

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

1. GRANT/AGREEMENT NO. NRC-HQ-11-G-38-0051		2. MODIFICATION NO.		3. PERIOD OF PERFORMANCE FROM: 8/22/2011 TO: 8/31/2012		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 State-Controlled Institution of Higher ED DUNS: 069264398 NAICS: 611310		7. RECIPIENT NAME, ADDRESS, and EMAIL ADDRESS  University of Hartford 200 Bloomfield Avenue West Hartford, CT 06117-1545			
8. PROJECT TITLE:  Use of Physical and Computer Models to Enhance Learning for Nuclear Power Plant Design and Operation							
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 Attn: Dr. Tom Filburn College of Engineering, CETA Email: Filburn@hartford.edu 860-768-5554			
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: 2011-84-51-K-134 JOB CODE: T8453 BOC NO: 4110 OFFICE ID NO: RPPA: HR-11-261 FAMIS 620047		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 <u>\$121,560.00</u>  PREVIOUS OBLIGATION _____  TOTAL <u>\$121,560.00</u>		16. TOTAL FUNDING AGREEMENT  NRC <u>\$121,560.00</u>  RECIPIENT <u>\$15,000.00</u>  TOTAL <u>\$136,560.00</u>  This action provides funds for Fiscal Year in the amount of <u>See Page Two</u>					
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  <u>Sheila Bumpass</u> <u>8/19/11</u> (Signature) (Date) NAME (TYPED) <u>Sheila Bumpass</u>  TITLE <u>Contracting Officer</u>  TELEPHONE NO. <u>301-492-3484</u>			
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 to the "Use of Physical and Computer Models to Enhance Learning for Nuclear Power Plant Design and Operation" 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, 2012.

2. Funds obligated hereunder are available for program expenditures for the estimated period: August 22, 2011 – August 31, 2012.

### A. GENERAL

1. Total Estimated NRC Amount:	\$121,560
2. Total Obligated Amount:	\$121,560
3. Cost-Sharing Amount:	\$15,000
4. Activity Title:	Use of Physical and Computer Models to Enhance Learning for Nuclear Power Plant Design and Operation
5. NRC Project Officer:	Tanya Parwani-Jaimes
6. DUNS No.:	069264398

### B. SPECIFIC

RFPA No.:	HR-11-261
FFS:	N/A
Job Code:	T8453
BOC:	4110
B&R Number:	2011-84-51-K-134
Appropriation #:	31X0200
Amount Obligated:	\$121,560

### A.3 BUDGET

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

Personnel	\$37,460
Fringe Benefit	3,005
Travel	5,000
Supplies	51,500
Contractual	3,000
Other	<u>5,000</u>
Total Direct Cost	\$104,965
Indirect Costs (47%)	<u>\$ 16,595</u>
Total	<b>\$121,560</b>

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

1. The total estimated amount of this Award is \$136,560 for the one-year period.
2. NRC hereby obligates the amount of \$121,560 for program expenditures during the period set forth above and in support of the Budget above. The Grantee will be given written notice by the Contracting Officer when additional funds will be added. 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**

This program will introduce a two semester senior level and graduate course sequence into the engineering curriculum at the University of Hartford. These two courses will be

1. ME 434/534 Fundamentals of Nuclear Engineering, This one semester, three credit course will use class room lectures to introduce the topics of Nuclear Physics, Radiation, Reactor Theory and Design, and Operation.
2. ME 435/535 Nuclear Applications for Power Engineering (NAPE), this one semester, four credit course will use lecture and laboratory examples (physical/computer models). Both lectures and models will focus on the design and operation of power reactors.

Both of the courses listed above will be offered as first year graduate courses within our Mechanical Engineering Curriculum. The courses will be co-listed and taught at the same time as the senior level undergraduate, technical elective course. Obviously additional requirements will be added to the graduate level courses, which may include additional special topics and/or semester long research topics with detailed reports.

To support the two courses, we will prepare a physical see-through, operating, sub-scale, electrically energized reactor model. This model will be used to generate laboratory experiments and reinforce the operation of Pressurized Water Reactors (PWR). A second adjunct to the two courses to be developed under this program will be Computational Fluid Dynamic modules using ANSYS Fluent.

While this project will be completed in one year, the second course in the nuclear technical elective sequence will be offered in the semester immediately following the end of the program. The first year of the program will predominantly involve course, model and CFD geometry creation. The course creation work will develop detailed course curriculum, syllabi and course notes. Our strong affiliation with the Nuclear Power Plant Design Group at Westinghouse LLC will allow us to provide accurate information related to all aspects of Nuclear Power for this introductory course. The Principal Investigators for this project have a wealth of experience in the power industry and significant experience with power plant design. Our Collaborators bring unique expertise and experience to both the creation and delivery of these nuclear courses. Our initial course instructors will come from among the PI's and collaborators. Our strong relationship with Westinghouse Electric LLC, will also provide guest lecturers and adjunct faculty from among active and retired engineers at Westinghouse.

##### **Program Assessment Plan**

## **Program Assessment Plan**

We have a two phase plan for assessing the impact of these two courses. The first phase will rely on our traditional classroom assessment form. These standard forms will be handed to every student who takes these two courses. The completed form provides feedback to the instructors on the textbook, lecture material and delivery. A second assessment tool will be used for these courses too. We have created an External Advisory Board (EAB) which contains seasoned nuclear engineers from Westinghouse, Electric Boat, and Millstone Station. The EAB also contains a member of the Connecticut Department of Higher Education, which will give us insight into the requirements and potential for incorporating a nuclear engineering major within Connecticut. This board will meet three times each year (1 per semester, once in the summer) to evaluate all of the programs we have ongoing in the nuclear field. This EAB will be able to provide suggestions for lab changes, course content and practical examples from the nuclear field to incorporate into the course content.

## **Student Impact**

Traditionally, senior level technical electives like these nuclear courses have enrollments of 8-10 students. However, we expect these courses to have enrollments of >20 students for two reasons. We will co-list these courses as graduate courses. Therefore, the eligible student population will be much greater (including Westinghouse Electric, which has a large group of new employees eager to work on a Master's degree). In addition, the University of Hartford is a member of a Higher Education consortium in the Hartford CT area. Several public and private institutions in the Greater Hartford area -Rensselaer in Hartford, Hartford Seminary, St. Joseph College, St. Thomas Seminary, Trinity College, Capital Technical-Community College, Central Connecticut State University (CCSU), and the University of Connecticut in Hartford and the University of Hartford -provide one another expanded course offerings for full-time undergraduate students through cross-registration when a course is not available at a home campus. We have attached letters from Trinity College and CCSU which will greatly expand the number of engineering students impacted by these courses.

We have recently instituted an energy concentration within our undergraduate mechanical engineering curriculum. Therefore, we are seeking additional courses to offer under this program. We have two nuclear courses listed in our bulletin (ME434, ME435) but unfortunately these courses have not been taught for nearly 20 years and no notes, or syllabi are available for these courses. Therefore we will use the experience of our Principal Investigators and Collaborators to produce detailed course notes.

## **Faculty**

Our team of Principal Investigators and Collaborators have decades of experience in the power industry and more importantly in the nuclear industry. Dr. Regis Matzie will bring decades of experience at CE and Westinghouse into the course development role. Dr. Tom Filburn has spent 5 years in the nuclear industry and has continued to perform research for the energy industry. Dr. James McDonald has many years of experience at Brookhaven and other nuclear facilities. Finally, Dr. Yavuzturk has decades of experience in the energy industry. In addition to content creation, we intend to use these PI's and Collaborators as the faculty for the initial course offerings.

In addition to this experience, we can draw upon numerous experts from Westinghouse LLC for topics including, NSSS design, thermal hydraulics, and radiation protection. The Dominion Corporation has donated \$10,000 to this program. Our team will also consult with

technical experts at the Dominion Nuclear site in Waterford CT. These experts work in plant engineering support, operations and training.

### **Program Summary.**

1. Develop Fundamentals of Nuclear Engineering Course. This 3 credit course will use class room lectures to introduce the topics of Nuclear Physics, Radiation, Neutron Diffusion, Reactor Theory, Reactor Design Safety and Licensing. This senior technical elective will be offered during the latter half of this program.
2. Produce sub-scale, see through reactor using Dominion example as a sample. The Dominion model (see photo in Figure 1) uses seven 1 kW electrical heaters to provide the initial heat source (in place of the reactor core). Using cylindrical heating elements will allow us to simulate typical enriched uranium fuel with zirconium cladding. We will build a See-through reactor with the same scale as the Dominion model. This sub-scale see through reactor will be predominantly used for the second course, Nuclear Applications for Power Engineering. This four credit course will have a weekly lab supporting the lecture. The operating model will be used to reinforce topics discussed in the classroom.
3. Develop at least 4 CFD modules for students to operate using our commercial CFD code. These modules will be developed during year 1 for students to use during the Nuclear Applications for Power Engineering course (year 2). These CFD modules will be used by students during the lab portion of the course to investigate fuel and cladding response to coolant flow changes, recirculation patterns in steam generators, and energy transfer during main coolant and steam line breaks. Other topics may be added at the discretion of the investigators and with technical assistance from Westinghouse.
4. Develop Nuclear Applications for Power Engineering course. This four credit course will combine classroom lecture with a laboratory section to help students understand the design and operation of water cooled reactor systems. The laboratory section will use a novel approach combining our physical see-through reactor with computer models. Both models (physical and computer) will focus on the Nuclear Steam Supply System (NSSS). The energy conversion system (feedwater heaters moisture separator/reheater and steam turbines of most US nuclear power plants differ very little compared to fossil fueled plants. System pressures and temperatures may be lower for the nuclear fueled plants, but the basic application is identical. Therefore, we will focus on the NSSS for student understanding.

### **Deliverables**

1. Fundamentals of Nuclear Engineering Syllabus, course notes and initial course offering
    - a. Detailed syllabus for 1 semester 400 (senior) and 500 (graduate) level three credit technical elective class in nuclear engineering (offered within energy concentration of mechanical engineering department)
    - b. Detailed class notes for 14 week Fundamentals of Nuclear Engineering class
    - c. Initial class offering (Fall 2011, assuming August 2011 program kick-off)
  2. Complete design and fabrication of sub-scale NSSS
    - a. Sub-scale, electric powered NSSS Schematic
    - b. Detailed drawings of manufactured parts
    - c. Ordering details for purchased parts
    - d. Overall plan for building, assembling and testing of sub-scale power plant
    - e. Fabrication and start up testing of NSSS
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3. Complete CFD modules for thermal hydraulic operation of specific areas of NSSS.
  - a. CFD model of single fuel element, with ability to investigate what-if scenarios including changes in coolant flow, pressure and power flux
  - b. CFD model of Reactor coolant pipe with ability to investigate energy transfer during pipe break
  - c. CFD model of Main Steam Generator with ability to investigate recirculation flow patterns, changes in steam generation with variable coolant flows and other scenarios
  - d. CFD model of Main Steam Line with ability to investigate energy transfer during pipe break.

4. Nuclear Applications for Power Engineering, syllabus, and course notes
  - a. Detailed syllabus for 1 semester 400 (senior) and 500 (graduate) level four credit technical elective class in nuclear engineering (offered within energy concentration of mechanical engineering department)
  - b. Summary class notes for 14 week Nuclear Applications for Power Engineering class
  - c. Provide details of computer and physical experiments to be completed in lab section of class
5. Year 1 summary report, including plans for activities in following years

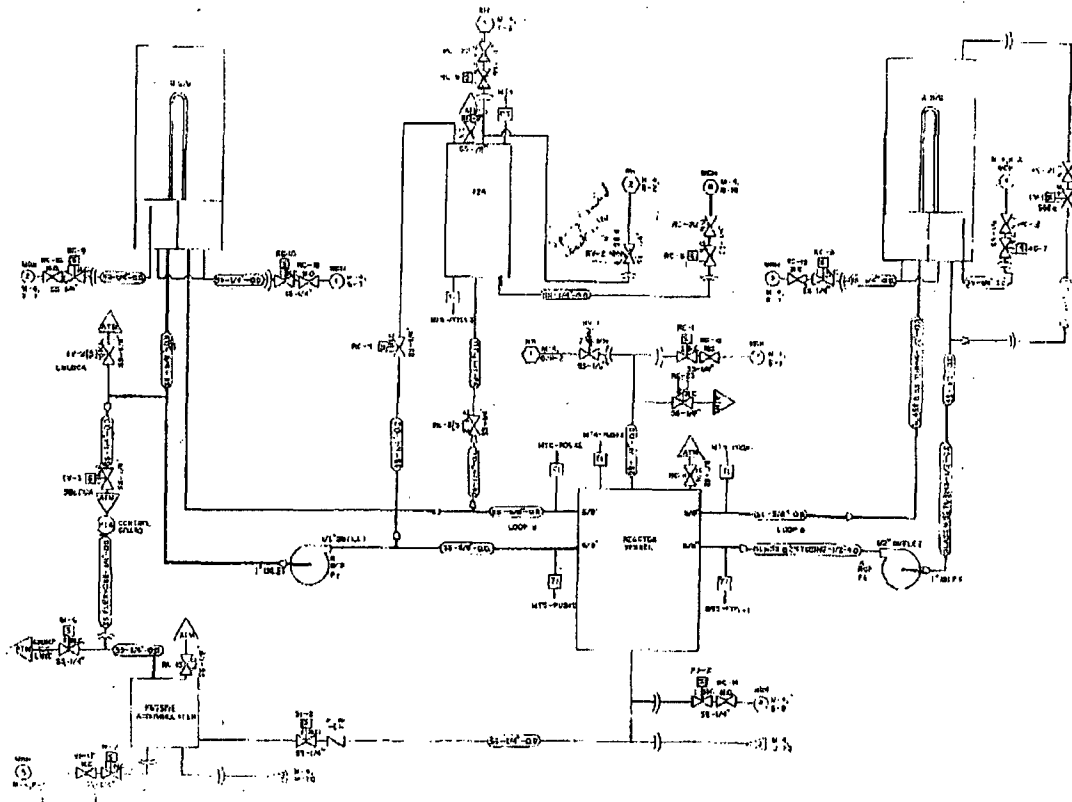
### **Program Specifics**

1. The initial effort for this program will be creating a one semester introductory course in the Fundamentals of Nuclear Engineering. We have already completed the administrative process of adding this undergraduate class to our course offering. It is a simple process to get approval for the graduate section of this course. We expect 8-10 UH undergraduate students to sign up for this Fundamentals of Nuclear Engineering course. We expect an additional 10-12 students to come from Trinity, CCSU and our graduate student population. This enrollment assessment comes from informal discussions with mechanical engineering students presently working toward the concentration in Energy engineering available within our ME department and from discussions with Trinity and CCSU faculty.

### **Table 1 Fundamentals of Nuclear Engineering course topics**

2. Design, Build and Operate Sub-scale see-through Nuclear Steam Supply System. This Sub-scale NSSS will operate with approximately 7kW of electric input power. Figure 2 below shows a detailed flow schematic of the two loop system we will be building. We intend to operate this system as a sub-cooled liquid through the reactor and coolant pumps at a pressure of 20 psig with nominal temperatures of 233-235 °F. Identical to Pressurized Water Reactors, we will maintain the pressurizer as a junction off the hot leg, at the saturation temperature of 249 °F.

The NSSS See-through reactor will be operated in conjunction with the four credit Nuclear Applications for Power Engineering Course. This bench top reactor will allow undergraduate students to see fluid flow, heat transfer, and two-phase regimes (nucleate boiling around fuel elements, steam bubble formed and maintained in pressurizer). This same model will reinforce concepts developed during the lecture portion of the course while also demonstrating the importance of understanding hardware (pump, valve and instrumentation).



**Figure 2 NSSS Flow Schematic**

1. Our team will use a commercial CFD code (eg ANSYS Fluent is presently operating within our college) to develop at least 4 modules for undergraduate students to operate "what-if" scenarios on various aspects of the NSSS. As presently envisioned these modules will also be used during the lab portion of the Nuclear Applications for Power Engineering course. We expect that the undergraduate students will use these CFD modules to investigate several important "what-if" scenarios. We will examine the coolant flow around an individual fuel element. This scenario can be used to demonstrate the effects of lower coolant flow rates, higher heat fluxes and reduced coolant pressure. A second CFD module will model coolant flow through hot leg or cold leg piping. This model will be used to examine the energy transfer to containment with pipe rupture. The third CFD model will look at recirculating secondary coolant flow within the main steam generator. This model will be able to track water and steam flow rates within a typical steam generator. The fourth model will examine energy transfer from a main steam line break either within the containment building or outside.
2. While our year long program does not allow time to offer the Nuclear Applications for Power Engineering course, we will complete a course syllabus, course outline, summary notes and schedule including the incorporation of experiments with the see through NSSS and CFD modules into the laboratory section of this class.

Figure 3 below contains a detailed schedule of our year long program.

	2011					2012						
	8	9	10	11	12	1	2	3	4	5	6	7
Task 1 - Development of the first course "Introduction to Nuclear Engineering"	X		X	X	X	X	X	X	X	X		
Task 1.1 - Research and acquisition of course materials	X	X	X									
Task 1.2 - Course development including syllabi, teaching schedule and staffing		X	X	X	X							
Task 1.3 - Offer and teach in Spring 2011						X	X	X	X	X		
Task 1.4 - Course assessment and assessment report								X	X	X	X	
Task 2 - Development, construction and testing of See-Through Nuclear Steam Supply System	X	X	X	X	X	X	X	X				
Task 2.1 - Development of materials lists	X	X	X									
Task 2.2 - Construction		X	X	X	X	X	X					
Task 2.3 - Testing and operation				X	X	X	X	X				
Task 3 - Development of Computational Fluid Dynamics modules	X	X	X	X	X	X						
Task 3.1 - Coolant flow around fuel elements simulation	X	X	X	X	X	X						
Task 3.2 - Main pipe break simulation	X	X	X	X	X	X						
Task 3.3 - Main steam generator flow simulation	X	X	X	X	X	X						
Task 3.4 - Main steam pipe break simulation	X	X	X	X	X	X						
Task 4 - Development of the second course "Applications in Power Engineering"						X	X	X	X	X		
Task 4.1 - Research and acquisition of course materials						X	X	X				
Task 4.2 - Course development including syllabi, teaching schedule and staffing							X	X	X	X		
QUARTERLY PROGRESS REPORTS			X			X			X			X

.. reduced effort yet ongoing task

**Figure 3 Year Long Program Schedule**

### Potential for Supporting Nuclear Safety

This proposed two course technical elective sequence will directly support Nuclear power plant safety. This new course sequence will be taken by undergraduate students interested in pursuing an Energy Concentration within their Mechanical Engineering program at the University of Hartford. Graduates of this program will be able to work at General Dynamics, Electric Boat Division, Westinghouse Nuclear LLC, Dominion or other companies interested in the safe design and operation of nuclear power plants. These same students will have increased familiarity with the rigors required for nuclear design and the pitfalls arising from inadequate safety standards.

We expect that these two technical electives will be another step in a continued progression of connection and support for the nuclear industry. Our University has worked senior design projects, placed interns, placed full time staff within Westinghouse Nuclear LLC.



Our students and faculty have visited the Millstone site of Dominion including the training facility, the operating plants and dry cask storage facility.

#### **Proposed Approach**

The innovation from this program comes from coupling both physical and computer models with the introduction of two new senior level technical electives Fundamental of Nuclear Engineering and Nuclear Applications for Power Engineering. The first course will provide an introduction to the fundamentals required to understand nuclear physics. The second course in this sequence will combine traditional classroom lecture with an operating model NSSS and CFD computer models to greatly improve student understanding and retention.

The working NSSS will allow students to view a variety of phenomena, including a steam/liquid pressurizer and nucleate boiling around the fuel elements. The operating NSSS will also allow students to understand the design and performance of typical commercial items, including compression tube connectors, valves (with a variety of actuators) and centrifugal pumps. The CFD modules will allow students to visualize and understand more complex flow and heat transfer concepts within the NSSS. Both the See Through Reactor and CFD modules will reinforce classroom lecture topics from the Nuclear Applications for Power Engineering course.

#### **Figure 4 Static Display of Nuclear Reactor Core and Steam Generators**

Our working model will start with electric heaters embedded within a high temperature transparent polymer (a see-through reactor core). Our initial study indicates several polymers are available to provide the transparent view, strength and thermal resistance including some polysulfones. Plexiglass<sup>®</sup> (methylmethacrylate) has the light transmission characteristics, but cannot be used at the highest temperatures desired for this power plant.

Students will be able to see the effect that varying reactor power has on overall plant performance. The water coolant will circulate through the see through reactor, around the electric heaters (with a variable power controller) exiting the reactor "hot leg" into the steam generator. The steam generator will also employ high temperature transparent polymers so that students can see the phase transformation (boiling) occurring on the "secondary side". This equipment setup is identical to that found in an operating PWR minus the nuclear fuel elements.

**Institutional Capability** This program fits into the Institutional Capability of the University of Hartford. This program enhances the varied energy offerings for our ME department Energy concentration. Our institution has the personnel, equipment and software available to complete all four parts of this proposed program. In addition, by adding these 2 courses and material for a laboratory section (CFD modules plus See-Through Reactor) we will have the "critical mass" of courses to expand into graduate programs. We have already been contacted by Westinghouse Nuclear LLC to support graduate education among their engineering staff. **Key Personnel**

We have assembled a team of four individuals to support this program. Two faculty members come from the Mechanical Engineering Department and have various expertise to support the program, Tom Filburn will be responsible for overall program completion, as well assembling the course material for both the Fundamentals of Nuclear Engineering and Nuclear Applications for Power Engineering course. Dr. Filburn will be supported by Prof McDonald from the Physics Department and Dr. Matzie (Westinghouse) in developing material for both courses. Dr. Yavuzturk, an energy systems expert will take overall responsibility for building the See-Through Reactor assembly.

### **Cost Effectiveness**

Our program is cost-effective for a variety of reasons. We have received a \$10,000 commitment from the Dominion Foundation to support this project. While Westinghouse Nuclear LLC could not provide cash support for this program, their letter of support indicates strong desire to maintain the robust connection that our organizations have had for the last three years. Their technical staff is ready to provide detailed comments to both course projects based on the decades of experience in the design, operation and support of nuclear power plants.

This program is also cost-effective because of the strong commitment from the University of Hartford and the College of Engineering, Technology and Architecture.

### **Innovative Instructional Approach**

The Innovation from this program comes from combining computer modeling, actual sub-scale hardware with a see-through capability and new lecture/laboratory courses. Coupling hands-on experiments, with computer what-if scenarios should provide strong reinforcement for the traditional lectures that are part of this program. **Improved Education Infrastructure**

The College of Engineering, Technology and Architecture (CETA) within the University of Hartford offers a traditional engineering education with majors in Civil Engineering, Electrical Engineering and Mechanical Engineering. The College offers BS and MEng degrees for the aforementioned majors. The Mechanical Engineering department requires students to take two semesters of Thermodynamics to fulfill their degree requirement. This program will greatly enhance the education infrastructure for the mechanical engineering department and our proposed energy concentration.

A working Rankine power cycle will greatly improve the education infrastructure at the University of Hartford. This sub-scale, electric powered model will allow students to examine control aspects, safety features and varied operating parameters associated with a steam rankine cycle. The faculty at the University of Hartford focus on educating students while providing an education that is steeped in real-world experience. Building this new powerful tool (sub-scale power plant) for instruction will be extremely useful for instruction in the new Nuclear Engineering course, and will be able to support traditional Mechanical Engineering courses like Thermodynamics, Heat Transfer, and Fluid Mechanics. This power plant will have the opportunity to be added to the above mentioned courses and our present laboratory course in Heat Transfer/Fluid Mechanics (ME341).

Beyond the technical features associated with this course and model, we expect this program to positively impact student learning. Coupling traditional classroom lectures with operating the sub-scale power plant will address the multiple learning styles found in University students. Additionally this combined lecture/experimental "what if" combination will resonate with the newest generation of learners who are computer literate and have been surrounded by technology since their first days in school.

We expect that these classes and models (physical and computer) will benefit present and future engineering students in the Hartford area. As a member of the greater Hartford Higher Ed consortium, our classes are open to engineering students from three additional colleges and Universities (Trinity College, CCSU and the greater Hartford branch of the University of Connecticut).

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## **Academic Focus**

The academic focus of this project will provide two new technical elective courses (Fundamentals of Nuclear Engineering, Nuclear Applications for Power Engineering) within the Mechanical Engineering department of CETA. This academic focus will also include the development of the sub-scale power plant to be operated as an adjunct to the Introduction to Nuclear Engineering course. Therefore the focus of this project is on developing two new courses, and providing a teaching tool (sub-scale power plant, CFD modules) to reinforce many of the concepts to be explored within these new courses.

## **Sustainability**

Our project is sustainable for a variety of reasons. These include;

1. College commitment
2. Mechanical Engineering department commitment
3. large and diverse *local* industrial base for nuclear trained graduates

The college level commitment is briefly listed in the attached support letter from the Dean of CETA. Our college has an active Clean Energy Institute that is part of our Engineering Applications Center. This Clean Energy Institute has been working on renewable and sustainable engineering projects for nearly five years. This nuclear course development project fits squarely in the goals of the Clean Energy Institute.

The Mechanical Engineering Department has begun efforts to include an Energy Engineering and Sustainable Design concentration within our present Mechanical Engineering major. This Introduction to Nuclear Engineering course would be a cornerstone course within that Energy Concentration.

In order for any academic program to succeed there must be a technical/industrial need for the program graduates. The University of Hartford has three major corporations within 60 miles of our campus that routinely hire engineers with nuclear power training. This proximity is important as many companies find that personnel retention is enhanced when new hires are familiar with the company location (e.g. received a BS degree in the area). The three companies seeking nuclear trained engineers are:

- 1 Westinghouse LLC, This Company has both a fuel appurtenance fabrication facility and a large Nuclear Steam System Design and Support group within Connecticut. Both of these are growing concerns located less than 20 miles from our campus.
- 2 Electric Boat Division, General Dynamics. This company builds nuclear powered submarines for the US Navy. The lengthy history of safe Navy Nuclear power operation is a testimony to the well trained work force that designs, builds and tests these platforms.
- 3 Millstone Nuclear Power Plant, Dominion Energy. This three unit site, (two operating units) contains both BWR and PWR reactors.

## **SMART Goals**

### **Specific**

There are four specific goals for this project.

- 1 Develop Fundamentals of Nuclear Engineering Course
  - 2 Produce sub-scale, see through reactor using Dominion example as a model.
  - 3 Develop at least 4 CFD modules for students to operate using our commercial CFD code
  - 4 Develop Nuclear Applications for Power Engineering course.
-

### **Measureable**

- The goals of this project are easily quantified
- 1 Did we successfully offer the Fundamentals of Nuclear Engineering course?
  - 2 Did we complete the sub-scale see-through reactor?  
Did we create at least four CFD modules to be incorporated into the Nuclear Applications for Power Engineering course?
  - 3 Did we develop the materials for the Nuclear Applications for Power Engineering Course?

### **Achievable**

We have offered eminently achievable goals for this project and allocated sufficient resources to accomplish these goals. We intend to dedicate three faculty member to this project along with 1 graduate and 1 undergraduate student in Mechanical Engineering. Additional resources within CETA will also be supporting this project. These resources include two full-time research engineers, a mechanical technician as well as informal support from CETA faculty. We have commitments from Westinghouse LLC to support the development of both the sub-scale power plant and the Introduction to Nuclear Engineering course. The support of Westinghouse will greatly enhance the course content, the operating power plant design and the experience of students taking part in the pilot courses. We fully expect these pilot courses to become offered annually as part of the Mechanical Engineering specifically the Energy concentration now available within that curriculum. Students will be able to take the courses either as a technical elective or as part of their core requirements for those students electing to take the energy engineering and sustainable design concentration within mechanical engineering. **Realistic**

We believe we have established realistic goals for this Nuclear Regulatory Commission project. The overall goal is to establish a Fundamentals of Nuclear Engineering course and a Nuclear Applications for Power Engineering course within the Mechanical Engineering Department for the University of Hartford. This department, college, and university has a strong interest in energy and developing this course will be a direct contributor to that energy focus. We believe that our program is realistic in its scope, length and goals. We have allocated sufficient college resources which include full-time faculty, graduate students and research engineers contributing to achieving the goals of this project. In addition, external expertise will be available to ensure the content offered in both the Fundamentals of Nuclear Engineering and Nuclear Applications for Power Engineering are accurate.

### **Time-bound**

We have allotted one year to complete this project. That time is sufficient to develop and operate the Fundamentals of Nuclear Engineering pilot course and develop the materials for the Nuclear Applications for Power Engineering course. This same period is also sufficient to complete the sub-scale see-through NSSS along with the CFD modules to be created. While the NRC funding will support the implementation of this course, we expect to continue to offer courses in Nuclear Engineering after the NRC funded portion of this program has ended. Our Mechanical Engineering department seeks to focus on energy topics, including Nuclear Energy. The combination of NRC support, department commitment and ready local market for nuclear trained engineers will insure that this program will continue after the funding effort has been completed. The incorporation of the operating sub-scale NSSS will also provide a ready tool for future engineering students. **Support for Nuclear Safety Education Infrastructure**

This project clearly improves Nuclear Safety Education Infrastructure in the northeast. Our program will provide two new courses within Connecticut. Connecticut does not have any university that offers a major in nuclear engineering. These courses will provide details on the safe operation of nuclear power plants. Combining our introductory course with the sub-scale power plant, the CFD modules and the second course in Nuclear Power Applications will provide strong reinforcement for the topics to be covered.

#### **Collaborative Linkage**

During the 2008-2010 academic years, ME and MET seniors successfully completed six capstone projects sponsored by the Nuclear Power Plant Design office and the Nuclear Fuel Division of Westinghouse LLC, Windsor CT. These projects focused on the design of the components that are part of the Reactor Coolant System for Pressurized Water Reactors along with the redesign of a fuel component manufacturing cell. Our partnership is growing as illustrated by the two ME Capstone projects completed during the fall 2009 semester and the two MET capstone projects provided by Westinghouse for the spring 2010 semester.

Our College has been successful in forging collaborative linkages with Dominion Energy. This group is operating the remaining two units of the Millstone Nuclear Power Station. Finally, our Mechanical Engineering Department has also collaborated with the Electric Boat Division of General Dynamics. All of these companies represent various aspects of nuclear power, including commercial power plant design, fuel fabrication, commercial nuclear power plant operation, and the Navy's nuclear program.

In addition to the industrial collaborations previously listed our proposed introductory course and concentration in energy have alternate collaborations within academia. The PI has most recently been added the Advisory Board for the Nuclear Power Technology program at Three Rivers Community College, also in Connecticut.

#### **Institutional Capability**

The University of Hartford has the capabilities to successfully complete this project. The College of Engineering has the nimbleness and commitment to energy to introduce this Introduction to Nuclear Engineering course. Our College has the personnel (PI, research engineers, graduate students) to successfully complete the design, assembly and testing of the sub-scale reactor.

Specific college resources available to this program include;

#### **Machine Shop**

This is a newly modernized facility in which students learn principles of machining and fabrication of projects. The shop contains various machining and assembly equipment.

#### **Electronic Shop**

200 square foot electronics shop is used to store components, calibrate/repair measurement equipment and fabricate test fixtures.

#### **Computing Resources**

Our team will have access to a wide range of engineering application software. Licenses are maintained current for ANSYS<sup>TM</sup>, AutoCAD<sup>TM</sup>, CATT Acoustics Modeling, Fluent<sup>TM</sup>, DFMA Design for Manufacture and Assembly, LabVIEW<sup>TM</sup>, MATLAB<sup>TM</sup>, MiniTab Statistical Software, SMS STAR Modal, Systems Design Load, Pro/ENGINEER<sup>TM</sup>,

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PULSE by Bruel & Kjaer, Odeon – Room Acoustics Software and VisSim<sup>TM</sup>. In AY 20082009, faculty grants contributed towards perpetual licenses for COMSOL, Tecplot 360, and Solid Works. Out group will also have access to Microsoft Office and to laptops and LCD projectors for classroom presentations of their projects.

## **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.

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**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.
- 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)).

#### **Award Term**

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.
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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.