

<b>AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT</b>		BPA NO	CONTRACT # CODE	DATE	PAGE
2 AMENDMENT/MODIFICATION NO. AD003	3 EFFECTIVE DATE See Block 15C 02/16/2011	4 ACQUISITION/CONTRACT NO HK-11-28	5 PROJECT NO. (See 4.1.1)		
6 ISSUO U.S. Nuclear Regulatory Commission Civil Contracts Attn: Monique B. Williams Hqs. Stop: TWB-01-8108 Washington, DC 20555	7 ADMINISTERED BY (If other than 6) U.S. Nuclear Regulatory Commission Div. of Contracts Mail Stop: TWB-01-8108 Washington, DC 20555	8 CONTRACT CODE 3100			
9 NAME # NUMBER OF CONTRACTOR (No. 1 copy, State and ZIP Code) GRF IRR SYSTEMS, INC. 1112 BROADWAY BLVD STE 201 STARKVILLE MS 39726-8787	10 ADDRESS OF CONTRACTOR 118 CALLED (SEE ITEM 11) 12 MODIFICATION OF CONTRACT ORDER NO. MOC-13-10-707 13 DATED (SEE ITEM 13) 06-17-2010	14 FACILITY CODE 6797264			

**11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS**

The a/b numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offers  is extend.  is not extended. Offers to acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended, by one of the follow methods: (a) By calling items B and 15, and mailing \_\_\_\_\_ copies of the amendment; (b) By acknowledging receipt of this amendment on a copy of the offer submitted; or (c) By separate letter telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGMENT 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 OFF. If by virtue of this amendment you desire to change an offer already submitted, such change must be made by letter or letter, provided each teletype or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. ACCOUNT AND APPROPRIATION DATA (If any) 2011-04-17-5-156, X8455, 3142, 31X0290  
Amount Obligated: \$478,081

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

13. CHANGE ORDER IS ISSUED PURSUANT (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A

B. ABOVE NUMBERED CONTRACT/ORDER MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (Such as changes in pricing or appropriation Acct. No.) SET FORTH IN ITEM 14 PURSUANT TO THE AUTHORITY OF FAR 43.103(b)

C. THE SUPPLEMENTAL AGREEMENT IS ENTERED PURSUANT TO AUTHORITY OF

D. OT Specify type of modification and units

X 53,243-3 Change in Time and Material or Labor Hours

**E. IMPORTANT:** Contractor  or  is required to sign this document and return 01 \_\_\_\_\_ copies to the issuing office.

13. DESCRIPTION OF AMENDMENT/MODIFICATION (Include by UIC action in change, including the solicitation or contract number, and when necessary:

THE PURPOSE OF THIS MODIFICATION NUMBER 03 IS TO MODIFY THE STATEMENT OF WORK TO ADD TWO (2) ADDITIONAL TASKS FOR THE DEVELOPMENT OF API1000 SIMULATION MODELS WHICH INCLUDES PROVIDING A API1000 REACTOR CORE MODEL AND API1000 REACTOR COOLANT AND PWR CORE COOLING SYSTEM MODEL. THIS MODIFICATION INCREASES THE TOTAL ESTIMATED COST, THE TOTAL OBLIGATION, REVISES CRON 3.5 PRIOR SCHEME, AND EXTENDS THE PERIOD END DATE TO JUNE 13, 2012.  
Please see page 2 for specific changes

Total Ceiling Price: \$1,942,500 (Change)  
Total Ceiling Authorized to Use: \$1,764,568 (Change)  
Total Obligation: \$1,473,595 (Change)  
Period of Performance: 6/10/2010 - 6/13/2013 (Change)

14. THE SIGNATURE OF THE CONTRACTOR AND APPROVAL OF THE MODIFICATION BY THE GSA OR IAC, AS APPLICABLE, REMAINS UNCHANGED AND IS VALID AND BINDING

15A NAME AND TITLE OF CONTRACTOR (Type or Print) GRI GRADY S. VICE PRESIDENT	15B NAME AND TITLE OF CONTRACTING OFFICER (Type or Print) Monique B. Williams Contracting Officer
15C CONTRACTING OFFICER Signature of Contracting Officer 9/9/11	15D DATE SIGNED Signature of Contracting Officer 9/9/2011

NON READABLE INTO PREVIOUSION NOT USABLE

STANDARD FORM NO. 656 (REV. 10-89)  
Prescribed GSA - FPMR (41 CFR) 101-11.6

TEMPLATE - ADM001

SUNSI REVIEW COMPLETE

SEP 21 2011

ADM002

2. AMENDMENT/MODIFICATION NO. M003      3. EFFECTIVE DATE See Block 15C.      4. REQUISITION/PURCHASE REQ. NO. HR-11-287  
08/16/2011      5. PROJECT NO. (If applicable)

6. ISSUED BY CODE 3100      7. ADMINISTERED BY (If other than Item 6) CODE 3100  
U.S. Nuclear Regulatory Commission      U.S. Nuclear Regulator Commission  
Div. of Contracts      Div. of Contracts  
Attn: Monique B. Williams      Mail Stop: TWB-01-B10M  
Mail Stop: TWB-01-B10      Washington, DC 20555  
Washington, DC 20555

8. NAME AND ADDRESS OF CONTRACTOR (No. street, county, State ZIP Code)      (X) 9A. AMENDMENT OF SOLICITATION NO.  
GSE POWR SYSTEMS, INC.      9B. DATED (SEE ITEM 11)  
1332 LODONTOWN BLVD S. 200      10A. MODIFICATION OF CONTRACT/ORDER NO.  
SYKESVILLE MD 21784658      NR-38-10-702  
CODE 60637264      FACILITY CODE      X 10B. DATED (SEE ITEM 13)  
0617-2010

**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 the amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment number. FAILURE OF YOUR ACKNOWLEDGMENT 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. ACCOUNT AND APPROPRIATION DATA (If required)      20-84-17-5-156, X8455, 3142, 31X0200  
Amount Obligated: \$478,084

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

(X) 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 103(b)  
C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:  
D. OTHER (Specify type of modification authority)  
X 52.23-3 Changes, Time and Material or Labor Hours

**E. IMPORTANT:** Contract:  is not,  is required to sign this document and return 01 \_\_\_\_\_ copies to the issuing office.

14. DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCode section headings, including solicitation/contract subject matter where feasible.)  
The purpose of this modification number 3 is to modify the Statement of Work to add to (2) additional tasks for the developer of AP1000 simulation models which includes providing a AP1000 Reactor Core Model and AP1000 Reactor Coolant and Passive Core Cooling System Models. This modification increases the Total Estimated Cost, the Total Obligation, revises Section B.5 Price Schedule, and extends the period end date to June 11, 2012.  
Please see page 2 for specific changes

Total Ceiling Price: \$1,42,568 (Change)  
Total Ceiling Authorized Date: \$1,76,568 (Change)  
Total Obligation: \$1,473,95 (Change)  
Period of Performance: (10/2010 - 6/11/2012) (Change)

Except as provided herein, all terms and conditions of the document referenced in Item 9A 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)  
Monique B. Williams  
Contracting Officer  
15B. CONTRACTOR/OFFEROR      15C. DATE SIGNED      16B. UNITED STATES OF AMERICA  
BY Monique B. Williams      16C. DATE SIGNED  
(Signature of person authorized to sign)      (Signature of Contracting Officer)      9/9/2011

1. On page 4, Section B, CONSIDERATION AND OBLIGATION—FIRM FIXED PRICE (JUN 1988) revise paragraphs #1 and #2 as follows:

The total price of this contract (ceiling) for the products/services ordered, delivered, and accepted under this contract is \$1,942,568. Of that amount the total ceiling authorized to date totals: \$1,473,995 which is comprised of \$1,430,095 for the fixed price portion and \$43,900 for the cost reimbursement portion (Travel). This includes the following CLINs

- 1) CLINs 001 – 013 for GE Simulator Rehost;
  - 2) CLINs 014 -015 for Replacement Containment Model for GE BWR/4 Simulator; and
  - 3) CLINs 019-020 for AP1000 Reactor Core Model and Reactor Coolant and Passive Core Cooling Systems.
2. On page 5, PRICE/COST SCHEDULE, is revised to incorporate taxes for: AP1000 Reactor Core Model (\$8,598), AP1000 Reactor Coolant and Passive Core Cooling Systems (\$364,486), and associated Travel. (SEE ATTACHMENT I for Revised Price Schedule)
  3. On page 29, DURATION OF CONTRACT PERIOD, change the section to read as follows: The overall period of performance on this contract is changed to June 17, 2010 to June 11, 2012.
    - The base period of performance for the rehost and model upgrade of the GE simulator is June 17, 2010 to October 31, 2011;
    - The period of performance for the GE BWR/4 Simulator containment model replacement is from June 18, 2011 to March 31, 2012.
    - The period of performance for the AP1000 Reactor Core Model and Reactor Coolant and Passive Core Cooling System is from September 12, 2011 to June 11, 2012.
  4. On page 7, Statement of Work incorporates the following for Tasks 4.2.13 and 4.2.14:

**TASK 4.2.13 Provide an AP1000 Reactor Core Model**

The Contractor shall develop, provide, and integrate a model for an AP1000 reactor core, using publicly-available information.

The AP1000 reactor core model shall be developed using the same base modeling techniques used to develop the replacement reactor core model described in task 4.2.11 (i.e., RMARK).

The AP1000 reactor core model shall produce the same core thermal power as that provided by the Westinghouse Trojan simulator (3411 MWth). The AP1000 core model shall include:

- The use of 157 fuel assemblies, each with an active fuel length of 14 feet;
- The use of 16 "gray" rods and 53 "black" control rods, i.e., control rods with two different levels of reactivity, where "gray" rods have lower reactivity;
- Control of reactor  $k_{eff}$  (core reactivity coefficient) with overall reactor neutron flux greater than approximately 20% of rated neutron flux (i.e., reactor power greater than approximately 20%) achieved by manipulation of "gray" rod position; in this configuration, maintaining  $T_{avg}$  at power is achieved by manipulation of "gray" rod position rather than the manipulation of reactor coolant boron concentration;
- Fixed (i.e., non-movable) in-core flux detectors, with seven axially-spaced detectors in each detector string, with 42 radially-spaced detector strings;
- Core exit thermocouples at the top of each of the 42 radially-spaced in-core flux detectors.

The Contractor shall provide stable initial conditions for:

- Full power operation (i.e., 100% rated core thermal power) at beginning of core life, middle of core life and end of core life, with core life defined as 18 months of continuous full power operation; and
- Cold shutdown (i.e., all control rods fully inserted with reactor coolant temperature at 18°F) at beginning of core life, middle of core life, and end of core life as defined above.

The Contractor shall provide NRC with full source code and all applicable licenses and rights to use the source code for all software delivered under this task.

The Contractor shall integrate the AP1000 core model with the AP1000 reactor coolant system and passive core cooling systems models delivered under Task 4.2.14. All of these models are intended to be used as the basis for the development of a limited-scope, stand-alone AP1000 simulator.

#### **TASK 4.2.14 Provide AP1000 Reactor Coolant and Passive Core Cooling Systems Model**

The Contractor shall develop, provide, and integrate models for AP1000 reactor coolant system and passive core cooling systems, using publicly-available information.

The AP1000 reactor coolant system model shall be developed using the same base modeling techniques used to develop the replacement thermal-hydraulic model described in task 4.2.3 (i.e., RELAP5 HD). The AP1000 passive core cooling systems model shall be developed using the software modeling tools provided under Task 4.2.3.

The reactor coolant system shall have the following features:

- Two reactor loops each with a single steam generator and two reactor coolant pumps directly connected to each of two outlet nozzles on the steam generator channel head;
- The model shall provide for a reactor head vent, consisting of one penetration and two parallel trains of two series valves, discharging to the In-Containment Reactor Water Storage Tank;
- The reactor coolant pumps shall be capable of operating via either a variable frequency drive during heatup and cooldown or at a constant speed during power operations, and shall use canned motors (i.e., sealless reactor coolant pumps);
- The pressurizer shall have a volume of 2100 ft<sup>3</sup> and shall be equipped with two spring-loaded safety valves but no power-operated relief valves;
- For stages of automatic depressurization valves, each stage consisting of two parallel valves; the stages are motor-operated, connecting to the pressurizer steam dome, discharging via spargers to the In-Core Reactor Water Storage Tank; the fourth stage shall provide depressurization squib valves connected to each of the reactor coolant system hot legs and discharging to the loop compartment in the containment;
- The reactor coolant system cold loop centerlines shall be approximately 17.5" higher than the hot leg centerlines;
- The reactor vessels shall have no bottom head penetrations; all instrumentation and control rods enter from the top head;
- The reactor vessels shall have two radially-opposed direct vessel injection nozzles for injection of reactor coolant by the passive core cooling systems;

The passive core cooling systems shall include:

- Two Core Makeup Tanks of borated water, used for natural circulation core cooling and reactor vessel inventory makeup in the later phases of a design-basis loss of coolant accident; the source for natural circulation shall be the two reactor coolant system cold legs, and the discharge for natural circulation shall be the direct vessel injection nozzles;
- Two accumulator tanks of borated water, pressurized to 700 psi by a nitrogen blanket, and injecting into the direct vessel injection nozzles;
- One In-Containment Reactor Water Storage Tank of borated water, with gravity drain to the direct vessel injection nozzles and with return flow from condensation of steam from the containment wall;
- One Passive Residual Heat Removal System, providing natural circulation core cooling, with suction from the reactor coolant system hot legs (using the same penetration as the fourth-stage automatic depressurization valve) and with return to

the reactor coolant system cold legs at the steam generator connections; and with a heat exchanger located within the In-Containment Reactor Water Storage Tank.

The sizes, capacities and elevations of the reactor vessel, pressurizer, steam generators, and passive core cooling systems shall be determined from the AP1000 Design Control Document, Revision 19 or later.

The Contractor shall be responsible for providing the various logic systems necessary to operate the valves and controls associated with the reactor coolant system and passive core cooling systems.

The Contractor shall provide stable initial conditions for:

- Full power operation (i.e., 100% rated core thermal power) at beginning of core life, middle of core life and end of core life, with core life defined as 18 months of continuous full power operation; and
- Cold shutdown (i.e., all control rods fully inserted with reactor coolant temperature at 18 °F) at beginning of core life, middle of core life, and end of core life as defined above.

The Contractor shall provide NRC with full source code and all applicable licenses and rights to use the source code for all software delivered under this task.

The Contractor shall integrate the AP1000 reactor coolant system and passive core cooling systems models with the AP1000 core model delivered under Task 4.2.13. All of these models are intended to be used as the basis for the development of a limited-scope stand-alone AP1000 simulator.

5. Revise Section B.7, Deliverables, to incorporate the following:

16. Task 4.2.13 – AP1000 reactor core model, integrated with the AP1000 reactor coolant system and passive core cooling systems models, and all associated source code.

17. Task 4.2.14 – AP1000 reactor coolant system and passive core cooling systems model; integrated with the AP1000 reactor core model, and all associated source code.

6. In Section B.5 – Incorporate the Payment Schedule below for the AP1000 core, reactor coolant and passive core cooling systems models:

<u>Milestone:</u>	<u>Percentage</u>	<u>Amount</u>
1. Preliminary Design Specification	(20%)	\$ 92,617
2. Interim Design Specification	(30%)	\$138,925
3. Factory Acceptance Test	(30%)	\$138,925
4. Site Acceptance Test	(20%)	<u>\$92,617</u>
		\$463,084

All other terms and conditions remain unchanged

**Replacement Containment Model for GE BWR/4 Simulator (POP: 6/18/2011 - 3/1/2012)**

CLN	DESCRIPTION	ESTIMATED HOURS	UNIT	UNIT PRICE	TOTAL AMOUNT
	<b>FIXED PRICE LINE ITEMS</b>				
01	Provide a Replacement Containment Model for the GE BWR/4 Simulator	1	LOT	\$ 117,944.00	117,944
	<b>TOTL FIRM FIXED PFE</b>				117,944
CLN	DESCRIPTION	ESTIMATED HOURS	UNIT	UNIT PRICE	TOTAL AMOUNT
	<b>COST REIMBURSABLE LINE ITEMS</b>				
01	Travel Costs - The government will pay up to the rates specified in the Government Federal Travel Regulations (FT) for travel destinations. Contractor will be reimbursed actual costs only, with backup documentation/receipts attached to the invoice.	1	LOT	\$ 3,500.00	3,500
	<b>TOTAL COST REIMBURSEMENT COSTS:</b>				3,500
	<b>TOTAL PRICE DR GE/BWR/4 CMT MODEL:</b>				<b>121,444</b>

**Software License (optional Task)**

CLN	DESCRIPTION	ESTIMATED HOURS	UNIT	UNIT PRICE	TOTAL AMOUNT
	<b>FIXED PRICE LINE ITEMS</b>				
01	Each Additional Software License (Firm Fixed Price) a. GSE JADE Software (Run-time License)	1	each	\$ 37,500	37,500
	<b>TOTL PRICE OPTIONL SOFTWARE LICENSES</b>				37,500

**Reactor Coolant and Core Models for Full-Size ABWR (OPTIONAL TASK)**

CLN	DESCRIPTION	ESTIMATED HOURS	UNIT	UNIT PRICE	TOTAL AMOUNT
	<b>FIXED PRICE LINE ITEMS</b>				
01	Provide a Reactor Coolant and Core Models for a Full-Size ABWR	1	LOT	\$ 284,673.00	284,673
	<b>TOTL FIRM FIXED PFE</b>				284,673
CLN	DESCRIPTION	ESTIMATED HOURS	UNIT	UNIT PRICE	TOTAL AMOUNT
	<b>COST REIMBURSABLE LINE ITEMS</b>				
01	Travel Costs - The government will pay up to the rates specified in the Government Federal Travel Regulations (FT) for travel destinations. Contractor will be reimbursed actual costs only, with backup documentation/receipts attached to the invoice.	1	LOT	\$ 6,300.00	6,300
	<b>TOTAL COST REIMBURSEMENT COSTS:</b>				6,300
	<b>TOTAL PRICE DR ABWR RCS AND CORE:</b>				<b>290,973</b>

**A/1000 Reactor Core Model and Reactor Coolant and Passive Core Cooling System**

CLN	DESCRIPTION	ESTIMATED HOURS	UNIT	UNIT PRICE	TOTAL AMOUNT
<b>FIXED PRICE LINE ITEMS</b>					
01	Partial Scope AP00 Reactor Core Mel	1	LOT	\$ 98,598.00	98,598
	Partial Scope AP00 Reactor Coolant Passive Core Cooling System	1	LOT	\$ 364,486.00	364,486
<b>TOTL FIRM FIXED PCE</b>					<b>463,084</b>
CLN	DESCRIPTION	ESTIMATED HOURS	UNIT	UNIT PRICE	TOTAL AMOUNT
<b>COST REIMBURSABLE LINE ITEMS</b>					
02	Travel Costs - The government will pay up to the rates specified in the Government Federal Travel Regulations (FT) for travel destinations. Contractor will be reimbursed actual costs only, with back documentation/traces attached to the invoice.	1	LOT	\$ 15,000.00	15,000
<b>TOTAL COST REIMBURSEMENT COSTS:</b>					<b>15,000</b>
<b>TOTAL PRICE DR REACTOR CORE MODEL</b>					<b>478,084</b>

**OPTION YEAR 1 - Software Maintenance : (POP: Twelve months from Date of Award)**

CLI	DESCRIPTION	ESTIMATED HOURS	UNIT	UNIT PRICE	TOTAL AMOUNT
<b>FIXED PRICE LINE ITEMS</b>					
021	Software Maintenance and Offsite Archival Storage	100	hrs.	\$ 130.00	13,000
<b>TOTL PRICE OPTIONEAR ONE:</b>					<b>13,000</b>

**OPTION YEAR 2 - Software Maintenance: (POP: Twelve months from Date of Award)**

CLI	DESCRIPTION	ESTIMATED HOURS	UNIT	UNIT PRICE	TOTAL AMOUNT
<b>FIXED PRICE LINE ITEMS</b>					
022	Software Maintenance and Offsite Archival Storage	100	hrs.	\$ 135.00	13,500
<b>TOTL PRICE OPTIONEAR TWO:</b>					<b>13,500</b>

**OPTION YEAR 3 - Software Maintenance: (POP: Twelve months from Date of Award)**

CLI	DESCRIPTION	ESTIMATED HOURS	UNIT	UNIT PRICE	TOTAL AMOUNT
<b>FIXED PRICE LINE ITEMS</b>					
023	Software Maintenance and Offsite Archival Storage	400	hrs.	\$ 140.00	56,000
<b>TOTL PRICE OPTIONEAR THREE:</b>					<b>56,000</b>

**OPTION YEAR 4: (Period of Performance: Twelve months from Date of Award)**

CLI	DESCRIPTION	ESTIMATED HOURS	UNIT	UNIT PRICE	TOTAL AMOUNT
<b>FIXED PRICE LINE ITEMS</b>					
024	Software Maintenance and Offsite Archival Storage	400	hrs.	\$ 145.00	58,000
<b>TOTL PRICE OPTIONEAR FOUR:</b>					<b>58,000</b>

**GAND TOTAL BASE YEAR AND OPTIONS: 1,942,568**