INTERAGENCY AGREEMENT	1. IAA NO. NRC-HQ-60-11-I-0003/M0008	PAGE 1 OF 2
2. ORDER NO.	3. REQUISITION NO. RES-15-0394	4. SOLICITATION NO.

5. EFFECTIVE DATE	6. AWARD DATE	7. PERIOD OF PERFORMANCE
07/30/2015	07/30/2015	09/01/2011 TO 11/30/2015

8. SERVICING AGENCY
NAVAL SURFACE WARFARE CENTER NSWC
ALC:
DUNS: +4:
INDIAN HEAD EXPLOSIVE ORDINANCE DIS
TECHNOLOGY DIVISION
1767 STRAUSS AVE STE 201
INDIAN HEAD MD 20640-5150

POC Pam Speake
TELEPHONE NO. 301-744-6771

9. DELIVER TO
HERNANDO CANDRA
US NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REGULATORY RESEARCH
11555 ROCKVILLE PIKE
ROCKVILLE MD 20852

10. REQUESTING AGENCY
ACQUISITION MANAGEMENT DIVISION
ALC: 31000001
DUNS: 040535809 +4:
US NUCLEAR REGULATORY COMMISSION
ONE WHITE FLINT NORTH
11555 ROCKVILLE PIKE
ROCKVILLE MD 20852-2738

POC Sandra Nesmith
TELEPHONE NO. 301-415-6836

11. INVOICE OFFICE
US NUCLEAR REGULATORY COMMISSION
ONE WHITE FLINT NORTH
11555 ROCKVILLE PIKE
MAILSTOP O3-E17A
NRCIPACRESOURCENRCGOV
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
V6241

15. PROJECT TITLE
SNFP VULNERABILITIES TO THREATS

16. ACCOUNTING DATA
2015-X0200-FEEBASED-60-60D001-11-2-130-1021-253A

17. ITEM NO.	18. SUPPLIES/SERVICES	19. QUANTITY	20. UNIT	21. UNIT PRICE	22. AMOUNT
	NRC-HQ-60-11-I-0003 TITLE: SNFP Vulnerabilities to Threats Master IAA: N/A SUMMARY OF CHANGES: The purpose of this modification is to (1) add additional within scope tasks (subtasks 3.8 and 3.9); (2) incorporate the Supplemental Statement of Work modifications; (3) increase the authorized cost ceiling by $100,000.00 from $501,000.00 to $601,000.00; and(4) provide Continued				

23. PAYMENT PROVISIONS	24. TOTAL AMOUNT $50,000.00

25a. SIGNATURE OF CONTRACTOR (REPRESENTATIVE)	26a. SIGNATURE OF GOVERNMENT REPRESENTATIVE (REQUESTING)
HIGGINS.ROY.DAVID.1152902936 (Signature) Digitally signed by HIGGINS.ROY.DAVID.1152902936 DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USN, cn=HIGGINS.ROY.DAVID.1152902936 Date: 2015.08.05 15:24:01 -04'00'	Jeffrey R. Mitchell
25b. NAME AND TITLE: Roy Higgins, Financial Management Analyst	25c. DATE: 08/05/2015
26b. CONTRACTING OFFICER: JEFFREY R. MITCHELL	26c. DATE: 7/30/2015

TEMPLATE - ADM001

SUNSI REVIEW COMPLETE AUG 27 2015 ADM002

incremental funding in the amount of $50,000.00.

Accordingly the agreement is modified as follows:

The modified Statement of Work (Addendum No. 3) is hereby incorporated into this Agreement.

The new authorized cost ceiling is $601,000.00

This modification provides incremental funding in the amount of $50,000.00, thereby increasing the total obligations for this Agreement from $501,000.000 to $551,000.00.

All other terms and conditions remain unchanged.

Attachment: Supplemental Statement of Work, Addendum No. 3

NSWC PI: Reid McKeown
NRC COR: Hernando Candra

DUNS: 040535809 TAS: 31X0200.320
ALC: 31000001

STATEMENT OF WORK
Job code No.V6241
Contract: NRC-HQ-60-11-I-0003
Addendum No. 003

TITLE: Spent Nuclear Fuel Pool (SNFP) Vulnerabilities to Postulated Security Threats

SUMMARY OF MODIFICATIONS:

- Add Subtasks 3.8 and 3.9
- Execute plan for completion

MODIFICATION TO STATEMENT OF WORK

The purpose of this modification is add two new subtasks to Task 3 and to execute specific plans for the completion of the research and delivery of research products.

Due to the nature of the work undertaken in this agreement, there is no planned travel anticipated during the execution of this effort.

SubTask 3.8 Energy Deposition into Fuel Material and Determination of Respirable Mass

The determination of respirable fuel mass from the underwater (UNDEX) explosion is a very challenging analysis since there is not any software currently available to address this issue. However, there are several approximate indirect approaches to solve this problem that can be used in connection with the numerical modeling done with DYSMAS. The approach developed by Sandia National Laboratory for spent fuel vulnerability studies which uses energy deposition will be adopted in this study for respirable mass conversion.

DYSMAS code was used for UNDEX calculations of high explosive (HE) detonations on top of SFNP fuel racks to determine the amount of energy deposited into the fuel material. The results will be post processed and plotted in iso-contours of energy levels that decrease with range from the HE charge. Sandia's approach will then be used to convert this energy deposition to evaluate how much fuel mass gets broken down into respirable particles. The DYSMAS results will also be processed to determine how much of the fuel material is ejected from the SNFP pool during the explosion and subsequent explosion bubble pulsations.

Tracking the ejected fuel materials would require some additional new programming to be incorporated in the existing DYSMAS code similar to the "reactive burn" routines used in hydrocodes.

This subtask includes the following efforts:

- Determine the amount of energy deposited into the fuel material.
- Plot of iso-contours of energy deposition levels in the pool.

- Evaluate how much fuel mass gets broken down into respirable particles based on these energy levels.
- Determine how much fuel mass is ejected from the SNFP pool during the explosion.
- Evaluate respirable particle mass that gets scrubbed by water during explosion.

SubTask 3.9 DYSMAS Coupled Calculations of SNFP Structure Response to UNDEX

In reference to SubTask 3.8 above a representative BWR SNFP was selected for this study. Under this task, the Indian Head staff will use DYSMAS code to perform fluid structure coupled analysis to evaluate the structural response subjected to UNDEX for 50 and 150 lbs charges centered in the pool at the top of the fuel rack. The analysis will be performed for both 1) a pool with water without fuel rack assembly and 2) a pool with water and homogeneous fuel rack material in the pool. The results of these analyses will be included in the general Task 3 (Parametric Modeling and Analysis) as defined in the previous SOW.

This subtask includes the following level of efforts:

- Performed DYMAS coupled fluid-structure analysis subjected to two charges of under water explosion
- Evaluate the results that can be included in the general Task 3 specified in the previous SOW.

DELIVERABLES/SCHEDULES (UNCHANGED)

Tasks	**Current Statement of Work**
Task 1: Review of SNFP configuration Kickoff meeting Develop calculation matrix	11/1/2011 (No change)
Task 2: Develop SNFP-like sample calc. Install Dysmas at NRC Dysmas training	11/1/2011 (sample calc.) 9/1/2013, partially installed on 3/25/2013 12/1/2013 (Training)
Task 3: Parametric Analysis	9/30/2015
Task 4: Briefing and Report	11/30/2015