2019年6月14日 更新

# Nuclear Innovative R&D Program Specific Q&A for using the U.S. facilities

## 1. Overview

**1-1. Are the applicants limited to university researchers?**

No. Entities other than universities are allowed as long as research outcomes, such as IPs (Intellectual properties), are open to the public and work can be accomplished as "cooperative research"

**1-2. What does "publicly available" mean? Is the knowledge obtained to be shared? Or a paper to be co-authored?**

"Publicly available" means that the experimenter will publish the results in the open technical literature within a reasonable timeframe such that the information obtained by the experiment can be freely used by a third party.

**1-3. In the ATR explanation, it says "All experimental data and results would be made publicly available, unless other arrangements are made". Is the situation same for the TREAT as well? When will such arrangement be made, if necessary?**

Yes. Any deviation from this must be specified in the proposal phase. Details regarding dissemination of research results, or the protection of any intellectual property, would be documented and agreed to by both parties in the Cooperative Research and Development Agreement (CRADA) prior to beginning any experiment that is awarded.

**COOPERATIVE RESEARCH AND DEVELOPMENT AGREEMENTS (CRADA)**

A CRADA is an Agreement between one or more laboratories and one or more non-federal entities (CRADA Participants), including industry, that facilitates private sector collaboration utilizing laboratories' technologies, processes, R&D capabilities, or technical know-how. The Participant benefits from access to each laboratory's unique technologies, capabilities, and expertise; the option to negotiate up to an exclusive license in a field of use for any laboratory inventions that result from the work performed under the CRADA (subject inventions); and protection for up to five years of commercially valuable information generated through the work under the CRADA. The CRADA Participant must contribute in-kind resources manifest in personnel, equipment, facilities etc. As most DOE laboratories are full cost recovery, a funding source for the laboratory work must be identified before work can start; often the laboratory funding source under a CRADA is funding sent directly from the CRADA Participant. The DOE requires either 1) advance payment of the entire amount of funding or 2) a pay plan that requires the first payment to include a 60 (at minimum – some labs require 90) day reserve and in some instances funding for the first 30 days of work. DOE has developed a model CRADA that establishes uniform conditions for doing business with the laboratories. The modular CRADA can be viewed using the following link: https://www.directives.doe.gov/directives-documents/400-series/0483.1-BOrder-B

**GENERAL GUIDANCE:**

Regarding public release of information. {Ref DOE O 483.1B Attachment 4, Pg. 30}

The CRADA must include a provision setting forth the required minimum deliverables of a publically releasable abstract and final report. Other deliverables pertaining to the specific project are normally contained in the Statement of Work; however, some intellectual property might be useful to the Government or the public and should be delivered to the DOE Office of Scientific and Technical Information (OSTI) for distribution if DOE requests such delivery. CRADA reports should fully cover and describe the research done under the CRADA, incorporating technical data as needed to support conclusions, and including Protected CRADA Information as appropriate. Where the Participant and/or the contractor identifies that such reports contain Protected CRADA Information, the reports will be properly marked with a restrictive legend identifying the agreed-to period of withholding from public disclosure per DOE Directive DOE O 241.1B. CRADAs are made known to other DOE contractors for DOE program needs. Additional information on providing information to OSTI is available at www.osti.gov/stip.

A publication review provision must be included in the CRADA. The pre-publication review process must consider the protection of rights to filing U.S. and foreign patent applications, since any disclosure may be a bar to filing.

## 2. Cost / Schedule Estimate

**2-1. In order to clarify the costs for irradiation experiments in ATR and/or TREAT, could Japanese applicants contact the INL experts in May or June, prior to their application submission deadline?**

It is okay for Japanese proposers to contact INL experts in the May or June timeframe for help in developing cost estimates. Japanese applicants should provide sufficient detail on the proposed activities to INL technical experts to allow for efficient responses by INL experts. Note that all information provided will only be a rough estimate and detailed cost estimates cannot be provided until the full proposals are received by INL and evaluated. The number of requests do need to be kept to a manageable amount. Japanese researchers should contact Christopher Murdock at Christopher.Murdock@inl.gov for questions on ATR and Doug Dempsey at Douglas.Dempsey@inl.gov for questions on TREAT.

**2-2. In the Appendix C: ATR Our-Year Planning Schedule, what does “press up”, CIC and PALM mean?**

"Press up" means the ATR head is closed and pressurization of the primary reactor coolant system. "CIC" means Core Internals Changeout, which is an extended maintenance outage that occurs for ATR once every 7-10 years. "PALM" indicates a special short duration, very high power cycle performed in the ATR, usually once or twice per year. Most normal experiments are removed from the reactor during PALM cycles, unless the experiment has been pre-analyzed for the special high power conditions and shown to perform acceptably.

**2-3. What kind of testing is included in the "limited PIE testing"? Is it able for Japanese researchers to implement the measurement by themselves in your facilities? If yes, how much does it cost?**

Available examinations are listed in the scope narrative. For fuel tests, Japanese researchers will not be able to implement or perform any measurements themselves in INL facilities. New measurements methods could, in principle, be proposed by Japanese researchers for implementation into INL facilities, but INL would have to evaluate feasibility and cost after details of those techniques are provided. Note that implementation of new techniques in a hot cell environment is typically both a costly and lengthy process. For materials tests, there may be some possibility for Japanese researchers to perform measurements on instruments in the MaCS Lab at CAES but the details of who pays for the use of the instruments would have to be worked out and the Japanese researchers would have to demonstrate expertise in operating the instruments.

**2-4. In the document, it says that for ATR up to 7 capsule positions are available beginning in Cycle 168A. Are those positions available to Japanese researchers for the following years?**

Up to 7 capsule positions in ATR-1 test trains are currently available. If Japanese proposals occupy some number of these positions with experiments, those capsule positions will be retained for completion of the experiments once initiated. Any of these positions not in use by Japanese researchers after FY20 may be allocated to other experiments and may not be available in subsequent years.

**2-5. Japanese researchers will be able to use the funding starting from January 2020, after the award selection and contractual procedure is done. Starting from January researchers will start preparing the experiments, therefore Japanese researchers are not able to implement the experiment in 168A-1 cycle for ATR. Are Japanese researchers able to use the ATR positions I-22 and I-23 during the following experiment cycles such as 168B-1, 169A-1, 170A-1, and so on?**

The I-22 and I-23 positions will be available for Japanese experiments during 168B-1, 170A-1 and 170B-1. Most of cycle 169A-1 is a PALM cycle but Japanese experiments could potentially be irradiated for 14 days during this cycle. After cycle 170B-1, ATR will be unavailable for at least 9 months during the Core Internals Changeout (CIC). Once the reactor is back up in FY22, the I-22 and I-23 positions will again be available for Japanese experiments. Japanese researchers should note that it may take up to a year to fabricate and design an experiment, including safety analysis, prior to the experiment being inserted into ATR or TREAT. If funding is received in January 2020, experiments likely would not be ready to be inserted into ATR or TREAT until the late 2020 or early 2021 timeframe which is right before CIC begins.

**2-6. Are the TREAT operating cycles (schedule) available?**

TREAT's operating schedule is very flexible due to the short duration of individual experiments. Once a specific test (or test campaign) is identified it will be incorporated into the facility schedule. TREAT tests are typically planned to take 1-2 weeks reactor schedule per capsule (depending on the complexity of the requested transient). Test preparations, if the identified tests devices are utilized and operated with existing safety basis constraints, should take ~12 months to complete. The final experiment description should be available ~12 months prior to insertion to support safety calculations and TREAT transient design. The test specimen should be delivered ~6 months before insertion for capsule assembly and delivery.

**2-7. As for the schedule of the TREAT, by when do the Japanese researchers have to finish preparing for SETH or MARCH-SERTTA? When do the test specimens taken out from the reactor?**

Researchers should expect the collaborative design of the specific experiment to take ~1 year including conceptualization, safety analysis, final mechanical design, and production of experiment hardware. Assembly of the test should take ~3 months (depending on complexity). Thus samples should be supplied during the 2nd year of the experimental program. Irradiation will only require 1 month at TREAT and will be followed by ~6 months to complete a standard PIE programs.

**2-8. If the Japanese researchers want to test specimens fabricated in Japan, by when does the DOE/INL need to receive the specimens prior to the irradiation?**

A schedule for delivery of specimens will be developed after the details of the experiment are known.　Time frames could range from 1-2 months up to 6 months, depending on complexity of assembly.　The more challenging task will be to work to establish acceptability of Japanese institution as a quality supplier of materials to be included in an irradiation experiment, which is not guaranteed and must be evaluated by INL QA staff on a case-by-case basis.

**2-9. The assumed schedule would be to start the collaborative design from January 2020 and implement the irradiation in 2021. Are the positions available for Japanese researchers who plan to implement the irradiation starting from one of the cycles in your FY21?**

As previously discussed, CIC for ATR is currently scheduled to begin in March of 2021. Hence ATR will not be available for irradiations from March 2021 to December of 2021. Irradiations could potentially begin in January 2022 but this is dependent on the CIC schedule which is subject to change.

**2-10. It says in your document, regarding PIE plan, that "this plan can cover up to a period of three years". We Japanese side understand that this statement considers the period of Japanese funding program, which is up to four years. For example, it would take a year for preparation and irradiation, and then takes three years for PIE, Is our understanding correct?**

If the design, analyses, fabrication, and irradiation can all be completed within one year, then yes, the 3 years of PIE will fall within the Japanese four year funding period. If they take longer, then the PIE will end at the end of their four year funding period unless other arrangements have been made.

**2-11. It says in your document that there is "an audit of the fabrication facility by a team of U.S. Quality Assurance specialists". What kind of actions are required for Japanese researchers? Any costs to Japanese researchers?**

In order for any institution to supply materials, perform analyses, or perform fabrications that will be used in DOE reactors, the institution must meet QA requirements set by DOE and be listed on INL's Qualified Suppliers List for the QA level or type of service the institution intends to perform.　If not on this list, an on-site QA audit of the institution by INL and/or DOE is generally required to assess whether or not the institution meets the quality requirements.　As a point of reference, US universities are not generally able to meet the QA requirements associated with materials and services that are part of a reactor experiment. In addition to INL or Japan fabricating samples, irradiated materials in the NSUF Nuclear Fuels and Materials Library (NFML) can be made available to Japanese researchers. Access to the NFML can be gained through the NSUF website (https://nsuf.inl.gov) following a simple registration step. Requests for materials from the NSUF are reviewed for a number of aspects including, but not limited to, total number and type of material/samples requested, location of where samples will be studied (only locations within the United States are accepted), export control considerations, and programmatic needs. Requests for large sets of materials that would deplete the inventory for a particular type of material will not be accepted. Requesters are strongly encouraged to contact the NSUF office to discuss the availability of the materials of interest before including those materials in a proposal. Contact information for the NSUF office can be found on the NSUF website.

**2-12. Do Japanese researchers owe the responsibility/cost for the waste disposal (specimen, capsule, etc.) after the experiment?**

There will be no additional cost for waste disposal (specimen, capsule, etc.) after the experiment, provided that no new materials are introduced that would create the need for a new disposition path different from our routine waste. If the disposal path does not fit into one of our normal streams, there would be a cost associated with creating a new waste disposition path which will be communicated during the proposal review process.

3. Specifications of Facilities

**3-1. What is the fluence and temperature of the test materials in each of the 7 positions of the capsule in the ATR?**

Temperature of the test materials is entirely dependent on internal configuration proposed by the experimenter.

**3-2. What is the irradiation time, maximum and minimum value of the total fluence per a cycle? Up to how many consecutive cycles we could irradiate?**

Small-I positions are located in the ATR reflector region and have unperturbed fluxes that range from $2.2 \times 10^{13}$ to $1.0 \times 10^{14}$ n/cm$^2$-s (thermal) and $8.0 \times 10^{11}$ to $4.0 \times 10^{12}$ n/cm$^2$-s (fast), depending on the axial position of the capsule within the ATF-1 test train. ATR cycle lengths vary in duration. Japanese researchers should use these flux values and the specific ATR cycle durations provided in the ATR operating schedule to make estimates of total fluence achievable for the experiments they propose.

**3-3. We would like to see the data for Irradiation position dependency of the neutron energy spectrum.**

There is no data available for individual positions. Data is only available for the center flux trap and that spectrum is used to approximate values for all positions. The figure below illustrates the spectrum for the central flux trap.

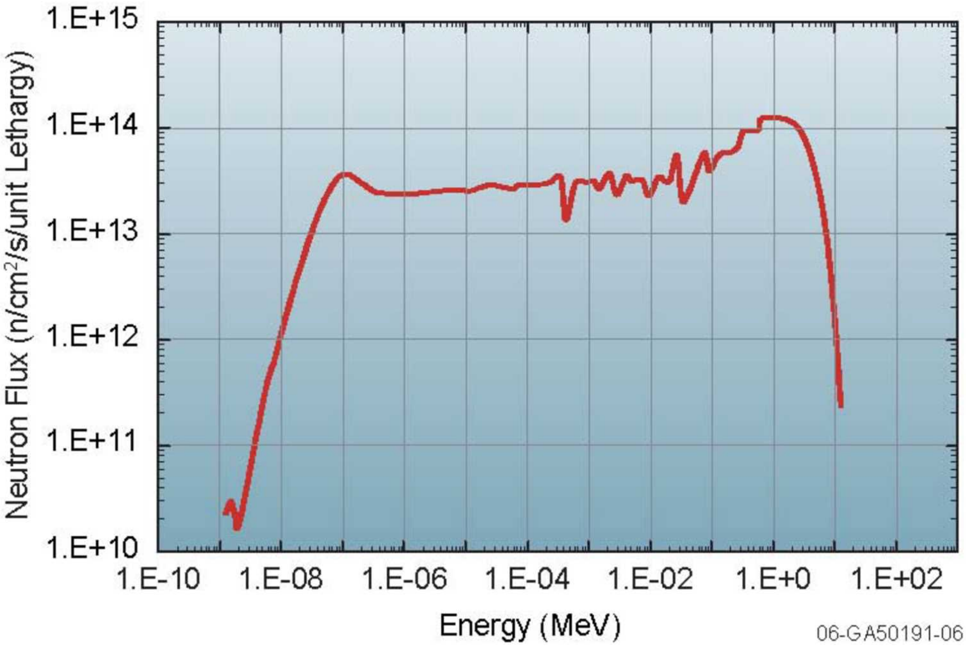


Figure 1. Unperturbed neutron energy spectrum for the center flux trap with the reactor operating at125 MW

**3-4. What is the maximum and minimum temperature of the materials during the irradiation? Is it able to control the temperature during the irradiation? Is it able to measure the temperature during the irradiation? If you could control the temperature during the irradiation, what is the range of temperature and the tolerance? If the irradiation temperature depends on the flux, please let us know of the relationship between the irradiation temperature and the flux.**
ATR coolant temperature on the outside of the ATF-1 capsule is approximately 55° C. The only way to control temperatures internal to the capsule is to design in gas gaps filled with inert gases between the capsule wall and the test specimens inside the capsule and use internal heating produced by the experiment contents to elevate temperatures. These design details are incumbent on the experimenter to propose/provide. For "drop in" irradiation experiments, the temperature fluctuations can be +/- 50C or even more. Temperatures can be measured during irradiation but costs can approach $2 million. Temperatures can also be controlled but costs can reach $4 million. The radiation temperature depends on the flux as well as a number of other factors (gap, gas, gamma heating, fission rate, etc.) that are calculated from the detailed thermal analysis performed for each experiment during the design stage. This is where the feasibility study starts the process to find out what the proposer wants and if it is achievable.

**3-5. What is the atmospheric environment of the materials during the irradiation? Vacuum? Filled with helium gas?**
Typically filled with He gas. Other inert gases (Ne, Ar) or inert gas mixtures have been used to help achieve desired temperatures inside the capsule.

**3-6. Is the irradiation condition the same for nuclear fuel material and non-fuel materials, such as structural materials or clad materials?**
Yes

**3-7. Does Fig 1 in attachment 3, Narrow Pulse Width Transient Power Histories, show the maximum and minimum?**
This plot only shows the tests conducted to determine the minimum pulse width currently available (~89 ms). Much longer pulses lasting ~1 sec or psuedo-steady state operations are also possible.

**3-8. How much flexibility do we have, to change the relationship between the reactor power and operating time?**

This flexibility is not available for ATR experiments. For TREAT, we are able to tailor the transient shape within certain operational limits for both the test capsule and reactor. Energy can be deposited using shaped transients ranging from 'flat-top' to 'pulse' mode or some combination of the two. Discussion with experimental staff is essential to assessing detailed transients.

**3-9. We understand that experiments for Att-1 and Att-3 are done in a certain condition. Could the Japanese applicants propose the experimental condition different to the conditions in Att-1 or Att-3?**

The experiments described in the attachments (the SETH and MARCH-SERTTA devices) are the only irradiation devices currently available for experimental uses. However, the configuration of the experimental sample within the capsule can be modified. The nuclear transient can also be modified to meet specific experimental objectives. Users are encouraged to contact TREAT staff to discuss modifications to ensure that the proposed experiment is within the approved safety envelope for the device and reactor.

**3-10. Is there any way for the applicants to see the latest version of the drawings of the I-22 and I-23 of the ATR?**

Drawings for the individual I positions are not available. The small I positions are 1.5in diameter holes in the beryllium reflector. The ATF-1 basket fits in this hole and the capsule fits in the basket. The Japanese experiments must fit inside of the capsule. A drawing of ATF-1 has been provided.