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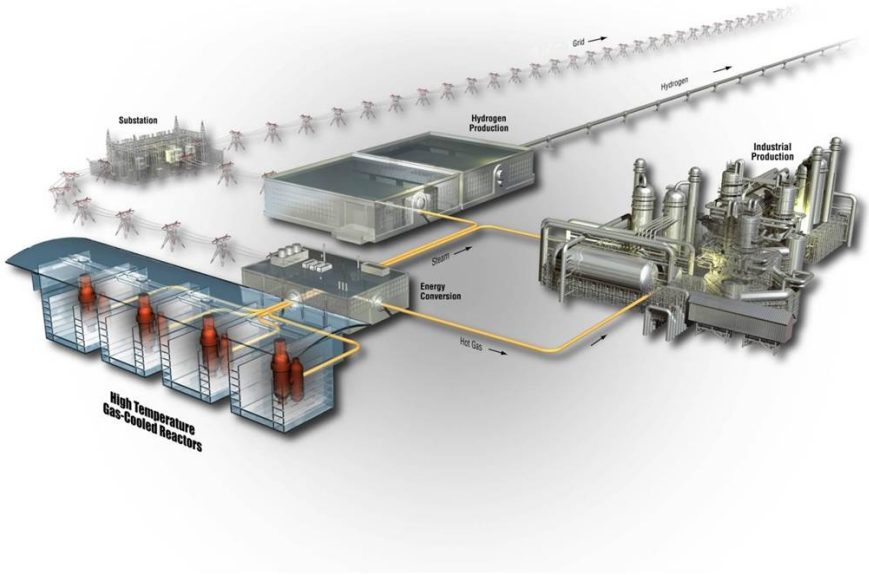
Statement of Work

Project No. 23841, 29412

Support for INL ART Advanced Gas Reactor Fuel Fabrication and Characterization



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SUPPORT FOR INL ART ADVANCED GAS REACTOR FUEL FABRICATION AND CHARACTERIZATION	Identifier: SOW-10649 Revision: 11 Effective Date: 09/27/2018	Page 2 of 8

INL ART Program Statement of Work

SIGNATURES

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P For Preparer of the document.

A For Approval: This is for non-owner approvals that may be required as directed by a given program or project.

C For documented review and concurrence.

Note Quality Level 3 (QL3)

REVISION LOG

Rev.	Date	Affected Pages	Revision Description
0	09/28/2012	All	New document.
1	05/21/2013	Pages 7, 9, and 10	Revised to include additional scope and applicable Quality Assurance program changes.
2	10/01/2013	All	Revised to incorporate additional work scope and remove completed work scope.
3	12/20/2013	All	Revised to incorporate additional FY-14 work scope.
4	04/16/2014	All	Revised to incorporate plus-up funding work scope.
5	10/01/2014	All	Revised to incorporate planned FY-15 work scope.
6	07/20/2015	All	Revised to add coating of materials work scope.
7	10/01/2015	All	Revised to incorporate planned FY-2016 work scope.
8	11/28/2016	All	Revised to incorporate planned FY-2017 work scope.
9	06/16/2017	6-7	Added characterization support for AGR-5/6/7 compacts.
10	12/04/2017	5-8	Revised to incorporate planned FY-2018 work scope.
11	09/27/2018	All	Added FY2019 characterization support for AGR-5/6/7 overcoated TRISO particles and compacts and removed TDO references

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INTRODUCTION

1.1 Background

Oak Ridge National Laboratory (ORNL) has participated in the Advanced Gas Reactor (AGR) program for the Next Generation Nuclear Plant (NGNP) and the transition to the Idaho National Laboratory (INL) Advanced Reactor Technologies (ART) since the inception of the program. In this effort, ORNL has fabricated tristructural isotropic (TRISO) fuel and fuel compacts for AGR-1, AGR-2, and AGR-3/4 experiments; provided matrix only components for Advanced Graphite Creep (AGC)-2, AGC-4, the AGR-3/4 experiment and for university studies ORNL also provided characterization, coating, and compaction support for INL and BWX Technologies Nuclear Operations Group (BWXT).

In fiscal year (FY) 2019, the activities for the INL ART fuel development are focused on final characterization to support the AGR-5/6/7 experiments and documenting the Generation-IV International Forum (GIF) pre-irradiation leach-burn-leach (LBL) round robin effort with China and South Korea.

1.2 Purpose/Objectives

1.2.1 ORNL Laboratory Operations and Support Services

This task incorporates miscellaneous physical and administrative work activities needed to maintain the characterization laboratory in an operable state to support fuel characterization.

1.2.2 ORNL Project Management and Reporting

This task embodies work activities related to project planning, administration, and reporting status and outcomes of work performed.

1.2.3 ORNL Confirmatory Analyses and Characterization Support

ORNL will provide analytical and characterization support to INL to continue AGR-5/6/7 fuel compact and overcoated TRISO particle characterizations.

1.2.4 ORNL Technical Support and Participation in Generation-IV International Forum Activities

ORNL shall continue to participate in the GIF Very High Temperature Reactor (VHTR) Fuel and Fuel Cycle Project Management Board (FFC-PMB) activities, including supporting the GIF LBL round robin being conducted with China and South Korea. The technical support will include collaboration meetings and issuance of reports.

1.3 Anticipated Benefits

Activities related to compact deconsolidation leach burn leach are intended to provide accurate TRISO particle defect data in support of the current AGR-5/6/7 irradiation and future post-irradiation examination work activities.

The analytical and characterization support provided by ORNL per this statement of work (SOW) allows for comparison of results obtained from the BWXT lab analysis for the same or similar samples.

2. APPLICABLE CODES AND REFERENCES

American Society of Mechanical Engineers NQA-1 2008/1a 2009, Part I is applicable to the work scope performed.

Specification (SPC)-1352, "AGR-5/6/7 Fuel Specification", Revision 8, March 9, 2017.

3. SCOPE

3.1 Work to Be Performed

3.1.1 ORNL Laboratory Operations and Support Services

ORNL shall maintain the data acquisition methods and equipment in the uranium fuel characterization laboratory in an operable state to support the planned work scope.

3.1.2 ORNL Project Management and Reporting

ORNL shall conduct necessary activities for project management and reporting activity status and progress.

3.1.3 ORNL Characterization and Analyses Support

ORNL will provide additional analytical and characterization support in FY2019 to validate and/or verify the results obtained for AGR-5/6/7 fuel compact characterization, which includes leach-burn-leach analysis on overcoated TRISO particles, compact deconsolidation method refinement, and deconsolidation-leach-burn-leach of AGR-5/6/7 compacts.

3.1.4 ORNL Technical Support and Participation in Generation-IV International Forum Activities

ORNL shall provide technical support and participate in GIF VHTR FFC PMB activities, including an LBL round-robin. The U.S., China, and South Korea will be the primary participants in the LBL benchmarking round-robin. ORNL has shipped to Korea a series of samples prepared for this experiment that contain depleted-uranium-bearing coated particles with simulated LBL defects. A similar sample set has been prepared and shipped to China. Each primary participant will perform LBL analysis (ORNL analysis of these samples is already complete). China shipped large-coater depleted-uranium TRISO particles to primary participants for similar analysis. ORNL performed analysis

on the samples they received from China. ORNL shall prepare a summary report on the ORNL LBL methods used and data acquired on both sets of round robin samples, collect similar reports and supporting data from Korea and China, assemble a deliverable report for the GIF, and attend a GIF meeting where final results from each participant will be presented and compared.

ORNL will organize and provide a technical chair for the 5th Workshop on HTGR SiC Material Properties to be held in conjunction with the May meeting of the GIF VHTR-FFC-PMB. If ORNL is chosen by the PMB as the location of the May meeting, then ORNL will host the meeting on the ORNL campus.

3.2 Work Excluded

Work not specifically identified to be performed in this SOW or previous revisions is excluded.

3.3 Requirements

ORNL internal environmental, safety and health, quality assurance program, and radiological control requirements apply to all work performed under this SOW.

3.4 Place of Performance

The primary place where this work will be executed is at ORNL.

3.5 Interfaces

BWXT, ORNL and INL investigators will interface with each other.

3.6 Miscellaneous

None

4. DELIVERABLES AND SCHEDULE

Principal investigator(s) shall report progress in bi-weekly INL ART AGR teleconferences and written monthly progress reports.

Activity Description	Completion Date	Deliverable
GIF Round Robin	As completed	Reports on ORNL analysis of Round Robin samples and final GIF deliverable report.
§3.1.3 FY2019 overcoated TRISO particle and AGR-5/6/7 fuel compact defect analyses	April 15, 2019	Report detailing results of characterization of the dispersed uranium, exposed kernel, and defective SiC fractions.

5. COMPLETION CRITERIA AND FINAL ACCEPTANCE

Acceptance of task completion will be upon receipt and review by INL personnel of the applicable deliverable documentation.

6. APPENDICES

None

7. ATTACHMENTS

None