

**ORDER FOR SUPPLIES OR SERVICES**

PAGE OF PAGES  
1 20

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

1. DATE OF ORDER 09/29/2016		2. CONTRACT NO. (If any) NRC-HQ-12-C-04-0086		6. SHIP TO: a. NAME OF CONSIGNEE US NUCLEAR REGULATORY COMMISSION-				
3. ORDER NO. NRC-HQ-60-16-T-0002		4. REQUISITION/REFERENCE NO. RES-16-0454		b. STREET ADDRESS MAIL PROCESSING CENTER 4930 BOILING BROOK PARKWAY		c. CITY ROCKVILLE	d. STATE MD	e. ZIP CODE 20852
5. ISSUING OFFICE (Address correspondence to) US NRC - HQ ACQUISITION MANAGEMENT DIVISION MAIL STOP TWFN-5E03 ATTN ROB ROBINSON 301-415-0728 WASHINGTON DC 20555-0001				f. SHIP VIA				
7. TO: JOHN W HANOLD a. NAME OF CONTRACTOR PENNSYLVANIA STATE UNIVERSITY THE				8. TYPE OF ORDER <input type="checkbox"/> a. PURCHASE <input checked="" type="checkbox"/> b. DELIVERY				
b. COMPANY NAME				REFERENCE YOUR:				
c. STREET ADDRESS 110 TECHNOLOGY CENTER				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.				
d. CITY UNIVERSITY PARK		e. STATE PA	f. ZIP CODE 168027000		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.			
9. ACCOUNTING AND APPROPRIATION DATA See Schedule				10. REQUISITIONING OFFICE OFF OF NUCLEAR REG RESEARCH				
11. BUSINESS CLASSIFICATION (Check appropriate box(es)) <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. SERVICE-DISABLED VETERAN-OWNED <input type="checkbox"/> g. WOMEN-OWNED SMALL BUSINESS (WOSB) ELIGIBLE UNDER THE WOSB PROGRAM <input type="checkbox"/> h. EDWOSB							12. F.O.B. POINT	
13. PLACE OF		14. GOVERNMENT B/L NO.		15. DELIVER TO F.O.B. POINT ON OR BEFORE (Date) 12/31/2017		16. DISCOUNT TERMS		
a. INSPECTION Destination	b. ACCEPTANCE Destination							

**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)
	In accordance with Section G.4 of the subject contract, entitled "Task Order Procedures," this order definitizes Task Order 4 of the "Spacer Grid Thermal Hydraulics" Program. These services shall be performed in accordance with the Continued ...					

18. SHIPPING POINT		19. GROSS SHIPPING WEIGHT		20. INVOICE NO.		17(h) TOTAL (Cont. pages)
21. MAIL INVOICE TO:						
a. NAME US NUCLEAR REGULATORY COMMISSION					\$0.00	▲
b. STREET ADDRESS (or P.O. Box) TWO WHITE FLINT NORTH 11545 ROCKVILLE PIKE MAILSTOP T9-B07 NRCPAYMENTSNRGOV						17(i) GRAND TOTAL
c. CITY ROCKVILLE		d. STATE MD	e. ZIP CODE 20852-2738		\$835,426.00	▲

22. UNITED STATES OF AMERICA BY (Signature) 09/29/2016 <i>Monique B. Williams</i>			23. NAME (Typed) MONIQUE B. WILLIAMS TITLE: CONTRACTING/ORDERING OFFICER			
---	--	--	--	--	--	--

TEMPLATE - ADM001 SUNSI REVIEW COMPLETE ADM002  
JAN 25 2017

**ORDER FOR SUPPLIES OR SERVICES  
SCHEDULE - CONTINUATION**

PAGE NO


2

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

DATE OF ORDER  
09/13/2016

CONTRACT NO.  
NRC-HQ-12-C-04-0086

ORDER NO.  
NRC-HQ-60-16-T-0002

ITEM NO. (a)	SUPPLIES/SERVICES (b)	QUANTITY ORDERED (c)	UNIT (d)	UNIT PRICE (e)	AMOUNT (f)	QUANTITY ACCEPTED (g)
	<p>attached the attached terms and conditions and Statement of Work.</p> <p>Period of Performance: Date of Award - 12/31/2017 Total Task Order Ceiling: \$835,426.00 Total Obligated Amount: \$180,000.00</p> <p>See attached pages for specific details regarding this award.</p> <p>Contracting Officer's Representative (COR) Kirk Tien, 301-415-1606 kirk.tien@nrc.gov</p> <p>Contractor Principal Investigator (PI) Dr. Fan-Bill Cheung, fxc4@psu.edu</p> <p>Contractor Business Point of Contact Danelle Kissell, dlk20@psu.edu</p> <p> 09/29/16 Contractor Authorized Official Date Lisa A. Butler, CRA Associate Director of Sponsored Accounting Info: Programs 2016-X0200-REIM-60-60D003-11-R-729-1302-252A</p>					

TOTAL CARRIED FORWARD TO 1ST PAGE (ITEM 17(H))

\$0.00

A.1 NRCB010 BRIEF PROJECT TITLE AND WORK DESCRIPTION .....4  
A.2 NRCB050 CONSIDERATION AND OBLIGATION-TASK ORDERS.....4  
A.3 COST/PRICE SCHEDULE.....5  
A.4 DELIVERABLE SCEDULE .....5  
A.5 NRCF032 TASK/DELIVERY ORDER PERIOD OF PERFORMANCE (SEP 2013)  
.....6  
A.6 2052.215-71 PROJECT OFFICER AUTHORITY. (OCT 1999).....6  
A.7 TASK ORDER STATEMENT OF WORK.....7

ATTACHMENT 1 - BILLING INSTRUCTIONS FOR COST REIMBURSEMENT TYPE  
CONTRACTS.....12

**A.1 NRCB010 BRIEF PROJECT TITLE AND WORK DESCRIPTION**

(a) The title of this project is:

Task Order 4 under Spacer Grid Thermal Hydraulics Program

(b) Summary work description:

The purpose of this Task Order consists of two areas: The first objective is to continue the data evaluation and correlation development of reflood data with the expanded database. The second objective is to finalize the design parameters of a High Pressure Post-CHF Rod Bundle Test facility. Some new data were collected during the Task Order #3 period, and more test points at different flow rates have been identified. Also, the NRC staff would like to improve the accuracies of the estimate with design, materials and instrumentation requirements developed in task order #3 for the high pressure bundle.

(End of Clause)

**A.2 NRCB050 CONSIDERATION AND OBLIGATION-TASK ORDERS**

(a) The ceiling of this order for services is \$835,426.00.

(b) This order is subject to the minimum and maximum ordering requirements set forth in the contract.

(c) The amount presently obligated with respect to this order is \$180,000.00. The obligated amount shall, at no time, exceed the order ceiling as specified in paragraph (a) above. When and if the amount(s) paid and payable to the Contractor hereunder shall equal the obligated amount, the Contractor shall not be obligated to continue performance of the work unless and until the Contracting Officer shall increase the amount obligated with respect to this order, in accordance with FAR Part 43 - Modifications. Any work undertaken by the Contractor in excess of the obligated amount specified above is done so at the Contractor's sole risk and may not be reimbursed by the Government.

(d) The Contractor shall comply with the provisions of FAR 52.232-22 - Limitation of Funds, for incrementally-funded delivery orders or task orders.

(End of Clause)

**A.3 COST/PRICE SCHEDULE**

Period of Performance: Date of Award – 12/31/2017

CLIN	LABOR CATEGORY	% LEVEL OF EFFORT	TOTAL
0001	PI – Cheung (Fringe Category 1)		<b>\$30,135.00</b>
	Year 1 - Academic Year 2016 (9 months)	5%	\$27,268.00
	Summer 2017 (3 months)	33.3%	---
	Year 2 - Academic Year 2017 (3 months)	5%	\$2,867.00
0002	CO-PI – Kim (Fringe Category 1)		<b>\$19,235.00</b>
	Year 1 - Academic Year 2016 (9 months)	3%	\$17,944.00
	Summer 2017 (3 months)	33.3%	---
	Year 2 - Academic Year 2017 (3 months)	3%	\$1,291.00
0003	Research Associate – Miller (Fringe Category 1) Summer Support only (3 months)	70.4%	<b>\$9,800.00</b>
0004	Research Associate – To Be Named (Fringe Category 1)		<b>\$43,847.00</b>
	Year 1 - Academic Year 2016 (12 months)	60%	\$35,078.00
	Year 2 - Academic Year 2017 (3 months)	58.9%	\$8,769.00
0005	Graduate Assistants – 3 total		<b>\$111,630.00</b>
	3 GAs at Grade 16, Half-Time for Fall and Spring Semesters (Fringe Category II)	50%	\$89,390.00
	3 GAs at Grade 16, Half-Time for Summer Semester (Fringe Category III)	50%	\$22,240.00
0006	Fringe		<b>\$56,912.00</b>
	• 40.20% for Category I	-	\$41,411.00
	• 15.4% for Category II		\$13,766.00
	• 7.8% for Category III		\$1,735.00
0006	Travel	LOT	<b>\$1,400.00</b>
0007	ODCs		<b>\$404,046.00</b>
	• Laboratory Supplies	-	\$4,000.00
	• Capital Equipment (NI Data Acquisition System)		\$68,508.00
	• Penn State Applied Research Laboratory (ARL)		\$262,500.00
	• Tuition Remission		\$69,038.00
0008	F&A (57.2%)	-	<b>\$158,421.00</b>
<b>GRAND TOTAL</b>			<b>\$835,426.00</b>

**A.4 DELIVERABLE SCHEDULE**

DELIVERABLE	DUE DATE
New Test Matrix	1 month after task order award
Quick Look Report (QLR)	1 month after approved tests are completed
Final Conceptual Design of High-Pressure Test Loop and Final Cost Estimate	2 months after task order award
Draft Updated Data Evaluation Report	6 months after task order award
Final Report for Advanced Instrumentation (In NUREG Format)	6 months after task order award
Detailed Drawings of High Pressure Test Loop	1 year after task order award

\*See also A.7.6 of statement of Work.

**A.5 NRCF032 TASK/DELIVERY ORDER PERIOD OF PERFORMANCE (SEP 2013)**

This order shall commence on Date of Award and will expire on 12/31/2017.

(End of Clause)

**A.6 2052.215-71 PROJECT OFFICER AUTHORITY. (OCT 1999)**

(a) The contracting officer's authorized representative hereinafter referred to as the project officer for this contract is:

Name: Kirk Tien  
Address: US NRC  
RES/DSA/RSCB  
Washington DC 20555

Telephone Number: 301-415-1606

(b) Performance of the work under this contract is subject to the technical direction of the NRC project officer. The term technical direction is defined to include the following:

(1) Technical direction to the contractor which shifts work emphasis between areas of work or tasks, authorizes travel which was unanticipated in the Schedule (i.e., travel not contemplated in the Statement of Work or changes to specific travel identified in the Statement of Work), fills in details, or otherwise serves to accomplish the contractual statement of work.

(2) Provide advice and guidance to the contractor in the preparation of drawings, specifications, or technical portions of the work description.

(3) Review and, where required by the contract, approve technical reports, drawings, specifications, and technical information to be delivered by the contractor to the Government under the contract.

(c) Technical direction must be within the general statement of work stated in the contract. The project officer does not have the authority to and may not issue any technical direction which:

(1) Constitutes an assignment of work outside the general scope of the contract.

(2) Constitutes a change as defined in the "Changes" clause of this contract.

(3) In any way causes an increase or decrease in the total estimated contract cost, the fixed fee, if any, or the time required for contract performance.

(4) Changes any of the expressed terms, conditions, or specifications of the contract.

(5) Terminates the contract, settles any claim or dispute arising under the contract, or issues any unilateral directive whatever.

(d) All technical directions must be issued in writing by the project officer or must be confirmed by the project officer in writing within ten (10) working days after verbal issuance. A copy of the written direction must be furnished to the contracting officer. A copy of NRC Form 445, Request for Approval of Official Foreign Travel, which has received final approval from the NRC must be furnished to the contracting officer.

(e) The contractor shall proceed promptly with the performance of technical directions duly issued by the project officer in the manner prescribed by this clause and within the project officer's authority under the provisions of this clause.

(f) If, in the opinion of the contractor, any instruction or direction issued by the project officer is within one of the categories defined in paragraph (c) of this section, the contractor may not proceed but shall notify the contracting officer in writing within five (5) working days after the receipt of any instruction or direction and shall request that contracting officer to modify the contract accordingly. Upon receiving the notification from the contractor, the contracting officer shall issue an appropriate contract modification or advise the contractor in writing that, in the contracting officer's opinion, the technical direction is within the scope of this article and does not constitute a change under the "Changes" clause.

(g) Any unauthorized commitment or direction issued by the project officer may result in an unnecessary delay in the contractor's performance and may even result in the contractor expending funds for unallowable costs under the contract.

(h) A failure of the parties to agree upon the nature of the instruction or direction or upon the contract action to be taken with respect to the instruction or direction is subject to 52.233-1 - Disputes.

(i) In addition to providing technical direction as defined in paragraph (b) of the section, the project officer shall:

(1) Monitor the contractor's technical progress, including surveillance and assessment of performance, and recommend to the contracting officer changes in requirements.

(2) Assist the contractor in the resolution of technical problems encountered during performance.

(3) Review all costs requested for reimbursement by the contractor and submit to the contracting officer recommendations for approval, disapproval, or suspension of payment for supplies and services required under this contract.

(End of Clause)

## **A.7 TASK ORDER STATEMENT OF WORK**

### **A.7.1 PROJECT TITLE**

**Task Order #4 of Spacer Grid Thermal-Hydraulic Program.**

## **A.7.2 BACKGROUND**

The U.S. Nuclear Regulatory Commission's (NRC) system thermal-hydraulic code TRACE (TRAC RELAP Advanced Computational Engine) is being developed to provide a best-estimate accident analysis capability for operating pressurized- and boiling-water reactors, as well as the next generation of evolutionary light-water reactor designs. The NRC has sponsored many experiments to obtain high-quality data to assess the TRACE code. The Rod Bundle Heat Transfer (RBHT) test facility at Pennsylvania State University (PSU) for example, has been especially important in generating data relevant to reflood of a core following a hypothetical loss-of-coolant-accident (LOCA).

In Task Orders #1, #2 and #3 of this program, under IDIQ contract no. (NRC-HQ-12-C-04-0086), funding was provided to refurbish the worn and damaged original rod bundle and performed an in-depth data evaluation of all the heat transfer data collected from all the test series. The data evaluation has revealed two major concerns: The first concern is that most tests were carried out with either 1 in/s or 6 in/s reflood rates, and that for better correlation development, this range should be expanded. The second concern is that all previous tests were performed at low pressure. Due to the structural limitations, the data obtained from RBHT and most other sponsored research programs have been conducted at low pressure ( $P < 0.7$  MPa). The lack of high pressure data limits the development of models and validation of TRACE for certain scenarios of interest to plant safety.

High pressure inverted annular flow film boiling can occur during an Anticipated Transient Without Scram (ATWS) event while regions of a BWR core exceed the critical heat flux during power oscillations. Inverted annular flow film boiling and inverted slug film boiling can also occur during the rapid reflooding of a partially uncovered core following loop seal clearance in a PWR. Both scenarios involve high pressure, post-CHF flows for which very little data exist. Heat transfer is low during these periods of inverted annular flow and some simulations using TRACE have indicated that ATWS related oscillations may result in maximum cladding temperatures near the 2200 degree F regulatory limit. Models in TRACE and most other thermal-hydraulic codes are largely based on low-pressure data and then extrapolated. Thus, the uncertainty in simulations using these models is high and difficult to quantify. Accurate models for inverted annular film boiling and inverted slug film boiling are important in order to have reliable LOCA simulations and support NRR and NRO in on-going licensing activities. Currently, high uncertainty in TRACE assessment has complicated the review process. Therefore, a new test facility capable of producing high pressure inverted annular film boiling data is considered a high priority. Because data from the proposed test facility will be used for model development, advanced instrumentation is considered vital in order to provide sufficient information on the flow to enable development of a mechanistic model appropriate for a rod bundle. Data obtained in the proposed facility will also be used to validate new and existing models in TRACE and to determine the effect of spacer grids on high pressure rod bundle thermal-hydraulics.

## **A.7.3 SCOPE**

The purpose of this Task Order consists of two areas: The first objective is to continue the data evaluation and correlation development of reflood data with the expanded database. The second objective is to finalize the design parameters of a High Pressure



Post-CHF Rod Bundle Test facility. Some new data were collected during the Task Order #3 period, and more test points at different flow rates have been identified. Also, the NRC staff would like to improve the accuracies of the estimate with design, materials and instrumentation requirements developed in task order #3 for the high pressure bundle.

#### **A.7.4 APPLICABLE DOCUMENTS AND STANDARDS**

More background information on licensing of domestic nuclear reactor, the information can be found in NRC Regulations, Title 10, Code of Federal Regulations Title 50 Sec. 46, about maximum clad temperature and other parameters relevant to the safety of the reactor coolant system.

#### **A.7.5 SPECIFIC TASKS**

The following are the specific tasks for Task Order #4:

##### **Task 1. Develop a new test matrix for Task Order #4.**

As described in the Background section, the original reflood test series data were collected at only a couple of flood rates. This shortcoming was realized in Task Order #2 and #3, attention was made to broaden the test database. NRC staff and contractor will review the database from original bundle and refurbished bundle test database, identify data needs and develop a new test matrix.

##### **Task 2. Characterize the fouling layers on the surface of selected RBHT heater rods.**

During oscillatory reflood tests NRC staff and contractor noticed the quench behavior was very different from the original tests. Inspections revealed there were crud layers on the surface of the heater rods. Since the effect on reflood were significant, it is important to pull the used rods from the original bundle during the refurbishing task, select rods with most crud/fouling layers, especially at the peak power location, perform a detailed chemical and physical analysis to characterize the fouling layers.

##### **Task 3. Perform additional oscillatory reflood tests.**

Before the RBHT test bundle refurbishment, a series of oscillatory reflood tests were carried out, and due to the age and crud on the heater rods, data indicated they could not reproduce the quenching behavior obtained in the original tests. With the refurbished bundle and new heater rods, NRC staff and contractor will review the data from old bundle and repeat some of the oscillatory reflood to check the reproducibility of data. Additional oscillatory reflood tests will be performed to cover the ranges of oscillation frequencies and magnitudes as those in the new bundle

##### **Task 4. Identify the effect of fouling on droplet and oscillatory reflood behavior.**

With new data collected from the oscillatory reflood tests with the new bundle, results will be compared with those obtained with the old bundle before refurbishment. Quantify the effect of fouling on the droplet field, the quenching behavior and the resulting heat transfer.

**Task 5. Complete other types of RBHT tests**

NRC plans to perform additional tests with the new bundle, this includes constant reflood tests with specific droplet measurements, steam cooling tests for steam probe calibration and level swell tests.

**Task 6. Continue the effort of data evaluation and correlation development.**

After additional reflood tests described in Tasks 3 and 5 above, new data will be incorporated into the existing Data Evaluation reports developed in Task Order #2. Effort will include data evaluation and correlation development for single phase flows, two phase flows and oscillatory flows.

**Task 7. Continue development of advanced instrumentation.**

The contractor will continue development of droplet measurement technique using the Firefly laser system, develop the advanced conductivity probe for local droplet size and velocity and steam probe for local steam velocity measurement in the rod bundle.

**Task 8. Upgrade the RBHT Data Acquisition System (DAS)**

The DAS at RBHT is over 13 years old and there are much better systems available these days. The contractor shall acquire an updated DAS, subject to the approval of the COR.

**Task 9. Prepare final SGTH program reports**

The contractor shall prepare the final Comprehensive Data Evaluation report and the Advanced Instrumentation Development report.

**A.7.6 DELIVERABLES AND DELIVERY SCHEDULE**

The Contractor shall submit a Monthly Letter Status Report (MLSR) describing the work performed under this task order to the NRC Contracting Officer's Representative (COR) by the 20th of each month, following the month to be reported, with copies provided to the following:

[RESDSAMLSR.Resource@nrc.gov](mailto:RESDSAMLSR.Resource@nrc.gov)

The MLSR shall identify the title of the project, the job code, the Principal Investigator, the period of performance, the reporting period, summarize each month's technical progress, list monthly spending, total spending to-date, and the remaining funds and will contain information as directed in NRC Management Directive 11.1. The Contractor shall immediately bring any administrative or technical difficulties which may affect the

schedule or costs of the project to the attention of the NRC COR.

In addition to the MLSR, the Contractor shall prepare and deliver to the NRC COR the following deliverables, according to the identified milestone for each individual task:

1. The new test matrix shall be submitted to NRC within one month after task order award, and the NRC staff will work with contractor to develop a final approved set.
2. A Quick Look Report (QLR) with data in approved databank format will be submitted to NRC for review and acceptance, within one month after each of the approved tests is completed.
3. The final conceptual design of the high-pressure test loop and cost estimate shall be submitted within two months after task order award, and detailed drawings will be delivered within one year after task order award.
4. The draft updated Data Evaluation report for this Task Order #4 shall be submitted to NRC within six months after task order award. This final report will be in NUREG format for permanent agency archival. The final report for Advanced Instrumentation will also be submitted within six months after contract award.

#### **A.7.7 PERSONNEL REQUIREMENTS**

This project requires a densely instrumented, half height (6 ft.) rod bundle test section with pressurized steam supply and data acquisition system. To be able to heat the test rods to realistic temperatures, the power supply for this facility is required to have a capacity of 14,000 Amp DC and higher. The test section is to simulate the thermal-hydraulic conditions in a BWR core and downcomer in an ATWS event or a PWR reactor core experiencing rapid reflood after loop clearance has been reached. In addition, the project requires computer capabilities to perform model development and code validation. Finally, experience and knowledge of multiphase flow and experimental techniques are essential to the performance of this type of work.

The contractor is responsible for assigning technical staff, employees, subcontractors, or specialists who have the required educational background, experience, or combination thereof to meet the technical objectives of the work specified in this statement of work (SOW). The NRC will rely on the contractor to verify the qualifications of the personnel assigned to this task order, including assurance that all information contained in the technical and cost proposals (including resumes) is accurate and truthful.

The designation of Key Personnel and any proposed changes to Key Personnel on this contract is subject to the NRC COR's approval. This includes proposed use of principal persons (i.e., key contributors) during the life of the contract.

For any work to be subcontracted or performed by consultants, the contractor shall obtain the NRC COR's written approval of the subcontractor or consultant prior to initiation of the subcontract effort. Conflict-of-interest considerations shall apply to any subcontracted effort.

**A.7.8 GOVERNMENT-FURNISHED PROPERTY**

None.

**A.7.9 PLACE OF PERFORMANCE**

The work proposed in this shall will be performed at the PSU Applied Research Laboratory Rod Bundle Heat Transfer Test Facility (RBHT) located near the PSU University Park campus.

## **BILLING INSTRUCTIONS FOR COST REIMBURSEMENT TYPE CONTRACTS**

**General:** During performance and through final payment of this contract, the contractor is responsible for the accuracy and completeness of data within the System for Award Management (SAM) database and for any liability resulting from the Government's reliance on inaccurate or incomplete SAM data.

The contractor shall prepare invoices/vouchers for reimbursement of costs in the manner and format described herein. **FAILURE TO SUBMIT INVOICES/VOUCHERS IN ACCORDANCE WITH THESE INSTRUCTIONS MAY RESULT IN REJECTION OF THE INVOICE/VOUCHER AS IMPROPER.**

**Standard Forms:** Reimbursement requests shall be submitted on the payee's letterhead, invoice/voucher, or on the Government's Standard Form 1034, "Public Voucher for Purchases and Services Other than Personal," and Standard Form 1035, "Public Voucher for Purchases Other than Personal--Continuation Sheet."

**Electronic Invoice/Voucher Submissions:** The preferred method of submitting invoices/vouchers is electronically to the U.S. Nuclear Regulatory Commission, via email to: [NRCPayments@nrc.gov](mailto:NRCPayments@nrc.gov).

**Hard-Copy Invoice/Voucher Submissions:** If you submit a hard-copy of the invoice/voucher, a signed original and supporting documentation shall be submitted to the following address:

NRC Payments  
U.S. Nuclear Regulatory Commission  
One White Flint North  
11555 Rockville Pike  
Mailstop O3-E17A  
Rockville, MD 20852-2738

**Purchase of Capital Property:** *(\$50,000 or more with life of one year or longer)*

Contractors must report to the Contracting Officer, electronically, any capital property acquired with contract funds having an initial cost of \$50,000 or more, in accordance with procedures set forth in NRC Management Directive (MD) 13.1, IV, C – "Reporting Requirements" (revised 2/16/2011).

**Agency Payment Office:** Payment will continue to be made by the office designated in the contract in Block 12 of the Standard Form 26, or Block 25 of the Standard Form 33, whichever is applicable.

**Frequency:** The contractor shall submit requests for reimbursement once each month, unless otherwise authorized by the Contracting Officer.

**Format:** Invoices/Vouchers shall be submitted in the format depicted on the attached sample form entitled "Invoice/Voucher for Purchases and Services Other Than Personal". Alternate formats are permissible only if they address all requirements of the Billing Instructions. The instructions for preparation and itemization of the invoice/voucher are included with the sample form.

**Task Order Contracts:** The contractor must submit a separate invoice/voucher for each individual task order with detailed cost information. This includes all applicable cost elements and other items discussed in paragraphs (a) through (s) of the attached instructions. In addition, the invoice/voucher must specify the contract number, and the NRC-assigned task/delivery order number.

**Billing of Costs after Expiration of Contract:** If costs are incurred during the contract period and invoiced after the contract has expired, you must cite the period during which these costs were incurred. To be considered a proper expiration invoice/voucher, the contractor shall clearly mark it "EXPIRATION INVOICE" or "EXPIRATION VOUCHER".

Final invoices/vouchers shall be marked "FINAL INVOICE" or "FINAL VOUCHER".

**Currency:** Invoices/Vouchers must be expressed in U.S. Dollars.

**Supersession:** These instructions supersede previous Billing Instructions for Cost-Reimbursement Type Contracts (July 2011).

**INVOICE/VOUCHER FOR PURCHASES AND SERVICES OTHER THAN PERSONAL  
(SAMPLE FORMAT - COVER SHEET)**

**1. Official Agency Billing Office**

NRC Payments  
U.S. Nuclear Regulatory Commission  
One White Flint North  
11555 Rockville Pike  
Mailstop O3-E17A  
Rockville, MD 20852-2738

**2. Invoice/Voucher Information**

a. **Payee's DUNS Number or DUNS+4.** The Payee shall include the Payee's Data Universal Number (DUNS) or DUNS+4 number that identifies the Payee's name and address. The DUNS+4 number is the DUNS number plus a 4-character suffix that may be assigned at the discretion of the Payee to identify alternative Electronic Funds Transfer (EFT) accounts for the same parent concern.

b. **Taxpayer Identification Number.** The Payee shall include the Payee's taxpayer identification number (TIN) used by the Internal Revenue Service (IRS) in the administration of tax laws. (See IRS Web site: [http://www.irs.gov/Businesses/Small-Businesses-&Self-Employed/Employer-ID-Numbers-\(EINs\)](http://www.irs.gov/Businesses/Small-Businesses-&Self-Employed/Employer-ID-Numbers-(EINs))).

c. **Payee's Name and Address.** Show the name of the Payee as it appears in the contract and its correct address. If the Payee assigns the proceeds of this contract as provided for in the assignment of claims terms of this contract, the Payee shall require as a condition of any such assignment, that the assignee shall register separately in the System for Award Management (SAM) database at <http://sam.gov> and shall be paid by

EFT in accordance with the terms of this contract. See Federal Acquisition Regulation (FAR) 52.232-33(g) Payment by Electronic Funds Transfer - Central Contractor Registration (October 2003).

- d. Contract Number. Insert the NRC contract number (including Enterprise-wide Contract (EWC)), GSA Federal Supply Schedule (FSS), Governmentwide Agency Contract (GWAC) number, or Multiple Agency Contract (MAC) number, as applicable.
- e. Task Order Number. Insert the task/delivery order number (If Applicable). **Do not include more than one task order per invoice or the invoice may be rejected as improper.**
- f. Invoice/Voucher. The appropriate sequential number of the invoice/voucher, beginning with 001 should be designated. Contractors may also include an individual internal accounting number, if desired, in addition to the 3-digit sequential number.
- g. Date of Invoice/Voucher. Insert the date the invoice/voucher is prepared.
- h. Billing Period. Insert the beginning and ending dates (day, month, year) of the period during which costs were incurred and for which reimbursement is requested.
- i. Description of Deliverables. Provide a brief description of supplies or services, quantity, unit cost, and total cost.
- j. Work Completed. Provide a general summary description of the services performed or products submitted for the invoice period and specify the section or Contract Line Item Number (CLIN) or SubCLIN in the contract pertaining to the required deliverable(s).
- k. Shipping. Insert weight and zone of shipment, if shipped by parcel post.
- l. Charges for freight or express shipments. Attach prepaid bill if shipped by freight or express.
- m. Instructions. Include instructions to consignee to notify the Contracting Officer of receipt of shipment.
- n. For Indefinite Delivery contracts, the final invoice/voucher shall be marked "FINAL INVOICE" or "FINAL VOUCHER".
- o. Direct Costs. Insert the amount billed for the following cost elements, adjustments, suspensions, and total amounts, for both the current billing period and for the cumulative period (from contract inception to end date of this billing period).

(1) Direct Labor. This consists of salaries and wages paid (or accrued) for direct performance of the contract itemized as follows:

<u>Labor Category</u>	<u>Hours Billed</u>	<u>Rate</u>	<u>Total</u>	<u>Cumulative Hours Billed</u>
-----------------------	---------------------	-------------	--------------	--------------------------------

(2) Fringe Benefits. This represents fringe benefits applicable to direct labor

and billed as a direct cost. Where a rate is used indicate the rate. Fringe benefits included in direct labor or in other indirect cost pools should not be identified here.

(3) Contractor-acquired property (\$50,000 or more). List each item costing \$50,000 or more and having a life expectancy of more than one year. List only those items of equipment for which reimbursement is requested. For each such item, list the following (as applicable): (a) an item description, (b) manufacturer, (c) model number, (d) serial number, (e) acquisition cost, (f) date of purchase, and (g) a copy of the purchasing document.

(4) Contractor-acquired property (under \$50,000), Materials, and Supplies. These are equipment other than that described in (3) above, plus consumable materials and supplies. List by category. List items valued at \$1,000 or more separately. Provide the item number for each piece of equipment valued at \$1,000 or more.

(5) Premium Pay. This enumeration in excess of the basic hourly rate. (Requires written approval of the Contracting Officer.)

(6) Consultant Fee. The supporting information must include the name, hourly or daily rate of the consultant, and reference the NRC approval (if not specifically approved in the original contract).

(7) Travel. Total costs associated with each trip must be shown in the following format:

<u>Start Date</u>		<u>Destination</u>		<u>Costs</u>
From	To	From	To	\$

*(Must include separate detailed costs for airfare, per diem, and other transportation expenses. All costs must be adequately supported by copies of receipts or other documentation.)*

(8) Subcontracts. Include separate detailed breakdown of all costs paid to approved subcontractors during the billing period.

(9) Other Costs. List all other direct costs by cost element and dollar amount separately.

p. Indirect Costs (Overhead and General and Administrative Expense). Cite the formula (rate and base) in effect in accordance with the terms of the contract, during the time the costs were incurred and for which reimbursement is requested.

q. Fixed-Fee. If the contract provides for a fixed-fee, it must be reimbursed as indicated in the contract. Cite the formula or method of computation. Include this information as it applies to individual task orders as well.

(1) The NRC will withhold payment of 15% of the negotiated contract fixed-fee amount, not to exceed \$100,000.



(2) If the fee withholding amount has reached \$100,000, the contractor may resume billing the NRC for the balance of its fee under subsequent invoices for work completed.

(3) Any fee amounts withheld by the NRC will be paid to the contractor during contract closeout in increments, following the submission/settlement of indirect rate proposals in accordance with FAR 52.216-8, "Fixed Fee" (JUN 2011).

r. Total Amount Billed. Insert columns for total amounts for the current and cumulative periods.

s. Adjustments. Insert columns for any adjustments, including outstanding suspensions for deficient or defective products or nonconforming services, for the current and cumulative periods.

t. Grand Totals.

**3. Sample Invoice/Voucher Information**

Sample Invoice/Voucher Information (Supporting Documentation must be attached)

This invoice/voucher represents reimbursable costs for the billing period from \_\_\_\_\_ through \_\_\_\_\_.

	<u>Amount Billed</u>	
	<u>Current Period</u>	<u>Cumulative</u>
<b>(a) <u>Direct Costs</u></b>		
(1) Direct labor	\$ _____	\$ _____
(2) Fringe benefits (% of direct labor)	\$ _____	\$ _____
(3) Government property (\$50,000 or more)	\$ _____	\$ _____
(4) Government property, Materials, and Supplies (under \$50,000 per item)	\$ _____	\$ _____
(5) Premium pay (NRC approved overtime)	\$ _____	\$ _____
(6) Consultants Fee	\$ _____	\$ _____
(7) Travel	\$ _____	\$ _____
(8) Subcontracts	\$ _____	\$ _____
(9) Other costs	\$ _____	\$ _____
Total Direct Costs:	\$ _____	\$ _____

**(b) Indirect Costs (provide the rate information applicable to your firm)**

(10) Overhead _____ % of _____ (Indicate Base)	\$ _____	\$ _____
--	----------	----------

(11) General and Administrative (G&A) \_\_\_\_\_%  
 of \_\_\_\_\_ (Indicate Base) \$ \_\_\_\_\_ \$ \_\_\_\_\_  
 Total Indirect Costs: \$ \_\_\_\_\_ \$ \_\_\_\_\_

**(c) Fixed-Fee:**

(12) Fixed-Fee Calculations:

- i. Total negotiated contract fixed-fee percent \_\_\_\_\_ and amount \$ \_\_\_\_\_
- ii. 85% allowable fee amount \$ \_\_\_\_\_
- iii. Cumulative fee billed on prior invoices \$ \_\_\_\_\_
- iv. Fee due this invoice (*not to exceed 85% of fee earned based upon negotiated contract fee percentage*) \$ \_\_\_\_\_

*Note: The fee balance withheld by NRC may not exceed \$100,000.*

Total Fixed-Fee: \$ \_\_\_\_\_ \$ \_\_\_\_\_  
 (d) Total Amount Billed \$ \_\_\_\_\_ \$ \_\_\_\_\_  
 (e) Adjustments (+/-) \$ \_\_\_\_\_ \$ \_\_\_\_\_  
 (f) Grand Total \$ \_\_\_\_\_ \$ \_\_\_\_\_

(The invoice/voucher format provided above must include information similar to that included below in the following to ensure accuracy and completeness.)

**SAMPLE SUPPORTING INFORMATION**

The budget information provided below is for format purposes only and is illustrative.

Cost Elements:

1) Direct Labor - \$2,400

<u>Labor Category</u>	<u>Hours Billed</u>	<u>Rate</u>	<u>Total</u>	<u>Cumulative Hours Billed</u>
Senior Engineer I	100	\$14.00	\$1,400	975
Engineer	50	\$10.00	\$500	465
Computer Analyst	100	\$5.00	\$500	320
			\$2,400	1,760

2) Fringe Benefits - \$480

Fringe @ 20% of Direct Salaries

<u>Labor Category</u>	<u>Salaries</u>	<u>Fringe Amount</u>
-----------------------	-----------------	----------------------

Senior Engineer I	\$1,400	\$280
Engineer	\$500	\$100
Computer Analyst	<u>\$500</u>	<u>\$100</u>
	\$2,400	\$480

3) Government-furnished and contractor-acquired property (\$50,000 or more) - \$60,000

Prototype Spectrometer - item number 1000-01 = \$60,000

4) Government-furnished and contractor-acquired property (under \$50,000), Materials and Supplies - \$2,000

10 Radon tubes @ \$110.00	=	\$1,100
6 Pairs Electrostatic gloves @ \$150.00	=	<u>\$900</u>
		\$2,000

5) Premium Pay - \$150

Walter Murphy - 10 hours @ \$10.00 Per Hour (Reg. Pay) = \$100 x 1.5 OT rate = \$150

(EX: Premium pay for this individual was approved and authorized under this contract by the NRC Contracting Officer by letter dated 6/1/2011.)

6) Consultants' Fee - \$100

Dr. Carney - 1 hour fully-burdened @ \$100 = \$100

7) Travel - \$2,640

(i) Airfare: (2 Roundtrip trips for 1 person @ \$300 per r/t ticket)

<u>Start Date</u>	<u>End Date</u>	<u>Days</u>	<u>From</u>	<u>To</u>	<u>Cost</u>
4/1/2011	4/7/2011	7	Philadelphia, PA	Wash, D.C.	\$300
7/1/2011	7/8/2011	8	Philadelphia, PA	Wash, D.C.	\$300

(ii) Per Diem: \$136/day x 15 days = \$2,040

8) Subcontracting - \$30,000

Company A	= \$10,000
Company B	= <u>\$20,000</u>
	\$30,000

(EX: Subcontracts for Companies A & B were consented to by the Contracting Officer by letter dated 6/15/2011.)

9) Other Costs - \$5,100

Honorarium for speaker at American Nuclear Society conference = \$5,000  
*Nuclear Planet Journal* subscription fee = \$100

10) Overhead Expense - \$41,148

Overhead @ 40% of Total Direct Costs

11) General and Administrative (G&A) Expense - \$22,784

G&A @ 20% of Total Costs, excluding subcontracts and consultants

12) Fixed-Fee - \$8,218

Fixed-Fee applied to Total Costs @ 5%

Fixed-Fee Calculations:

- i. Total contract fixed-fee \$100,000
- ii. 85% allowable fee \$85,000
- iii. Cumulative fee billed on prior invoices \$85,000
- iv. Fee due this invoice (*not to exceed 85% of fee earned based upon negotiated contract fee percentage*) \$8,218

Total Amount Billed	\$175,020
Adjustments (+/-)	<u>- \$8,218</u>
Grand Total	\$166,802