

ORDER FOR SUPPLIES OR SERVICES

PAGE 1 OF 10 PAGES

IMPORTANT: Mark all packages and papers with contract and/or order numbers.

BPA NO.

1 10

1. DATE OF ORDER AUG 24 2010		2. CONTRACT NO. (if any) NRC-04-10-170		6. SHIP TO:	
3. ORDER NO. NRC-T001		MODIFICATION NO.		b. NAME OF CONSIGNEE U.S. Nuclear Regulatory Commission	
5. ISSUING OFFICE (Address correspondence to) U.S. Nuclear Regulatory Commission Div. of Contracts Attn: Monique B. Williams Mail Stop: TWB-01-B10M Washington, DC 20555		4. REQUISITION/REFERENCE NO. RES-09-140 8/4/2010		b. STREET ADDRESS	
7. TO:		c. CITY Washington		d. STATE DC	e. ZIP CODE 20555
a. NAME OF CONTRACTOR AMEC NSS LIMITED		f. SHIP VIA		8. TYPE OF ORDER	
b. COMPANY NAME		<input type="checkbox"/> a. PURCHASE		<input checked="" type="checkbox"/> b. DELIVERY	
c. STREET ADDRESS 700 UNIVERSITY AVE 4 FL		REFERENCE YOUR Please furnish the following on the terms and conditions specified on both sides of this order and on the attached sheet, if any, including delivery as indicated.		Except for billing instructions on the reverse, this delivery order is subject to instructions contained on this side only of this form and is issued subject to the terms and conditions of the above-numbered contract.	
d. CITY TORONTO		e. STATE ON	f. ZIP CODE M5G 1X6		
9. ACCOUNTING AND APPROPRIATION DATA Attention NRC Accounting Office - See Block 17(b) for appropriation data. DUNS:201209546 Commitment Number: FSS RES-C10-657		10. REQUISITIONING OFFICE RES			
11. BUSINESS CLASSIFICATION (Check appropriate box(es))				12. F.O.B. POINT Destination	
<input type="checkbox"/> a. SMALL		<input checked="" type="checkbox"/> b. OTHER THAN SMALL		<input type="checkbox"/> c. DISADVANTAGED	
<input type="checkbox"/> d. WOMEN-OWNED		<input type="checkbox"/> e. HUBZone		<input type="checkbox"/> f. EMERGING SMALL BUSINESS	
<input type="checkbox"/> g. SERVICE-DISABLED VETERAN-OWNED					
13. PLACE OF		14. GOVERNMENT B/L NO. N/A		15. DELIVER TO F.O.B. POINT ON OR BEFORE (Date) 11/16/2010	
a. INSPECTION Destination		b. ACCEPTANCE Destination		16. DISCOUNT TERMS N/A	

17. SCHEDULE (See reverse for Rejections)

ITEM NO. (a)	SUPPLIES OR SERVICES (b)	QUANTITY ORDERED (c)	UNIT (d)	UNIT PRICE (e)	AMOUNT (f)	QUANTITY ACCEPTED (g)
	<p>Task Order #1 for Preliminary Code Assessment and Uncertainty Analysis</p> <p>Period of Performance: 8/23/2010 - 8/22/2012 Estimated Reimbursable Cost: \$743,913 Fixed Fee: \$74,391 Total Estimated Cost plus Fee (Ceiling): \$818,304</p> <p>**Note to NRC Accounting Office** ACCOUNTING AND APPROPRIATION DATA \$147,306.00 previously obligated under the base contract (NRC-04-10-170) is to be transferred to this Task Order. 06015171172, N6619, 252A, 31X0200.060</p> <p>Task #1 is fully funded for the amount of \$147,306. Tasks 2-4 will be exercised at a later date.</p>					

18. SHIPPING POINT		19. GROSS SHIPPING WEIGHT		20. INVOICE NO.		\$818,304.00		
21. MAIL INVOICE TO:								
SEE BILLING INSTRUCTIONS ON REVERSE		a. NAME Department of Interior / NBC NRCPayments@nbc.gov						17(h) TOTAL (Cont. pages)
		b. STREET ADDRESS (or P.O. Box) Attn: Fiscal Services Branch - D2770 7301 W. Mansfield Avenue						
		c. CITY Denver	d. STATE CO	e. ZIP CODE 80235-2230				\$818,304.00

22. UNITED STATES OF AMERICA BY (Signature) 	23. NAME (Typed) Monique B. Williams Contracting Officer TITLE: CONTRACTING/ORDERING OFFICER
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AUTHORIZED FOR LOCAL REPRODUCTION PREVIOUS EDITION NOT USABLE
TEMPLATE - ADM001

SUNSI REVIEW COMPLETE

NOV 5 2010

OPTIONAL FORM 347 (REV. 4/2008)
PRESCRIBED BY GSA/FAS
ADM001

In accordance with Section G.4, Task Order Procedures (Oct 1999), of the contract number NRC-04-10-170, is hereby definitized. This Task Order No. 001 shall be executed in accordance with the attached Statement of Work. The objective of this task order is to perform a review of relevant computer programs, computational models, GUIs, and statistical approaches, as well as the NGNP Phenomena Identification and Ranking Tables (PIRTs); to develop a plan for preliminary assessment of MELCOR; and to provide alternatives a recommendation on the selection of an uncertainty analysis methodology.

The period of performance for Task Order No. 001 shall be effective from August 23, 2010 to August 22, 2012.

The ceiling for this task order shall be \$818,304 of which \$743,913 represents the estimated reimbursable costs and the amount of \$74,391 represents the fixed fee. At the time of award, Task Order 1 is fully funded for the amount of \$147,306 of which \$133,915 represents the estimated reimbursable costs and the amount of \$13,391 represents the fixed fee. The NRC Project Officer may require that Optional Tasks 2-4 be exercised during the period of performance of this task order. The cost ceiling is a not to exceed amount for \$147,306. Any work undertaken by the contractor in excess of the ceiling is done at the contractor's risk.

Three optional objectives may also result in three additional tasks: 1) the performance of a preliminary assessment of MELCOR, 2) the implementation of the uncertainty analysis methodology, and 3) the demonstration of the uncertainty analysis methodology. The task order will be modified accordingly, if the NRC Project Officer exercises the optional tasks under the statement of work. The total costs for the optional tasks are: \$670,998.

The following individual is considered key personnel and as such is essential to the successful performance of the work under Task Order NRC-T001:

- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]

The contractor agrees that such personnel shall not be removed from the effort under the task order without compliance with Contract Clause H.2, Key Personnel. The contract deliverables must be submitted in accordance with Section F.5 of the Basic Contract and as indicated in the attached Statement of Work.

Your NRC points of contact during the course of this task order are:

Technical Matters:	Michael B. Rubin Project Officer (301) 251-7549	Contractual Matters:	Monique B. Williams Senior Contracts Specialist (301) 492-3640
	Tarek Zaki Technical Monitor (301) 251-7986		

The contractor shall be required to comply with the Contractor Spending Plan submitted on January 19, 2010 in the amount of \$147,306 for the first three months. The contractor shall immediately notify both the Contracting Officer and the Project Officer, in writing, if the estimated monthly amounts stated in the contractor Spending Plan change at any time during the period of performance.

Please find the listing of the prices below:

<u>Cost Elements</u>	<u>Year 1</u>	<u>Year 2</u>	<u>Total</u>
Total Direct Labor			
Salary and Wages	\$ [REDACTED]	\$ [REDACTED]	[REDACTED]
Consultants	\$ [REDACTED]	\$ [REDACTED]	[REDACTED]
Travel and Per Diem	\$ [REDACTED]	\$ [REDACTED]	[REDACTED]
Total Estimated Cost	\$ [REDACTED]	\$ [REDACTED]	[REDACTED]
TOTAL COST PLUS FIXED FEE	\$ [REDACTED]	\$ [REDACTED]	\$ 818,303

Task Order Cost by Task:

Task 1 – Code Assessment Plan and Uncertainty Methodology Selection	[REDACTED]
Optional Task 2 – Preliminary Assessment of MELCOR	[REDACTED]
Optional Task 3 – Implementation of Uncertainty Analysis Methodology -	[REDACTED]
Optional Task 4 – Demonstration of Uncertainty Analysis Methodology -	[REDACTED]
TOTAL TASK ORDER CEILING:	\$818,803

The issuance of this task order does not amend any terms or conditions of the subject contract.

Acceptance of Task Order No. 001 should be made by having an official, authorized to bind your organization, execute three copies of this document in the space provided and return two copies to the Contract Specialist. You should retain the third copy for your records.

ACCEPTED: Task Order No. 001

[Signature]
 NAME
VP Commercial Operations
 TITLE
20 August, 2010
 DATE

STATEMENT OF WORK TASK ORDER NO. 01

Title: Preliminary Code Assessment and Uncertainty Analysis

1. Background

As described in the base contract, the Next Generation Nuclear Plant (NGNP) Evaluation Model (EM) will be a calculational framework that includes a number of NRC computer programs and computational models such as MELCOR, SCALE/AMPX, and PARCS-AGREE. These computational models will be integrated into an automated workflow package through the development of plug-ins for the NRC's Graphical User Interface (GUI) toolkit SNAP. This integration will also take other NRC GUIs such as MELMACCS into consideration. Assessment and validation of individual codes as well as integrated models will be performed through comparisons with appropriate experimental data, benchmark problems, and possibly CFD analyses. Uncertainty analyses will be performed based on acceptable statistical approaches; implementation of the uncertainty methodology will also be accomplished through the development of plug-ins for SNAP.

One of the principal components of this NGNP EM is the MELCOR systems analysis code. MELCOR will be responsible for the transient analysis of reactor system thermo-fluid behavior, fission product transport, and graphite oxidation. The calculational envelope for the MELCOR code encompasses the reactor vessel and helium pressure boundary, the reactor cavity, and the confinement or containment building.

2. Objective

The main objective of this task order is to perform a review of relevant computer programs, computational models, GUIs, and statistical approaches, as well as the NGNP Phenomena Identification and Ranking Tables (PIRTs); to develop a plan for preliminary assessment of MELCOR; and to provide alternatives and a recommendation on the selection of an uncertainty analysis methodology.

Other objectives may include any or all of the following 3 options: (1) the performance of a preliminary assessment of MELCOR, (2) the implementation of the uncertainty analysis methodology, and (3) the demonstration of the uncertainty analysis methodology.

3. Scope of Work

The contractor shall perform Task 1 below as directed by the government representative and in accordance with the guidelines and requirements of the base contract. If the government exercises any or all of the 3 options (Tasks 2 through 4) listed below, the contractor shall also perform such task(s) as directed by the government representative and in accordance with the guidelines and requirements of the base contract.

3.1 Task 1 – Code Assessment Plan and Uncertainty Methodology Selection

- *Review* – For familiarization purposes, the contractor shall review relevant computer programs and computational models including MELCOR, SCALE/AMPX, and PARCS-AGREE; relevant GUIs including SNAP and MELMACCS; and relevant statistical approaches used by the NRC and by the international reactor safety community and other industries (e.g., Wilk's method). The contractor shall also review the NGNP PIRTs as well as general code/model assessment and integration techniques currently used by the NRC (e.g., through SNAP).
- *Development of a Plan for Preliminary Assessment of MELCOR* – MELCOR is being modified under a separate contract to address NGNP specific needs. The contractor shall develop a plan for preliminary assessment of MELCOR. The plan shall be comprehensive, shall include a PIRT-based assessment matrix, shall identify specific data needed to perform the preliminary assessment, and shall list performance metrics and major milestones.

The contractor shall deliver a draft plan to the government no later than (NLT) 2 months after award; the government shall provide its comments 2 weeks after receiving the draft plan. The contractor shall deliver the final plan to the government NLT 3 months after award. Upon review and approval of the final plan by the government and if the government exercises Option 1 (Task 2) below, the contractor shall begin work on Task 2 as directed by the government representative and in accordance with the guidelines and requirements of the base contract.

- *Selection of Uncertainty Analysis Methodology* – The contractor shall evaluate relevant statistical approaches used by the NRC and by the international reactor safety community and other industries and prepare a letter report that documents the evaluation. The report shall provide a description of all uncertainty methods considered, expound on the rationale for the selection of the proposed method, and document the details of that method.

The selected method shall be: (1) easily automated such that the spectrum of calculations needed can be performed through successive perturbations of the input file varying both the plant state and the modeling uncertainties; (2) practicable such that the required number of system calculations for a given uncertainty and confidence level is reasonably achievable; (3) able to take into account uncertainties both in the plant state and in the physical models; (4) capable of treating model biases, uncertainties, and uncertainty distributions; (5) capable of considering NGNP specific figures-of-merit such as peak fuel temperature, dose, and oxidation extent of core support structures; (6) capable of providing estimates for the selected figures-of-merit for user specified uncertainty and confidence levels; and (7) well suited for incorporation within SNAP, taking advantage of plug-ins being developed under separate contract(s).

The contractor shall deliver a draft letter report to the government NLT 2 months after award of Task 1; the government shall provide its comments 2 weeks after receiving the draft plan. The contractor shall deliver the final plan to the government NLT 3 months after award of Task 1. Upon review and approval of the final letter report by the government and if the government exercises Option 2 (Task 3) below, the contractor shall begin work on Task 3 as directed by the government representative and in accordance with the guidelines and requirements of the base contract.

- *Travel Requirements* – It is assumed that 4 two-day trips to Rockville, MD will be required for Task 1.
- *Deliverables* – As described above, the deliverables of this task shall be a plan (draft and final) for preliminary assessment of MELCOR, and a letter report (draft and final) that documents the evaluation and selection of the uncertainty method.
- *Schedule and Level-of-Effort (LOE)* – Estimated LOE for Task 1 is 6 staff-months. Estimated completion date is 3 months after award of Task 1.

3.2 Task 2 (Option 1) – Preliminary Assessment of MELCOR

- *Preliminary Assessment of MELCOR* – MELCOR is being modified under a separate contract to address NGNP specific needs. The contractor shall perform a preliminary assessment of MELCOR in accordance with the assessment plan developed by the contractor in Task 1 and approved by the government. The contractor shall produce and deliver to the government all calculation notebooks, input decks, AVF input files, and any other extraneous scripts or files required to perform the assessment, as well as a final letter report documenting the results of the assessment.
- *Travel Requirements* – It is assumed that 6 two-day trips to Rockville, MD will be required for Task 2.
- *Deliverables* – All calculation notebooks, input decks, AV input files, and any other extraneous scripts or files required to perform the assessment, as well as a final letter report documenting the results of the assessment.
- *Schedule and Level-of-Effort (LOE)* – Estimated LOE for Task 2 is 16 staff-months. Estimated Completion date is 12 months after award of Task 2

3.3 Task 3 (Option 2) – Implementation of Uncertainty Analysis Methodology

- *Implementation of Uncertainty Analysis Methodology* – The contractor shall implement the uncertainty analysis methodology selected in Task 1 into SNAP as a plug-in. This implementation shall be capable of performing an automated uncertainty analysis for the transient response of the NGNP using the MELCOR systems analysis code. Furthermore, the architecture of this plug-in shall be designed so as to be readily extensible to the complete EM when it becomes available. Upon successful completion of Task 3 and if the government exercises Option 3 (Task 4) below, the contractor shall begin work on Task 4 as directed by the government representative and in accordance with the guidelines and requirements of the base contract.
- *Travel Requirements* – It is assumed that 2 two-day trips to Rockville, MD will be required for Task 3.
- *Deliverables* – The SNAP plug-in and a user's manual describing how to perform the uncertainty analysis.
- *Schedule and Level-of-Effort (LOE)* – Estimated LOE for Task 3 is 8 staff-months. The estimated completion date is 9 months after award of Task 3.

3.4 Task 4 (Option 3) – Demonstration of Uncertainty Analysis Methodology

- *Demonstration of Uncertainty Analysis Methodology* – The contractor shall perform and document a sample uncertainty analysis performed using the methodology implemented above. This analysis shall be performed using the MELCOR code and a base input model that will be provided by the NRC. The analysis shall be limited to the response of the components within the reactor vessel to a depressurized loss-of-forced circulation event with air ingress. This analysis shall include the variation of parameters that affect both the plant configuration (e.g., the size and associated loss coefficient for a leakage path of air into the confinement) and the model uncertainties (e.g., the graphite oxidation rate). Although the parameters selected for variation and their associated uncertainties are not expected to provide a realistic quantification of the uncertainty for this type of analysis, they should provide for a reasonable estimation of the plant response and demonstrate the capabilities of the implemented uncertainty methodology.
- *Travel Requirements* – It is assumed that 2 two-day trips to Rockville, MD will be required for Task 4.
- *Deliverables* – A letter report describing the results of this demonstration calculation.
- *Schedule and Level-of-Effort (LOE)* – Estimated LOE for Task 4 is 4 staff-months. Estimated completion date is 12 months after award of Task 4.

4. Research Quality

The quality of NRC research programs is 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%)

The contractor shall ensure that these quality criteria are adequately addressed throughout the course of the work that is performed. The NRC Project Manager (PM), and co-Technical Monitors (co-TMs), will review all products with these criteria in mind.

5. Level of Effort and Period of Performance

It is anticipated for funding purposes that this work (including all options) shall require an expenditure of 34 staff-months, and a period of performance of 24 months from the date of award.

6. Reporting Requirements

The contractor shall submit the following monthly, annual, and topical reports following the requirements of the base contract:

- *Monthly Letter Status Report (MLSR)* – The contractor shall submit an MLSR in electronic format via e-mail to the NRC PM and co-TMs by the 20th of the month following the month to be reported. The contractor shall also mail a hard copy of each MLSR to the NRC PM.
- *Annual Progress Letter Reports* – The contractor shall submit an annual progress letter report within 30 days of the close of the fiscal year. The annual progress report shall summarize all efforts on the tasks conducted during the corresponding period, including the status of each ongoing task.
- *Topical Reports* – No topical reports are required.

Following the requirements of the base contract, a copy of all written and oral presentations, including technical papers and abstracts to be submitted for publication in technical journals, related to or funded by this task order, will be transmitted to the NRC PM prior to presentation or submittal for publication. The contractor shall abide by the requirements of the base contract on presentations at professional meetings and publications in peer-reviewed professional journals.

7. Publications Note

The contractor shall abide by the base contract “Publication Note” procedures and requirements.

8. Anticipated Deliverables and Schedule

As described in Tasks 1 through 4 above, the contractor shall deliver the following:

- *Task 1* – A plan (draft and final) for preliminary assessment of MELCOR, and a letter report (draft and final) that document the evaluation and selection of the uncertainty method. The overall schedule is 3 months after award of this task.
- *Task 2 (Option 1, if exercised)* – All calculation notebooks, input decks, AVF input files, and any other extraneous scripts or files required to perform the assessment, as well as a final letter report documenting the results of the assessment. The overall schedule is 12 months after award of Task 2.
- *Task 3 (Option 2, if exercised)* – The SNAP plug-in and a user’s manual describing how to perform the uncertainty analysis. The overall schedule is 9 months after award of Task 3.
- *Task 4 (Option 3, if exercised)* – A letter report describing the results of the demonstration calculation. The overall schedule is 12 months after award of Task 4.

9. Organizational Conflict of Interest (COI) Disclosure

The contractor shall abide by the organizational COI requirements of the base contract. The contractor shall list any work in the proposal that is similar to that previously performed or is to be performed by the contractor on behalf of another sponsor that might give rise to an apparent (perceived) or actual organizational conflict of interest, including duplication of effort.

10. Meetings and Travel

As described in Tasks 1 through 4 above, it is anticipated that requirements for this Task Order will be satisfied with the following travel:

- *Task 1* – 4 two-day trips to Rockville, MD.
- *Task 2 (Option 1, if exercised)* – 6 two-day trips to Rockville, MD.
- *Task 3 (Option 2, if exercised)* – 2 two-day trips to Rockville, MD.
- *Task 4 (Option 3, if exercised)* – 2 two-day trips to Rockville, MD.

Meetings will be approved as needed for consultation with NRC staff or for presentation of the work at technical conferences or meetings. The contractor shall present the technical progress of the project at NRC headquarters on an annual basis, and make additional trips to NRC related contractor meetings and professional technical symposia as requested by the NRC PM. Any additional domestic travel to be charged against project funds requires prior approval by the NRC PM. All foreign travel related to and/or funded by the project must be approved in writing by the NRC PM and his management chain.

11. NRC-Furnished Material

All pertinent NRC documents necessary to perform each task under this task order shall be identified and provided by the NRC PM. These include the NGNP PIRTs as well as user's manuals for NRC computer programs and computational models such as MELCOR, SCALE/AMPX, and PARCS-AGREE, and for NRC GUIs such SNAP and MELMACCS. The NRC shall also give the contractor access to the NRC computer programs required to perform the work.

12. Technical and Other Special Qualifications Required

Following the requirements of the base contract, the contractor shall assign technical staff, employees, subcontractors, or specialists who have the required educational background, experience, or combination thereof to meet the technical objectives in the statement of work. Personnel shall have demonstrated the capability to deal with complex technical issues and identify innovative approaches. The contractor shall provide representative resumes, describe participation in professional societies, identify associations with universities or offer similar evidence of the ability to deliver highly qualified personnel to complete this work.

Key personnel identified for this contract must be recognized technical experts in high temperature gas reactor safety analysis in the areas of nuclear analysis, thermo-fluids, fission product transport, and source term analysis. A recognized technical expert is defined as an individual who is regarded so by their peers, management, and/or by national leaders in the field. A recognized expert shall also be evident by their relevant education, training, experience, and other activities, such as participation in the professional society activities.

Key personnel shall be responsible for the technical aspects of the specified work. Other personnel shall provide additional technical support required to complete all deliverables in a timely manner and with sufficient level of quality. The contractor project manager shall be

responsible for overall performance and interfacing with the NRC. The contractor is expected to work independently of NRC staff unless a specific collaborative effort is specified in the statement of work. It is the responsibility of the contractor to acquire all information that is not identified as NRC-furnished material in this statement of work.

Demonstrated expertise in the usage and/or development of NRC computer codes (i.e., MELCOR, PARCS, SCALE/AMPX, and SNAP) will be considered a positive factor in the proposal evaluation. However, as the extension of these codes to gas reactors is a new feature, experience with the NRC codes is considered of secondary importance relative to gas reactor experience for the performance of this contract.

13. Subcontracting/Consultant Information

Subcontracts related to or funded under this task order require the prior written approval of the NRC PM as discussed in the FAR clause 52.244-2. Conflict of interest considerations shall apply to any subcontracted effort.

The contractor shall describe the 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. 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, the contractor shall 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
- The method of selection of the subcontractor or consultant

14. Related RES Projects

The contractor shall work with the NRC PM to coordinate this work with closely related RES projects.