STATEMENT OF WORK
REVISION 3

NRC TASK ORDING AGREEMENT NUMBER:		NRC-HQ-60-14-D-0005
PROJECT TITLE:	SCALE Support For Reactor and Spent Fuel Analyses	JOB CODE: V6449 LABORATORY: ORNL SITE: Oak Ridge STATE: TN
NRC Contracting Officer's Representative (COR):		Mourad Aissa (301) 415-0380
PRINCIPAL INVESTIGATOR:		Steve Bowman

1. BACKGROUND

The Nuclear Regulatory Commission (NRC) has invested heavily in the development and maintenance of the Standardized Computer Analysis for Licensing Evaluation (SCALE), 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. Expertise in neutronics for reactor analysis and for fresh and spent nuclear fuel criticality safety are essential to the NRC's mission.

For the past three decades, Oak Ridge National Laboratory (ORNL) had developed and maintained the SCALE code system for NRC. SCALE provides a comprehensive, verified and validated, user-friendly tool set in support of several licensing and regulatory areas, including:

- Neutron cross sections and nuclear data libraries
- Lattice physics
- Criticality safety analysis
- Reactor analysis
- Radiation transport and shielding
- Isotopic depletion
- Decay heat calculation
- Source term evaluation
- Sensitivity and uncertainty analysis
- Spent fuel burnup credit
- Spent fuel casks loading curves
- Analysis of new and advanced nuclear fuel design such as Mixed Oxide fuel (MOX) and thorium-based fuel cycles
- Analysis of new and advanced reactors and support reactor design certification including small modular reactors (SMR),

In addition, SCALE is integrated in the NRC reactor safety and accident analysis suite of codes and provides important nuclear data input files to the PARCS/TRACE and MELCOR codes.

The NRC will need capability for the foreseeable future to continue to independently evaluate neutronics issues in a wide range of discipline areas covering the entire nuclear fuel cycle.

Some of the phenomena and behavior important to nuclear safety are still estimated with considerable uncertainty. Consequently, enhancements in pertinent neutronics analytical models and the validation of the associated computer methods will continue to be an important focus for the agency. Future needs will also include development of insights on the behavior of advanced reactor designs as well as advanced nuclear fuel designs.

The SCALE code has been regularly updated to incorporate the current knowledge in the area of neutronics and to provide an efficient code structure for ease of use and maintenance, resulting in the release of SCALE 6.1. The new upgraded version of the code architecture supports some advancements in computer hardware and software, and the code numeric improvements to carry out reasonable execution times in many of the automated calculation sequences. However, further modernization to the SCALE infrastructure is needed to bring the code in line with the current computing state-of-the-art computing environment and to allow for improved analytical methods and execution times. Examples of areas for modernization and improvement include, but are not limited to:

- SCALE is composed of a large number (89) of executable modules and codes that still communicate through the out-of-date file input/output protocol, involving internal scratch files and more than a dozen data file formats

- Some SCALE features were initiated decades ago (e.g. KENO Monte-Carlo method code for criticality analysis) with other key capabilities introduced over past 20 years.

- SCALE has reliable and tried calculation modules and sequences, but some of these are in need of review and upgrade, for example:
    - Most calculations are performed in series (only limited parallel calculations).
    - The large system code (close to one million lines of code) is primarily tested with “sample” problems, and not modern units tests.
    - Over the years, there were some code duplication instances where a component is copied by a developer for a given task, is modified, and given a new purpose. The code system is therefore in of consolidation and streamlining.
    - The current data file formats date from the 1980’s and are restrictive: they are coded into each module, complicating introduction of new features.

- The newly developed POLARIS module for accelerated neutron cross generation needs additional features to bring it to the current state of knowledge as well as additional validation activities:
    - Implementation and testing of Sanchez methods for DH treatment
    - Implementation and testing of the CENTRM-based self-shielding option in POLARIS ESSM method
    - Development of a comprehensive set of TRITON, POLARIS, and CE_KENO models for benchmarking 2D LWR pin and lattice configurations
    - Validation of POLARIS for spent nuclear fuel using newly available measured assay data

- The SCALE utility AMPX performs the critical function of processing the Evaluated Nuclear Data Files B (ENDF/B) nuclear data from Brookhaven National Laboratory (BNL) to generate application specific nuclear data libraries for SCALE. AMPX has not had a significant upgrade in over a decade and is in need of upgrade to support modern nuclear data format compatible with the current practices.

- Addition of the following reactor physics capabilities:
    - Robust restart capability

- Automated Dancoff calculation in resonance self-shielding
- Rapid pin-cell calculation
- Gamma-energy deposition model
- Fuel temperature model and thermal expansion model

- SCALE/SNAP integration: develop interface along with input validator to provide immediate feedback to the user on any input error

- Monte-Carlo method integration: Consolidate and enhance the most utilized features of the existing SCALE stochastic nuclear analysis codes (KENO-V, KENO-VI, and MONACO) for criticality safety and radiation shielding

2. OBJECTIVE

This will be a Task Order Agreement (TOA) that will support the ongoing work of the NRC staff in the performance of licensing reviews and support emergent issues with regards to SCALE. The TOA will allow multiple tasks to be submitted under this TOA, as work needs emerge. All the work performed under this TOA will ensure that SCALE remains a robust nuclear analysis code system that support NRC staff's in their licensee applications evaluations in an efficient and timely manner. Each Task Order will be provided a new job code number when submitted. V6449 will remain the base TOA.

In general, the objective of this TOA is:

- To support the ongoing work of the NRC staff in the performance of licensing reviews.
- To support emergent issues.
- To ensure that SCALE remains capable to meet the Agency mission and NRC staffs particular needs in an efficient and timely manner.

3. TECHNICAL AND OTHER SPECIAL QUALIFICATIONS REQUIRED

For each task order submitted under this base job code V6449, ORNL Laboratory shall commit the appropriate number of qualified personnel to the project. Team members such as Senior Scientists, Principal Engineers, Engineers, Computer Scientists and Engineers, etc. – or their equivalents – are to be available as needed for the completion of any tasks submitted. It is imperative that the staff involved with this project have knowledge or easy access to, of the last three decades' worth of experimental and measured data that have been used in the benchmarking, validation and development of SCALE models and capabilities.

The NRC reserves the right to approve the Project Manager and the individual personnel assigned to each task. The DOE Laboratory project manager shall be well experienced with SCALE, its application areas and the peculiarities that are inherent with the code system

4. SCOPE OF WORK

The DOE Laboratory shall provide support in a wide range of technical and scientific disciplines, in accomplishing nuclear analyses and SCALE related activities aimed at ensuring the overall safety, security, and adequacy of nuclear power plant design, construction, and operations and of nuclear fuel . Services expected to be fulfilled in this Agreement are generalized into the following categories below. Note that with any activity, each Task Order may involve a combination of the following described general areas.

1. Development:
   The NRC needs include development and implementation of new and/or improved models, modules, and automated calculation sequences to evaluate and analyze parameters and phenomena important to nuclear safety in fuel fabrication facilities, reactor operation, and spent fuel management. This leads to a developmental assessment of the code that can only be exercised by the code development team since it requires a working knowledge of the source code and an understanding of the way models work in the code, rather than reliance on model parameters. Code development also requires modernization efforts as a result of continuous advancement in computer software and hardware. Examples of modernization include code parallelization and improvement of the code solvers to maintain and/or achieve reasonable execution times, and acceleration of lattice neutron cross sections generation for existing and advanced reactors. An expert level knowledge of the source code is required for the efficient implementation of the models and the development of interfaces with other NRC codes such as SNAP (graphical user interface) and PARCS.

2. Maintenance:
   This includes activities that require modifications to the source code and models as a result of software “bugs” and other errors, as well as software quality assurance, code build testing, integration and validation of new models during the development phase, and code numerical methods and algorithm optimization. Related activities include updating the code documentation based on implementation of new and improved models; improving input/output and graphics features; and releasing interim code versions when minor modifications are made under this task.

3. Applications:
   This includes targeted applications of the code that require development of simulation models, nuclear data libraries and input decks for running or testing of the SCALE modules and calculation sequences in support of NRC staff safety evaluations. Examples of such activities would include activities in support of safety and accident analysis for advanced reactor (SMR, EBWR, EPR, etc.), evaluation of new fuel designs such as MOX and thorium, investigation of emerging reactor safety issues, and review of license submittals. Targeted application of the code often requires development of new models (e.g., Method of Characteristics for the acceleration of lattice physics calculations as applied to PWR and BWR designs) that are most efficiently handled by the code development team. Because each design involves unique features, application of the code also requires an in-depth knowledge of the models as implemented in the code. SCALE will continue to be used in support of confirmatory analyses for current and advanced reactors and nuclear fuel. Activities in support of these analyses will be implemented as separate task orders.

4. Technical Assistance:
   This provides provision for technical support to the NRC staff on an as needed basis for emergent issues that are impacted or are informed by the SCALE code in response to regulatory requirements. This may involve attending meetings and making presentations at NRC or SCALE technical review meetings, reviewing documents, and performing additional analyses as specified in the Task Order SOW. It also includes on-call support for the code users and responding to code input and execution issues.

5. Training:
   Training to NRC staff in generic and application-specific areas as well as workshops (basic training or special topic) are expected to be conducted by the code development team as new features are added to the code. The objective of the technical review meetings and workshops is to maintain the technical skills of the NRC users through an information exchange forum with the code developers and other users which is the ideal means of preserving and managing knowledge in SCALE utilization.

The scope of work involves placement of Task Orders. ORNL performance for each Task Order will be evaluated based on meeting the performance standard established for each Task Order and relevant Management Directives. It should be noted that award of subsequent Task Orders will be based on: 1)The proposed tasks being subject to the above described general areas, and 2)assigned team's ability to meet the schedule, milestones, and deliverable requirements of the preceding Task Orders.

The deliverables required under this TOA shall conform to the standards contained, or referenced, in the SOW for each Task Order. Individual Task Orders may modify the performance requirements depending on the Task Order scope of work.

4.1 Procedures for Placing Task Orders Under This TOA.

Task Order Request for Proposal: When the need for a Task Order arises, the NRC Contracting Officer will send a request for proposal, requesting a technical and cost proposal which may include the following as appropriate:

(1) Scope of work/meetings/travel and deliverables;
(2) Reporting requirements;
(3) Period of performance - place of performance;
(4) Applicable special provisions;
(5) Technical skills required; and
(6) Estimated level of effort.

Task Order Technical Proposal: The DOE Laboratory's technical proposal shall include a staffing plan and project plan (if requested) for performance of the effort. For each Task Order request for proposal, the DOE Laboratory shall identify all key personnel and the number of staff hours that will be committed to complete the work specified in the Task Order (See Appendix A for example of what may be expected). The DOE Laboratory shall include the resumes for all professional personnel proposed to be utilized in the performance of any resulting Task Order, unless otherwise available as part of the basic agreement.

Cost Proposal: The DOE Laboratory's cost proposal for each Task Order must be fully supported by cost and pricing data adequate to establish the reasonableness of the proposed amounts. The DOE Laboratory is required to submit a spending plan for each Task, as part of its cost proposal.

The DOE Laboratory shall submit the Task Order proposal to the Contracting Officer and provide a copy to the COR(s) and Management Analyst by the date specified in the TORFP.

Task Order Award: After reaching agreement on the approach and estimated cost of the Task Order with the Laboratory, the Contracting Officer will issue the Task Order. The DOE Laboratory shall perform all work described in Task Orders issued by the Contracting Officer, Task Orders include the following:

(1) SOW/meetings/travel and deliverables;
(2) Reporting requirements;
(3) Period of performance;
(4) Key personnel;
(5) Applicable special provisions; and
(6) Total Task Order amount

Accelerated Task Order Procedures: In case of urgency, the NRC through the Contracting Officer, may request that the DOE Laboratory immediately begin work before a definitive Task Order under an existing DOE approved Task Ordering agreement is negotiated in accordance with MD 11.7. When this accelerated procedure is requested by the NRC, DOE agrees to begin promptly negotiating the terms of the Task Order under the existing agreement. Once agreement is reached, a Task Order will be issued by the Contracting Officer in accordance with the procedure described above.

5. DELIVERABLES/SCHEDULES AND/OR MILESTONES

Deliverables will be addressed with the submission of each task under this base contract.

6. REPORTING REQUIREMENTS

Reporting requirements will be stated within each individual task submitted. Upon receipt of each task under this base contract, any administrative or technical difficulties which may affect the schedule or costs of the project shall be immediately brought to the attention of the NRC project manager

7. MONTHLY LETTER STATUS REPORTS

In accordance with Section 4 of the attached Standard Terms and Conditions for DOE Work, a copy of the Monthly Letter Status Report (MLSR) is to be submitted to the following mailboxes:

RESDSAMLSR.Resource@nrc.gov
ContractsPOT.Resource@nrc.gov
Mourad.Aissa@nrc.gov
Don.Algama@nrc.gov
Nathanael.Hudson@nrc.gov
Peter.Yarsky@nrc.gov

Note:
This is a Task Order contract; each task may be managed by separate NRC staff. Each task submitted will include the COR and their email address to submit the monthly reports to. The MLSR will identify the title of the project, the job code for the task that is being reported, along

with the base job code V6449, the Principal Investigator, the period of performance, the reporting period, summarize each month's technical progress, any issues, list monthly spending, total spending to date, and the remaining funds and will contain information as directed in NRC Management Directive 11.7, Exhibit 7.

NO MSLR is required on the base Task Ordering Agreement.

8. MEETINGS AND TRAVEL

International travel and domestic travel is anticipated during the course of this TOA. Each Task Order will specify the travel requirements. If international travel is necessitated it must be addressed separately and approval must be obtained by processing NRC Form 445, in addition to being provided as part of the approved proposal.

Any expected travel requirements will be submitted in each Task Order separately. Any travel either expected or unexpected will be contingent on the approval of the NRC COR.

For estimation purposes, the following amount is used for the total cost of travel for this TOA, $80,000.00.

9. NRC-FURNISHED MATERIAL

NRC-furnished material is governed on a task by task basis. Please refer to the statement of work when a new Task Order is submitted.

10. 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(s) will review all research products with these criteria in mind.

11. NEW STANDARDS FOR DOE LABORATORIES 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 COR 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 COR for the publication of the assigned designator when the final manuscript is sent to the printer.

For the electronic manuscript, the DOE Laboratory 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.

12. SUBCONTRACTING/CONSULTANT INFORMATION

Describe any technical support effort that is proposed to be performed by a subcontractor or consultant. Identify the level of effort, by task, of any proposed subcontractor or consultant and provide an explanation of the need for subcontracting that portion of the effort. Note that “pass through” contracting is not allowed under the requirements of the DOE/NRC Memorandum of Understanding. For the purposes of this effort, a “pass through” contract is generally defined as subcontracting 50 percent or more of the technical effort. For any subcontract or consultant effort, describe the following:

- the necessity of subcontracting,
- the tasks and subtasks the subcontractor or consultant will perform,
- the level of effort proposed for the subcontract effort,
- the status and expected time frame for selection, and

- the method of selection of the subcontractor or consultant.

13. INFORMATION TECHNOLOGY (IT) RESOURCES:

When IT resources are proposed by a DOE Laboratory that are not specifically identified in the Statement of Work, the need for and cost of those resources must be justified. Exhibit 8 of MD 11.7 can be used to help determine justification. Proposed IT resources should be those required to accomplish the work, but which are not available from within the laboratory's inventory of IT resources. Common office automation equipment and software, i.e., personal computers, word processing and spreadsheet software, and printers, should not routinely be proposed as they should normally be provided as part of the laboratory's information processing infrastructure. Whenever IT resources are proposed, justification is necessary for the NRC to be able to evaluate the requirements and to approve their acquisition.

In addition to the total cost of IT resources to be reported on the NRC Form 189, the following justification is to be included in the proposal:

1. IT Resource Requirements. List as line items each IT resource (hardware, e.g., laptop computer, engineering workstation; software - by product name; and services, e.g., computer time, database services) proposed for acquisition and estimate the cost of each item by fiscal year. Funding should be indicated for the year in which the IT resources are needed. Provide totals for all items for each fiscal year which match the costs listed on the line labeled IT RESOURCES on the NRC Form 189. Any IT acquisition shall conform to the acquisition and reporting requirements identified in NRC Management Directive 11.7, Part 9.

2. Justification. For each required IT resource with an acquisition cost of $500 or more, or group of resources, e.g., a system, provide specifications or the specific make/model, and other acquisition and reporting requirements identified in NRC Management Directive 11.7, Part 9. Briefly discuss how the IT resources will be used, including information about workload to be processed, required capacities, throughput, transfer rates, compatibility and expandability requirements, or any other information that supports the need to acquire the specific resources being proposed.

14. NRC Contracting Officers Representative's (COR)

Technical direction as defined in Section 1 of the Standard Terms and Conditions will be provided by the COR, Mourad Aissa, who can be reached at:

U. S. Nuclear Regulatory Commission
Mail Stop C3-A07M
Washington, D. C. 20555-0001

PRIMARY COR:
Mourad Aissa
Phone: (301) 415-0380
Fax: (301) 415-6671
Email: Mourad.Aissa@nrc.gov

ALTERNATE COR'S:

Don Algama
Phone: (301) 415-1940
Fax: (301) 415-6671
Email: Don.Algama@nrc.gov

Express mail should be sent to:

U. S. Nuclear Regulatory Commission
Mail Stop: TWFN 10B58
11545 Rockville Pike
Rockville, MD 20852-2738

Appendix A
Staffing Plan

The staffing plan shall identify all proposed organizational resources to be dedicated to the Task Order effort. The plan shall clearly indicate the capabilities of the proposed personnel to perform the effort described in the statement of work for the specific Task Order effort. The following (or similar) format shall be used to represent the staffing plan. The staffing plan shall include the name, discipline/expertise, project role, and estimated hours of all personnel proposed to accomplish the effort, as well as, all proposed consultants and subcontract personnel. For all personnel not initially proposed in the base agreement, provide a resume.

You are also required to identify any current/former NRC employees (list name, title, and date individual left NRC and provide a brief description of the individual=s role under this proposal). If there are no current/former NRC employees involved, a negative statement is required.

Staffing Plan - Task Order

Name	Expertise	Project Role (task)	Title	Est. Hours