

WORK FOR OTHERS AGREEMENT NO. WFO-13-002
(RESEARCH AND DEVELOPMENT ON GRAPHITE DESTRUCTION FOR THE PEBBLE
BED FUEL ELEMENTS)

BETWEEN

SAVANNAH RIVER NUCLEAR SOLUTIONS, LLC (SRNS)

OPERATING UNDER PRIME CONTRACT NO. DE-AC09-08SR22470 FOR THE
U.S. DEPARTMENT OF ENERGY

AND

FORSCHUNGSZENTRUM JULICH GmbH

The obligations of the above-identified DOE Contractor shall apply to any successor in interest to said Contractor continuing the operation of the DOE facility involved in this Work for Others Agreement.

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GENERAL TERMS AND CONDITIONS

Article I. PARTIES TO THE AGREEMENT

The U.S. Department of Energy Contractor, Savannah River Nuclear Solutions, LLC, hereinafter referred to as the "Contractor," has been requested by Forschungszentrum Julich GmbH, hereinafter referred to as the "Sponsor," to perform the work set forth in the Statement of Work, attached hereto as Appendix A. It is understood by the Parties that, except for the intellectual property provisions of this Agreement, the Contractor is obligated to comply with the terms and conditions of its M&O contract with the United States Government (hereinafter called the "Government") represented by the United States Department of Energy (hereinafter called the "Department" or "DOE") when providing goods, services, products, processes, materials, or information to the Sponsor under this Agreement.

Article II. TERM OF THE AGREEMENT

The Contractor estimated period of performance for completion of the Statement of Work is twelve (12) months. The term of this Agreement shall be effective as of the date on which it is signed by the last of the Parties hereto.

Article III. COSTS

- A. The Contractor's estimated cost for the work to be performed under this Agreement is (b) (4). The details of these costs are provided in Appendix B. and the payment schedule is provided in Appendix C.

A DOE Administrative Cost (b) (4) of the costs of (b) (4) is included in the estimated cost for this Agreement as well as DOE personnel travel costs of (b) (4) associated with the acceptance of this work.

- B. The Contractor has no obligation to continue or complete performance of the work at a cost in excess of its estimated cost, including any subsequent amendment.
- C. The Contractor agrees to provide at least 30 days' notice to the Sponsor if the actual cost to complete performance will exceed its estimated cost.

Article IV. FUNDING AND PAYMENT

The Sponsor shall provide sufficient funds in advance to reimburse the Contractor for costs to be incurred in performance of the work described in this Agreement, and the Contractor shall have no obligation to perform in the absence of adequate advance funds. If the estimated period of performance exceeds 90 days or the estimated cost exceeds (b) (4) the Sponsor may, with the Contractor's approval, advance funds incrementally. In such a case, the Contractor will initially invoice the Sponsor in an amount sufficient to permit the work to proceed for 90 days and thereafter invoice the Sponsor monthly so as to maintain approximately a 90-day period that is funded in advance. Payment shall be made directly to the Contractor. Upon termination or completion, any excess funds shall be refunded by the Contractor to the Sponsor. The Sponsor agrees to make payments so as to reach the Contractor in accordance with the following schedule upon signing of both parties:

- United States Dollars (USD) (b) (4) See Appendix C. Payment Schedule)

Article V. SOURCE OF FUNDS

The Sponsor hereby warrants and represents that, if the funding it brings to this Agreement has been secured through other agreements, such other agreements do not have any terms and conditions (including intellectual property terms and conditions) that conflict with the terms of this Agreement.

Article VI. PROPERTY

Unless the Parties otherwise agree in writing, all equipment produced or acquired with funds provided by the Sponsor shall be disposed of at the Sponsor's expense.

Article VII. (RESERVED)

Article VIII. LEGAL NOTICE

The parties agree that the following legal notice shall be affixed to each report furnished to the Sponsor under this Agreement and to any report resulting from this Agreement which may be distributed by the Sponsor:

"DISCLAIMER NOTICE

This report was prepared by Savannah River Nuclear Solutions, LLC (SRNS) under contract with the U.S. Department of Energy (DOE), as an account of work sponsored by Forschungszentrum Julich GmbH. Neither SRNS, DOE, the U.S. Government, or any person acting on their behalf makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by SRNS, DOE, or the U.S. Government. The views and opinions of authors expressed herein do not necessarily state or reflect those of SRNS, DOE or the U.S. Government."

Article IX. DISCLAIMER

THE GOVERNMENT AND THE CONTRACTOR MAKE NO EXPRESS OR IMPLIED WARRANTY AS TO THE CONDITIONS OF THE RESEARCH OR ANY INTELLECTUAL PROPERTY, GENERATED INFORMATION, OR PRODUCT MADE OR DEVELOPED UNDER THIS WORK FOR OTHERS AGREEMENT, OR THE OWNERSHIP, MERCHANTABILITY, OR FITNESS FOR A PARTICULAR PURPOSE OF THE RESEARCH OR RESULTING PRODUCT, THAT THE GOODS, SERVICES, MATERIALS, PRODUCTS, PROCESSES, INFORMATION, OR DATA TO BE FURNISHED HEREUNDER WILL ACCOMPLISH INTENDED RESULTS OR ARE SAFE FOR ANY PURPOSE INCLUDING THE INTENDED PURPOSE, OR THAT ANY OF THE ABOVE WILL NOT INTERFERE WITH PRIVATELY OWNED RIGHTS OF OTHERS NEITHER THE GOVERNMENT NOR THE CONTRACTOR SHALL BE LIABLE FOR SPECIAL, CONSEQUENTIAL, OR INCIDENTAL DAMAGES ATTRIBUTED TO SUCH RESEARCH OR RESULTING PRODUCT, INTELLECTUAL PROPERTY, GENERATED INFORMATION, OR PRODUCT MADE OR DELIVERED UNDER THIS WORK FOR OTHERS AGREEMENT.

Article X. GENERAL INDEMNITY

The Sponsor agrees to indemnify and hold harmless the Government, the Department, the Contractor, and persons acting on their behalf from all liability, including costs and expenses incurred, to any person, including the Sponsor, for injury to or death of persons or other living things or injury to or destruction of property arising out of the performance of the Agreement by the Government, the Department, the Contractor, or persons acting on their behalf, or arising out of the use of the services performed, materials supplied, or information given hereunder by any person including the Sponsor, and not directly resulting from the fault or negligence of the Government, the Department, the Contractor, or persons acting on their behalf.

Article XI. PRODUCT LIABILITY INDEMNITY

Except for any liability resulting from any negligent acts or omissions of the Government or the Contractor, the Sponsor agrees to indemnify the Government and the Contractor for all damages, costs, and expenses, including attorney's fees, arising from personal injury or property damage occurring as a result of the making, using, or selling of a product, process, or service by or on behalf of the Sponsor, its assignees, or licensees, which was derived from the work performed under this Work for Others Agreement. In respect to this Article, neither the Government nor the Contractor shall be considered assignees or licensees of the Sponsor, as a result of reserved Government and Contractor rights. The indemnity set forth in this paragraph shall apply only if the Sponsor shall have been informed as soon and as completely as practical by the Contractor and/or the Government of the action alleging such claim and shall have been given an opportunity, to the maximum extent afforded by applicable laws, rules, or regulations, to participate in and control its defense, and the Contractor and/or Government shall have provided all reasonably available information and reasonable assistance requested by the Sponsor. No settlement for which the Sponsor would be responsible shall be made without the Sponsor's consent unless required by final decree of a court of competent jurisdiction.

Article XII. INTELLECTUAL PROPERTY INDEMNITY - LIMITED

The Sponsor shall indemnify the Government and the Contractor and their officers, agents and employees against liability, including costs, for infringement of any United States patent, copyright, or other intellectual property arising out of any acts required or directed by the Sponsor to be performed under this Agreement to the extent such acts are not already performed at the facility. Such indemnity shall not apply to a claimed infringement that is settled without the consent of the Sponsor unless required by a court of competent jurisdiction.

Article XIII. NOTICE AND ASSISTANCE REGARDING PATENT AND COPYRIGHT INFRINGEMENT

The Sponsor shall report to the Department and the Contractor, promptly and in reasonable written detail, each claim of patent or copyright infringement based on the performance of this Agreement of which the Sponsor has knowledge. The Sponsor shall furnish to the Department and the Contractor, when requested by the Department or the Contractor, all evidence and information in the possession of the Sponsor pertaining to such claim.

Article XIV. PATENT RIGHTS - USE OF FACILITIES (CLASS WAIVER) (SPONSOR RIGHTS)

1. Definitions

- A. "Subject Invention" means any invention or discovery of the Contractor, or, to the extent the Sponsor is performing any work under this Agreement, of the Sponsor, conceived in the course of or under this Agreement, or, in the case of an invention previously conceived by the Sponsor, first actually reduced to practice in the course of or under this Agreement. "Subject Invention" includes any art, method, process, machine, manufacture, design or composition of matter, or any new and useful improvement thereof, or any variety of plant, whether patented under the Patent Laws of the United States of America or any foreign country, or unpatented.
- B. "Patent Counsel" means the DOE Patent Counsel assisting the procuring activity which has the administrative responsibility for the facility where the work under this Agreement is to be performed.

2. Rights of the Sponsor; election to retain rights

Subject to the provisions of paragraph 3.B. with respect to any Subject Invention reported and elected in accordance with paragraph 4. of this article, the Sponsor may elect to obtain the entire right, title, and interest throughout the world to each Subject Invention and any patent application filed in any country on a Subject Invention and in any resulting patent secured by the Sponsor. Where appropriate, the filing of patent applications by the Sponsor is subject to DOE and other Government security regulations and requirements.

3. Rights of Contractor and Government

A. Assignment to Either the Contractor or the Government

The Sponsor agrees to assign to either the Contractor or the Government, as requested by the Contractor, the entire right, title, and interest in any country to

each Subject Invention of the Sponsor and to each Subject Invention of the Contractor, where the Sponsor:

- (1) does not elect pursuant to this article to retain such rights; or
- (2) elects to obtain title to a Subject Invention pursuant to paragraph 2. but fails to have a patent application filed in that country on the Subject Invention or decides not to continue prosecution or not to pay any maintenance fees covering the invention.

B. Terms and Conditions of Waived Rights

- (1) To preserve the Contractor's and the Government's residual rights to Subject Invention, and in patent applications and patents on Subject Inventions, the Sponsor shall take all actions in reporting, electing, filing on, prosecuting, and maintaining invention rights promptly, but in any event, in sufficient time to satisfy domestic and foreign statutory and regulatory time requirements, or , if the Sponsor decides not to take appropriate steps to protect the invention rights, it shall notify the Contractor in sufficient time to permit either the Contractor or the Government to file, prosecute, and maintain patent applications and any resulting patents prior to the end of such domestic or foreign statutory or regulatory time requirements.
- (2) The Sponsor shall convey or ensure the conveyance of any executed instruments necessary to vest in either the Contractor or the Government the rights set forth in this article.
- (3) With respect to any Subject Invention in which the Sponsor obtains title, the Sponsor hereby grants to the Government a non-exclusive, nontransferable, irrevocable, paid-up license to practice or have practiced by or on behalf of the United States the Subject Invention throughout the world.
- (4) The Sponsor shall provide the Government a copy of any patent application filed on a Subject Invention within 6 months after such application is filed, including its serial number and filing date.
- (5) Preference for U.S. Industry. Notwithstanding any other provision of this article, the Sponsor agrees that neither it nor any assignee will grant to any person the exclusive right to use or sell any Subject Invention in the United States unless such person agrees that any products embodying the Subject Invention or produced through the use of the Subject Invention will be manufactured substantially in the United States. However, in individual cases, the requirement for such an agreement may be waived by DOE upon a showing by the Sponsor or its assignee that reasonable but unsuccessful efforts have been made to grant licenses on similar terms to potential licensees that would be likely to manufacture substantially in the

United States or that under the circumstances domestic manufacture is not commercially feasible.

- (6) The Sponsor agrees to refund any amounts received as royalty charges on any Subject Invention in procurement by or on behalf of the Government and to provide for that refund in any instrument transferring rights to any party in the invention.
- (7) The Sponsor agrees to include, within the specification of any United States patent applications and any patent issuing thereon covering a Subject Invention, the following statement. "The Government has rights in this invention pursuant to M&O Contract DE-AC09-08SR22470 and Work for Others Agreement No. WFO-13-002".

4. Invention Identification, Disclosures, and Reports

- A. The Sponsor shall furnish the Patent Counsel a written report containing full and complete technical information concerning each Subject Invention it makes within 6 months after conception or first actual reduction to practice, whichever occurs first, in the course of or under this Agreement, but in any event prior to any on sale, public use, or public disclosure of such invention known to the Sponsor. The report shall identify the contract and inventor and shall be sufficiently complete in technical detail and appropriately illustrated by sketch or diagram to convey to one skilled in the art to which the invention pertains a clear understanding to the extent known at the time of disclosure, of the nature, purpose, operation, and to the extent known, the physical, chemical, biological, or electrical characteristics of the invention. The report should also include any election of invention rights under this article. When an invention is reported under this paragraph 4.A, it shall be presumed to have been made in the manner specified in Section (a)(1) and (2) of 42 USC 5908.
- B. The Contractor shall report Subject Inventions it makes in accordance with the procedures set forth in contract DE-AC09-08SR22470. In addition, the Contractor shall disclose to the Sponsor at the same time as disclosure to the Department any Subject Inventions made by the Contractor under this Agreement and the Sponsor shall notify the Department within 6 months of receipt of such disclosure by the Sponsor of any election of patent rights under this article.
- C. Requests for extension of time for election under subparagraphs A and B may be granted by Patent Counsel for good cause shown in writing.

5. Limitation of Rights

Nothing contained in this patent rights article shall be deemed to give the Government any rights with respect to any invention other than a Subject Invention except as set forth in the Facilities License of paragraph 6.

6. Facilities License

In addition to the rights of the Parties with respect to inventions or discoveries conceived or first actually reduced to practice in the course of or under this Agreement, the Sponsor agrees to and does hereby grant to the Government an irrevocable, non-exclusive, paid-up license in and to any inventions or discoveries regardless of when conceived or first actually reduced to practice or acquired by the Sponsor, which at any time, through completion of this Agreement, are owned or controlled by the Sponsor and are incorporated in the facility as a result of this Agreement to such an extent that the facility is not restored to the condition existing prior to the Agreement (1) to practice or to have practiced by or for the Government at the facility, and (2) to transfer such license with the transfer of the facility. The acceptance or exercise by the Government of the aforesaid rights and license shall not prevent the Government at any time from contesting the enforceability, validity, or scope of, or title to, any rights or patents herein licensed.

7. Early Termination of Agreement

The terms and conditions of this article shall survive the Agreement, in the event that the Agreement is terminated before completion of the Statement of Work.

Article XV. RIGHTS IN TECHNICAL DATA - USE OF FACILITY

1. The following definitions shall be used.
 - A. "Generated Information" means information produced in the performance of this Agreement.
 - B. "Proprietary Information" means information which is developed at private expense, is marked as Proprietary Information, and embodies (1) trade secrets or (2) commercial or financial information which is privileged or confidential under the Freedom of Information Act (5 USC 552 (b)(4).
 - C. "Unlimited Rights" means the right to use, disclose, reproduce, prepare derivative works, distribute copies to the public, and perform publicly and display publicly, in any manner and for any purpose, and to have or permit others to do so.
2. The Sponsor agrees to furnish to the Contractor or leave at the facility that information, if any, which is (1) essential to the performance of work by the Contractor personnel or (2) necessary for the health and safety of such personnel in the performance of the work. Any information furnished to the Contractor shall be deemed to have been delivered with Unlimited Rights unless marked as Proprietary Information. The Sponsor agrees that it has the sole responsibility for appropriately identifying and marking all documents containing Proprietary Information, whether such documents are furnished by the Sponsor or produced under this Agreement and made available to the Sponsor for review.

3. The Sponsor may designate as Proprietary Information any Generated Information where such data would embody trade secrets or would comprise commercial or financial information that is privileged or confidential if it were obtained from the Sponsor. Such Proprietary Information will, to the extent permitted by law, be maintained in confidence and disclosed or used by the Contractor (under suitable protective conditions) only for the purpose of carrying out the Contractor's responsibilities under this Agreement. Upon completion of activities under this Agreement, such Proprietary Information will be disposed of as required by the Sponsor. Before the Contractor releases data associated with this Agreement to anyone, the Sponsor will be afforded the opportunity to review that data to ascertain whether it is Proprietary Information and to mark it as such.
4. The Government and Contractor agree not to disclose properly marked Proprietary Information to anyone other than the Sponsor without written approval of the Sponsor, except to Government employees who are subject to the statutory provisions against disclosure of confidential information set forth in the Trade Secrets Act (18 USC 1905). The Government and Contractor shall have the right, at reasonable times up to 3 years after the termination or completion of the Agreement, to inspect any information designated as Proprietary Information by the Sponsor, for the purpose of verifying that such information has been properly identified as Proprietary Information.
5. The Sponsor is solely responsible for the removal of all of its Proprietary Information from the facility by or before termination of this Agreement. The Government and Contractor shall have Unlimited Rights in any Proprietary Information which is incorporated into the facility or equipment under this Agreement to such extent that the facility or equipment is not restored to the condition existing prior to such incorporation.
6. The Sponsor agrees that the Contractor will provide to the Department a nonproprietary description of the work performed under this Agreement.
7. The Government shall have Unlimited Rights in all Generated Information produced or information provided by the Parties under this Agreement, except for information which is disclosed in a Subject Invention disclosure being considered for patent protection, or which is marked as being Proprietary Information.
8. Copyrights. The Sponsor may assert copyright in any of its Generated Information, and may also require the Contractor, at the Sponsor's expense, to register copyright and assign copyright in any Generated Information produced by the Contractor which the Sponsor wishes to copyright. Subject to the other provisions of this article, and to the extent that copyright is asserted, the Government reserves for itself a royalty-free, world-wide, irrevocable, non-exclusive license for Government purposes to publish, distribute, translate, duplicate, exhibit, prepare derivative works, and perform any such data assigned to the Sponsor.
9. The terms and conditions of this article shall survive the Agreement, in the event that the Agreement is terminated before completion of the Statement of Work.

Article XVI. ASSIGNMENT

Neither this Agreement nor any interest therein or claim thereunder shall be assigned or transferred by either Party, except as authorized in writing by the other Party to this Agreement, provided, the Contractor may transfer it to the Department, or its designee, with notice of such transfer to the Sponsor, and the Contractor shall have no further responsibilities except for the confidentiality, use, and/or non-disclosure obligations of this Agreement.

Article XVII. SIMILAR OR IDENTICAL SERVICES

The Government and/or Contractor shall have the right to perform similar or identical services in the Statement of Work (SOW) for other Sponsors as long as the Sponsor's Proprietary Information is not utilized.

Article XVIII. EXPORT CONTROL

Each party is responsible for its own compliance with laws and regulations governing export control.

Article XIX. TERMINATION

Performance of work under this Agreement may be terminated at any time by either Party, without liability, except as provided above, upon giving written notice to the other party. The Contractor shall terminate this Agreement only when the Contractor determines, after direction from DOE, that such termination is in the best interest of the Government, provided however, that the Contractor shall have the right to terminate if the Sponsor shall have failed to advance the funds required by Article IV. In the event of termination, the Sponsor shall be responsible for the Contractor's costs (including closeout costs), through the effective date of termination, but in no event shall the Sponsor's cost responsibility exceed the total cost to the Sponsor as described in Article III, above.

It is agreed that any obligations of the Parties regarding Proprietary Information or other intellectual property will remain in effect, despite early termination of the Agreement.

Article XX. DISPUTES

The Parties shall attempt to settle any claim or controversy arising from this Agreement through consultation and negotiations in good faith and a spirit of mutual cooperation. If those attempts fail, then the dispute will be mediated by a mutually acceptable mediator chosen by the Parties within 30 days after written notice by one party demanding mediation. Neither Party may unreasonably withhold consent to the selection of a mediator, and the Parties will share the costs of the mediation equally.

This Agreement and the performance thereunder shall be governed by United States of America Federal law. To the extent that there is no applicable Federal law, this Agreement and performance thereunder shall be governed by the law of the State of South Carolina.

***Resolution of Sponsor Complaints/Inquiries (SRNS Ombudsman)**

It is the policy of SRNS that all employees, in the performance of their responsibilities, shall adhere to the highest possible standards of ethical and business conduct.

SRNS has established an Ombudsman in the SRNS Ethics Office. The Ombudsman is responsible for helping to resolve Sponsor complaints, disputes, or inquiries, arising under this Agreement when such concerns have not been resolved by responsible SRNS officials. The Ombudsman may be contacted by phone at (803) 725-7269. The Ombudsman will investigate the complaint or inquiry and provide the caller with a response. The caller may remain anonymous, if he or she chooses.

Article XXI. MODIFICATIONS

This Agreement may be amended or modified at any time by either Party, upon written request to the other Party. If acceptable to both Parties the requested amendment or modification will be contractually captured through a formal written Modification to this Agreement, signed by the duly authorized representatives of both Parties.

In witness whereof, the Parties hereto have executed this Agreement

FOR SAVANNAH RIVER NUCLEAR SOLUTIONS, LLC:

Signature: John W. Temple

Name: John W. Temple

Title: Director, Contracts

Date: 12/11/2012

FOR FORSCHUNGSZENTRUM JULICH GmbH:

Signature: Karsten Beneke

Name: Karsten Beneke

Title: Vice-Chairman of the Board of Directors

Date: DECEMBER 4, 2012

Signature: Rolf Heitz

Name: ppa. Rolf Heitz

Title: Authorized Signatory,
Head of Purchasing and Material

Date: DECEMBER 4, 2012

WFO AGREEMENT WFO-13-002

(RESEARCH AND DEVELOPMENT ON GRAPHITE DESTRUCTION FOR THE PEBBLE BED FUEL ELEMENTS)

APPENDIX A

STATEMENT OF WORK

1.0 SCOPE

General Description of the Service

Julich is currently storing 152 casks of graphite pebble bed fuel from the AVR reactor. They have a need to remove these casks. The Savannah River Site has fuel processing experience and have been asked to assist with the evaluation of a potential disposition of these fuel pebbles. A Memorandum between the Federal Republic of Germany and the United States Department of Energy was signed on October 18, 2012 for this research to be done. The research will be done in two phases (parts of which will be done concurrently): a R&D phase using non-irradiated material conducted at the Savannah River National Laboratory and a R&D phase using irradiated material to be conducted at the Julich facility in Germany with assistance from Savannah River National Laboratory. This work will be accomplished under the DOE Work For Others (WFO) program. This contract will include:

- All SRNS costs associated with this research and development,
- DOE costs for travel associated with the work to determine if this material can be accepted by the United States.
- All SRNS costs associated with travel for participation on the Technical Working Groups.

1.2 Background

The objective of this work is to perform exploratory research on chemical systems for dissolving fuel materials that contain a large fraction of graphite. Of particular interest is a system studied by the Savannah River National Laboratory (SRNL) (b) (4)

(b) (4)

There exists a set of nuclear fuels that are encased in graphite in the shape of pellets or kernels that are 60 mm in diameter. The fuels are predominantly graphite (~95%) with minor amounts of uranium oxide and thorium oxide, which are the fuel components. A subset of these fuels contains trace quantities of silicon carbide (SiC). Efforts to separate the graphite from the fuel components by physical means (i.e., grinding followed by exploiting density differences) have been generally unsuccessful. The use of graphite oxidation is impractical for the type of remote operations performed at the Savannah River Site (SRS)

(b) (4)

(b) (4)

REFERENCES

2.1 Definitions / Acronyms

DOE – Department of Energy
NRC – Nuclear Regulatory Commission
SAP – Sample and Analysis Plan
SOW – Statement of Work
SRS – Savannah River Site
SRNS, LLC – Savannah River Nuclear Solutions, LLC and its duly authorized representatives
U.S. – United States
WFO – Work for Others

2.2 Applicable Codes/Standards/Orders/Regulations

U.S. Department of Labor Relations (<http://www.gpoaccess.gov/cfr/index.html>) including, but not limited to, 29 CFR Part 1910 Occupational Safety and Health Standards

U.S. Department Of Energy Directives (www.directives.doe.gov) including but not limited to,

- DOE O 460.2, *Departmental Materials Transportation and Packaging Management*
- DOE O 5400.5, *Radiation Protection of the Public and the Environment*
- DOE O 5480.19, *Conduct of Operations Requirements for DOE Facilities*
- DOE O 5480.20A, *Personnel Selection, Qualification, and Training Requirements for DOE Nuclear Facilities*
- DOE O 414.1C, *Quality Assurance*
- DOE O 460.1C, *Packaging and Transportation Safety*
- DOE O 551.1C, *Official Travel*
- ISO 17025 Standard, *General Requirements for the Competence of Calibration and Testing Laboratories.*

United States Code of Federal Regulations

- 10 CFR Part 830, *Nuclear Safety Management*
- 10 CFR Part 71, *and supporting guides*
- 10 CFR Part 73, *Physical Protection of Plants and Materials*
- 10 CFR Part 110, *Export and Import of Nuclear Equipment and Material*
- 49 CFR, *Transportation*

WORK REQUIREMENTS

3.1 Task Requirements

(Reference/content e-mail November 16, 2012; Appendix D)

Task 1: Non-Irradiated Research and Development regarding Graphite Removal
using (b) (4)

(b) (4)

(b) (4)

The goal of the research is to validate the initial findings that this will dissolve the graphite (b) (4)

(b) (4)

Having selected three or four potential process conditions, evaluate the reaction of ground graphite powder in the systems. (b) (4)

(b) (4)

This work will likely be conducted in a radiological glovebox, and may require the installation of a muffle furnace in the glovebox. The kernels will be fused, dissolved, and filtered.

Test the fusion and dissolution (b) (4)

(b) (4)

Working with the two most-promising process conditions from the above studies, test the direct dissolution of an entire fuel sphere (60 mm diameter). (b) (4)

(b) (4)

Provide all test results in a technical report. Identify a recommended recipe and process approach for processing graphite-encased fuel kernels. Offer a recommended path forward for advancement of the technology.

Task 2: Assistance to Julich facility in Irradiated Research and Development

Provide for the Lead Scientist from SRNS to travel to Julich and assist Julich (b) (4)
(b) (4)
(b) (4) The tests will also provide information about what off gassing occurs. (b) (4) This task is envisioned to require a month's worth of time and travel for the Lead Scientist. It currently includes any specialized equipment (e.g., induction melter) costs needed to conduct the R&D at Julich.

Task 3: Technical Work Group Participation

Provide expertise (e.g., technical research as well as processing experience) to the Technical Working Group. Participate as members of the Technical Working group which may involve travel of the researchers and the facility lead. Assist in the identification and resolution of the technical issues. The WFO includes DOE staff travel for participation on the Technical Work Group.

Task 4: Logistical Work Group Participation

The WFO includes DOE staff travel for participation on the Logistical Work Group, where they will participate as a member of the Logistical Work group and assist in the identification and resolution of issues for package certification.

Task 5: Quarterly Status Reports

Provide quarterly status reports on cost, schedule, and scope regarding the tasks covered under this WFO to be reviewed by DOE (EM and SR), Julich, and German Ministry.

Task 6: Quarterly Project Reviews

Provide for travel of both the DOE staff and the SRNS personnel to participate in the Quarterly Reviews, with the German Ministry and the appropriate Julich facility personnel.

3.3 Quality Requirements

A. Sponsor

1. No Quality Assurance requirements apply for the Sponsor.

B. SRNS Laboratories/Operations (General)

1. SRNS shall comply with the Quality Assurance requirements as specified in DOE Order 414.1C for:

- Procedure development, review, approval, and execution;
- Use approved industry methods for analyses;
- Have an approved calibration program/process for analytical equipment;
- Training of personnel for heavy water disposition to the Sponsor;
- Third party analytical services;
- Procurement of heavy water containers;
- Research and Development (treatability plan);
- Sample analysis and sample control;

- Design, installation, and testing of facility modifications (b) (4) and (b) (4)
- QA records (surveys, completed procedures/forms, shipping documents, etc.).

3.4 **Site Conditions**

Sponsor personnel will be required to meet specific training requirements and to comply with specific security and procedural requirements if required to access the SRS facilities.

3.5 **Period of Performance/Schedule**

Period of performance shall be from receipt of the first funding and not extend beyond December 20, 2013.

3.7 **Deliverables**

- A. The process for contract changes/revisions are as specified in the SRNS Work for Others Agreement WFO-13-002, and must be agreed to by both the Sponsor and Contractor for acceptance.
- B. All transmittals, submittals and correspondence shall be uniquely identified and reference the following information:
 1. SRNS Work for Others (WFO) Agreement WFO-13-002
 2. WFO Agreement Name: RESEARCH AND DEVELOPMENT ON GRAPHITE DESTRUCTION FOR THE PEBBLE BED FUEL ELEMENTS
 3. Savannah River Nuclear Solutions, LLC
 4. Contract Administration
 5. Building 730-1B
 6. Aiken, SC 29808
 7. All other communications shall be directed to:

Savannah River Nuclear Solutions, LLC
Contract Administration
Building 730-1B, Room 3040
Aiken, SC 29808
Attention: John W. Temple
- C. Work is performed by SRNS with positive monies that support scheduled activities. No work will continue by SRNS work groups where negative funding is evident. The Sponsor is responsible for funding all SRNS work activities that they have approved.

3.8 **ACCEPTANCE OF SERVICES**

Acceptance of services is based on the SRNS fulfilling the requirements of this Statement of Work.

WFO AGREEMENT WFO-13-002

(RESEARCH AND DEVELOPMENT ON GRAPHITE DESTRUCTION FOR THE PEBBLE BED FUEL ELEMENTS)

APPENDIX B

ESTIMATE OF COSTS
(all costs in US Dollars)

Task 1: **Non-Irradiated Research and Development regarding Graphite Removal using**
(b) (4)

(b) (4) Type	(b) (4) Unit cost	(b) (4) Total
(b) (4) Labor hours (Lead Scientist)	(b) (4) hour	(b) (4)
(b) (4) Labor hours (Assistant Scientist)	(b) (4) hour	(b) (4)
(b) (4) Labor hours (Facility Technical Expert)	(b) (4)	(b) (4)
Specialized Equipment (induction melter, etc.)	(b) (4)	(b) (4)
Total Task 1:		(b) (4)

Task 2: **Assistance to Julich facility in Irradiated Research and Development**

Type	Unit cost	Total
(b) (4) Labor hours (Lead Scientist)	(b) (4) /hour	(b) (4)
Per Diem costs for (b) (4) days	(b) (4) day	(b) (4)
Travel Costs	(b) (4)	(b) (4)
Specialized Equipment (induction melter, etc.)	(b) (4)	(b) (4)
Total Task 2:		(b) (4)

Task 3: Technical Work Group Participation

Number of Travelers	Unit cost	Number of Trips	Total
(b) (4) DOE travelers	(b) (4) person	(b) (4)	(b) (4)
(b) (4) SRNS travelers	(b) (4) person	(b) (4)	(b) (4)
Total Task 3:			(b) (4)

Task 4: Logistical Work Group Participation

Number of Travelers	Unit cost	Number of Trips	Total
(b) (4) DOE travelers	(b) (4) person	(b) (4)	(b) (4)
Total Task 4:			(b) (4)

Task 5: Quarterly Status Reports

Number of Reports	Unit Cost	Total
(b) (4)	(b) (4)	(b) (4)
Total Task 6:		(b) (4)

Task 6: Quarterly Project Reviews

Number of Travelers	Unit cost	Number of Trips	Total
(b) (4) DOE travelers	(b) (4) person	(b) (4)	(b) (4)
(b) (4) SRNS travelers	(b) (4) person	(b) (4)	(b) (4)
Total Task 7:			(b) (4)

Total of all Task Costs

Task 1	(b) (4)
Task 2	(b) (4)
Task 3	(b) (4)
Task 4	(b) (4)
Task 5	(b) (4)
Task 6	(b) (4)
Total	(b) (4)

TOTAL COSTS FOR THE WORK FOR OTHERS

Total of all Task Costs	(b) (4)
DOE Administrative Costs (of Total costs)	(b) (4)
Total Costs for the WFO	(b) (4)

WFO AGREEMENT WFO-13-002

(RESEARCH AND DEVELOPMENT ON GRAPHITE DESTRUCTION FOR THE PEBBLE
BED FUEL ELEMENTS)

APPENDIX C

PAYMENT SCHEDULE

Payee	Amount	Date Required	Payment Method
US Department of Energy	(b) (4)		Check
SRNS			Electronic Funds Transfer (EFT)
US Department of Energy			Check
SRNS			EFT
SRNS			EFT
SRNS			EFT
SRNS			EFT
SRNS			EFT
SRNS			EFT
SRNS			EFT
SRNS			EFT

WFO AGREEMENT WFO-13-002

(RESEARCH AND DEVELOPMENT ON GRAPHITE DESTRUCTION FOR THE PEBBLE
BED FUEL ELEMENTS)

APPENDIX D

NOVEMBER 16, 2012 EMAIL



WFO/Calculation of Costs

Maxine Masted to Charles Messick, Jeffrey Galan, H Gunter,
edgardo.deleon, edgard.espinosa,
jay.rhoderick, wilfried.kraus,
Cc: Michael Chandler, Robert Pierce

11/16/2012 12:16 PM

Dear Dr. Damm and Mr. Klein-

We understand you are concerned with the amount of hours allotted in the Appendix B and the unit cost per hour.

First let me clarify that under the Work for Others program, only the money that is spent on the work scope (b) (4) provided by DOE/SRNS. For example if you provided (b) (4) and the work only cost (b) (4) then the remaining (b) (4) would be returned to you.

It was my understanding from our discussions on the WFO that we wanted it to be as flexible (broad) as possible without impeding our work forward. Therefore we provided a conservative estimate of hours which will provide the team with the most flexibility. In addition, we've included in the WFO for quarterly progress reports (which will provide details on costs spent and schedule progress). It is our expectation that any issues would be identified during the review of these reports and corrections made at that time.

(b) (4)

You also requested the contract referenced in Article XIV, 4.B. This contract is very large so I have pulled what I believe to be the relevant sections and have attached it. If you need more information please let me know, however some of the contract is business sensitive information and can not be released.



Section 1 of SRNS contract.docx

(b) (4)

Bob has provided additional information related to Tasks 1 and 2 of WFO-13-002 to help clarify what will be done under the tasks. See below.

I think that one of the points that should be made clear in this estimate is that this task is much more than a handful of chemistry tests. The plans for the WFO are to 1) perform the chemistry studies to develop a flowsheet, 2) engineer a system that can be tested as a pilot-scale apparatus suitable for remote operations, and 3) provide a system that can be safely tested at the Juelich facility. To get from where we are to an informed decision will take a significant effort and coordination. There is one thing I know for certain - I can digest large, thick pieces of graphite in a short time frame. However, I do not know enough about that digestion process to turn it into a working prototype.

There are places where I have broken down the tasks somewhat and assigned preliminary amounts of hours to each task. Within each of these tasks, there is the possibility that a task will either prove to be a

dead end such that it forces new tasks to be added, or possibly a task will be extremely successful such that it eliminates the need to perform certain tasks. Many of the tasks I foresee being necessary are included in the five-page technology discussion I provided you earlier (SRNL-L3100-2012-00191).

A more-specific schedule will be developed when funding becomes available. Once funding is available and the initial technical visit to Germany is complete, then the principal SRNL participants will lay out a specific schedule with resource allocations to ensure the resources will be made available to complete the project. However, until that meeting in Germany specifically lays out the objectives and expectations for the project, detailed schedules will be poor estimates of what will actually occur. The cost estimate is intended to cover expected tasks and contingencies.

TASK 1

Task 1 involves the participation of three principal professionals to address three major aspects of this development. Those three major aspects include 1) studying, developing, and optimizing the digestion chemistry, 2) development, procurement, and testing of prototypical equipment, and 3) managing the interfaces for operation in a remote facility.

Lead Scientist: The lead scientist has numerous tasks, including overall management of the technology development. The lead scientist selected for this task has 24 years experience developing processes and flowsheets for deployment in H-Canyon/MB-Line. He must also obtain facility approvals for testing, set up test equipment, and conduct a range of experiments directed at digestion of the individual fuel components as well as complete fuel pellets. He must study several potential chemical systems to determine the best system for the process, and then he must optimize the chemistry for the demands of the overall process. It is important for our customer to understand that the hours and costs assigned to the Lead Scientist are all-encompassing. They incorporate the fact that there will be technicians working with lead scientist. They incorporate charges that will be incurred as a result of analytical services that must be provided to develop the chemistry. While the lead scientist is the principal participant in the WFO, his activities will inevitably include part-time assistance from 6-10 other people. All of those costs are included in the Lead Scientist estimate. The (b) (4) reflects the fully-burdened charge rate for that grade level of researcher. The charge rate for the specific researcher who will be the lead scientist may be slightly less, but not likely more than (b) (4) lower, and it should be reiterated that the lead scientist assumes the participation of many other support personnel.

Assistant Scientist: The assistance scientist has the vital role of working with the lead scientist to develop the process equipment. The assistant scientist for this task has over 20 years experience developing one-of-a-kind pieces of equipment for application in the nuclear industry, including equipment operated in shielded cells and canyon facilities. The assistant scientist will need to identify potential equipment that can safely complete the task on a production scale. He will design conceptual equipment to enable loading, unloading, and disposition of chemicals used for the digestion process. He will help procure equipment and assist in the actual pilot-scale testing of the equipment. He will design equipment to operate in the shielded cells of the Juelich facility. While the assistant scientist is a main participant in the WFO, his tasks also include part time assistance from technicians, machine shop personnel, and buyers. All of those costs are included in the Assistant Scientist estimate. The (b) (4) is the fully-burdened charge rate for this category of researcher.

Facility Technical Expert: The facility technical expert has the role of providing the interface between the lead scientist, assistant scientist, and the operating facility to make sure that the chemistry and the engineering tasks are compatible with remote Canyon operations. The two men who are functioning in this role EACH have in excess of 28 years experience working with Canyon processing and interface issues. They will help obtain unirradiated HTGR fuel pellets from Oak Ridge National Laboratory for testing. In addition to their own time, these experts will also draw on the assistance of other experts in the facility such that the time specified in the WFO covers not only their time, but the time of others who will be involved in the project or in obtaining actual fuel pellets for testing.

Specialized Equipment: As specified, we expect at this stage to need to procure an induction melter for the process. After the melter is received, additional associated equipment will be procured, designed and fabricated to work with the furnace.

TASK 2

This task is straight forward. The only questions would be the duration of the assignment and the specific charge rate of the lead scientist. The (b) (4) reflects the fully-burdened charge rate for that category of researcher. The charge rate for the specific researcher who will be traveling to Juelich may be slightly less, but not likely more than (b) (4) lower. The specialized equipment charge assumes the same charge

for the Julich facility as is incurred for the SRNL facility.

Please let me know how you wish to proceed on WFO changes. Please also be aware that next week (Nov. 19-23) is a holiday week for us so I will only be available on the 19th of that week.

I hope this provides answers to your questions, if not please let me know.

Thanks,

Maxine Maxted

(803) 208-0506 pager (b) (6)

Correction of dates in above email paragraph discussing the minimum payments required:

- The November 30, 2013 should be November 30, 2012
- The February 28, 2014 should be November 30, 2013