INTERAGENCY AGREEMENT	1. IAA NO. NRC-HQ-60-15-T-0025	PAGE 1 OF 3
2. ORDER NO.	3. REQUISITION NO. RES-15-0455	4. SOLICITATION NO.
5. EFFECTIVE DATE 08/21/2015	6. AWARD DATE 08/21/2015	7. PERIOD OF PERFORMANCE 08/31/2015 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
DCN ALGAMA
MAIL STOP T10-B7
11555 ROCKVILLE PIKE
ROCKVILLE MD 20852

10. REQUESTING AGENCY
ACQUISITION MANAGEMENT DIVISION
ALC: 31000001
DUNS: +4:
US NUCLEAR REGULATORY COMMISSION
ONE WHITE FLINT NORTH
11555 ROCKVILLE PIKE
ROCKVILLE MD 20852-2738
POC Jeffrey R. Mitchell
TELEPHONE NO. 301-415-5074

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-5E03
WASHINGTON DC 20555-0001

13. LEGISLATIVE AUTHORITY
Energy Reorganization Act of 1974

14. PROJECT ID

15. PROJECT TITLE
APEX MODERNIZATION FOR SCALE NUCLEAR DATA LIBRARIE

16. ACCOUNTING DATA
2015-X0200-FEEBASED-60-60D003-11-6-213-1045-253D

17. ITEM NO.	18. SUPPLIES/SERVICES	19. QUANTITY	20. UNIT	21. UNIT PRICE	22. AMOUNT
	TASK ORDERING AGREEMENT: NRC-HQ-60-14-D-0005 TASK ORDER NUMBER: NRC-HQ-60-15-T-0025 The NRC and the DOE Lab (ORNL) hereby enter into this Agreement/Task Order, NRCHQ6014D0005 - NRCHQ6015T0025, for the project entitled, AMPX Modernization for SCALE Nuclear Data Libraries. The performance period for this agreement shall commence on August 31, 2015 and will expire on September 30, 2018. Continued ...				

23. PAYMENT PROVISIONS

24. TOTAL AMOUNT
$200,000.00

25a. SIGNATURE OF GOVERNMENT REPRESENTATIVE (SERVICING)
Deborah L. Garland

26a. SIGNATURE OF GOVERNMENT REPRESENTATIVE (REQUESTING)
Jeffrey R. Mitchell

25b. NAME AND TITLE
Deborah L. Garland, Contracting Officer

25c. DATE 8/27/15

26b. CONTRACTING OFFICER
JEFFREY R. MITCHELL

26c. DATE 8/21/2015

TEMPLATE - ADM001

SUNSI REVIEW COMPLETE

SEP 2 2 2015

ADM002

NRC Contracting Officers Representative (COR): Don Algama and Mourad Aissa
ORNL Project Manager: Stephen M. Bowman and Mike Dunn.

Consideration and Obligations:
(a) Authorized Cost Ceiling $600,000.00

(b) The amount presently obligated with respect to this DOE Agreement is $200,000.00. When and if the amount(s) paid and payable to the DOE Laboratory hereunder shall equal the obligated amount, the DOE Laboratory shall not be obligated to continue performance of the work unless and until the NRC Contracting Officer shall increase the amount obligated with respect to this DOE 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 made part of this Agreement:
Attachment No. 1: Statement of Work

The issuance of this Task Order does not amend any terms or conditions of the subject Agreement.
Master IAA: NRCHQ6014D0005

00001	Authorized Cost Ceiling Line Item Ceiling$600,000.00 Incrementally Funded Amount: $200,000.00	600,000.00

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.

[ ] Fee Recoverable Work
[x] Non-fee Recoverable Work

Notwithstanding the agreement effective dates and period of performance start dates stated
Continued ...

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.

The total amount of award: $600,000.00. The obligation for this award is shown in box 24.

STATEMENT OF WORK

NRC Agreement Number	NRC Agreement Modification Number	NRC Task Order Number (If Applicable)	NRC Task Order Modification Number (If Applicable)
NRC-HQ-60-14-D-0005		NRC-HQ-60-15-T-0025	

Project Title
AMPX Modernization for SCALE Nuclear Data Libraries

Job Code Number	B&R Number	DOE Laboratory
		ORNL

NRC Requisitioning Office
RES

NRC Form 187, Contract Security and Classification Requirements ☐ Applicable ☒ Note Applicable	☐ Involves Proprietary Information ☐ Involves Sensitive Unclassified
☒ Non Fee-Recoverable	☐ Fee-Recoverable (If checked, complete all applicable sections below)
Docket Number (If Fee-Recoverable/Applicable) N/A	Inspection Report Number (If Fee Recoverable/Applicable) N/A
Technical Assignment Control Number (If Fee-Recoverable/Applicable) N/A	Technical Assignment Control Number Description (If Fee-Recoverable/Applicable) N/A

1.0 BACKGROUND

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

This code affects all licensing evaluations that are being performed at the NRC that relies on independent nuclear data libraries.

Technical Context:
The NRC has supported AMPX maintenance and development incrementally in the past, and in particular with JCN W6479 and JCN 5609. However support for this modular system of computer programs has been sporadic,

AMPX is the cross-section processing software package used to provide nuclear data libraries for the SCALE code system. AMPX plays a vital role because it provides an independent capability to generate continuous energy (CE) and multigroup (MG) cross-section data and

cross-section covariance data for SCALE. Because the accuracy of SCALE calculations are dependent on the accuracy of the underlying nuclear data files, there is a strong need for reliable and accurate nuclear data processing capabilities to ensure confidence and reliability in nuclear analyses performed with SCALE (e.g., reactor physics, criticality safety, shielding, etc.).

In light of the ENDF/B community moving to a new library format that is based on XML, this project takes on increased importance to ensure that AMPX can process the latest ENDF/B data evaluations and provide nuclear data libraries for SCALE.

2.0 OBJECTIVE

The primary objective of this project is to modernize the AMPX cross-section processing system software and improve the overall reliability and quality of the nuclear data libraries for use with SCALE and continue to provide an independent capability for generation of cross sections for NRC applications

3.0 SCOPE OF WORK

The DOE Laboratory must provide all resources necessary to accomplish the tasks and deliverables described in this statement of work (SOW).

AMPX has recently been brought under the SCALE software quality assurance plan (SQAP), and the software development and testing has been merged with the SCALE development infrastructure. These modernization accomplishments are important initial steps towards improving the quality and reliability of AMPX-generated data libraries for SCALE. However, additional work is needed to modernize the AMPX software package to ensure the overall quality and reliability of AMPX-generated data libraries for SCALE. Three specific high-priority tasks have been identified to modernize key AMPX capabilities. It is important to note that AMPX modernization is a multi-year effort, and completion of all these tasks are needed to position AMPX to support SCALE in the future

4.0 SPECIFIC TASKS

The DOE Laboratory must perform the following tasks:

Task 1: Develop In Memory Continuous-Energy Nuclear Data Format for Use in SCALE and AMPX

Develop a single interface that shields users of AMPX from the details of data storage, and which has a focus on reducing the likelihood of data handling errors. With this, develop the CE Resource for SCALE and AMPX that has data consistent with the already existing MG and covariance data Resources. This work needs to be cognizant of the various teams involved, they being the AMPX, SCALE, and Shift developers, and should work together to develop the final design of the CE Resource.

This effort should include testing of the new format to ensure the CE Resource meets performance metrics for the respective code packages. Once the CE Resource is defined, a plan will be developed to implement the CE Resource in AMPX. The plan will define the

schedule for implementing the CE Resource in the key AMPX modules. Using the plan, the CE Resource will then be implemented in the AMPX CE processing modules that are modernized under Task 2 of this project.

Deliverable: 1. Letter report describing the development and implementation of this task such as details on the testing of new format and the CE resource performance metrics (definition of the CE Resource), limitations if any, areas of application, why a new module was created or not, any input decks developed, etc. Also provide with the deliverable any input decks as they are developed, preferably annotated with the coder's intent, and again the final versions with the report. 2. A road map that clearly breaks down this task with deliverable dates before work is to be started.

Estimated completion date: 6 months after day of award.

Task 2: Modernize AMPX Modules and Implement Improved Software Testing Procedures

Refactor the key AMPX physics processing modules into a modern format for long-term sustainability and development while preserving the functional capability of the software once the refactoring is complete. The use of unit tests before and after refactoring is required to ensure consistent performance of the code suite. Codes to be refactored are:

Subtask	Module	Functional Capability	Estimated Completion Date
2a	PUFF	Generate covariance data from ENDF/B evaluations	6 months after day of award.
2b	POLIDENT	Generate CE data from ENDF/B evaluations	12 months after day of award.
2c	JAMAICAN	Produce CE collision kinematics PDFs and CDFs for Monte Carlo libraries	18 months after day of award.
2d	PLATINUM	Assemble CE library	24 months after day of award.
2e	BROADEN	Doppler broaden CE data	36 months after day of award.

Deliverable: 1. Annual letter report on the progress of the modernization of key AMPX physics module which includes the following: description of

the refactoring/development in the implementation of this task, limitations if any, areas of application, why a new module was created or not, any input decks developed, etc. Also provide with the deliverable any input decks as they are developed, preferably annotated with the coder's intent, and again the final versions with the report. 2. Final report that documents development, 3. Completed software updates implemented in the MPX code package, and 4. A road map that clearly breaks down this task with deliverable dates before work is to be started.

Estimated completion date: 36 months after day of award.

Task 3: Update AMPX to Process the New, Modern ENDF Evaluation Format

Update the AMPX code to be able to process the new modern ENDF evaluation format. This effort shall include testing to ensure that the processing of the files into MG or CE data is as expected.

Deliverable: 1. Annual letter report documenting status of AMPX for processing new ENDF format. Also provide with the deliverable any input decks as they are developed, preferably annotated with the coder's intent, and again the final versions with the report. 2. A road map that clearly breaks down this task with deliverable dates before work is to be started.

Estimated completion date: 36 months after day of award.

Task 4: Expert Technical Assistance

Technical support and on-call assistance in the operation of the SCALE system shall be provided to NRC staff identified by the NRC COR. ORNL shall prepare monthly letter status reports, interface with NRC staff, and perform the necessary administrative functions in support of this work. It is expected that some of the work required for this task may involve collaborations with other contractors.

A road map for the completion of each requested task is to be developed and provided to the PM.

Deliverable: All technical support must be documented in the Monthly Letter Status Report. At a minimum the documentation must include who requested the technical support, what was requested and the outcome of the technical support.

Estimated completion date: Agreement Expiration

5.0 DELIVERABLES AND/OR MILESTONES SCHEDULE

Task Number	Deliverable/Milestone Description	Due Date

1	Develop in memory continuous – Energy Nuclear Data Format for use in SCALE and AMPX	6 months after day of award.
2a PUFF	Generate covariance data from ENDF/B evaluations	6 months after day of award.
2b POLIDENT	Generate CE data from ENDF/B evaluations	12 months after day of award.
2c JAMAICAN	Produce CE collision kinematics PDFs and CDFs for Monte Carlo libraries	18 months after day of award.
2d PLATINUM	Assemble CE library	24 months after day of award.
2e BROADEn	Doppler broaden CE data	36 months after day of award.
3	Updated AMPX to process the new, modern ENDF evaluation format	36 months after day of award.
4	Expert Technical Assistance	Agreement Expiration

6.0 TECHNICAL AND OTHER SPECIAL QUALIFICATIONS REQUIRED

Steve Bowman will be the Project Manager and Mike Dunn will be the Principal Investigator for this work. He will be supported by Dorothea Wiarda, Cihangir Celik, Shane Hart, Mark Williams, and other staff as needed. All assigned staff shall be experienced with SCALE and in particular, code development with regard to cross section generation, and the peculiarities that are inherent with the code system.

NRC reserves the right to approve the Project Manager and the individual personnel assigned to this task. The project manager and assigned staff shall be experienced with SCALE and in particular, code development with regard to cross section generation, and the peculiarities that are inherent with the code system.

7.0 ESTIMATED LABOR CATEGORIES AND LEVELS OF EFFORT

Intentionally left blank.

8.0 MEETINGS AND TRAVEL

Travel to NRC Headquarters will be performed as needed to meet with NRC staff to discuss the status of the project.

In addition, the new ENDF/B format is being developed and coordinated by the Organization for Economic Co-operation and Development (OECD) Nuclear Energy Agency (NEA) Working Party on International Nuclear Data Evaluation Co-operation (WPEC) Subgroup 38 (SG38). The WPEC SG38 conducts working group meetings two times per year (typically at OECD/NEA Headquarters in Paris, France). In order to influence the ENDF/B format development and stay abreast of the new format development, the lead AMPX developer will need to participate in the bi-annual WPEC SG38 Meetings. Therefore, two foreign trips will be needed each year to support the AMPX modernization task to process the new ENDF/B format.

All travel requires written Government approval from the CO, unless otherwise delegated to the COR.

Foreign travel for the DOE laboratory personnel requires a 60-day lead time for NRC approval. For prior approval of foreign travel, the DOE laboratory shall submit 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/. Foreign travel is approved by the NRC Executive Director for Operations (EDO).

9.0 REPORTING REQUIREMENTS

The DOE Laboratory is responsible for structuring the deliverable to follow agency standards. The current agency standard is Microsoft Office Suite 2010. The current agency Portable Document Format (PDF) standard is Adobe Acrobat 9 Professional. Deliverables must be submitted free of spelling and grammatical errors and conform to requirements stated in this section.

Please note that all deliverables are to provide for a 3 week NRC review period and include all input decks generated or used to complete the task, and where possible to be appropriately annotated for legibility. All submissions are to be provided in WORD and PDF format

Monthly Letter Status Reports

In accordance with Management Directive 11.7, NRC Procedures for Placement and Monitoring of Work with the U.S. Department of Energy, the DOE Laboratory must electronically submit a Monthly Letter Status Report (MLSR) by the 20th day of each month to the Contracting Officer Representative (COR) with copies to the Contracting Officer (CO) and the Office Administration/Division of Contracts to ContractsPOT.Resource@nrc.gov. If a project is a task ordering agreement, a separate MLSR must be submitted for each task order with a summary project MLSR, even if no work has been performed during a reporting period. Once NRC has determined that all work on a task order is completed and that final costs are acceptable, a task order may be omitted from the MLSR.

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 Attachment 1. The preferred format for a MLSR can also be found in Attachment 1.

10.0 PERIOD OF PERFORMANCE

Intentionally left blank.

11.0 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 DOE Laboratory 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 DOE Laboratory concerning technical aspects of the agreement/task order; issue written interpretations of technical requirements, including Government drawings, designs, specifications; monitor the DOE Laboratory's performance and notify the DOE Laboratory of any deficiencies; coordinate availability of NRC-furnished material and/or GFP; and provide site entry of DOE Laboratory personnel.

Contracting Officer's Representative

Name: Don R. Algama
Agency: U.S. Nuclear Regulatory Commission
Office: RES
Mail Stop: CSB-03A7M
Washington, DC 20555-0001
E-Mail: don.algama@nrc.gov
Phone: 301.251.7940

Alternate Contracting Officer's Representative

Name: Dr. Mourad Aissa
Agency: U.S. Nuclear Regulatory Commission
Office: RES
Mail Stop: CSB-03A7M
Washington, DC 20555-0001
E-Mail: Mourad.Aissa@nrc.gov
Phone: 301.251.7511

12.0 MATERIALS REQUIRED

N/A

13.0 NRC-FURNISHED PROPERTY/MATERIALS

N/A

14.0 RESEARCH QUALITY

The quality of NRC research programs are assessed each year by the Advisory Committee on Reactor Safeguards. Within the context of their reviews of RES programs, the definition of quality research is based upon several major characteristics:

Results meet the objectives (75% of overall score)

- Justification of major assumptions (12%)
- Soundness of technical approach and results (52%)
- Uncertainties and sensitivities addressed (11%)

Documentation of research results and methods is adequate (25% of overall score)

- Clarity of presentation (16%)
- Identification of major assumptions (9%)

It is the responsibility of the DOE Laboratory to ensure that these quality criteria are adequately addressed throughout the course of the research that is performed. The NRC COR will review all research products with these criteria in mind.

15.0 STANDARDS FOR CONTRACTORS WHO PREPARE NUREG-SERIES MANUSCRIPTS

The U.S. Nuclear Regulatory Commission (NRC) began to capture most of its official records electronically on January 1, 2000. The NRC will capture each final NUREG-series publication in its native application. Therefore, please submit your final manuscript that has been approved by your NRC Project Manager in both electronic and camera-ready copy.

The final manuscript shall be of archival quality and comply with the requirements of NRC Management Directive 3.7 "NUREG-Series Publications." The document shall be technically edited consistent with NUREG–1379, Rev. 2 (May 2009) "NRC Editorial Style Guide." The goals of the "NRC Editorial Style Guide" are readability and consistency for all agency documents.

All format guidance, as specified in NUREG-0650, "Preparing NUREG-Series Publications," Rev. 2 (January 1999), will remain the same with one exception. You will no longer be required to include the NUREG-series designator on the bottom of each page of the manuscript. The NRC will assign this designator when we send the camera-ready copy to the printer and will place the designator on the cover, title page, and spine. The designator for each report will no longer be assigned when the decision to prepare a publication is made. The NRC's Publishing Services Branch will inform the NRC Project Manager for the publication of the assigned designator when the final manuscript is sent to the printer.

For the electronic manuscript, the Contractor shall prepare the text in Microsoft Word, and use any of the following file types for charts, spreadsheets, and the like:

File Types to be Used for NUREG-Series Publications	
File Type	File Extension
Microsoft®Word®	.doc
Microsoft® PowerPoint®	.ppt
Microsoft®Excel	.xls
Microsoft®Access	.mdb
Portable Document Format	.pdf

This list is subject to change if new software packages come into common use at NRC or by our licensees or other stakeholders that participate in the electronic submission process. If a portion of your manuscript is from another source and you cannot obtain an acceptable electronic file type for this portion (e.g., an appendix from an old publication), the NRC can, if necessary, create a tagged image file format (file extension.tif) for that portion of your report. Note that you should continue to submit original photographs, which will be scanned, since digitized photographs do not print well.

If you choose to publish a compact disk (CD) of your publication, place on the CD copies of the manuscript in both (1) a portable document format (PDF); (2) a Microsoft Word file format, and (3) an Adobe Acrobat Reader, or, alternatively, print instructions for obtaining a free copy of Adobe Acrobat Reader on the back cover insert of the jewel box.

16.0 OTHER CONSIDERATIONS

References

N/A

Access to Non-NRC Facilities/Equipment

N/A

Applicable Publications

N/A

Controls over document handling and non-disclosure of materials

N/A