

**Annex to the Implementing Arrangement Between
the United States Department of Energy and
the Japan Atomic Energy Research Institute on
Cooperation in Research and Development in the
Area of High Temperature Gas-Cooled Reactors**

**Annex 2. Collaborative Program for the
Coated Particle Fuel Performance Test**

1.0 Introduction and Terms of Reference

Pursuant to Article III-2 of the Implementing Arrangement between the United States Department of Energy (DOE) and the Japan Atomic Energy Research Institute (JAERI) on Cooperation in Research and Development in the area of High Temperature Gas-Cooled Reactors (HTGRs) of September 27, 1985 (hereinafter referred to as the "DOE-JAERI Implementing Arrangement"), DOE and JAERI (hereinafter referred to as the "Parties") agree to establish this Annex to define the detailed provisions of a collaborative program for the performance testing of coated particle fuels for HTGRs (hereinafter referred to as the "Collaborative Program") in accordance with the provisions of the DOE-JAERI Implementing Arrangement, as follows:

2.0 Collaborative Program

2.1 The objectives of the Collaborative Program are to determine (1) the performance of both Parties' Low Enriched Uranium (LEU) coated particle fuels during irradiation under normal operating conditions, and (2) the capability of the irradiated coated particle fuels to meet specified failure fraction limits under core heatup simulation test (CHST) conditions.

2.2 The Collaborative Program shall consist of irradiation of fuel rods containing reference coated fuel particles of each Party in the High Flux Isotope Reactor (HFIR) at the Oak Ridge National Laboratory (ORNL), post-irradiation examinations (PIEs) at ORNL and at the GA Technologies' (GA) facility in San Diego, California, and CHSTs at ORNL.

2.3 In consultation with DOE, JAERI shall be responsible for fabrication of the JAERI fuel rod specimens and for safekeeping of the specimens during their transportation to the United States. JAERI shall use its best efforts to deliver their fuel rods to the Los Angeles International Airport by February 1987 for transfer to DOE.

2.4 In consultation with JAERI, DOE shall be responsible for the following:

- (1) Safekeeping of the JAERI fuel rods during all operations subsequent to receiving them at the Los Angeles International Airport.
- (2) Transportation of the JAERI fuel rods to the GA facility.

- (3) Fabrication of the DOE fuel rods and preirradiation characterization testing of both Parties' fuel rods.
- (4) Transportation of both Parties' fuel rods to ORNL, design and fabrication of two identical HFIR capsules, and assembly of each Parties' fuel rods into separate capsules.
- (5) Performance of the irradiation tests, disassembly and PIE of both capsules; the CHSTs on both Parties' irradiated fuel rods; and the analysis of data and documentation of results.
- (6) Final disposal of the irradiated coated particle fuels used in the Collaborative Program and other radioactive waste arising from the Collaborative Program.

2.5 In consultation with JAERI, DOE shall prepare a Test Plan for the Collaborative Program which shall describe the capsule design, irradiation tests, PIEs and CHSTs; and shall provide the documentation requirements and projected schedule and costs. The Test Plan shall be mutually agreed to in writing.

2.6 The JAERI fuel rods shall contain coated UO_2 fuel particles of approximately six percent enrichment and the JAERI capsule shall be irradiated for four HFIR cycles to produce the desired burnups and neutron fluences. The DOE fuel rods shall contain coated UCO fissile fuel particles of approximately 20 percent enrichment plus coated ThO_2 fertile particles, and the DOE capsule shall be irradiated for six HFIR cycles.

2.7 During the HFIR irradiations, DOE shall monitor fission gas release and temperatures, and after irradiation, fuel burnups and neutron fluences shall be determined for both capsules.

2.8 DOE shall conduct PIEs on each capsule that will include: capsule disassembly, visual examination, fuel rod and graphite component metrology, TRIGA fission gas release tests, long-term acid leach tests, ceramography, electron microprobe examination and other examinations or tests as mutually agreed by the Parties.

2.9 DOE shall conduct a series of CHSTs on selected JAERI and DOE irradiated fuel rods. The CHST exposure cycles (temperatures and times) shall be specified in the Test Plan, and the number of tests to be conducted for each Party shall be limited to a maximum of four tests of up to approximately 1000 hours duration. The apparatus for the CHSTs shall include a heatup furnace with a capacity for up to four reference size fuel rods per test. DOE shall assemble such an apparatus at ORNL for this Collaborative Program. Following the completion of this Collaborative Program, this apparatus shall be available on a priority basis for additional CHSTs on JAERI fuel specimens that are covered under subsequent DOE/JAERI agreements. Costs to JAERI for any such future CHSTs shall consist of the labor and any material costs required to conduct tests, but shall not include facility use charges or apparatus costs, except for any agreed to apparatus modifications. The term of this shall be for five years following the conclusion of the CHSTs under this Collaborative

Program. Costs for decontamination and final disposition of this apparatus shall be borne by DOE.

2.10 JAERI personnel may observe test activities of the Collaborative Program, as indicated in the Test Plan, by short-term visits of up to two visitors at any one time. Such visits shall be subject to prior DOE approval on each occasion.

2.11 The cost of the Collaborative Program shall be shared by the Parties. The total cost shall include the costs for all activities required to conduct the Collaborative Program, excluding personnel, travel and fuel rod fabrication costs. These activities include test planning, capsule design, fuel rod quality assurance and characterization tests, capsule fabrication, irradiation and surveillance, PIEs, CHST apparatus preparation, CHSTs, data analysis and documentation.

3.0 Management

3.1 The Parties agree to establish a Coordinating Committee to manage the Collaborative Program.

3.2 The Coordinating Committee shall be composed of two members, one being designated by each Party. Each member shall have one vote and all decisions of the Coordinating Committee shall be by unanimity.

3.3 The Coordinating Committee shall meet annually or as required on a date and at a location as mutually agreed by the Parties.

3.4 The functions of the Coordinating Committee shall be to:

- (1) Review and approve the Test Plan for the Collaborative Program.
- (2) Review, update, and revise the Test Plan as needed.
- (3) Review the implementation of the Collaborative Program and recommend corrective actions to resolve any problems.
- (4) Review the cost and the projection of expenditures.
- (5) Review and approve plans for personnel visits.

3.5 The Coordinating Committee shall coordinate its activities with the Joint Steering Committee established by the DOE-JAERI Implementing Arrangement.

4.0 Finance

4.1 JAERI shall provide a financial contribution to DOE on an annual basis, as mutually agreed upon in writing. The lump sum payments shall be made on or before March 31 of each year in compliance with an invoice which shall be sent to JAERI on or before February 28. JAERI shall provide an initial payment to DOE within 30 days after this Annex has been signed by

both Parties. JAERI shall arrange to make the payments in U.S. dollars in accordance with instructions provided by DOE.

4.2 In January of each year, DOE shall provide to JAERI a projection of expenditures for the Collaborative Program covering the next U.S. fiscal year.

4.3 In January of each year, DOE shall provide to JAERI an accounting of expenditures for the Collaborative Program for the previous U.S. fiscal year.

4.4 It is understood that the ability of the Parties to carry out their obligations under the Collaborative Program is subject to the availability of appropriated funds. If at any time DOE or JAERI is unable to provide its financial contribution, neither DOE nor JAERI shall be obligated to continue to expend any funds for the Collaborative Program.

5.0 Information

5.1 JAERI shall provide to DOE all information that is required for DOE to conduct the proposed irradiation, PIEs and CHSTs of the JAERI fuel rods.

5.2 DOE shall provide to JAERI all information obtained from the fuel irradiation test and the CHSTs of the JAERI fuel rods, as well as the post-irradiation analyses and other data analyses of these tests. Furthermore, DOE shall provide to JAERI the same information obtained from the testing, post-irradiation analyses, and other data analyses of the DOE fuel rods.

5.3 The Parties shall each have all right to use, disclose, publish, or disseminate information provided to DOE by JAERI and provided to JAERI by DOE in Sections 5.1 and 5.2 above, for any and all purposes whatsoever.

5.4 Proprietary information as defined in Article VI of the DOE-JAERI Implementing Arrangement shall not be accepted for or utilized in the Collaborative Program without the express mutual written agreement of the Parties setting forth the terms and conditions for such acceptance or utilization.

5.5 DOE shall use its best efforts to send JAERI all information obtained from the testing and analyses prior to the release of such information to any third party.

6.0 Patents

With regard to inventions or discoveries made or conceived by DOE in the course of or under the testing of the JAERI coated fuel particles that are improvements to the JAERI coated fuel particles, JAERI shall acquire all right, title, and interest in and to such inventions or discoveries in Japan, subject to a nonexclusive, irrevocable, royalty-free license to DOE, its Government, and its nationals designated by it. DOE shall acquire all right, title, and interest in and to such inventions or discoveries in the United States and third countries, subject to a nonexclusive, irrevocable,

royalty-free license to JAERI, its Government, and its nationals designated by it. The Parties shall each assume the responsibility to pay awards or compensation required to be paid to its own nationals according to its own laws. The Parties shall each, without prejudice to any rights of inventors under its national laws, take all necessary steps to provide the cooperation from its inventors required to carry out the provisions of this paragraph.

7.0 Duration

The Collaborative Program shall enter into force upon the latter date of signature of this Annex by the Parties and shall remain in force for a period of five years.

For THE UNITED STATES
DEPARTMENT OF ENERGY

BY: *Francis X. Garyan*
TITLE: Director of Advanced
Reactor Programs
DATE: 3/17/86

For THE JAPAN ATOMIC ENERGY
RESEARCH INSTITUTE

BY: *Tsuneo Fujinami*
TITLE: Tsuneo Fujinami
President
DATE: March 24, 1986