INTERAGENCY AGREEMENT	1. IAA NO. NRC-HQ-60-17-T-0020	PAGE 1 OF 2

2. ORDER NO.	3. REQUISITION NO. RES-17-0288	4. SOLICITATION NO.

5. EFFECTIVE DATE 08/15/2017	6. AWARD DATE 08/15/2017	7. PERIOD OF PERFORMANCE 08/28/2017 TO 09/30/2018

8. SERVICING AGENCY
OAK RIDGE NATIONAL LAB
ALC:
DUNS: 012075755 +4:
US DEPARTMENT OF ENERGY
OAK RIDGE NATION LABORATORY SITE OFFICE
BUILDING 4500N MS 6269
PO BOX 2008
OAK RIDGE TN 37831-6269
POC Deborah Garland, CO
TELEPHONE NO. (865) 241-9566

9. DELIVER TO
DON ALGAMA
US NUCLEAR REGULATORY COMMISSION
TWO WHITE FLINT NORTH BUILDING
11545 ROCKVILLE PIKE
MAIL STOP T-10B58
ROCKVILLE MD 20852

10. REQUESTING AGENCY
ACQUISITION MANAGEMENT DIVISION
ALC: 31000001
DUNS: 040535809 +4:
US NUCLEAR REGULATORY COMMISSION
TWO WHITE FLINT NORTH
11545 ROCKVILLE PIKE
MAIL STOP T-8E06M
ROCKVILLE MD 20852-2738
POC Carolyn A. Cooper
TELEPHONE NO. 301-415-6734

11. INVOICE OFFICE
US NUCLEAR REGULATORY COMMISSION
ONE WHITE FLINT NORTH
11555 ROCKVILLE PIKE
MAILSTOP O3-E17A
ROCKVILLE MD 20852-2738

12. ISSUING OFFICE
US NRC - HQ
ACQUISITION MANAGEMENT DIVISION
MAIL STOP TWFN-8E06M
WASHINGTON DC 20555-0001

13. LEGISLATIVE AUTHORITY
Energy Reorganization Act of 1974

14. PROJECT ID

15. PROJECT TITLE
ORIGEN ENHANCEMENTS TO SUPPORT MELCOR/MACCS2 ANALY

16. ACCOUNTING DATA
2017-X0200-EEEBASED-60-60D003-60B302-1145-11-6-213-253-D-11-6-213-1145

17. ITEM NO.	18. SUPPLIES/SERVICES	19. QUANTITY	20. UNIT	21. UNIT PRICE	22. AMOUNT
	NRC-HQ-60-17-T-0020 The NRC and the DOE Laboratory (ORNL) hereby enter into this Task Order Agreement No. NRC-HQ-60-17-T-0020, for the project entitled "ORIGEN Enhancements to Support MELCOR/MACCS2 Analysis." NRC COR: Don Algama (301)415-1940 ALT COR: Dr. Mourad Aissa (301)415-0380 ORNL PI: Williams A. Wieselquist (865)574-0204 Continued ...				

23. PAYMENT PROVISIONS	24. TOTAL AMOUNT $52,103.00

25a. SIGNATURE OF GOVERNMENT REPRESENTATIVE (SERVICING)	26a. SIGNATURE OF GOVERNMENT REPRESENTATIVE (REQUESTING)
25b. NAME AND TITLE Deborah L. Garland, Contracting Officer	25c. DATE 8/16/17
26b. CONTRACTING OFFICER CAROLYN A. COOPER	26c. DATE 8/15/2017

SUNSI REVIEW COMPLETE

AUG 22 2017

TEMPLATE - ADM001

ADM002

INTERAGENCY AGREEMENT	1. IAA NO. NRC-HQ-60-17-T-0020	PAGE 1 OF 2

2. ORDER NO.	3. REQUISITION NO.	4. SOLICITATION NO.
	RES-17-0288	

5. EFFECTIVE DATE	6. AWARD DATE	7. PERIOD OF PERFORMANCE
08/15/2017	08/15/2017	08/28/2017 TO 09/30/2018

8. SERVICING AGENCY
OAK RIDGE NATIONAL LAB
ALC:
DUNS: 012075755 +4:
US DEPARTMENT OF ENERGY
OAK RIDGE NATION LABORATORY SITE OFFICE
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US NUCLEAR REGULATORY COMMISSION
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11545 ROCKVILLE PIKE
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POC Carolyn A. Cooper
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12. ISSUING OFFICE
US NRC - HQ
ACQUISITION MANAGEMENT DIVISION
MAIL STOP TWFN-8E06M
WASHINGTON DC 20555-0001

13. LEGISLATIVE AUTHORITY
Energy Reorganization Act of 1974

14. PROJECT ID

15. PROJECT TITLE
ORIGEN ENHANCEMENTS TO SUPPORT MELCOR/MACCS2 ANALY

16. ACCOUNTING DATA
2017-X0200-FEEBASED-60-60D003-60B302-1145-11-6-213-253-D-11-6-213-1145

17. ITEM NO.	18. SUPPLIES/SERVICES	19. QUANTITY	20. UNIT	21. UNIT PRICE	22. AMOUNT
	NRC-HQ-60-17-T-0020 The NRC and the DOE Laboratory (ORNL) hereby enter into this Task Order Agreement No. NRC-HQ-60-17-T-0020, for the project entitled "ORIGEN Enhancements to Support MELCOR/MACCS2 Analysis." NRC COR: Don Algama (301)415-1940 ALT COR: Dr. Mourad Aissa (301)415-0380 ORNL PI: Williams A. Wieselquist (865)574-0204 Continued ...				

23. PAYMENT PROVISIONS	24. TOTAL AMOUNT
	$52,103.00

25a. SIGNATURE OF GOVERNMENT REPRESENTATIVE (SERVICING)	26a. SIGNATURE OF GOVERNMENT REPRESENTATIVE (REQUESTING)
	Carolyn A. Cooper

25b. NAME AND TITLE	25c. DATE	26b. CONTRACTING OFFICER	26c. DATE
		CAROLYN A. COOPER	8/15/2017

The period of performance shall commence on August 28, 2017 and shall end on September 30, 2018. Notwithstanding the agreement effective dates and period of performance start dates stated elsewhere in the agreement, the effective date of the agreement and start date of the period of performance are the last date of signature by the parties.

CONSIDERATION AND OBLIGATION:

(a) Authorized Ceiling Amount: $150,000.00
(b) The amount presently obligated with respect to this task order is $52,103.00. When and if the amount(s) paid and payable to the DOE Laboratory hereunder equals the amount obligated, the DOE Laboratory shall not be obligated to continue performance of the work unless and until the NRC Contracting Officer increases the amount obligated with respect to this DOE Task Order Agreement. Any work undertaken by the DOE Laboratory in excess of the obligated amount specified above is done so at the DOE Laboratory's sole risk.

The following documents are hereby incorporated as part of this Agreement:

Attachment No. 1: Statement of Work
Attachment No. 2: DOE Standard Terms and Conditions

The work hereunder is non-fee recoverable.

This agreement is entered into pursuant to the authority of the Energy Reorganization Act of 1974, as amended (42 U.S.C 5801 et seq.). This work will be performed in accordance with the NRC/DOE Memorandum of Understanding dated November 24, 1998. To the best of our knowledge, the work requested will not place the DOE and its contractor in direct competition with the domestic private sector.
Master IAA: NRCHQ6014D0005

STATEMENT OF WORK
ORIGEN Enhancements to Support MELCOR/MACCS2 Analysis

Background

Regulatory Context:
The Nuclear Regulatory Commission (NRC) relies on SCALE as a robust, state-of-the-art nuclear analysis computer code system that allows for independent review of licensee submittals and accurate investigations of reactor and fuel phenomena important to nuclear safety.

The SCALE/ORIGEN computer code affects all licensing evaluations that are being performed at the NRC that rely on accurate spent fuel characterization, such as isotopics and decay heat. This work will impact analyses related to spent fuel characterization and source terms for analysis of potential accident releases with the NRC's MELCOR/MACCS2 codes.

Technical Context:
The ORIGAMI Automator in SCALE was developed to support large-scale source terms analysis of a reactor site, including spent fuel pool heat load and with output in a format adaptable to MELCOR and MACCS2, setting up hundreds to thousands of ORIGAMI/ORIGEN calculations. ORIGAMI is designed for easy modeling of US spent fuel inventory and limited to LWR UO_2 fuel. However, currently due to the general underlying ORIGEN module it requires heavy post-processing to output radioisotopes in a format able to be easily processed by MELCOR, leading to unnecessarily long analysis time. This task will implement the MELCOR and MACCS2 formats as generally available outputs which can be produced by any SCALE/ORIGEN depletion/decay calculation, including those from Polaris, TRITON, or ORIGEN stand-alone.

It is a time-consuming and error-prone process to convert ORIGEN isotopics in current formats to MELCOR or MACCS2 that requires the efforts of experts at ORNL and Sandia National Laboratory. The value of this task will be in the time and error reductions to this very important and common application of ORIGEN for NRC safety assessments.

Isotopic output formats in SCALE are scattered throughout the code base. All sequences support the most general output: the ORIGEN binary concentration file (typically with an ".f71" suffix) which contains all isotopic information. However, to access this data, the OPUS module must be used, which only has the ability to output a SCALE-specific plot file (typically with a ".plt" suffix).

Additional isotopic output formats now include:

- ORIGAMI can produce isotopics in an MCNP format and SCALE Standard Composition format in order to "import" spent fuel isotopics into other types of calculations, e.g. shielding with MAVRIC.

- TRITON can produce isotopics directly in the ".plt" plotfile but Polaris cannot.
- ORIGAMI Automator can produce MELCOR or MACCS output but only in the version 2.1 format and not the version 1.8 format.
- The Shift Monte Carlo code can produce isotopic data in an HDF5 binary file.
- A SCALE utility "f71tocsv" can convert the binary ".f71" file to a text ".csv" file.

Relationship to Other Projects

Task 2 "Automated ORIGEN Source Terms and Spent Fuel Storage Pool Analysis" of IAA NRCHQ6014D0005 Task Order NRCHQ6014T0002 "SCALE Support for Reactor and Spent Fuel Analyses," which was completed in 2014, funded the development of the ORIGAMI Automator. Task Order NRCHQ6015T0014 "Radionuclide Data for Site Level 3 Probabilistic Risk Assessment and Code Assessment" applied ORIGEN and the ORIGAMI Automator to perform a spent fuel pool analysis of an operating nuclear power plant and generate source terms for MELCOR/MACCS2.

Objective(s) of Proposed Work

The objective of this task order is to implement SCALE/ORIGEN enhancements to support MELCOR/MACCS2 analyses. The main objective of this task is to provide the ability to produce MELCOR/MACCS output in both the version 1.8 and 2.1 formats. However, as part of the work, to both maximize the availability of the MELCOR/MACCS output (e.g. from Polaris) and minimize future costs of new output formats, a refactoring of the basic ORIGEN output capabilities is necessary

Work to Be Performed and Expected Results

Oak Ridge National Laboratory (ORNL) provide all resources necessary to accomplish the tasks and deliverables described in this Statement of Work (SOW).

Task 1. Implement SCALE Enhancements for MELCOR/MACCS2

- ORNL shall collect the .plt, .csv, MELCOR/MACCS, MCNP, and Standard Composition (StdComp) isotopic output formats into a more central location as part of the ORIGEN Application Programming Interface (API). Routines in the ORIGEN API are callable from any SCALE code.
- ORNL shall replace the internal output capabilities in the following SCALE sequences with calls to the new isotopic output subroutines in the ORIGEN API:
    - ORIGAMI – MNCP and StdComp
    - ORIGAMI Automator – MELCOR/MACCS

- ORNL shall implement the ability to specify in the ORIGEN, ORIGAMI, OPUS, TRITON, Polaris, and ORIGAMI Automator inputs, the desired format for the isotopic output, choosing one or more of the following: .f71, .plt, MELCOR, MACCS, .csv, StdComp, M CNP.

- ORNL shall document the new output options in the respective sections of the SCALE code manual.

  NOTE: Computer code development must conform to NURG/BR-0167 requirements for Software Quality Assurance.

Task 2. Technical Support

Technical support and on-call assistance in the operation of the SCALE system shall be provided to NRC staff as requested by the NRC COR. This technical support shall include providing assistance with technical issues as they arise during Task 1, and may include interaction with ACRS, and collaborations with other staff and/or contractors, as appropriate.

Key Personnel

Matthew Jessee will be the Project Manager, and William Wieselquist will be the Principal Investigator for this task.

Subcontractors/Consultants Information

No subcontracting effort is anticipated at this time.

Travel

The following travel is anticipated under the task order:

FY18

- One, one-person, two-day trip to NRC HQ to support activities of the project.

ORNL personnel will be authorized travel expenses consistent with the Federal Travel Regulation (FTR) and the limitation of funds specified for the travel within this agreement/order. All travel requires prior written approval from the COR.

Foreign travel for ORNL personnel requires a 60-day lead time for NRC approval. For prior approval of foreign travel, the servicing agency shall submit to the COR an NRC Form 445, "Request for Approval of Official Foreign Travel." NRC Form 445 is available in the MD 11.7 Documents library and on the NRC Web site at: http://www.nrc.gov/reading-rm/doc-collections/forms/. All foreign travel requires prior written approval from the NRC Executive Director for Operations (EDO).

Reporting Requirements and Schedule

Task Number	Deliverable	Deliverable Format	Due Date
1	Technical letter report. The report should detail the developments made, new input deck commands, and testing performed.	Technical letter report in WORD and PDF. Technical letter report in WORD and PDF.	09/30/18
2	Computer Code delivery with SCALE release.	6.3 or next earliest release	09/30/18

ORNL is responsible for structuring the deliverables to follow current agency standards. Deliverables will be technically edited and submitted free of spelling and grammatical errors and conform to requirements stated in this section.

Monthly Letter Status Reports
ORNL will provide a Monthly Letter Status Report, which consists of a technical progress report and financial status report. This report will be used by the sponsoring agency to assess the adequacy of the resources utilized by ORNL to accomplish the work contained in this SOW and to provide status of ORNL progress in achieving tasks and producing deliverables. The report shall include agreement/order summary information, work completed during the specified period, milestone schedule information, problem identification and resolution, travel plans, and staff hour summary. Copies shall be sent to the COR and AMD at ContractsPOT.Resource@nrc.gov.

The MLSR must include the following: agreement number; task order number, if applicable; job code number; title of the project; project period of performance; task order period of performance, if applicable; COR's name, telephone number, and e-mail address; full name and address of the performing organization; principal investigator's name, telephone number, and e- mail address; and reporting period. At a minimum, the MLSR must include the information discussed in the NRC's [preferred] MSLR template.

The COR will acknowledge receipt of deliverables by email.

Period of Performance

The period of performance of this task order is from August 28, 2017 through September 30, 2018.

NRC-Furnished Property/Materials

N/A

Access to Non-NRC Facilities/Equipment

No special facilities are required for this project.

CONTRACTING OFFICER'S REPRESENTATIVE

The COR monitors all technical aspects of the agreement/task order and assists in its administration. The COR is authorized to perform the following functions: assure that the servicing agency performs the technical requirements of the agreement/task order; perform inspections necessary in connection with agreement/task order performance; maintain written and oral communications with the servicing agency concerning technical aspects of the agreement/task order; issue written interpretations of technical requirements, including Government drawings, designs, specifications; monitor the servicing agency's performance and notify the servicing agency of any deficiencies; coordinate availability of NRC-furnished material and/or GFP; and provide site entry of servicing agency personnel.

Contracting Officer's Representative

Name: Don Algama
Agency: U.S. Nuclear Regulatory Commission
Office: TWFN/10B7
Mail Stop: TWFN/10B58
Washington, DC 20555-0001
E-Mail: Don.Algama@nrc.gov
Phone: 301-415-1940

Alternate Contracting Officer's Representative

Name: Mourad Aissa
Agency: U.S. Nuclear Regulatory Commission
Office: TWFN/10B7
Mail Stop: TWFN/10B58
Washington, DC 20555-0001
E-Mail: Mourad.aissa@nrc.gov
Phone: 301-415-0380