

2. AMENDMENT/MODIFICATION NO. M001	3. EFFECTIVE DATE March 31, 2009	4. REQUISITION/PURCHASE REG. NO. 04-08-134M001 RFPA: RES-08-134 FFS: RES-C09-501	5. PROJECT NO. (if applicable)
6. ISSUED BY U.S. Nuclear Regulatory Commission Div. of Contracts Attn: Sheila Bumpass Mail Stop: TWB-01-B10M Rockville MD 20855	CODE 3100	7. ADMINISTERED BY (if other than item 6) U.S. Nuclear Regulatory Commission Div. of Contracts Mail Stop: TWB-01-B10M Attn: Sheila Bumpass Rockville MD 20855	CODE 3100

6. NAME AND ADDRESS OF CONTRACTOR (No. street, county, State and ZIP Code) FRANKIE FRIEND & ASSOCIATES, INC. 7936 E ARAPAHOE CT STE 2000 ENGLERWOOD CO 801121372	(X) 9A. AMENDMENT OF SOLICITATION NO.
	9B. DATED (SEE ITEM 11)
	10A. MODIFICATION OF CONTRACT/ORDER NO. (NRC-DR-04-08-134)
	10B. DATED (SEE ITEM 11)

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offers is extended, is not extended. Offers must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended, by one of the following methods:
 (a) By completing Items 8 and 15, and returning _____ copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR 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. ACCOUNTING AND APPROPRIATION DATA (if required) B&R:9-60-15-111-114; JC:N6629 HOC:252A AN:31X0200.960
Obligation Amount: \$34,989.48 DUNS:867441669

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

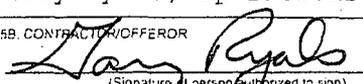
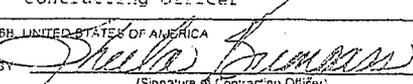
(X) A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A. X Changes Clause 52.212-4(c)
B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (such as changes in paying office, appropriation date, etc.) SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(b).
C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:
D. OTHER (Specify type of modification and authority)

E. IMPORTANT: Contractor is not, is required to sign this document and return 1 copies to the issuing office.

14. DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCF section headings, including solicitation/contract subject matter where feasible.)
 The purpose of this modification is to:
 1. Extend the period of performance.
 2. Exercise CLIN 2 and increase the unit price.
 3. Obligate additional funding
 4. Change the SOW to allow for with-in scope changes for course modifications.

Specific changes are reflected on the following pages.

Except as provided herein, all terms and conditions of the document referenced in item 14 or 10A, as hereinafter changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER (Type or print) Gary Ryals, Operations Manager	15A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print) Sheila Bumpass Contracting Officer
15B. CONTRACT/OFFEROR  (Signature of person authorized to sign)	15C. DATE SIGNED April 6, 2009
16B. UNITED STATES OF AMERICA BY  (Signature of Contracting Officer)	16C. DATE SIGNED 4/6/09

Accordingly, this modification:

1. Extends the period of performance until June 1, 2009.
2. Exercises CLIN 2 and augments the service to increase the course length as reflected in the Scope of Work, add an additional instructor, update and revise the course material, thereby increasing the course material by 45 pages per work book. As a result of these changes, the unit price of CLIN 2 to include course material printing, binding, and shipping is hereby increased to \$34,989.48.

Professional Support	Task	Quantity	UM	Unit Cost	Cost
Base Item #2 Cost					
less LS printing					
John Bickel	Course Update				
	Course Presentation				
	Travel (additional day)				
Joe Miller	Course Update				
Joe Miller	Course Presentation				
Print Course Materials					
Printing - Color					
Printing -B&W					
Binders					
Shipping					
Total Additional Cost - Item 2:					\$34,989.48

3. Obligates additional funding as follows:

RFP No.: RES-08-134
 FFS: RES-C09-501
 Job Code: N6629
 BOC: 252A
 B&R Number: 9-60-15-111-114
 Appropriation #: 31X0200.960
 Amount Obligated: \$34,989.48

As a result of the above stated obligation the contract ceiling is hereby increased from \$54,209.20 to \$89,198.68. The obligation amount increased from \$54,209.00 to \$89,198.68, thereby fully funding this contract.

4. Change the SOW to allow for within scope changes for course modifications by deleting the contract's SOW and replace with the following:

STATEMENT OF WORK

B.1 INTRODUCTION

B.1.2 BACKGROUND

A "Fundamentals of Nuclear Engineering" course was given from September 30 – October 2, 2008. Based upon student feedback from the initial session of the class, the SOW is being revised to incorporate needed changes.

B.1.2 SCOPE

The NRC intends to further refine the original course given in 2008 in order to provide for a more effective presentation of the course material and maximum opportunity for exercise of the technical concepts by the students in the class.

B.1.3 OBJECTIVE

The primary objective of this course is for the attendees to have a basic knowledge of nuclear engineering in order to aid their work in the Office of Nuclear Regulatory Research and facilitate communication between their disciplines. The instructor shall provide a training course that will provide the fundamentals of nuclear reactor physics and an understanding of thermal-hydraulic behavior in a reactor core and system, including a basic understanding of two-phase flow and heat transfer phenomena.

Specifically, the instructor shall:

- develop those aspects of neutron interactions with matter that are pertinent to understanding the establishment of a chain-reaction and of the neutron space- and energy-distribution in the nuclear reactor core,
- show how the complex neutron transport and slowing-down processes can be described by simple, though approximate, analytical models,
- develop the students' insight and understanding of neutron-related phenomena in nuclear reactors,
- describe the heat transfer and fluid flow phenomena occurring in a nuclear reactor core during normal operation, and
- introduce the two-phase heat transfer and fluid flow behavior present in a reactor core especially for transient conditions such as a LOCA.

B.2. STATEMENT OF WORK

The contractor shall conduct one three full-day course in the fall of 2008 and one four full-day course in May 2009 on the Fundamentals of Nuclear Engineering with a focus on mathematical derivations and relationships. The goal of the course shall be to provide engineers (or other technical staff) of non-nuclear backgrounds with the fundamentals of nuclear reactor engineering that are necessary to working in research.

B.2.1 Course Date Confirmations

The specific start date of the initial course shall be decided by the project manager and will be negotiated between the contractor and NRC, depending on the contractor's availability and time needed to prepare for the course and NRC headquarters' room availability. NRC shall notify the

contractor of the specific start date via phone or email and the contractor shall notify NRC of their availability within one week of NRC's notification. The contractor shall be given notification of course date as soon as practicable but no later than three months prior to the course date.

B.2.2 Course Materials

Course materials shall be considered all handouts, homework, reviews and activities.

Topics shall include the Boltzman equation and its relationship to diffusion, temperature distributions, 6 factors, neutronics, prompt critical vs. critical, and other relevant concepts. Course materials shall be developed with these topics in mind and shall be based on the literature in the following sources:

El-Wakil, M. M., **Nuclear Heat Transport**, International Textbook Company
Lamarsh, J. R., **Introduction to Nuclear Reactor Theory**, Addison-Wesley
Publishing Company

Specifically, the chapters of **Nuclear Heat Transport** can be considered a general guide for course development. Information contained in **Introduction to Nuclear Reactor Theory** would provide additional information which could be incorporated into the course material.

The course instructors shall consult and utilize any additional textbooks or other reference material that will assist in finalizing the course materials that would facilitate the lesson plan. Ronald A. Knief, **Nuclear Engineering: Theory and Technology of Commercial Nuclear Power (SCPP)**, Hemisphere Publishing Corporation, is recommended as an additional textbook.

Deliverables: Course Materials

This shall include any handouts or materials, homework assignments, activities and final exam, to be given to the participants.

Due Date: Six weeks before the course. (Required number of copies: one of each document)

B.2.3 Lesson Plan

The lesson plan shall consist of a detailed framework for the course. This shall include instructor's topics and the associated schedule of days/times for each lecture subject (or group of topics). Within each topic and timeframe there shall be included the corresponding examples, several multiple-choice review questions, list of references, any planned handouts, class exercises and planned break out problem-working sessions. Below is a general topic outline, to which the contractor may refer as a guide for developing the lesson plan structure. The course instructors shall feel free to modify the outline while designing the lesson plan as long as the basic topics are addressed.

1. Nuclear Physics Basics
 - a. Atomic structure

2. Neutron Interactions
 - a. Elastic, inelastic, absorption, etc.
 - b. Cross sections

3. Nuclear Fission
 - a. Practical fuels
 - b. Energy from reactions
 - i. Power, burnup, consumption
 - c. Decay
 - d. Prompt/delayed neutrons
4. Chain Reactions
 - a. Reactor Types – Thermal, Fast
 - b. Neutron Diffusion – Fick's Law
 - c. Flux Distribution
 - d. Reflections
 - e. Moderation
5. Neutron Flux Database
 - a. Coefficients of Reactivity
6. Neutron Absorption
 - a. Control Rods
7. Heat Generation
 - a. Fission Energy
 - i. Homogeneous Core
 - ii. Heterogeneous Core
 - b. Shutdown
8. Criticality – Fermi Theory
 - a. k_{∞}
 - b. k_{eff}
9. Steady-State Heat Conduction in Reactor Elements
 - a. One-Dimensional
 - b. Thermal Radiation
 - c. Absorbed Radiation
 - d. Thermal Shields
 - e. Two-Dimensional
10. Transient Heat Conduction in Reactor Elements
 - a. Lumped Parameter Method
11. Single Phase Heat Transfer and Fluid Flow
 - a. Heat Transfer
 - i. Geometry and Nondimensional Numbers
 1. Circular Geometry
 2. Noncircular Geometry
 - b. Pressure Drop
 - i. Geometry and Nondimensional Numbers
12. Two-Phase Heat Transfer and Fluid Flow
 - a. Flow Definitions

- i. Void Fraction, Quality, Slip, etc
- b. Heat Transfer
 - i. Boiling
 - ii. Condensation
- c. Critical Heat Flux and Burnout
- d. Pressure Drop
 - i. Homogeneous Model
 - ii. Separated Flow Model
 - iii. Area Changes
 - iv. Acceleration
- e. Critical Flow

13. Core Thermal Design

- a. Axial Temperature Distribution
- b. Maximum Temperature Concerns
- c. Boiling

Deliverables: Lesson plan

This shall include complete times, organization, data and direction regarding the instructor's topics to be presented and delivered to the participants.

Due Date: Six weeks before the course. (Required number of copies: one of each document)

B.2.4 Final Lesson Plan and Course Materials

The NRC project manager and/or technical monitor shall review the lesson plan and course materials and return it with a statement that no changes are necessary or include suggestions and changes that must be incorporated. NRC's approval of the lesson plan and course material with or without changes shall occur three weeks before the start of the course.

If no changes are necessary, these items shall be considered final. If there are necessary changes, the contractor shall have one week to deliver the finalized versions of the lesson plan and course materials to NRC, incorporating any suggestions and/or changes.

Deliverables: Finalized Versions When NRC Changes/Suggestions Occur

This shall only occur if NRC responds three weeks prior to the start of the course that there are necessary changes the contractor shall make. The contractor shall incorporate and address all of NRC's suggestions.

Due Date: Two weeks before the start of the course

B.2.5 Final Copies

This shall include an estimated 30 copies of the total course materials which shall be provided on the day of the course to the course participants. This number is dependent on the final number of participants for each course. NRC will inform the contractor of the number of participants three weeks prior to the course. The contractor will provide an additional 2 copies to that number, as a margin of error for participants that may sign up closer to the date.

Deliverables: Course materials provided to the students.

Due Date: Day of the course.

B.2.6 Evaluations

Subsequent of the course, the contractor will be notified within thirty days of any course evaluations and changes that are suggested by NRC. Any future ordering shall acknowledge these changes and be inclusive of these recommendations or changes.

B.3 OPTIONAL COURSE DATE

After exercise of the optional course by the contracting officer, the specific date of the optional course shall be decided by the project manager and will be negotiated between the contractor and NRC, depending on the contractor's availability and time needed to prepare for the course and NRC headquarters' room availability. NRC shall notify the contractor of the specific optional course start date via phone or email and the contractor shall notify NRC of their availability within one week of NRC's notification. The contractor shall be given notification of the course date as soon as practicable but no later than two months prior to the course date.

Deliverables: Final Lesson Plan and Course Materials Pursuant to Changes
Contractor shall supply NRC with the final documents, where there were changes recommended from the initial course.

Due Date: Three weeks prior to the course date

B.4 COMPLETION REQUIREMENTS OF GRAPHICS AND COURSE MATERIAL

The Contractor shall finalize all deliverables resulting from each task described in section 2 above. Any additional revisions shall be incorporated, as appropriate. All specified deliverables shall be provided in final and shall be thorough and complete. See Section 8, Schedule of Deliverables.

Tasks are not considered complete until all applicable open issues have been resolved and all specified deliverables approved.

All deliverable products shall be grammatically correct according to industry standard rules and contain correct spelling. All technical and financial terms shall be clearly defined to be understood by all readers. Final deliverables should be transmitted to the NRC Project Manager in hard copy and electronic form. All major work deliverables are considered complete upon receipt and final review and approval by the NRC Project Manager.

Projection graphics for classroom use shall be produced in color computer presentation format using Microsoft PowerPoint, and NRC agrees to print color copies for inclusion in the student manual. The course Instructor(s) will have access to a Microsoft Windows-based PC with LCD projector, Windows XP operating system and Microsoft Office 2003 software. A copy of all training material shall also be delivered in MS Office format as well as PDF format on a CD or DVD. The files in PDF format may be loaded on NRC's internal website as reference material. All materials developed are considered works-for-hire and become NRC property.

B.5 NRC RESPONSIBILITIES AND TECHNICAL DIRECTION

RES will coordinate with the contractor regarding the dates of the courses.

RES will respond to the contractor's initial course plan submission with suggestions and feedback regarding whether any changes are necessary and is responsible for resolving internal issues that affect the project.

The Project Officer for this contract is:

Deborah Chan
Mail Stop: T-10D5
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Phone: (301) 415- 7041
Fax: (301) 415-5151
Email: DLC@nrc.gov

The Technical Monitor (and back-up Project Manager) for this contract is:

William Krotiuk
Mail Stop: T-10K8
U.S. Nuclear Regulatory Commission
Washington, D.C. 20055-0001

Phone: (301) 415-6839
Fax: (301) 415-5160
Email: WJK@nrc.gov

Hand-carried mail should be sent to:
U.S. Nuclear Regulatory Commission
11545 Rockville Pike
Mailstop C-2A07M
Rockville, MD 20852-2738

B.6 SCHEDULE OF DELIVERABLES

Deliverables are scheduled for completion as follows, or as otherwise agreed to by the Project Manager:

Id	Name	Type	Due Date
2.1	Date Confirmation	Email/Phone	Within one week of NRC date notification
2.2	Course Materials	Draft	6 weeks prior to course date
2.3	Lesson Plan	Draft	6 weeks prior to course date
2.4	Final Materials and Plan (Only applies when NRC has changes to the draft)	Final	2 weeks prior to course date
2.5	Final Copies	Final	Day of the course

B.7 PERSONNEL

The use of qualified personnel for the key positions on this project is considered essential to its success. At a minimum, key personnel shall include the Contractor's Project Manager, who is responsible for overseeing or performing the actual work and/ or Course Instructor.

Key personnel must possess the instructor shall have an advanced degree in nuclear engineering and the ability to conduct a lecture for approximately 25 participants. When on NRC property, the instructor will be escorted as a visitor.

B.8 MEETINGS AND TRAVEL

One trip for two people for 3 full days of work, and 1 additional travel day, for each session is anticipated. For B.3 Options, one trip for two people for 4 days of work, and 1 additional travel day. The contractor will not be reimbursed for local travel to the NRC headquarters or Professional Development Center.

Period of Performance: 5/14/08 – 6/1/09 (Changed)
Total Obligated Amount: \$89,198.68 (Changed)
Total Obligated Ceiling Amount: \$89,198.68 (Changed)