ORDER FOR SUPPLIES OR SERVICES

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

1. DATE OF ORDER: 04/30/2015

2. CONTRACT NO. (If any): NRC-HQ-12-C-04-0086

3. ORDER NO.: NRC-HQ-60-15-T-0001

4. REQUISITION/REFERENCE NO.: RES-15-0095

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

6. SHIP TO:
a. NAME OF CONSIGNEE: US NUCLEAR REGULATORY COMMISSION-
b. STREET ADDRESS: MAIL PROCESSING CENTER
4930 BOILING BROOK PARKWAY
c. CITY: ROCKVILLE
d. STATE: MD
e. ZIP CODE: 20852

7. TO: RICHARD KILLIAN
a. NAME OF CONTRACTOR: PENNSYLVANIA STATE UNIVERSITY THE
b. COMPANY NAME:
c. STREET ADDRESS:
THE PENNSYLVANIA STATE UNIVERSITY
101 HAMMOND BUILDING
ATTN DANELLE KISSELL
d. CITY: UNIVERSITY PARK
e. STATE: PA
f. ZIP CODE: 168021505

f. SHIP VIA:

8. TYPE OF ORDER
☐ a. PURCHASE
REFERENCE YOUR: proposal dated 4/15/15
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.
☒ b. DELIVERY
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))
☐ a. SMALL ☐ b. OTHER THAN SMALL ☐ c. DISADVANTAGED ☐ d. WOMEN-OWNED ☐ e. HUBZone
☐ f. SERVICE-DISABLED ☐ g. WOMEN-OWNED SMALL BUSINESS (WOSB) ELIGIBLE UNDER THE WOSB PROGRAM ☐ h. EDWOSB

12. F.O.B. POINT:

13. PLACE OF
a. INSPECTION: Destination
b. ACCEPTANCE: Destination

14. GOVERNMENT B/L NO.:

15. DELIVER TO F.O.B. POINT ON OR BEFORE (Date):

16. DISCOUNT TERMS:

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 Number 2. This efforts shall be performed in accordance with the enclosed statement of work. Continued ...					

18. SHIPPING POINT:
19. GROSS SHIPPING WEIGHT:
20. INVOICE NO.:

17(h) TOTAL (Cont. pages): $499,997.00

21. MAIL INVOICE TO:
a. NAME: US NUCLEAR REGULATORY COMMISSION
b. STREET ADDRESS (or P.O. Box): ONE WHITE FLINT NORTH
c. CITY:
d. STATE:
e. ZIP CODE:

SEE BILLING INSTRUCTIONS ON REVERSE

17(i) GRAND TOTAL: $499,997.00

22. UNITED STATES OF AMERICA BY (Signature): 04/30/2015

23. NAME (Typed): SHARLENE M. MCCUBBIN
TITLE: CONTRACTING/ORDERING OFFICER

AUTHORIZED FOR LOCAL REPRODUCTION
PREVIOUS EDITION NOT USABLE

OPTIONAL FORM 347 (Rev. 2/2012)
Prescribed by GSA/FAR 48 CFR 53.213(f)

SUNSI REVIEW COMPLETE

TEMPLATE - ADM001

MAY 05 2015

ADM002

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

DATE OF ORDER	CONTRACT NO.	ORDER NO.
04/30/2015	NRC-HQ-12-C-04-0086	NRC-HQ-60-15-T-0001

ITEM NO. (a)	SUPPLIES/SERVICES (b)	QUANTITY ORDERED (c)	UNIT (d)	UNIT PRICE (e)	AMOUNT (f)	QUANTITY ACCEPTED (g)
	Task Order #2, entitled "Task Order #2 of Spacer Grid Thermal Hydraulics Program" Period of Performance: 4/30/2015 - 3/31/2016 Total Estimated Cost: $499,997.00 Total Obligated Amount $250,000.00 The issuance of this Task Order does not amend any other terms or conditions of the subject contract. Accounting Info: 2015-X0200-FEEBASED-60-60D003-11-6-213-1045-252A Period of Performance: 04/30/2015 to 03/31/2016					
00001	Cost for Performance of Task Order 2 Line Item Ceiling$499,997.00 Incrementally Funded Amount: $250,000.00 The obligated amount of award: $250,000.00. The total for this award is shown in box 17(i).				499,997.00	

TOTAL CARRIED FORWARD TO 1ST PAGE (ITEM 17(H)) $499,997.00

A.1 NRCB010 BRIEF PROJECT TITLE AND WORK DESCRIPTION 4
A.2 NRCB050 CONSIDERATION AND OBLIGATION-TASK ORDERS.....4
A.3 NRCF032 TASK/DELIVERY ORDER PERIOD OF PERFORMANCE (SEP 2013) 4
A.4 CONTRACTOR ACCEPTANCE OF TASK ORDER 02.....3
A.5 TASK ORDER STATEMENT OF WORK..... 3
A.6 BILLING INSTRUCTIONS FOR COST REIMBURSEMENT TYPE CONTRACTS.....7

A.1 NRCB010 BRIEF PROJECT TITLE AND WORK DESCRIPTION

(a) The title of this project is: Task Order #2 of Spacer Grid Thermal Hydraulic Program

(b) Summary work description:

The purpose of this Task Order consists of two areas. The first objective is to expand the data range of reflood tests with the refurbished bundle. Additional high -temperature reflood tests will be performed with the newly-refurbished bundle at RBHT Test Facility under the conditions identified as having data void (such as reflood rate, input power, degree of subcool, etc.). New test results will be implemented in the Data Evaluation analysis obtained in Task Order #1 to broaden the data base. The second objective is to develop a conceptual design of a High Pressure Post–CHF Rod Bundle Test facility. A new test facility capable of producing high pressure inverted annular film boiling is considered a high priority. At present the RBHT Test Facility is only capable to perform tests up to 60 psia. While in a postulated ATWS event the flow boiling caused by power oscillation is around reactor operating pressure near 1000 psia. The staff would like to develop a design which could approach this high -pressure range.

A.2 NRCB050 CONSIDERATION AND OBLIGATION-TASK ORDERS

(a) The ceiling of this order for services is $499,997.00.

(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 $250,000.00. 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.

A.3 NRCF032 TASK/DELIVERY ORDER PERIOD OF PERFORMANCE (SEP 2013)

This order shall commence on the 4/30/2015 and will expire on 3/31/2016.

A.4 CONTRACTOR ACCEPTANCE OF TASK ORDER 02

Acceptance of Task Order 2 (NRC-HQ-60-15-T-0001) shall be made by having an official, authorized to bind your organization, execute this document in the space provided and return one electronic copy to the Contract Specialist, Rob Robinson at richard.robinsonii@nrc.gov. You should retain a copy for your records.

Accepted Task Order 2 (NRC-HQ-60-15-T-0001):

Robin Riglin Associate Director, OSP		April 30, 2015
Printed Name and Title	Signature	Date

A.5 TASK ORDER STATEMENT OF WORK

A.5.1 PROJECT TITLE

Task Order #2 of Spacer Grid Thermal-Hydraulic Program.

A.5.2 BACKGROUND

The U.S. Nuclear Regulatory Commission (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. NRC has sponsored many experiments to obtain high-quality data to assess the TRACE code. The Rod Bundle Heat Transfer (RBHT) test facility at the Pennsylvania State University 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 Order #1 of this program (NRC-HQ-12-T-04-0001), 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 most tests were carried out with either 1in/s or 6 in/s reflood rates. For better correlation development this range should be expanded. The second concern is 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

A.4 CONTRACTOR ACCEPTANCE OF TASK ORDER 02

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Accepted Task Order 2 (NRC-HQ-60-15-T-0001):

Printed Name and Title	Signature	Date

A.5 TASK ORDER STATEMENT OF WORK

A.5.1 PROJECT TITLE

Task Order #2 of Spacer Grid Thermal-Hydraulic Program.

A.5.2 BACKGROUND

The U.S. Nuclear Regulatory Commission (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. NRC has sponsored many experiments to obtain high-quality data to assess the TRACE code. The Rod Bundle Heat Transfer (RBHT) test facility at the Pennsylvania State University 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 Order #1 of this program (NRC-HQ-12-T-04-0001), 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 most tests were carried out with either 1in/s or 6 in/s reflood rates. For better correlation development this range should be expanded. The second concern is 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.

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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.5.3 SCOPE

The purpose of this Task Order consists of two areas. The first objective is to expand the data range of reflood tests with the refurbished bundle. Additional high -temperature reflood tests will be performed with the newly-refurbished bundle at RBHT Test Facility under the conditions identified as having data void (such as reflood rate, input power, degree of subcool, etc.). New test results will be implemented in the Data Evaluation analysis obtained in Task Order #1 to broaden the data base. The second objective is to develop a conceptual design of a High Pressure Post–CHF Rod Bundle Test facility. A new test facility capable of producing high pressure inverted annular film boiling is considered a high priority. At present the RBHT Test Facility is only capable to perform tests up to 60 psia. While in a postulated ATWS event the flow boiling caused by power oscillation is around reactor operating pressure near 1000 psia. The staff would like to develop a design which could approach this high -pressure range.

A.5.4 APPLICABLE DOCUMENTS AND STANDARDS

For background knowledge 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.5.5 SPECIFIC TASKS

Following are the specific tasks for the development of the High Pressure Post-CHF Test Bundle:

<u>Task 1. Conceptual design of a High Pressure Rod Bundle Test Loop.</u>

The general requirement for the High Pressure Bundle is a test facility that will be capable to perform multiphase heat transfer experiments up to 1000 psia system pressure. The rod bundle configuration shall be a 5 X 5 array of high powered electrically–heated rod similar to that used in current RBHT test facility. Due to the high pressure requirement and future plan to be able to swap different types of spacer grids in the rod bundle, the length of the rod bundles might not be the full length (12 ft) in each configuration, however they must be at least 5 ft in height, with a minimum of 48 inches heated length and six (6) inches unheated length on each end. The tests facility shall

also be able to support a much higher reflooding rate (in the six (6) to ten (10) inches per second range). The proposed test loop shall be a skid mounted package system where all pressure vessels shall be mounted, with the ability to be transported on a lift for test and storage. NRC will also look into various advanced two-phase flow instrumentation including the Gamma Tomography technology being developed under another RES contract (University of Michigan, NRC-HQ-13-C-04-0022, Task Order #2, Advanced Two-Phase Instrumentation: Experimental Support for TRACE Model Development) for additional flow field parameter collection. With this design in mind, the high pressure test rig can share some infrastructure already built in current RBHT test area such as steam supply and piping system. The Contractor shall work in collaboration with University of Michigan on the detailed design so the Gamma Tomography equipment can fit into the High Pressure Test Bundle design configuration.

Task 2. Define a Test Matrix for Additional High Temperature Reflood Tests.

Under Task 4 of Task Order #1 of the Spacer Grid Thermal Hydraulic program (NRC-HQ-12-T-04-0001) data evaluation was carried out to perform in-depth analysis of all data from previous test series. Some data void has been identified such as a lack of various reflood rate range. The NRC staff finds it necessary to carry out additional test with various reflood rates and system pressures that can be accomplished with current RBHT pumping system.

Task 3. Conduct of Experiments Defined in the new Test Matrix.

After the Test Matrix has been finalized and approved by NRC staff, the contractor shall conduct the reflood experiments with the refurbished Rod Bundle Test Facility.

Task 4. Upgrade the Data Evaluation Reports with new data.

After additional reflood tests described in Task 3 above have been completed, the new data will be incorporated into the Data Evaluation reports developed in the Task Order #1 (NRC-HQ-12-T-04-0001) in order to broaden the data base and upgrade the correlation developed in earlier effort.

Task 5. Further development of Advanced Instrumentation

Under Task 4 of Task Order #1 of the Spacer Grid Thermal Hydraulic program (NRC-HQ-12-T-04-0001) advanced instrumentation for multi-phase flow experiments were developed. The contractor has developed advanced conductivity probe for measuring of local droplet size and velocity and pitot tube type probe for measurement of local steam velocity in the rod bundle. These developments have shown some promising results and shall be continued under the new task order for further development.

A.5.6 DELIVERABLES AND DELIVERY SCHEDULE

A Monthly Letter Status Report (MLSR) describing the work performed under this contract modification will be submitted to the NRC Contracting Officer's Representative (COR) by the 20th of the month following the month to be reported, with copies provided to the following:

RESDSAMLSR.Resource@nrc.gov
Richard.robinsonii@nrc.gov

The MLSR shall identify the title of the project, 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. Any administrative or technical difficulties which may affect the schedule or costs of the project will be immediately brought to the attention of the NRC COR.

In addition to the MLSR, the following deliverables will be prepared and delivered to NRC COR according to the identified milestone for each individual task:

1. The conceptual design of the high pressure test loop shall be submitted within six months after the contract award, and detailed drawings will be delivered within one year after the contract award.

2. The test matrix of additional high temperature reflood test shall be submitted to NRC within one month after contract award and the staff will work with contractor to develop a final approved set, no later than 1 month after receipt of NRC's comments.

3. A Quick Look Report (QLR) with data in approved databank format will be submitted to NRC within one month after each of the approved test is completed for review.

4. The draft updated Data Evaluation report for this Task Order #2 shall be submitted to NRC within ten months after contract award. This final report will be in NUREG format for permanent agency archive. The final report for Advanced Instrumentation will also be submitted within ten months after contract award.

A.5.7 REQUIRED LABOR CATEGORIES (Except for Information Technology Services)

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 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. NRC will rely on the contractor to verify the qualifications of the personnel assigned to this contract including assurance that all information contained in the technical and cost proposals (including resumes) is accurate and truthful.

The use of key personnel and any proposed change 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.5.8 GOVERNMENT-FURNISHED PROPERTY

None.

A.5.9 PLACE OF PERFORMANCE

The proposed work will be performed at the Pennsylvania State University (PSU), University Park, PA 16802. Specifically, the proposed experiments will be conducted at the PSU Applied Research Laboratory (ARL) Rod Bundle Heat Transfer (RBHT) Test Facility located near the PSU University Park campus. The RBHT Facility as the ARL test site has the capacity to meet the power supply requirement of 14,000 Amp DC and higher. On the other hand, the proposed computational work will be conducted in the PSU Department of Mechanical & Nuclear Engineering that is equipped with the required computer capabilities to perform model development and code validation.

A.5.10. SECURITY

The work conducted under this Task Order is UNCLASSIFIED.

A.6 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.

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)).

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:

Labor Category	Hours Billed	Rate	Total	Cumulative Hours Billed

(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:

Start Date		Destination		Costs
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____.

		Amount Billed Current Period	Amount Billed Cumulative
(a)	**Direct Costs**		
(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

Labor Category	Hours Billed	Rate	Total	Cumulative Hours Billed
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

Labor Category	Salaries	Fringe Amount
Senior Engineer I	$1,400	$280
Engineer	$500	$100
Computer Analyst	$500	$100
	$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	=	$900
		$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)

Start Date	End Date	Days	From	To	Cost
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	= $20,000
	$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 (+/-)	- $8,218
Grand Total	$166,802