Task 4	Feasibility Assessment					X	X	X	X				
	Experiment Planning									X	X	X	X
Task 5	Feasibility Assessment		X	X	X	X							
	Process Definition					X	X	X	X				

* "CY" is Calendar Year, Q1: January-March, Q2: April-June, Q3: July-September, Q4: October-December

4. Deliverables

A joint progress report will be produced by DOE and JAEA on active tasks at the end of 2014CY and 2015CY. A joint final report for all tasks will be produced by DOE and JAEA.

PROJECT ARRANGEMENT NE-05

APPENDIX II-1

Key Personnel List

U.S. Department of Energy, National Nuclear Security Administration

1. DOE Headquarters

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2. National Laboratories

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Japan Atomic Energy Agency

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