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| AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT | | 1. CONTRACT ID CODE | | PAGE OF PAGES 1 2 | |
| 2. AMENDMENT/MODIFICATION NO. M0002 | | 3. EFFECTIVE DATE 03/13/2014 | | 4. REQUISITION/PURCHASE REQ. NO. RES-14-0111 | |
| 5. PROJECT NO. (If applicable) | | 6. ISSUED BY US NRC - HQ DIVISION OF CONTRACTS | | 7. ADMINISTERED BY (If other than Item 6) | |
| 8. NAME AND ADDRESS OF CONTRACTOR (No. street, county, State and ZIP Code) See Schedule | | 9A. AMENDMENT OF SOLICITATION NO. (x) | | 9B. DATED (SEE ITEM 11) | |
| 10A. MODIFICATION OF CONTRACT/ORDER NO. NRC-HQ-13-C-04-0026/NRC-HQ-13-C-04-0026 | | 10B. DATED (SEE ITEM 13) 03/26/2013 | | | |
| CODE | | FACILITY CODE | | | |

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

☐ The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offers ☐ is extended. ☐ is not extended.
Offers must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended, by one of the following methods: (a) By completing Items 8 and 15, and returning _____ copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGEMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. ACCOUNTING AND APPROPRIATION DATA (If required) Net Increase: \$69,643.00
See Schedule

13. THIS ITEM ONLY APPLIES TO MODIFICATION OF CONTRACTS/ORDERS. IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.

| | |
|-----------|---|
| CHECK ONE | A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A. |
| | B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (such as changes in paying office, appropriation date, etc.) SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(b). |
| X | C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF: Mutual Agreement and Optional CLIN exercise |
| | D. OTHER (Specify type of modification and authority) |

E. IMPORTANT: Contractor ☐ is not. ☒ is required to sign this document and return 0 copies to the issuing office.

14. DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCF section headings, including solicitation/contract subject matter where feasible.)

ALDEN RESEARCH LABORATORY INC

175795392

ALDEN RESEARCH LABORATORY INC

30 SHREWSBURY ST

HOLDEN MA 015201843

NRC-HQ-13-C-04-0026

LIST OF CHANGES:

Reason for Modification : Supplemental Agreement for work within scope

Continued ...

Except as provided herein, all terms and conditions of the document referenced in Item 9 A or 10A, as heretofore changed, remains unchanged and in full force and effect.

| | | | |
|---|------------------|---|--|
| 15A. NAME AND TITLE OF SIGNER (Type or print) | | 16A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print) STEPHEN M. POOL | |
| 15B. CONTRACTOR/OFFEROR (Signature of person authorized to sign) | 15C. DATE SIGNED | 16C. DATE SIGNED 03/13/2014 | |

NSN 7540-01-152-8070
Previous edition unusable

STANDARD FORM 30 (REV. 10-83)
Prescribed by GSA
FAR (48 CFR) 53.243

TEMPLATE - ADM001

SUNSI REVIEW COMPLETE

MAR 18 2014

ADM002

| | | | | |
|---------------------------|---|--------------------------|------|----|
| CONTINUATION SHEET | REFERENCE N | DOCUMENT BEING CONTINUED | PAGE | OF |
| | NRC-HQ-13-C-04-0026/NRC-HQ-13-C-04-0026/M0002 | | 2 | 2 |

NAME OF OFFEROR OR CONTRACTOR

See Schedule

| ITEM NO (A) | SUPPLIES/SERVICES (B) | QUANTITY (C) | UNIT (D) | UNIT PRICE (E) | AMOUNT (F) |
|----------------|---|-----------------|-------------|-------------------|---------------|
| | <p>New Total Obligated Amount for this Award: \$148,846.00</p> <p>Period of Performance: 03/26/2013 to 03/25/2016</p> <p>Change Item 09500 to read as follows (amount shown is the total amount):</p> | | | | |
| 09500 | <p>Commercial Unexercised Ceiling as of 10/1/2013 Amount: \$260,046.00 (Option Line Item) Anticipated Exercise Date 03/24/2016 Line Item Ceiling \$260,046.00 Incrementally Funded Amount: \$0.00</p> <p>Delivery Location Code: NRCHQ US NRC - HQ DIVISION OF CONTRACTS</p> <p>Amount: \$260,046.00 Accounting Info: 0000-00000-RECON-00-000000-00-0-000-00000-0000 Funded: \$0.00</p> <p>Add Item 09501 as follows:</p> | | | | 0.00 |
| 09501 | <p>CFD Modeling and Simulation Support for EU ERCOSAM Project Obligated Amount: \$69,643.00</p> <p>Delivery: 03/07/2014 Delivery Location Code: NRCHQ US NUCLEAR REGULATORY COMMISSION- MAIL PROCESSING CENTER 4930 BOILING BROOK PARKWAY ROCKVILLE MD 20852 USA Amount: \$69,643.00 Accounting Info: 2014-X0200-REIM-60-60D003-11-R-710-F6022-255A Funded: \$69,643.00</p> | | | | 69,643.00 |

The purpose of this modification is to exercise optional CLIN 3 and 4 and to exercise modified CLIN 6 (task 3A and optional task 3B. The price schedule for CLIN 3 and 4 is as set forth in Mod 1. For CLIN 3, Task 1 report deliverable date is 31 October 2014, and for CLIN 4 Task 2 report deliverable date is 30 January 2015. The price schedule for task 3A is \$6866 monthly for 5 five months and a final payment of \$6870 upon completion and acceptance. Optional Task 3B is priced at a lot of \$57,900 with payment schedule to be set upon its exercise. The following is the SOW for revised task 3A and optional task 3B. The total ceiling and obligated amount of the contract is increased by \$69,643 from \$79,203 to \$148,846.

Task 3A: Model Refinement and First Round Sensitivity Studies

In coordination with the NRC COR, the contractor shall refine the development and validation of the UDF developed and utilized with the FLUENT CFD models of Facility 1 generated in Task 2. Additionally, the contractor will use the model to complete a set of 3 sensitivity studies for two of the three test sequences at conditions supplied by the NRC COR. Best practice guidelines for the application of CFD should be followed as noted in Task 2. Specifically, Task 3A will be made up of the following activities:

- Consider the available options for determining the wall condensation rates and validate the wall condensation UDF with data from a simplified case, making refinements to the UDF where necessary.
- Develop the capability for bulk condensation and wall re-evaporation into the UDF. These additions to the UDF will be fully validated in future tasks.
- Complete up to three sensitivity studies for two of three test sequences on the Facility 1 geometry, not including any bulk condensation phenomena.
- Write a draft letter report summarizing this effort.

The goal of the work is to demonstrate and benchmark the capabilities and options for the wall condensation model as well as the development of an initial capability to predict bulk condensation and re-evaporation from walls. In addition, the work will study key model sensitivities, as well as highlight modeling improvements or modifications that could improve the accuracy of the containment test facility simulations relative to test data. All sensitivity study options will be pre-approved by NRC technical staff.

Completion Date:

All deliverables under Task 3A will be submitted within 6 months of award of contract.

Deliverables:

- 1) All final FLUENT CFD models (case and data files) used in the above studies (in electronic format, suitable for reading on NRC computer systems)
- 2) Final UDF validated for wall condensation, and also with capability of including bulk condensation and wall evaporation (in electronic format, suitable for reading on NRC computer systems)
- 3) An informal draft letter report, including the following:
 - a. Documentation of settings and boundary conditions for FLUENT CFD models and the condensation UDF for all validations and sensitivity studies
 - b. Documentation of the procedure for the application of the UDF models as well as the underlying methodology and assumptions used to predict the wall and bulk condensation

- c. Results of validations and sensitivity studies, compared with benchmark and/or test data
- d. Lessons learned, modeling deficiencies, and areas for future modeling

3B: Bulk Condensation Validation and Second Round Sensitivity Study

In coordination with the NRC COR, the contractor shall validate the UDF developed and utilized with the FLUENT CFD models of Facility 1 generated in Task 2, but allowing for the phenomenon of bulk condensation. Additionally, the contractor will use the model to complete up to three sensitivity studies for one additional test sequence at conditions supplied by the NRC COR. Best practice guidelines for the application of CFD should be followed as noted in Task 2. Specifically, Task 3B will be made up of the following activities:

- Validate the bulk condensation portion of the UDF with data from a simplified case, making refinements to the UDF where necessary
- Develop up to three sensitivity studies for one additional test sequence on the Facility 1 geometry, possibly including spray and the resulting condensation
- Write full report for all activities in Task 3A and 3B

The goal of the work will be to show key model sensitivities associated with bulk condensation, as well as to highlight modeling improvements or modifications that could improve the accuracy of the simulations relative to test data. All sensitivity study options will be pre-approved by NRC technical staff.

Deliverables:

- 1) All final FLUENT CFD models (case and data files) used in the above studies (in electronic format, suitable for reading on NRC computer systems)
- 2) Final UDF, validated for bulk condensation (in electronic format, suitable for reading on NRC computer systems)
- 3) A formal and comprehensive draft report for all sensitivity studies and validations in Tasks 3A and 3B that includes:
 - a. Documentation of settings and boundary conditions for FLUENT CFD models and the condensation UDF for all validations and sensitivity studies
 - b. Documentation of the methodology for the wall and bulk condensation UDF
 - c. Results of validations and sensitivity studies, compared with benchmark and/or test data
 - d. Lessons learned, modeling deficiencies, and areas for future modeling
- 4) A final report including comments from NRC staff