

**U.S. NUCLEAR REGULATORY COMMISSION  
NOTICE OF GRANT/ASSISTANCE AWARD**

1. GRANT/AGREEMENT NO. NRC-HQ-11-G-38-0076	2. MODIFICATION NO.	3. PERIOD OF PERFORMANCE FROM: 8/22/2011 TO: 8/31/2013	4. AUTHORITY Pursuant to Section 31b and 141b of the Atomic Energy Act of 1954, as amended
5. TYPE OF AWARD  <input checked="" type="checkbox"/> GRANT  <input type="checkbox"/> COOPERATIVE AGREEMENT	6. ORGANIZATION TYPE  Public Institution of Higher ED DUNS: 064234610 NAICS: 611310	7. RECIPIENT NAME, ADDRESS, and EMAIL ADDRESS  University of Texas at Arlington 701 S. Nedderman Dr., Box 19145 Arlington, Texas 76019-0145	
8. PROJECT TITLE:  "Nuclear Engineering Technology Program Development (Electrical and Mechanical Pathways)"			
9. PROJECT WILL BE CONDUCTED PER GOVERNMENT'S/RECIPIENT'S PROPOSAL(S) DATED  See Program Description AND APPENDIX A-PROJECT GRANT PROVISIONS	10. TECHNICAL REPORTS ARE REQUIRED  <input checked="" type="checkbox"/> PROGRESS AND FINAL  <input type="checkbox"/> FINAL ONLY  <input type="checkbox"/> OTHER (Conference Proceedings)	11. PRINCIPAL INVESTIGATOR(S) NAME, ADDRESS and EMAIL ADDRESS  University of Texas at Arlington Attn: Mr. Jeremy Forsberg 701 S. Nedderman Dr., Box 19145 Arlington, Texas 76019-0145 Email: ogcs@uta.edu 817-272-2105	
12. NRC PROGRAM OFFICE (NAME and ADDRESS) NRC Attn: Tanya Parwani-Jaimes Office of Human Resources MS: GW5A06 (301) 492-2308 11545 Rockville Pike Rockville, Maryland 20852 Email: Tanya.Parwani-Jaimes@NRC.GOV	13. ACCOUNTING and APPROPRIATION DATA APPN. NO: 31X0200 B&R NO: 2011-64-51-K-134 JOB CODE: T8453 BOC NO: 4110 OFFICE ID NO: RFP: HR-11-269 <b>FAIMS GR 0057</b>	14. METHOD OF PAYMENT  <input type="checkbox"/> ADVANCE BY TREASURY CHECK  <input type="checkbox"/> REIMBURSEMENT BY TREASURY CHECK  <input type="checkbox"/> LETTER OF CREDIT  <input checked="" type="checkbox"/> OTHER (SPECIFY) Electronic ASAP.gov (See Remarks in Item #20 "Payment Information")	
15. NRC OBLIGATION FUNDS  THIS ACTION                      \$191,150.00  PREVIOUS OBLIGATION              \$      00.0  TOTAL                                  \$191,150.00		16. TOTAL FUNDING AGREEMENT  NRC                      \$191,150.00  RECIPIENT \$ 67,588.00  TOTAL                      \$258,738.00  This action provides funds for Fiscal Year in the amount of      See Page Two	
17. NRC ISSUING OFFICE (NAME, ADDRESS and EMAIL ADDRESS)  U.S. Nuclear Regulatory Commission Div. of Contracts Attn: Shashi Malhotra Email: Shashi.Malhotra@NRC.GOV Mail Stop: TWB-01-B10M Rockville MD 20852			
18.  Signature Not Required		19. NRC CONTRACTING OFFICER  <div style="text-align: right;"><i>Sheila Bumpass</i>      8/22/11 _____ (Signature)                      (Date)</div> <div>NAME (TYPED)      Sheila Bumpass</div> <div>TITLE                      Contracting Officer</div> <div>TELEPHONE NO.      301-492-3484</div>	
20. PAYMENT INFORMATION  Payment will be made through the Automated Standard Application for Payment (ASAP.gov) unless the recipient has failed to comply with the program objectives, award conditions, Federal reporting requirements or other conditions specified in 2 CFR 215 (OMB Circular A110).			
21. Attached is a copy of the "NRC General Provisions for Grants and Cooperative Agreements Awarded to Non-Government Recipients. Acceptance of these terms and conditions is acknowledged when Federal funds are used on this project.			
22. ORDER OF PRECEDENCE  In the event of a conflict between the recipient's proposal and this award, the terms of the Award shall prevail.			
23. By this award, the Recipient certifies that payment of any audit-related debt will not reduce the level of performance of any Federal Program.			

**TEMPLATE - ADM001**

**SUNSI REVIEW COMPLETE**

**ADM002**

## ATTACHMENT A - SCHEDULE

### A.1 PURPOSE OF GRANT

The purpose of this Grant is to provide support for "Development & Deployment of Web-Based Interactive Thermal-Hydraulics Educational Modules for the Nuclear Engineering Program" The University of Texas at Arlington, as described in Attachment B entitled "Program Description."

### A.2 PERIOD OF GRANT

1. The effective date of this Grant is August 22, 2011. The estimated completion date of this Grant is August 31, 2013.

2. Funds obligated hereunder are available for program expenditures for the estimated period: August 22, 2011 – August 31, 2013.

#### A. GENERAL

- |                                |  |
|--------------------------------|--|
| 1. Total Estimated NRC Amount: | \$191,150  |
| 2. Total Obligated Amount:     | \$191,150  |
| 3. Cost-Sharing Amount:        | <b>\$ 67,588 (cost share/in-kind)</b>  |
| 4. Activity Title:             | "Development & Deployment of Web-Based Interactive Thermal-Hydraulics Educational Modules for the Nuclear Engineering Program" |
| 5. NRC Project Officer:        | Tanya Parwani-Jaimes   |
| 6. DUNS No.:                   | 064234610  |

#### B. SPECIFIC

- |                   |                  |
|-------------------|------------------|
| RFPA No.:         | HR-11-269        |
| FAIMIS:           | GR0057           |
| Job Code:         | T8453            |
| BOC:              | 4110             |
| B&R Number:       | 2011-84-51-K-134 |
| Appropriation #:  | 31X0200          |
| Amount Obligated: | \$191,150        |

### A.3 BUDGET

Revisions to the budget shall be made in accordance with Revision of Grant Budget in accordance with 2 CFR 215.25.

	Year 1	Year 2
Total Cost	\$ 75,877	\$55,293
Indirect Cost (F & A)	<u>\$ 32,609</u>	<u>\$27,370</u>
Yearly Total	<b>\$108,486</b>	<b>\$82,663</b>

#### **A.4 AMOUNT OF AWARD AND PAYMENT PROCEDURES**

1. The total estimated amount of this Award is \$191,150.00 for the two-year period.
2. NRC hereby obligates the amount of \$191,150.00 for program expenditures during the period set forth above and in support of the Budget above. This grant program is fully funded. NRC is not obligated to reimburse the Grantee for the expenditure of amounts in excess of the total obligated amount.
3. Payment shall be made to the Grantee in accordance with procedures set forth in the Automated Standard Application For Payments (ASAP) Procedures set forth below.

#### **Attachment B – Program Description**

##### **PROGRAM DESCRIPTION**

<b>Collaborative personnel</b>	<b>Introduction</b>
--------------------------------	---------------------

The College of Engineering at the University of Texas at Arlington (UT Arlington) is submitting this proposal in response to the educational funding opportunity from the U.S. Nuclear Regulatory Commission for FY 2011. The proposal describes plans to enhance the Nuclear Reactor Thermal Hydraulics (NE 4303) course, which is one of the core course offerings in the nuclear engineering (NE) minor program at UT Arlington. The enhancement will be done by developing and deploying interactive web-based simulations. Some of the salient features of this project are:

- NE 4303 addresses the Nuclear Engineering area with Thermal-hydraulics emphasis.
- NE 4303 is a permanent course that is required for all NE minor at UT Arlington.
- NE 4303 is an undergraduate course
- Initially, we anticipate 20-25 students/year at UT Arlington to be directly impacted by this project. However, through our collaboration with Univ. of Texas at Austin (UT Austin) this project will benefit 75-80 students at UT Austin and the Big-12 Nuclear Consortium.
- The project is focused on developing an integrated set of web-based simulation tools that will supplement in-class lecture materials for the NE 4303 course.

The UT Arlington College of Engineering began the offering of a minor in NE in Fall 2009. The NE minor is available to UT Arlington's students pursuing a major in either engineering or physics. This offering was strongly influenced by the following facts:

- UT Arlington is in close proximity to the Comanche Peak Nuclear Power Plant and the Region IV Office of the US Nuclear Regulatory Commission. In addition there are a number of companies in the area which provide services and consultation to these entities.
- Luminant Power and South Texas Project have indicated their intent to build more new nuclear power plants in the state.
- The national and regional need for engineers with training in NE is currently not being met by any university in the Dallas / Ft. Worth Metroplex.

- Several faculty members hold PhD degrees in nuclear and related engineering fields.
- Several members of the College's Advisory Board are involved in power generation industry, and have voiced unequivocal support for this program.
- The NE minor program has its own Advisory Committee which includes representatives from NRC and UT Austin, as well as several other industrial experts from the nuclear field.
- The faculty and administration of the College have been very supportive, providing both moral and financial support to initiate the minor.
- Amongst the UT Arlington students, there has been a very strong interest for the Nuclear Engineering program.

A student earns the NE minor by taking three (3) core courses (Introduction to Nuclear Engineering, Nuclear Reactor Theory/Analysis and Nuclear Reactor Thermal Hydraulics) and three (3) elective courses, chosen from a set of 8 currently available courses related to NE. The initial offerings of the three core courses were in Fall 2009, Spring 2010, and Summer 2010. As these courses are being planned and taught, it has become evident that enhancements are needed to make each as effective as possible.

The project goal is to augment the Reactor Thermal Hydraulics course by developing and incorporating web-based simulations. Such simulation tools will allow for better student comprehension of a mathematically intensive subject matter through animations and virtual-labs. Similar activities have proven to be extremely successful in other engineering areas, but are seldom found in the Nuclear Engineering and especially in the thermal-hydraulics course. Lessons and instructional modules created will be published and shared with the nuclear community. Additionally, this will help in the future expansion of the NE undergraduate minor to a graduate certificate program in NE for working professional engineers, continuing education short courses in specific topics for nuclear personnel, and seminars / demonstrations suitable for the general public in north Texas

## **Item 1: Potential for Supporting or Advancing the Nuclear Safety, Nuclear Security, or Nuclear Environmental Protection Education Infrastructure**

### **1.1 Institutional long-range goals**

UT Arlington is a comprehensive research, teaching and public service institution whose mission is the advancement of knowledge and the pursuit of excellence. It is striving to attain national research university status. As such, the offering of additional engineering curriculum options such as NE is completely in line with the university's mission (see attached letter from the Provost). Since its initiation one year ago, the UT Arlington NE minor has begun contributing to the nation's NE education infrastructure. Indications are that interest will continue to be at a high level among our students in this minor. This interest is gauged by student survey, class enrollment, attendance in seminars and workshops. UT Arlington feels strongly committed to the program based on this student interest, the renewed interest in nuclear-energy in US and several other countries, and the proximity of the university to nuclear-related organizations. In fact the next goal being contemplated at the College of Engineering is the addition of a graduate certificate in Nuclear Engineering, as

### **1.2 Identification of the problems or opportunities to be addressed**

The nuclear renaissance that is currently being experienced offers academic institutions a chance to stay current by presenting innovative teaching styles and materials. The world-wide-web presents an opportunity to bring new teaching techniques into the classroom. The objective of this project is to develop web-based interactive learning modules for the *Nuclear Reactor Thermal Hydraulics* course. These modules will complement and enhance the traditional lecture format used in-class through visually active learning methods.

Nuclear Reactor Thermal Hydraulics is a computationally intensive course and is an excellent candidate that can make use of simulations for student comprehension of concepts associated with complex flow physics. Web-based simulation will allow students to learn and appreciate the coupled and abstract thermal and fluid equations in a flexible and visual manner. The premise for our proposed activity is centered on the following facts:

- Traditional instructions in thermal sciences make use of end-of-chapter problems that typically has a single correct answer. Quite often it does not allow the student to get a good feel and appreciation of the governing equations. Computer simulation allows the “experimentation” and visualization as a means of reinforcing and extending what they are exposed to in lecture and in the textbook presentation.
- Web-based interactive teaching and learning activity has been shown to be very successful in enhancing the student’s learning experience. However such materials are far and few in the Nuclear Engineering area.
- The NE minor program at UT Arlington has an interdisciplinary student population. As such certain fundamental topics in thermal sciences have already been taught to some students, but less thoroughly and possibly less recently to others. Web-based interactive training materials for such topics can be assigned as self learning and will allow the proper time management for the remaining critical nuclear topics.
- Current nuclear thermal-hydraulics simulation tools like RETRAN, RELAP, TRAC and GOTHIC etc. model the entire nuclear system and require a steep learning curve. They are more suited for graduate research and project. In order to educate and illustrate concepts typically presented in text-books, the use of sophisticated software becomes cumbersome.
- Web-based simulation modules do exist in the thermal sciences area, but they are mostly confined to non-nuclear usage. Nuclear engineering applications necessitate the usage of empirical and specialized equations that are not present in traditional thermal sciences textbooks and consequently are not addressed in existing web simulations.

### **1.3 Project Justification**

A clear understanding of the fundamental topics in the nuclear reactor thermal-hydraulics is not only essential to the safe design of the next generation of nuclear reactor but the modification and operation of existing ones as well. The project is aimed at enhancing the manner in which the teachers disseminate information and the students learn nuclear thermal-hydraulics course material, by making use of computer simulations. These simulations when available on the web, will allow for the flexibility in student learning and discovering issues not obvious during classroom lectures and problem solving. This project will help to improve the educational

infrastructure, teaching competencies and skills of students studying nuclear engineering. Each of these items is discussed below:

### 1.3.1 Improvement in Educational Infrastructure:

The traditional lecture-based/weekly problem set paradigm has the advantage of leveraging the numerous end-of-chapter homework problems and, more importantly, the exhaustive answer books provided to the instructor along with the major textbooks in the field. This is the current state for several engineering courses. However in many instances, for developing physical insight and for ready application in design, the end-of-chapter homework problems with a single correct answer seem to be just not appropriate. The creation of this web-based module will train the students to observe, hypothesize, test, verify, design and synthesize – skills that are essential for a well-educated engineer.

A paradigm shift has taken place in engineering education by using technology as an integral part of instruction<sup>1</sup>. Due to the dwindling student population and grants in Nuclear Engineering education for the past several years, a majority of the nuclear engineering departments did not have the resources to adapt to and implement such changes and continued in the “business as usual” mode. Through this NRC grant, such educational improvements can now be achieved to make the nuclear education technologically current.

### 1.3.2 Improvement in Teaching Competencies:

Instructors who teach courses that are best learned through design based problems, such as reactor thermal-hydraulics, can get a big help from computer simulations. It allows them to show the students the trend of important parameters whose values are calculated through complex mathematical steps. Such trends, which are important to the understanding of the physical phenomenon, cannot be discovered by solving an involved mathematical problem that culminates into a unique answer.

Due to the limited classroom time, an instructor is often not able to cover all the relevant materials and student questions. To make up for this paucity, optional reading assignments or bonus home-work problems are added on. Not all students are motivated to again go through another set of textual material, especially when the requirement is optional. But several instructors can vouch for the fact that these optional materials are equally important and help them along in their future class lectures. Computer simulations are an attractive option to lure the students to such studies.

Computer based learning also addresses various issues related to students’ learning styles. It has been found that women students respond better to the use of visualization in heat transfer instruction<sup>2</sup>. Also some students do not react well to passive participation as provided during chalk-and-talk lecture<sup>3</sup>. At the same time, it is well known that not all students are comfortable in asking questions in-class and these unanswered queries can be detrimental to their education. Web-based simulations and teaching, for the thermal-hydraulics course, can play a pivotal role in addressing several of these issues. As a result, we strongly believe that such simulations should help in the teaching competency of instructors from both the academia as well as from the industry.

### 1.3.3 Skills Serving Students in the Target Disciplines

By using the web-based tools, students will recognize and appreciate that they are being introduced to the kinds of computational, simulation and visualization procedures that they will routinely use in their working careers – even though many will never work directly in nuclear heat transfer again. These skills have become a necessity in our high tech, global economy. With nearly all of the existing modules representing simulations of real nuclear thermal-hydraulics issues, it should be possible to “discover” several items discussed in the corresponding section of a typical textbook.

### **1.4 Innovation and effectiveness in advancing the educational infrastructure**

As indicated ahead, the proposed project addresses improvement to our existing course in Nuclear Reactor Thermal Hydraulics by the addition of web-based simulation modules. This will facilitate an interactive approach in teaching an undergraduate nuclear thermal-hydraulics course. To our knowledge, such resources are currently very few and scattered and address different topics at random and do not coherently address NE undergraduate education. The advantages in the creation and addition of these modules include:

- Providing the student a mechanism for carrying out “what if” queries which bring to life concepts often hidden in mathematical equations.
- Allowing the student more control over his/her learning time by making these modules accessible through the web.
- Encouraging students to learn in a way that has been shown to be more engaging than learning from textbooks and lectures alone.
- The on-line simulations would serve as virtual laboratories and help in pedagogy like active learning; provide relevance, meaning and context for the material; and inquiry-based learning including experimentation and discovery.
- Nuclear thermal-hydraulics is typically taught to graduate / senior undergraduate nuclear or mechanical engineering students. These supplementary materials will be designed to allow students from multidisciplinary programs as well as students from both university and industry to advance their knowledge of key nuclear engineering subject matter.

## **Item 2: Proposed Approach and Collaborative Linkages**

### **2.1 Overview**

To assure undergraduate students’ broad understanding and competence in the vital area of reactor thermal-hydraulics and to achieve a high educational standard in the same subject matter, various interactive software modules will be developed in a web-based environment. The web interfaces created for the course will provide the student an opportunity to study some abstract concepts involved in nuclear reactor heat generation and its transport for power generation. The main aim is to supplement the traditional in-class presentation that predominantly involves discussions of equations with derivations and analytical examples.

### **NE 4303 Course outline:**

The Reactor Thermal Hydraulics course is a core course that is taught to the undergraduate NE minor students at UT Arlington.

**Description of Course Content:** This course will introduce the students to the processes of energy (heat) generation in nuclear reactor, the transport of that energy by the reactor coolant to the power cycle, and the limitations imposed by the transport mechanism on the design of nuclear reactor cores. Fundamental calculations associated with these processes will be explained, examples set and results discussed. An effort will be made to familiarize the students with a thermal hydraulic software code. Also invited speaker(s) from industry and tours will complement the lectures with real life experiences.

**Student Learning Outcomes:** The student will learn about:

- Fundamentals of fluid flow and heat transfer in a power plant
- Heat generation by nuclear fission in the reactor core
- Heat transfer by conduction in reactor elements
- Heat removal by convection
- Heat transfer with change in phase
- Reactor thermal-hydraulic performance
- Thermal design of the reactor core
- Safety Analysis

**Required Textbooks and Other Course Materials:**

- Nuclear Heat Transport: M.M.El-Wakil; ANS publication (main textbook)
- Nuclear Systems: Todreas and Kazimi; Taylor and Francis (reference book)
- Handouts provided by instructor

This course is traditionally taught at several universities as a graduate / senior level course for nuclear or mechanical engineering students. Keeping our interdisciplinary student demography in mind, we feel it is necessary to supplement the theory behind these topics with experiments, simulation and analysis. These activities would allow the students to focus on the design aspects of the course and not spend too much time on the pedagogical aspect, as endured by typical mechanical engineering students. Also, this type of interactive activity has been shown to be very successful in enhancing the student's learning experience. Modeling, simulation and visualization have evolved from a practice of researchers to a routine activity of just about any engineer in an industrial setting. To address this change in industry practice, we strongly believe that computer and laboratory based simulation should be an integral part of this course.

Unfortunately current nuclear-related simulation packages like RETRAN, GOTHIC, etc. require

a steep learning curve and are more suited for graduate research. In order to comprehend the rudimentary fundamentals of thermal sciences, pertinent to a nuclear power plant, these tools become excessive. This project intends to build rich web-based educational modules, which will help students to rapidly perform “what-if” analyses, and get a hands-on experience with “virtual laboratories” etc. for a better comprehension of fundamental concepts. To complement the theoretical learning and virtual simulations, a partial funding for Rankine-Cycler laboratory equipment is also being requested. This equipment will provide the students a good hands-on feeling for a power plant thermal operating parameters.

During the selection of topics for simulations, an effort has been made to follow the relevant sections of a standard text book (such as M.M. El-Wakil that is used by us) as well as the topics required by NRC for reactor and senior reactor personnel of the nuclear power plant. The Knowledge and Abilities catalog of NRC for Nuclear Power Plant operators (NUREG-1122) identifies essential pedagogical needs in thermal-hydraulics for the safe operation of nuclear power plants.

We plan on covering several salient topics by maintaining a balance between the undergraduate academic needs and some of the industrial needs. The simulations will be housed under four major headings and each of which will in turn host several relevant subsections. The different headings and sub-headings are being shown below:

Heat Generation	Heat Transfer	Hydrodynamics	Safety/Misc. Issues
Introduction	Introduction	Introduction	Introduction
By U-235 fission	From Fuel Element	Pressure drop 1-phase	Critical Heat Flux
In Fuel pellet	From Fuel Rod	Pressure drop 2-phase	Hot Channel Factor
In Fuel Rod	1-phase fluid	Pump Behavior	Thermal Limits
Total in Core	2-phase fluid	Critical Flow 1-phase	Shutdown Heat
Reactor Structure	From Shielding	Critical Flow 2-phase	Flow induced vibration

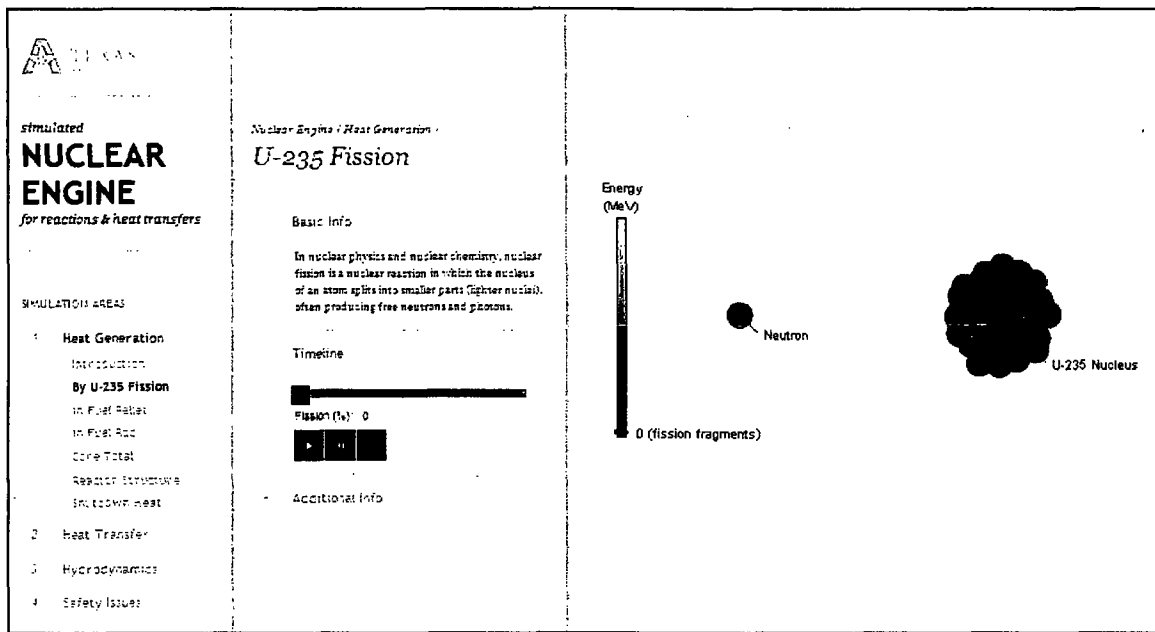
### 2.1.1 Description of the Simulations:

To illustrate the functionality of the simulations, we have created ‘*a very brief demonstration*’ for a single item (heat generation during fission of a single U-235 nucleus). This can be viewed at <http://www.uta.edu/art/uploads/nuclear>. Heat generation by fission is one of the very first topics that is typically discussed in the traditional thermal-hydraulics lecture. Some of the concepts that the students learn are:

- The source of energy during fission
- How this released energy is distributed amongst different fission products
- The stochastic process associated with fission which results in the release of different products and energies.

This concept of energy released during fission of a single nucleus is then expanded into energy released from fuel pellets, to the fuel rod to the fuel bundles and finally to the energy from the reactor core. Each of these topics will be covered by their respective simulations.

Figures 1a and 1b, show screenshots from the fission simulation. *It should be noted that it is the only simulation that has been partly developed to show the proof of concept. It can be found under "Heat Generation ----- By U-235 Fission" menu.* Different runs will show how fission gives rise to different fission products and released energy. Each of the simulations that will be created will have 3 sections: Introduction, Simulator and Additional information. The "Introduction" section will briefly describe the topic under investigation and how the simulation tool needs to be used. The "Simulator" section will contain the interactive tools to visualize the topic under consideration. The "Additional information" section will have images, plots, calculators to glean a little bit more information about the subject matter.



**Figure 1a: Simulation of Nuclear Fission**

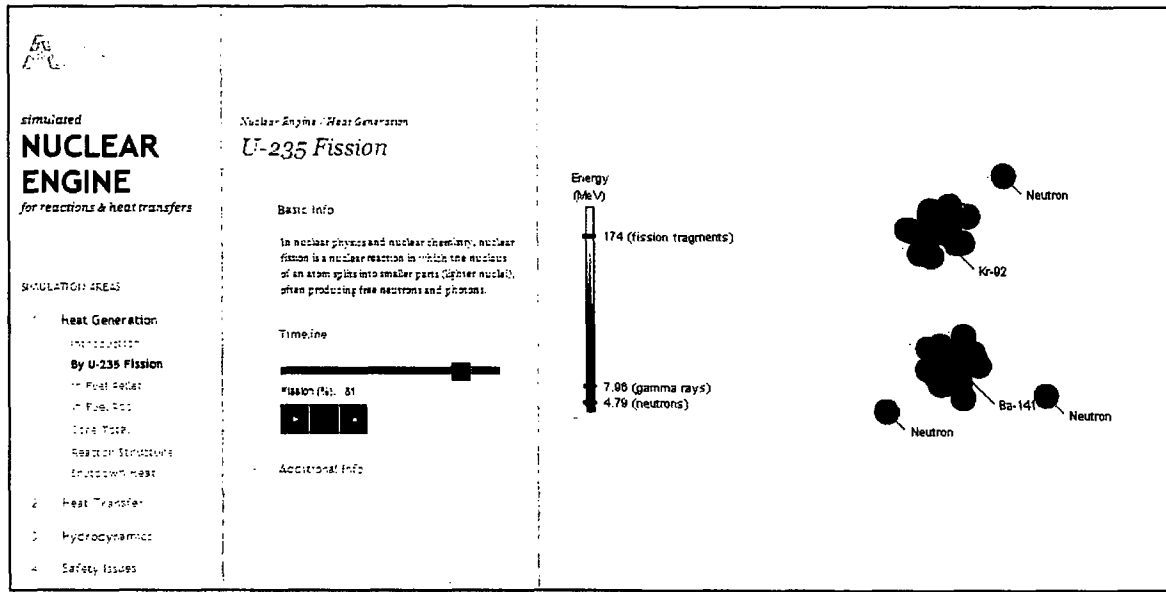


Figure 1 b: Energy released during U-235 fission

To illustrate this thought, a brief explanation for each section is mentioned below:

- The “*Introduction*” section will describe the fission process, and highlight the significance of the energy released when compared to other sources of energy used for power generation.
- On running the “*Simulator*” tool one will notice that for the same neutron and nucleus interaction, different fission fragments, different number of neutrons and corresponding energies are released. Although we teach this in class, this simulation serves the purpose of actively observing the randomness of the fission process. While we do not delve into the nuclear-physics portion of fission in this class, we do want the students to grasp and appreciate the significant values of energies that are generated. The “*Additional Info*” section will contain information about the fission yield through an interactive graph. It will also contain a calculator for computing binding energy values.

A similar structure will be followed for each of the simulations that will be created for this project.

## 2.2 Timeline

The project timeline is best shown by means of a table

	Fall 2011	Spring 2012	Summer 2012	Fall 2012	Spring 2013	Summer 2013
NE 4303			Course Offered			Course Offered
Reactor Thermal-Hydraulics	Web Module Design  Start Heat	Web programming (Complete Heat generation)	Web programming (Start Heat Transfer)	Web programming (Complete Heat Transfer)	Web programming (Complete Hydrodynamics)	Web programming (Complete Safety / Misc.)

	<b>generation module programming</b>	<i>module)</i>	<i>module)</i>	<i>module and begin Hydrodynamics module)</i>	<i>module and begin Safety module)</i>	<i>issues module)</i>
	Collaborative efforts with UT Austin	Beta test some modules for class-room implementation	Training for Thermal-hydraulic code (RETRAN or GOTHIC)	Collaborative efforts with UT Austin	Plans to incorporate Thermal-hydraulic code (RETRAN or GOTHIC)	Implementation of Web simulations Implementation of RETRAN or GOTHIC
		Collaborative efforts with UT Austin and Westinghouse	Compilation of student evaluation and feedback from students	Present working results at ANS conference	Write conference paper	Evaluation from other NE programs Start writing a Journal and conference paper on this experience

**Table 1 Project Timeline**

### **2.3 Evaluation**

The evaluation of this project will primarily be performed through answers to a questionnaire that will be provided to UT Arlington students, the collaborating members and to other Nuclear Engineering programs. The questionnaire will focus on the following areas:

- A general information section to seek the institution's name and user status (student/faculty, male/female, department, etc.)
- Course title, course level (graduate/undergraduate), and class size.
- Educational value and pedagogy (rated with 5 being best and 1 as poor) that will consist of criteria such as relevance to course, technical soundness, ability to help in student learning, ability to engage the user and the ability to supplement and enhance classroom learning.
- Ease of use (rated with 5 being best and 1 as poor) that will judge the navigation system, graphic and color usage, ability to follow on-screen instructions, organization of the materials
- Overall ratings as a relevant educational tool, ease of use, motivation for the student to learn, encouraging of collaborative learning,

The questionnaire will be provided to the UT Arlington students, at the completion of the course, but will be provided to the other Nuclear Engineering program once the project has been completed. Results from this questionnaire will be compiled and used for project refinement and future development. Also results from this questionnaire and the relevant efforts taken in this regard will be reported in technical/educational publications.

### **2.4 Collaborative Linkages**

During the short time since its inception, the minor program in Nuclear Engineering at UT Arlington has developed a number of relationships that have a direct benefit to the program and to our students:

- Students in the NE 3301 course (Introduction to Nuclear Engineering) have had an opportunity to visit the nuclear engineering laboratory facilities and the TRIGA nuclear reactor at UT Austin and at Texas A&M.
- As a part of NE 4302 Reactor Analysis course, necessary arrangements are being made for our students to take part on one or two on-line experiments related to nuclear reactor analysis on the TRIGA nuclear reactor at UT Austin.
- As part of the NE 4303 Reactor Thermal Hydraulics course, arrangements have been made with Westinghouse Electric Company and Luminant power to offer a seminar that provides an industrial overview of this subject matter. Also University of Pittsburgh has tentatively agreed to collaborate in sharing some industry-oriented thermal-hydraulics material that was prepared with DOE and Westinghouse funding.
- Several professionals/educators from NRC, universities (both national and international) and industry have been invited to give a seminar on nuclear engineering issues.

An external advisory committee has been established for the minor in NE. Its objective is to help us tailor the program to nuclear industry needs and practices. The NE Advisory Committee has met twice a year since summer 2009. Members include:

- Dr. Gerald Schlapper, Inspector, U.S.NRC Region IV Office (serving without conflict of interest)
- Prof. Sheldon Landsberger, Coordinator of Nuclear and Radiation Engineering Program at the University of Texas at Austin
- Mr. Mike Blevins, Chief Operating Officer, Luminant (now retired, formerly Chief Nuclear Officer, Luminant Energy, and Director of Comanche Peak Generating Station)
- Mr. Chris Davenport, Partner, DP Engineering Ltd.
- Mr. Joseph Tapia, Licensing Manager, Mitsubishi Nuclear Energy Systems, Inc.

However just for this project, we have set up strategic relationships both within and outside UT Arlington. The goal is to seek expert advice for both technical aspects and for web page design.

#### Collaboration within UTA:

We are collaborating with our College of Fine Arts to get their expertise in the visual lay-out and design for the simulations. Such cross-disciplinary collaboration has been successfully employed at other engineering institutions (Product Design and Development course taught collectively by MIT's engineering program, Univ. of Pennsylvania's business school and Rhode Island School of Design). Additionally, the two key members of the NE minor program Dr. Lynn Peterson (Senior Associate Dean) and Dr. Rasool Kenarangui (Dept. Of Electrical Engineering) will serve as Senior Personnel. Dr. Peterson is also a Professor in Computer Science and Engineering and has excellent knowledge of programming and engineering education. Dr. Kenarangui, as the instructor for two of the Nuclear Engineering minor course, will provide his guidance in the integration of this project into the overall NE minor framework at UTA.

### External Collaboration:

Prof. Sheldon Landsberger from UT Austin and Dr. Hugo da-Silva from Westinghouse Electric company will be our two main external collaborators (letter of collaboration/support is enclosed). Mr. Chuck Kesinger, from the Commanche Peak Nuclear power plant of Luminant Power has also agreed to support this project in the form of collaboration and guidance (letter enclosed).

Dr. Landsberger has been very active in the area of Nuclear Engineering education and research and has made significant contributions in this field (see attached resume). He also has pioneering experience in executing web-based courses for distance learning in the nuclear sciences area. He will collaborate to overview the design of the project and will also provide necessary help to create the on-line experiments. Dr Hugo da-Silva has spent a prolific professional career in the area of nuclear reactor thermal-hydraulics and has had numerous publications (internal and external) in this area. His has been recognized as a Engineering Fellow by the Westinghouse Electric company for his contribution in nuclear engineering. He has graciously accepted to offer his input and feedback to this project.

## **Item 3: Institutional Capability and Capability Building**

### **3.1 Institutions commitment to the project**

UT Arlington's commitment to this project is directly linked to its support of the NE minor program at UT Arlington. Senior administrators at UT Arlington are extremely supportive of the Nuclear Engineering minor program and any elements that may enhance the course offerings. This support is present at all significant levels viz: the Provost office, the Dean of the College of Engineering and the Department Chairpersons of Mechanical & Aerospace Engineering and the Visual Arts (support letters from the Provost and the Dean are attached).

The Dean of the College of Engineering enthusiastically supported the initiation of the NE minor program, and continues to do so. In fact, the Dean provided start-up funding for the program which made possible the initial purchase of laboratory equipment. This funding was crucial to the success of the very first course that was offered (NE 3301: Introduction to Nuclear Engineering). The Dean continues his support in the form of funding for trips to ANS meetings and NRC and DOE workshops for the NE faculty members. These trips are relevant for disseminating the outcomes of this proposed project and to gain feedback to refine and further enhance the web-based modules. The Departments of Electrical Engineering and Mechanical & Aerospace Engineering have provided faculty time to teach and develop the NE courses since Fall '09. It should be noted that NE courses are offered every semester and the NE faculty members are relieved from teaching one departmental course during this time.

### **3.2 Adequacy of resources (admin, facilities, equipment, material)**

The College of Engineering at the UT Arlington is a premier college of engineering in the Dallas / Ft. Worth Metroplex with 3988 of the university's 32,000 students, over 2400 of whom are undergraduates. The college offers eight (8) ABET-accredited bachelor's degrees: aerospace, civil, computer, electrical, industrial, mechanical, and software engineering as well as computer science.

The institution possesses the necessary faculty, students, industrial partners, and computing resources to successfully implement the web-based module development in this proposal. Resources such as facilities, equipment and material are not a capital intensive requirement for this project and the institution either already has them or is fully capable of absorbing them with

no external funding. What the program lacks is the funding to support the development of this project, and which is being requested here. The key resources crucial to the success of this project are technical and programming expertise and relevant collaborations. The university has several internationally recognized scholars in the area of thermal sciences as well as in computer simulation. The institution's strategic relationships with several key nuclear players, such as the Nuclear Regulatory Commission Region IV, Westinghouse, Comanche Peak Nuclear power plant and UT Austin, to name a few, allows this project to get relevant input during the development and execution of this project.

### **3.3 Academic enhancement potential**

The NE minors goal at UT Arlington is to further develop / enhance the core courses of the NE minor program which was initiated using resources of the College of Engineering. Additionally, this will lay the groundwork for the future expansion of the NE undergraduate minor to a graduate certificate program in NE for working professional engineers, continuing education short courses in specific topics for nuclear personnel, and seminars / demonstrations suitable for the general public in north Texas.

The expected output of the proposed project will be the enhancement of the NE 4303 course through the development of web-based modules. It will result in newly-graduated engineers better equipped to contribute to the field in a safe manner. Lessons and instructional modules created will be published and shared with the nuclear community. The major outcome will be strengthening the NE program at UT Arlington by expanding its teaching and research capability, contributing to the regional and national needs for a nuclear workforce able to respond to 21<sup>st</sup> century challenges.

### **3.4 Plans to continue or expand the project beyond the NRC support period.**

The initial grant from NRC will be exceptionally timely when the program is aiming to move to the next stage. If this project is successful, it will serve as a model for the development of future web-based simulations for several key subjects of Nuclear Engineering. Such a comprehensive on-line tool is currently lacking for this vital energy industry. This would benefit not only the educational institutions but the workforce in the industry too. Once we get a template in place for module development, we will continue to use UT Arlington students doing projects to develop materials for additional topics. Also we may seek future grants both from governmental as well as private industries to keep on enhancing the project as needed.

## **Item 4: Key Personnel**

### **Principal Investigator:**

Dr. Ratan Kumar, faculty member teaching one of the required NE courses, holds an MS and PhD in Nuclear Engineering from the University of Florida and a BS in Mechanical Engineering from Jadavpur University (see attached CV). He was employed as a mechanical engineer and as a nuclear consultant for 6 years. He has 10 years experience in teaching mechanical engineering and mechanical engineering technology, with four of those years at UT Arlington. His position as senior lecturer in Mechanical & Aerospace Engineering is as a full-time faculty member and

undergraduate advisor.

Dr. Kumar will be the project lead and has taught the thermal-hydraulics course in various forms at the university and industry and has several publications (including best-paper) both in the thermal sciences and nuclear engineering area. He is actively involved in computer-based engineering education and created software for web-based education that was a finalist in the International Web-based education conference. He will be involved in the overall design and execution, providing technical content for the various topics, integrating the underlying equations and data with the web-modules and in the interaction with collaborators.

### **Collaborative Personnel**

Dr. Sheldon Landsberger, Professor and Coordinator of Nuclear and Radiation Engineering Program received his PhD in Chemical Engineering from University of Toronto. He has over 25 years teaching and research experience in the area of Nuclear Engineering. During this time he has published over 150 refereed publications with several of them in the area of nuclear engineering and in web-based education.

Dr. Landsberger will play a major role in the collaborative effort between UT Arlington and UT Austin. He will provide his expertise in the initial design stage, help in some of the on-line simulations and also in allowing our students to use some of the simulations developed by UT Austin for the Big-12 consortium. He will also be responsible for knowledge dissemination through joint publications.

### **Senior Personnel**

Dr. Lynn Peterson, Sr. Associate Dean of Engineering, serves to coordinate the NE minor program. She has expertise in monitoring and evaluating academic programs, having served as Associate Dean for Academic Affairs of the College of Engineering for 13 years. Dr. Peterson will provide necessary help with issues related to programming and how the project addresses issues linked with engineering education. She will also play a major role in the evaluation of project results and in the dissemination of the results. As Professor in Computer Science and Engineering, she has experience in development of computer-based instructional systems as well as engineering education.

Dr. Rasool Kenarangui, faculty member teaching two of the required NE courses, holds an MS and PhD in NE from Iowa State University and a BS in Electrical Engineering from the same institution (see attached CV). He has over 20 years experience in teaching in electrical engineering, with 14 of those years at UT Arlington. His position as senior lecturer in electrical engineering is as a full-time faculty member, with prior service as a research faculty member in the Energy Systems Research Center at UT Arlington. He will oversee the integration of this project into our NE minor program.

It should also be noted that the NE Advisory Committee will provide experience and knowledge of the current needs that will be relevant to this project. In this regard Mr. Chuck Kessinger from Luminant Power has also agreed to collaborate in providing us with information and feedback appropriate to the Reactor and Senior Reactor training at a Nuclear Power plant. Students who would like to pursue a career at a Nuclear Power plant will definitely benefit from this collaborative effort.

## **Item 5: Budget and Cost-Effectiveness**

### **5.1 Budget and Cost Effectiveness for Project Implementation:**

The budget below addresses costs for enhancing the reactor thermal-hydraulics core course in the NE minor program in terms of resources needed to develop web-based simulation to supplement classroom lectures. A request is also being made to purchase laboratory equipment (*Rankine Cyclar*) to demonstrate the thermal workings of a steam power plant. Between the web-based simulations and the Rankine Cyclar, an excellent enhancement to the existing course in thermal-hydraulics will be achieved.

#### **5.1.1 Personnel Budget & Justification**

#### **Year 1**

#### **Year 2**

**\$ 4,500**

**\$ 4,500**

*Fringe benefits will be 30% for PI and Co-PI and 10% for Graduate Assistant*

Resources for the development of web-based simulation are heavily dependent on the development time and very little on any hardware or software resources. A single good programmer with skills in developing interactive web pages will be a minimum requirement to execute this project. The graduate assistant's (programmers) salary is @\$1200/month and a 20 hour/week workload is expected. The PI has extensive web programming experience and will also contribute into the programming needs along with other functions as outlined in the *Key Personnel* section. The time requested for PI for budgeting purpose is not adequate to execute this project. As a result the MAE department has committed to a cost-sharing (in kind). The collaborative personnel (Dr. Sheldon Landsberger) will be providing at least 1.5 hour/week on this project. The amount requested for him is marginal considering he will also be travelling within his allocated budget.

#### **5.1.2 Equipment Budget & Justification**

#### **Year 1**

#### **Year 2**

- Hardware and Visualization software

**\$10,000**

**---**

For the success of this project, and its ongoing development, we will require dedicated computer for development and for testing. This hardware cost will be shared between the NRC grant and the College of Engineering at the University of Texas at Arlington. To this extent, we will need dedicated development computers (for Microsoft operating system and for Apple operating system). We will also need tablet PC and other devices to view the web modules on different platform and at different resolutions and a dedicated server. We are requesting a portion of the total hardware cost (>\$15,000) from NRC for this project. We also plan to purchase some high end visualization software, such as ILog from IBM, and Silverlight product from ComponentArt for a rich web visualization experience (around \$10,000 total).

#### **5.1.3 Travel Budget & Justification:**

#### **Year 1**

#### **Year 2**

- For RELAP / GOTHIC training
- For paper presentation

**\$ 5,000**

**----**

**---**

**\$ 5,000**

We are requesting for travel budget to offset the cost associated with software training and for conference paper presentation. It should be noted that College of Engineering has supported the travel cost as and when needed. The software training for RELAP / GOTHIC will include registration, airfare, lodging, meals and other expenses for at least 6 days for 2 faculty member. The cost for paper presentation is for 2 persons and includes registration, airfare, lodging, meals and other expenses for 3 days. Some of the pertinent conferences for this presentation would be the ANS or ASEE conference.

## **5.2 Cost-Sharing:**

The College of Engineering at UT Arlington is committed to be a player in the current energy challenges through interest in sustainable energy sources particularly nuclear energy. There is a strong commitment and endorsement by the university and college to the NE program, as is partly displayed through its cost sharing

### **Cost already borne to date:**

- \$50,000 provided by the College of Engineering up to this point to develop a radiation detection laboratory
- Travel support to the two NE faculty to ANS meetings and NRC Workshop
- Faculty time to develop courses in the NE minor, the program and the lab up to this point.
- Use of LabView software, relevant instrumentation and 5 desktop computers

### **Cost-Sharing for this project**

- \$15,000 for purchase of hardware and misc. costs.
- For Dr. Kumar, 15% time over the 2 years of this proposed grant (\$32,659 - in kind)
- For Dr. Peterson, 5% time over the 2 years for program support (\$19,929 - in kind)

## **Item 6: Program's Sustainability**

All the support, indicated ahead, suggests that the commitment of UT Arlington to the NE minor program is not dependent on the NRC support and it is reasonable to assume that the commitment will extend beyond the requested 2 year support period. Also, as a public institution that receives state funding based on a formula involving student credit hours, state support to the university for these courses will be a function of the enrollment in them. In other words, while the interest in the courses continues and grows, university and college support of the course offering is almost assured. Student enrollment in the Nuclear Engineering minor program has been very solid and we strongly believe that all relevant support will continue. It should be noted that the programs sustainability was scrutinized when DOE awarded us with a \$295K grant to develop the Nuclear Radiation laboratory.

The student interest level has been strong right from the program's inception and grows unabated. This interest level can be gauged by an impressive student survey (when the program was planned), a healthy enrollment in the very first class that was offered (40 students), and a large turnout at seminars when attendance is voluntary. Even local high-school students have shown up in healthy numbers for the workshops that were conducted for them. All these point to

the fact that from the student's perspective, the NE minor program will continue to be an attractive option.

Sustainability of the proposed project will be further ensured by commitment not only at the College level but also at the departmental level. The department of Mechanical & Aerospace Engineering is considering giving a course release to the PI (Ratan Kumar) even if the requested funding does not come through. All the involved departments (Mechanical and Aerospace, Fine Arts, and Electrical Engineering) are prepared for cost-sharing to accommodate the faculty's time to make this project a success.

References:

1. Wulf, W. A., and Fisher, G. M. C., "A Makeover for Engineering Education," *Issues in Science and Technology*, Vol. XVIII, No. 3, pp. 35-39, Spring 2002.
  2. Farrell, E. F., "Engineering a Warmer Welcome for Female Students," *The Chronicle of Higher Education*, February 22, 2002.
- Ribando, R.J., Scott, T.C., Richards, L.G., O'Leary, G.W., "Using Software with Visualization to Teach Heat Transfer Concepts," *Proceedings of the 2002 American Society for Engineering Education Annual Conference & Exposition*, Montreal, CA, June 2002.

## **Attachment C – Standard Terms and Conditions**

### **The Nuclear Regulatory Commission's Standard Terms and Conditions for U.S. Nongovernmental Grantees**

#### **Preface**

This award is based on the application submitted to, and as approved by, the Nuclear Regulatory Commission (NRC) under the authorization 42 USC 2051(b) pursuant to section 31b and 141b of the Atomic Energy Act of 1954, as amended, and is subject to the terms and conditions incorporated either directly or by reference in the following:

- Grant program legislation and program regulation cited in this Notice of Grant Award.
- Restrictions on the expenditure of Federal funds in appropriation acts, to the extent those restrictions are pertinent to the award.
- Code of Federal Regulations/Regulatory Requirements - 2 CFR 215 Uniform Administrative Requirements For Grants And Agreements With Institutions Of Higher Education, Hospitals, And Other Non-Profit Organizations (OMB Circulars), as applicable.

To assist with finding additional guidance for selected items of cost as required in 2 CFR 220, 2 CFR 225, and 2 CFR 230 this URL to the Office of Management and Budget Cost Circulars is included for reference to:

A-21 (now 2 CFR 220)

A-87 (now 2 CFR 225)

A-122 (now 2 CFR 230)

A-102:

[http://www.whitehouse.gov/omb/circulars\\_index-ffm](http://www.whitehouse.gov/omb/circulars_index-ffm)

Any inconsistency or conflict in terms and conditions specified in the award will be resolved according to the following order of precedence: public laws, regulations, applicable notices published in the Federal Register, Executive Orders (EOs), Office of Management and Budget (OMB) Circulars, the Nuclear Regulatory Commission's (NRC) Mandatory Standard Provisions, special award conditions, and standard award conditions.

**Certifications and Representations:** These terms incorporate the certifications and representations required by statute, executive order, or regulation that were submitted with the SF424B application through Grants.gov.

#### **I. Mandatory General Requirements**

The order of these requirements does not make one requirement more important than any other requirement.

##### **1. Applicability of 2 CFR Part 215**

a. All provisions of 2 CFR Part 215 and all Standard Provisions attached to this grant/cooperative agreement are applicable to the Grantee and to sub-recipients which meet the definition of "Grantee" in Part 215, unless a section specifically excludes a sub-recipient from coverage. The Grantee and any sub-recipients must, in addition to the assurances made as part of the application, comply and require each of its sub-awardees employed in the completion

of the project to comply with Subpart C of 2 CFR 215 and include this term in lower-tier (subaward) covered transactions.

b. Grantees must comply with monitoring procedures and audit requirements in accordance with OMB Circular A-133. <

[http://www.whitehouse.gov/omb/circulars/a133\\_compliance/08/08toc.aspx](http://www.whitehouse.gov/omb/circulars/a133_compliance/08/08toc.aspx) >

## **2. Award Package**

### **§ 215.41 Grantee responsibilities**

The Grantee is obligated to conduct such project oversight as may be appropriate, to manage the funds with prudence, and to comply with the provisions outlined in 2 CFR 215.41. Within this framework, the Principal Investigator (PI) named on the award face page, Block 11, is responsible for the scientific or technical direction of the project and for preparation of the project performance reports. This award is funded on a cost reimbursement basis not to exceed the amount awarded as indicated on the face page, Block 16., and is subject to a refund of unexpended funds to NRC.

The standards contained in this section do not relieve the Grantee of the contractual responsibilities arising under its contract(s). The Grantee is the responsible authority, without recourse to the NRC, regarding the settlement and satisfaction of all contractual and administrative issues arising out of procurements entered into in support of an award or other agreement. This includes disputes, claims, protests of award, source evaluation or other matters of a contractual nature. Matters concerning violation of statute are to be referred to such Federal, State or local authority as may have proper jurisdiction.

### **Subgrants**

#### **Appendix A to Part 215—Contract Provisions**

Sub-recipients, sub-awardees, and contractors have no relationship with NRC under the terms of this grant/cooperative agreement. All required NRC approvals must be directed through the Grantee to NRC. See 2 CFR 215 and 215.41.

### **Nondiscrimination**

(This provision is applicable when work under the grant/cooperative agreement is performed in the U.S. or when employees are recruited in the U.S.)

No U.S. citizen or legal resident shall be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any program or activity funded by this award on the basis of race, color, national origin, age, religion, handicap, or sex. The Grantee agrees to comply with the non-discrimination requirements below:

Title VI of the Civil Rights Act of 1964 (42 USC §§ 2000d et seq)

Title IX of the Education Amendments of 1972 (20 USC §§ 1681 et seq)

Section 504 of the Rehabilitation Act of 1973, as amended (29 USC § 794)

The Age Discrimination Act of 1975, as amended (42 USC §§ 6101 et seq)

The Americans with Disabilities Act of 1990 (42 USC §§ 12101 et seq)

Parts II and III of EO 11246 as amended by EO 11375 and 12086.

EO 13166, "Improving Access to Services for Persons with Limited English Proficiency."

Any other applicable non-discrimination law(s).

Generally, Title VI of the Civil Rights Act of 1964, 42 USC § 2000e et seq, provides that it shall be an unlawful employment practice for an employer to discharge any individual or otherwise to discriminate against an individual with respect to compensation, terms, conditions, or privileges of employment because of such individual's race, color, religion, sex, or national origin. However, Title VI, 42 USC § 2000e-1(a), expressly exempts from the prohibition against discrimination on the basis of religion, a religious corporation, association, educational institution, or society with respect to the employment of individuals of a particular religion to perform work connected with the carrying on by such corporation, association, educational institution, or society of its activities.

#### **Modifications/Prior Approval**

NRC's prior written approval may be required before a Grantee makes certain budget modifications or undertakes particular activities. If NRC approval is required for changes in the grant or cooperative agreement, it must be requested of, and obtained from, the NRC Grants Officer in advance of the change or obligation of funds. All requests for NRC prior approval should be made, in writing (which includes submission by e-mail), to the designated Grants Specialist and Program Office no later than 30 days before the proposed change. The request must be signed by both the PI and the authorized organizational official. Failure to obtain prior approval, when required, from the NRC Grants Officer may result in the disallowance of costs, or other enforcement action within NRC's authority.

#### **Lobbying Restrictions**

The Grantee will comply, as applicable, with provisions of the Hatch Act (5 U.S.C. §§1501-1508 and 7324-7328) which limit the political activities of employees whose principal employment activities are funded in whole or in part with Federal funds.

The Grantee shall comply with provisions of 31 USC § 1352. This provision generally prohibits the use of Federal funds for lobbying in the Executive or Legislative Branches of the Federal Government in connection with the award, and requires disclosure of the use of non-Federal funds for lobbying.

The Grantee receiving in excess of \$100,000 in Federal funding shall submit a completed Standard Form (SF) LLL, "Disclosure of Lobbying Activities," regarding the use of non-Federal funds for lobbying within 30 days following the end of the calendar quarter in which there occurs any event that requires disclosure or that materially affects the accuracy of the information contained in any disclosure form previously filed. The Grantee must submit the SF-LLL, including those received from sub-recipients, contractors, and subcontractors, to the Grants Officer.

#### **§ 215.13 Debarment And Suspension.**

The Grantee agrees to notify the Grants Officer immediately upon learning that it or any of its principals:

- (1) Are presently excluded or disqualified from covered transactions by any Federal department or agency;
- (2) Have been convicted within the preceding three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State, or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or

destruction of records, making false statements, tax evasion, receiving stolen property, making false claims, or obstruction of justice; commission of any other offense indicating a lack of business integrity or business honesty that seriously and directly affects your present responsibility;

(3) Are presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State, or local) with commission of any of the offenses enumerated in paragraph (1)(b); and

(4) Have had one or more public transactions (Federal, State, or local) terminated for cause or default within the preceding three years.

b. The Grantee agrees that, unless authorized by the Grants Officer, it will not knowingly enter into any subgrant or contracts under this grant/cooperative agreement with a person or entity that is included on the Excluded Parties List System (<http://epls.arnet.gov>).

The Grantee further agrees to include the following provision in any subgrant or contracts entered into under this award:

'Debarment, Suspension, Ineligibility, and Voluntary Exclusion

The Grantee certifies that neither it nor its principals is presently excluded or disqualified from participation in this transaction by any Federal department or agency. The policies and procedures applicable to debarment, suspension, and ineligibility under NRC-financed transactions are set forth in 2 CFR Part 180.'

#### **Drug-Free Workplace**

The Grantee must be in compliance with The Federal Drug Free Workplace Act of 1988. The policies and procedures applicable to violations of these requirements are set forth in 41 USC 702.

#### **Implementation of E.O. 13224 -- Executive Order On Terrorist Financing**

The Grantee is reminded that U.S. Executive Orders and U.S. law prohibits transactions with, and the provision of resources and support to, individuals and organizations associated with terrorism. It is the legal responsibility of the Grantee to ensure compliance with these Executive Orders and laws. This provision must be included in all contracts/sub-awards issued under this grant/cooperative agreement.

Award Grantees must comply with Executive Order 13224, Blocking Property and Prohibiting Transactions with Persons who Commit, Threaten to Commit, or Support Terrorism. Information about this Executive Order can be found at: [www.fas.org/irp/offdocs/eo/eo-13224.htm](http://www.fas.org/irp/offdocs/eo/eo-13224.htm).

#### **Procurement Standards. § 215.40-48**

Sections 215.41 through 215.48 set forth standards for use by Grantees in establishing procedures for the procurement of supplies and other expendable property, equipment, real property and other services with Federal funds. These standards are furnished to ensure that such materials and services are obtained in an effective manner and in compliance with the provisions of applicable Federal statutes and executive orders. No additional procurement standards or requirements shall be imposed by the Federal awarding agencies upon Grantees, unless specifically required by Federal statute or executive order or approved by OMB.

**Travel**

Travel must be in accordance with the Grantee's Travel Regulations or the US Government Travel Policy and Regulations at: [www.gsa.gov/federaltravelregulation](http://www.gsa.gov/federaltravelregulation) and the per diem rates set forth at: [www.gsa.gov/perdiem](http://www.gsa.gov/perdiem), absent Grantee's travel regulation. Travel costs for the grant must be consistent with provisions as established in Appendix A to 2 CFR 220 (J.53). All other travel, domestic or international, must not increase the total estimated award amount.

**Domestic Travel:**

Domestic travel is an appropriate charge to this award and prior authorization for specific trips are not required, if the trip is identified in the Grantee's approved program description and approved budget. Domestic trips not stated in the approved budget require the written prior approval of the Grants Officer, and must not increase the total estimated award amount.

All common carrier travel reimbursable hereunder shall be via the least expensive class rates consistent with achieving the objective of the travel and in accordance with the Grantee's policies and practices. Travel by first-class travel is not authorized unless prior approval is obtained from the Grants Officer.

**International Travel:**

**International travel requires PRIOR written approval by the Project Officer and the Grants Officer, even if the international travel is stated in the approved program description and the approved budget.**

The Grantee shall comply with the provisions of the Fly American Act (49 USC 40118) as implemented through 41 CFR 301-10.131 through 301-10.143.

**Property and Equipment Management Standards**

Property and equipment standards of this award shall follow provisions as established in 2 CFR 215.30-37.

**Procurement Standards**

Procurement standards of this award shall follow provisions as established in 2 CFR 215.40-48

**Intangible and Intellectual Property**

Intangible and intellectual property of this award shall generally follow provisions established in 2 CFR 215.36.

**Inventions Report** - The Bayh-Dole Act (P.L. 96-517) affords Grantees the right to elect and retain title to inventions they develop with funding under an NRC grant award ("subject inventions"). In accepting an award, the Grantee agrees to comply with applicable NRC policies, the Bayh-Dole Act, and its Government-wide implementing regulations found at Title 37, Code of Federal Regulations (CFR) Part 401. A significant part of the regulations require that the Grantee report all subject inventions to the awarding agency (NRC) as well as include an acknowledgement of federal support in any patents. NRC participates in the trans-government Interagency Edison system (<http://www.iedison.gov>) and expects NRC funding Grantees to use this system to comply with Bayh-Dole and related intellectual property reporting requirements. The system allows for Grantees to submit reports electronically via the Internet. In addition, the invention must be reported in continuation applications (competing or non-competing).

**Patent Notification Procedures-** Pursuant to EO 12889, NRC is required to notify the owner of any valid patent covering technology whenever the NRC or its financial assistance Grantees, without making a patent search, knows (or has demonstrable reasonable grounds to know) that technology covered by a valid United States patent has been or will be used without a license from the owner. To ensure proper notification, if the Grantee uses or has used patented technology under this award without license or permission from the owner, the Grantee must notify the Grants Officer. This notice does not necessarily mean that the Government authorizes and consents to any copyright or patent infringement occurring under the financial assistance.

**Data, Databases, and Software** - The rights to any work produced or purchased under a NRC federal financial assistance award are determined by 2 CFR 215.36. Such works may include data, databases or software. The Grantee owns any work produced or purchased under a NRC federal financial assistance award subject to NRC's right to obtain, reproduce, publish or otherwise use the work or authorize others to receive, reproduce, publish or otherwise use the data for Government purposes.

**Copyright** - The Grantee may copyright any work produced under a NRC federal financial assistance award subject to NRC's royalty-free nonexclusive and irrevocable right to reproduce, publish or otherwise use the work or authorize others to do so for Government purposes. Works jointly authored by NRC and Grantee employees may be copyrighted but only the part authored by the Grantee is protected because, under 17 USC § 105, works produced by Government employees are not copyrightable in the United States. On occasion, NRC may ask the Grantee to transfer to NRC its copyright in a particular work when NRC is undertaking the primary dissemination of the work. Ownership of copyright by the Government through assignment is permitted under 17 USC § 105.

**Records Retention and Access Requirements** for records of the Grantee shall follow established provisions in 2 CFR 215.53.

### **Organizational Prior Approval System**

In order to carry out its responsibilities for monitoring project performance and for adhering to award terms and conditions, each Grantee organization shall have a system to ensure that appropriate authorized officials provide necessary organizational reviews and approvals in advance of any action that would result in either the performance or modification of an NRC supported activity where prior approvals are required, including the obligation or expenditure of funds where the governing cost principles either prescribe conditions or require approvals.

The Grantee shall designate an appropriate official or officials to review and approve the actions requiring NRC prior approval. Preferably, the authorized official(s) should be the same official(s) who sign(s) or countersign(s) those types of requests that require prior approval by NRC. The authorized organization official(s) shall not be the principal investigator or any official having direct responsibility for the actual conduct of the project, or a subordinate of such individual.

**Conflict Of Interest Standards** for this award shall follow OCOI requirements set forth in Section 170A of the Atomic Energy Act of 1954, as amended, and provisions set forth at 2 CFR 215.42 Codes of Conduct.

### **Dispute Review Procedures**

- a. Any request for review of a notice of termination or other adverse decision should be addressed to the Grants Officer. It must be postmarked or transmitted electronically no later than 30 days after the postmarked date of such termination or adverse decision from the Grants Officer.
- b. The request for review must contain a full statement of the Grantee's position and the pertinent facts and reasons in support of such position.
- c. The Grants Officer will promptly acknowledge receipt of the request for review and shall forward it to the Director, Office of Administration, who shall appoint an intra-agency Appeal Board to review a grantee appeal of an agency action, if required, which will consist of the program office director, the Deputy Director of Office of Administration, and the Office of General Counsel.
- d. Pending resolution of the request for review, the NRC may withhold or defer payments under the award during the review proceedings.
- e. The review committee will request the Grants Officer who issued the notice of termination or adverse action to provide copies of all relevant background materials and documents. The committee may, at its discretion, invite representatives of the Grantee and the NRC program office to discuss pertinent issues and to submit such additional information as it deems appropriate. The chairman of the review committee will insure that all review activities or proceedings are adequately documented.
- f. Based on its review, the committee will prepare its recommendation to the Director, Office of Administration, who will advise the parties concerned of his/her decision.

**Termination and Enforcement.** Termination of this award by default or by mutual consent shall follow provisions as established in 2 CFR 215.60-62.

#### **Monitoring and Reporting § 215.50-53**

a. Grantee Financial Management systems must comply with the established provisions in 2 CFR 215.21

- Payment – 2 CFR 215.22
- Cost Share – 2 CFR 215.23
- Program Income – 2 CFR 215.24
  - Earned program income, if any, shall be added to funds committed to the project by the NRC and Grantee and used to further eligible project or program objectives or deducted from the total project cost allowable cost as directed by the Grants Officer or the terms and conditions of award.
- Budget Revision – 2 CFR 215.25
  - The Grantee is required to report deviations from the approved budget and program descriptions in accordance with 2 CFR 215.25, and request prior written approval from the Program Officer and the Grants Officer.
  - The Grantee is not authorized to rebudget between direct costs and indirect costs without written approval of the Grants Officer.
  - The Grantee is authorized to transfer funds among direct cost categories up to a cumulative 10 percent of the total approved budget. The Grantee is not allowed

to transfer funds if the transfer would cause any Federal appropriation to be used for purposes other than those consistent with the original intent of the appropriation.

- o Allowable Costs – 2 CFR 215.27

#### **b. Federal Financial Reports**

The Grantee shall submit a "Federal Financial Report" (SF-425) on a quarterly basis for the periods ending March 31, June 30, September 30, and December 31, or any portion thereof, unless otherwise specified in a special award condition. Reports are due no later than 30 days following the end of each reporting period. A final SF-425 is due within 90 days after expiration of the award. The report should be submitted electronically to:

Grants\_FFR@NRC.GOV. (**NOTE: There is an underscore between Grants and FFR**).

#### **Period of Availability of Funds 2 CFR § 215.28**

a. Where a funding period is specified, a Grantee may charge to the grant only allowable costs resulting from obligations incurred during the funding period and any pre-award costs authorized by the NRC.

b. Unless otherwise authorized in 2 CFR 215.25(e)(2) or a special award condition, any extension of the award period can only be authorized by the Grants Officer in writing. Verbal or written assurances of funding from other than the Grants Officer shall not constitute authority to obligate funds for programmatic activities beyond the expiration date.

c. The NRC has no obligation to provide any additional prospective or incremental funding. Any modification of the award to increase funding and to extend the period of performance is at the sole discretion of the NRC.

d. Requests for extensions to the period of performance should be sent to the Grants Officer at least 30 days prior to the grant/cooperative agreement expiration date. Any request for extension after the expiration date may not be honored.

#### **Automated Standard Application For Payments (ASAP) Procedures**

Unless otherwise provided for in the award document, payments under this award will be made using the Department of Treasury's Automated Standard Application for Payment (ASAP) system < <http://www.fms.treas.gov/asap/> >. Under the ASAP system, payments are made through preauthorized electronic funds transfers, in accordance with the requirements of the Debt Collection Improvement Act of 1996. In order to receive payments under ASAP, Grantees are required to enroll with the Department of Treasury, Financial Management Service, and Regional Financial Centers, which allows them to use the on-line method of withdrawing funds from their ASAP established accounts. The following information will be required to make withdrawals under ASAP: (1) ASAP account number – the award number found on the cover sheet of the award; (2) Agency Location Code (ALC) – 31000001; and Region Code. Grantees enrolled in the ASAP system do not need to submit a "Request for Advance or Reimbursement" (SF-270), for payments relating to their award.

#### **Audit Requirements**

Organization-wide or program-specific audits shall be performed in accordance with the Single Audit Act Amendments of 1996, as implemented by OMB Circular A-133, "Audits of States, Local Governments, and Non-Profit Organizations."

<http://www.whitehouse.gov/omb/circulars/a133/a133.html> Grantees are subject to the provisions of OMB Circular A-133 if they expend \$500,000 or more in a year in Federal awards.

The Form SF-SAC and the Single Audit Reporting packages for fiscal periods ending on or after January 1, 2008 must be submitted online.

1. Create your online report ID at <http://harvester.census.gov/fac/collect/ddeindex.html>
2. Complete the Form SF-SAC
3. Upload the Single Audit
4. Certify the Submission
5. Click "Submit."

Organizations expending less than \$500,000 a year are not required to have an annual audit for that year but must make their grant-related records available to NRC or other designated officials for review or audit.

### **III. Programmatic Requirements**

#### **Performance (Technical) Reports**

a. The Grantee shall submit performance (technical) reports electronically to the NRC Project Officer and Grants Officer on a semi-annual basis unless otherwise authorized by the Grants Officer. Performance reports should be sent to the Program Officer at the email address indicated in Block 12 of the Notice of Award, and to Grants Officer at:

Grants\_PPR.Resource@NRC.GOV. (***NOTE: There is an underscore between Grants and PPR.***)

b. Unless otherwise specified in the award provisions, performance (technical) reports shall contain brief information as prescribed in the applicable uniform administrative requirements 2 CFR §215.51 which are incorporated in the award.

c. The Office of Human Resources requires the submission of the semi-annual progress report on the SF-PPR, SF-PPR-B, and the SF-PPR-E forms. The submission for the six month period ending March 31<sup>st</sup> is due by April 30<sup>th</sup>, or any portion thereof. The submission for the six month period ending September 30<sup>th</sup> is due by October 31<sup>st</sup> or any portion thereof.

d. Grant Performance Metrics:

The Office of Management and Budget requires all Federal Agencies providing funding for educational scholarships and fellowships as well as other educational related funding to report on specific metrics. These metrics are part of the Academic Competitiveness Council's (ACC) 2007 report and specifically relates to Science, Technology, Engineering, and Mathematics (STEM) curricula.

As part of the FY 2010 HR grant awards, in addition to the customary performance progress report requested on the SF-PPR, SF-PPR-B, and SF-PPR-E forms, HR requires the following metrics to be reported on by the awardees as follows:

#### **Curriculum Development Awards**

1. Overall number of new courses developed in NRC designated STEM areas;

2. Number of students enrolled in new STEM courses;
3. Number of these enrolled students retained in STEM major.

### **Unsatisfactory Performance**

Failure to perform the work in accordance with the terms of the award and maintain at least a satisfactory performance rating or equivalent evaluation may result in designation of the Grantee as high risk and assignment of special award conditions or other further action as specified in the standard term and condition entitled "Termination."

Failure to comply with any or all of the provisions of the award may have a negative impact on future funding by NRC and may be considered grounds for any or all of the following actions: establishment of an accounts receivable, withholding of payments under any NRC award, changing the method of payment from advance to reimbursement only, or the imposition of other special award conditions, suspension of any NRC active awards, and termination of any NRC award.

### **Other Federal Awards With Similar Programmatic Activities**

The Grantee shall immediately provide written notification to the NRC Project Officer and the Grants Officer in the event that, subsequent to receipt of the NRC award, other financial assistance is received to support or fund any portion of the program description incorporated into the NRC award. NRC will not pay for costs that are funded by other sources.

### **Prohibition Against Assignment By The Grantee**

The Grantee shall not transfer, pledge, mortgage, or otherwise assign the award, or any interest therein, or any claim arising thereunder, to any party or parties, banks, trust companies, or other financing or financial institutions without the express written approval of the Grants Officer.

### **Site Visits**

The NRC, through authorized representatives, has the right, at all reasonable times, to make site visits to review project accomplishments and management control systems and to provide such technical assistance as may be required. If any site visit is made by the NRC on the premises of the Grantee or contractor under an award, the Grantee shall provide and shall require his/her contractors to provide all reasonable facilities and assistance for the safety and convenience of the Government representative in the performance of their duties. All site visits and evaluations shall be performed in such a manner as will not unduly delay the work.

## **IV. Miscellaneous Requirements**

### **Criminal and Prohibited Activities**

- a. The Program Fraud Civil Remedies Act (31 USC §§ 3801-3812), provides for the imposition of civil penalties against persons who make false, fictitious, or fraudulent claims to the Federal government for money (including money representing grant/cooperative agreements, loans, or other benefits.)
- b. False statements (18 USC § 287), provides that whoever makes or presents any false, fictitious, or fraudulent statements, representations, or claims against the United States shall be subject to imprisonment of not more than five years and shall be subject to a fine in the amount provided by 18 USC § 287.

- c. False Claims Act (31 USC 3729 et seq), provides that suits under this Act can be brought by the government, or a person on behalf of the government, for false claims under federal assistance programs.
- d. Copeland "Anti-Kickback" Act (18 USC § 874), prohibits a person or organization engaged in a federally supported project from enticing an employee working on the project from giving up a part of his compensation under an employment contract.

#### **American-Made Equipment And Products**

Grantees are hereby notified that they are encouraged, to the greatest extent practicable, to purchase American-made equipment and products with funding provided under this award.

#### **Increasing Seat Belt Use in the United States**

Pursuant to EO 13043, Grantees should encourage employees and contractors to enforce on-the-job seat belt policies and programs when operating company-owned, rented or personally-owned vehicle.

#### **Federal Leadership of Reducing Text Messaging While Driving**

Pursuant to EO 13513, Grantees should encourage employees, sub-awardees, and contractors to adopt and enforce policies that ban text messaging while driving company-owned, rented vehicles or privately owned vehicles when on official Government business or when performing any work for or on behalf of the Federal Government.

#### **Federal Employee Expenses**

Federal agencies are generally barred from accepting funds from a Grantee to pay transportation, travel, or other expenses for any Federal employee unless specifically approved in the terms of the award. Use of award funds (Federal or non-Federal) or the Grantee's provision of in-kind goods or services, for the purposes of transportation, travel, or any other expenses for any Federal employee may raise appropriation augmentation issues. In addition, NRC policy prohibits the acceptance of gifts, including travel payments for Federal employees, from Grantees or applicants regardless of the source.

#### **Minority Serving Institutions (MSIs) Initiative**

Pursuant to EOs 13256, 13230, and 13270, NRC is strongly committed to broadening the participation of MSIs in its financial assistance program. NRC's goals include achieving full participation of MSIs in order to advance the development of human potential, strengthen the Nation's capacity to provide high-quality education, and increase opportunities for MSIs to participate in and benefit from Federal financial assistance programs. NRC encourages all applicants and Grantees to include meaningful participations of MSIs. Institutions eligible to be considered MSIs are listed on the Department of Education website:  
<http://www.ed.gov/about/offices/list/ocr/edlite-minorityinst.html>

#### **Research Misconduct**

Scientific or research misconduct refers to the fabrication, falsification, or plagiarism in proposing, performing, or reviewing research, or in reporting research results. It does not include honest errors or differences of opinions. The Grantee organization has the primary responsibility to investigate allegations and provide reports to the Federal Government. Funds expended on an activity that is determined to be invalid or unreliable because of scientific misconduct may result in a disallowance of costs for which the institution may be liable for repayment to the awarding agency. The Office of Science and Technology Policy at the White House published in the Federal Register on December 6, 2000, a final policy that addressed

research misconduct. The policy was developed by the National Science and Technology Council (65 FR 76260). The NRC requires that any allegation be submitted to the Grants Officer, who will also notify the OIG of such allegation. Generally, the Grantee organization shall investigate the allegation and submit its findings to the Grants Officer. The NRC may accept the Grantee's findings or proceed with its own investigation. The Grants Officer shall inform the Grantee of the NRC's final determination.

### **Publications, Videos, and Acknowledgment of Sponsorship**

Publication of the results or findings of a research project in appropriate professional journals and production of video or other media is encouraged as an important method of recording and reporting scientific information. It is also a constructive means to expand access to federally funded research. The Grantee is required to submit a copy to the NRC and when releasing information related to a funded project include a statement that the project or effort undertaken was or is sponsored by the NRC. The Grantee is also responsible for assuring that every publication of material (including Internet sites and videos) based on or developed under an award, except scientific articles or papers appearing in scientific, technical or professional journals, contains the following disclaimer:

"This [report/video] was prepared by [Grantee name] under award [number] from [name of operating unit], Nuclear Regulatory Commission. The statements, findings, conclusions, and recommendations are those of the author(s) and do not necessarily reflect the view of the [name of operating unit] or the US Nuclear Regulatory Commission."

### **Trafficking In Victims Protection Act Of 2000 (as amended by the Trafficking Victims Protection Reauthorization Act of 2003)**

Section 106(g) of the Trafficking In Victims Protection Act Of 2000 (as amended as amended, directs on a government-wide basis that:

"any grant, contract, or cooperative agreement provided or entered into by a Federal department or agency under which funds are to be provided to a private entity, in whole or in part, shall include a condition that authorizes the department or agency to terminate the grant, contract, or cooperative agreement, without penalty, if the grantee or any subgrantee, or the contractor or any subcontractor (i) engages in severe forms of trafficking in persons or has procured a commercial sex act during the period of time that the grant, contract, or cooperative agreement is in effect, or (ii) uses forced labor in the performance of the grant, contract, or cooperative agreement." (22 U.S.C. § 7104(g)).

### **Executive Compensation**

2 CFR 170.220 directs agencies to include the following text to each grant award to a non-federal entity if the total funding is \$25,000 or more in Federal funding.

Reporting Subawards and Executive Compensation.

#### *a. Reporting of first-tier subawards.*

1. *Applicability.* Unless you are exempt as provided in paragraph d. of this award term, you must report each action that obligates \$25,000 or more in Federal funds that does not include

Recovery funds (as defined in section 1512(a)(2) of the American Recovery and Reinvestment Act of 2009, Pub. L. 111-5) for a subaward to an entity (see definitions in paragraph e. of this award term).

*2. Where and when to report.*

- i. You must report each obligating action described in paragraph a.1. of this award term to <http://www.fsrs.gov>.
- ii. For subaward information, report no later than the end of the month following the month in which the obligation was made. (For example, if the obligation was made on November 7, 2010, the obligation must be reported by no later than December 31, 2010.)

*3. What to report.* You must report the information about each obligating action that the submission instructions posted at <http://www.fsrs.gov> specify.

*b. Reporting Total Compensation of Recipient Executives.*

*1. Applicability and what to report.* You must report total compensation for each of your five most highly compensated executives for the preceding completed fiscal year, if—

- i. the total Federal funding authorized to date under this award is \$25,000 or more;
- ii. in the preceding fiscal year, you received—

(A) 80 percent or more of your annual gross revenues from Federal procurement contracts (and subcontracts) and Federal financial assistance subject to the Transparency Act, as defined at 2 CFR 170.320 (and subawards); and

(B) \$25,000,000 or more in annual gross revenues from Federal procurement contracts (and subcontracts) and Federal financial assistance subject to the Transparency Act, as defined at 2 CFR 170.320 (and subawards); and

iii. The public does not have access to information about the compensation of the executives through periodic reports filed under section 13(a) or 15(d) of the Securities Exchange Act of 1934 (15 U.S.C. 78m(a), 78o(d)) or section 6104 of the Internal Revenue Code of 1986. (To determine if the public has access to the compensation information, see the U.S. Security and Exchange Commission total compensation filings at <http://www.sec.gov/answers/execomp.htm>.)

*2. Where and when to report.* You must report executive total compensation described in paragraph b.1. of this award term:

- i. As part of your registration profile at <http://www.ccr.gov>.
- ii. By the end of the month following the month in which this award is made, and annually thereafter.

*c. Reporting of Total Compensation of Subrecipient Executives.*

1. *Applicability and what to report.* Unless you are exempt as provided in paragraph d. of this award term, for each first-tier subrecipient under this award, you shall report the names and total compensation of each of the subrecipient's five most highly compensated executives for the subrecipient's preceding completed fiscal year, if—

i. in the subrecipient's preceding fiscal year, the subrecipient received—

(A) 80 percent or more of its annual gross revenues from Federal procurement contracts (and subcontracts) and Federal financial assistance subject to the Transparency Act, as defined at 2 CFR 170.320 (and subawards); and

(B) \$25,000,000 or more in annual gross revenues from Federal procurement contracts (and subcontracts), and Federal financial assistance subject to the Transparency Act (and subawards); and

ii. The public does not have access to information about the compensation of the executives through periodic reports filed under section 13(a) or 15(d) of the Securities Exchange Act of 1934 (15 U.S.C. 78m(a), 78o(d)) or section 6104 of the Internal Revenue Code of 1986. (To determine if the public has access to the compensation information, see the U.S. Security and Exchange Commission total compensation filings at <http://www.sec.gov/answers/execomp.htm>.)

2. *Where and when to report.* You must report subrecipient executive total compensation described in paragraph c.1. of this award term:

i. To the recipient.

ii. By the end of the month following the month during which you make the subaward. For example, if a subaward is obligated on any date during the month of October of a given year (i.e., between October 1 and 31), you must report any required compensation information of the subrecipient by November 30 of that year.

d. *Exemptions*

If, in the previous tax year, you had gross income, from all sources, under \$300,000, you are exempt from the requirements to report:

i. Subawards,

and

ii. The total compensation of the five most highly compensated executives of any subrecipient.

e. *Definitions.* For purposes of this award term:

1. *Entity* means all of the following, as defined in 2 CFR part 25:

i. A Governmental organization, which is a State, local government, or Indian tribe;

- ii. A foreign public entity;
- iii. A domestic or foreign nonprofit organization;
- iv. A domestic or foreign for-profit organization;
- v. A Federal agency, but only as a subrecipient under an award or subaward to a non-Federal entity.

2. *Executive* means officers, managing partners, or any other employees in management positions.

3. *Subaward*:

- i. This term means a legal instrument to provide support for the performance of any portion of the substantive project or program for which you received this award and that you as the recipient award to an eligible subrecipient.
- ii. The term does not include your procurement of property and services needed to carry out the project or program (for further explanation, see Sec. \_\_.210 of the attachment to OMB Circular A-133, "Audits of States, Local Governments, and Non-Profit Organizations").
- iii. A subaward may be provided through any legal agreement, including an agreement that you or a subrecipient considers a contract.

4. *Subrecipient* means an entity that:

- i. Receives a subaward from you (the recipient) under this award; and
- ii. Is accountable to you for the use of the Federal funds provided by the subaward.

5. *Total compensation* means the cash and noncash dollar value earned by the executive during the recipient's or subrecipient's preceding fiscal year and includes the following (for more information see 17 CFR 229.402(c)(2)):

- i. *Salary and bonus*.
- ii. *Awards of stock, stock options, and stock appreciation rights*. Use the dollar amount recognized for financial statement reporting purposes with respect to the fiscal year in accordance with the Statement of Financial Accounting Standards No. 123 (Revised 2004) (FAS 123R), Shared Based Payments.
- iii. *Earnings for services under non-equity incentive plans*. This does not include group life, health, hospitalization or medical reimbursement plans that do not discriminate in favor of executives, and are available generally to all salaried employees.
- iv. *Change in pension value*. This is the change in present value of defined benefit and actuarial pension plans.

v. *Above-market earnings on deferred compensation which is not tax-qualified.*

vi. Other compensation, if the aggregate value of all such other compensation (e.g. severance, termination payments, value of life insurance paid on behalf of the employee, perquisites or property) for the executive exceeds \$10,000.