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

1. GRANT/AGREEMENT NO.	2. MODIFICATION NO.	3. PERIOD OF PERFORMANCE	4. AUTHORITY
NRC-38-10-984		FROM: 7/1/2010 TO: 6/30/2011	Pursuant to Section 31b and 141b of the Atomic Energy Act of 1954, as amended

5. TYPE OF AWARD	6. ORGANIZATION TYPE	7. RECIPIENT NAME, ADDRESS, and EMAIL ADDRESS
[X] GRANT [ ] COOPERATIVE AGREEMENT	Public State-Controlled Institution of Higher ED DUNS:	Virginia Polytechnic Institute and State University Office of Sponsored Programs 1880 Pratt Drive, Suite 2006 Blacksburg, VA 24060

8. PROJECT TITLE:

Development of Online Distance Learning Courses for a Graduate Nuclear Engineering Certificate

9. PROJECT WILL BE CONDUCTED	10. TECHNICAL REPORTS ARE REQUIRED	11. PRINCIPAL INVESTIGATOR(S) NAME, ADDRESS and EMAIL ADDRESS
PER GOVERNMENT'S/RECIPIENT'S PROPOSAL(S) DATED See Program Description AND APPENDIX A-PROJECT GRANT PROVISIONS	[X] PROGRESS AND FINAL [ ] FINAL ONLY [ ] OTHER (Conference Proceedings)	Virginia Polytechnic Institute and State University Attn:Mark Pierson Email: mark.pierson@vt.edu 540-231-9112

12. NRC PROGRAM OFFICE (NAME and ADDRESS)	13. ACCOUNTING and APPROPRIATION DATA	14. METHOD OF PAYMENT
NRC Attn: Randi Neff Office of Human Resources MS: GW5A6 (301) 492-2301 11545 Rockville Pike Rockville, Maryland 20852	APPN. NO: 31X0200 B&R NO: 0-8415-5C1116 JOB CODE: T8453 BOC NO: 4110 OFFICE ID NO: RFPA: HR-10-984	[ ] ADVANCE BY TREASURY CHECK [ ] REIMBURSEMENT BY TREASURY CHECK [ ] LETTER OF CREDIT [X] OTHER (SPECIFY) Electronic ASAP.gov (See Remarks in Item #20 "Payment Information")

15. NRC OBLIGATION FUNDS		16. TOTAL FUNDING AGREEMENT		
THIS ACTION	$65,527	NRC	$65,527	This action provides funds for Fiscal Year in the amount of See Page Two
PREVIOUS OBLIGATION		RECIPIENT		
TOTAL	$65,527	TOTAL	$65,527	

17. NRC ISSUING OFFICE (NAME, ADDRESS and EMAIL ADDRESS)

U.S. Nuclear Regulatory Commission
Div. of Contracts
Attn: Sheila Bumpass
Mail Stop: TWB-01-B10M
Rockville MD 20852

18.	19. NRC CONTRACTING OFFICER
Signature Not Required	Sheila Bumpass 7/1/2010 (Signature) (Date) NAME (TYPED) Sheila Bumpass TITLE Contracting Officer TELEPHONE NO. 301-492-3484

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 "Virginia Polytechnic Institute and State University's Development of Online Distance Learning Courses for a Graduate Nuclear Engineering Certificate" as described in Attachment B entitled "Program Description."

A.2 PERIOD OF GRANT

1. The effective date of this Grant is July 1, 2010. The estimated completion date of this Grant is June 30, 2011.

2. Funds obligated hereunder are available for program expenditures for the estimated period: July 1, 2010 – June 30, 2011.

A. GENERAL

1. Total Estimated NRC Amount:	$65,527
2. Total Obligated Amount:	$65,527
3. Cost-Sharing Amount:	$0
4. Activity Title:	Development of Online Distance Learning Courses for a Graduate Nuclear Engineering Certificate
5. NRC Project Officer:	Randi Neff
6. DUNS No.:	003137015

B. SPECIFIC

RFPA No.:	HR-10-984
FFS:	N/A
Job Code:	T8453
BOC:	4110
B&R Number:	0-8415-5C1116
Appropriation #:	31X0200
Amount Obligated:	$65,527

A.3 BUDGET

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

Line Item	Year 1
Personnel	33,870
Fringe	8,526
Supplies	799
TOTAL DIRECT COSTS	$ 43,195
TOTAL INDIRECT COSTS @ 51.7%	$ 22,332
TOTAL COSTS	**$ 65,527**

All travel must be in accordance with the Virginia Polytechnic Institute and State University Travel Regulations or the US Government Travel Policy absent Grantee's travel regulation.

A.4 AMOUNT OF AWARD AND PAYMENT PROCEDURES

1. The total estimated amount of this Award is $65,527 for the one-year period.

2. NRC hereby obligates the amount of $65,527 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

Development of Online Distance Learning Courses for a Graduate Nuclear Engineering Certificate

1. Potential for Supporting or Advancing the Nuclear Educational Infrastructure

a. Project's Academic Focus

This project falls under the general focus areas of nuclear safety and nuclear security. Within those areas, the specific categories are:

Nuclear Engineering
- Reactor physics

Health Physics
- Reprocessing, recycle chemistry, and technology courses

Safeguards and Security
- Material control and accountability courses
- Vulnerability analysis

Specifically, three graduate-level courses will be developed in an asynchronous online format. These courses are Nuclear Reactor Analysis (reactor physics), Nuclear Fuel Cycle (reprocessing, recycling, nuclear safeguards and nonproliferation), and an engineering mathematics refresher course. The first two courses are part of the graduate nuclear engineering certificate and the third refresher course is a non-credit course designed to prepare potential nuclear engineers for graduate school after being out of the academic track for many years.

This year the Principal Investigator Mark Pierson *received* funding from Virginia Tech's Enterprise program to put the first two courses online for the graduate nuclear engineering certificate. The courses being developed now are Nuclear Engineering Fundamentals and Radiation Detection &Shielding. Thus, if this project is awarded by the NRC, it will allow adding two additional online courses and will therefore complete the online course development of the full nuclear engineering certificate of four courses. Furthermore, in the process of teaching these courses in a live lecture format it was discovered that many of the graduate students who are currently working in industry and who *have* been out of college for many years are having difficulty getting back up to speed in the mathematical tools used for these classes. Hence, if awarded by the NRC, a third non-credit engineering mathematics refresher course will be developed and made available online to help prepare working students for nuclear engineering graduate-level coursework.

Thus to recap what is requested, the *overall* online nuclear engineering certificate will consist of the following four courses: Nuclear Engineering Fundamentals, Radiation Detection and Shielding, Nuclear Reactor Analysis, and Nuclear Fuel Cycle. An optional engineering mathematics refresher course will also be available to help prepare for these courses. Virginia Tech is providing the funding to put the Nuclear Engineering Fundamentals and Radiation Detection & Shielding courses online. This proposal requests funding from the NRC to complete the online graduate nuclear engineering certificate through development of online Nuclear Reactor Analysis and Nuclear Fuel Cycle courses and development of an online engineering

mathematics refresher course. Hence, in development of the online nuclear engineering certificate, the NRC will be leveraging its funds with that of Virginia Tech.

A brief description of these five courses follows:

1) Nuclear Engineering Fundamentals

Description: A foundations course in nuclear engineering to prepare graduate students for all subsequent graduate work in the field of nuclear engineering. Topics include neutron physics, reactor theory and kinetics, basic reactor design and operation, and overall power plant operation.

- Fundamental particles. Atomic and nuclear structure.
- Nuclear stability and radioactive decay
- Nuclear reactions: Q-value, binding energy
- Neutron interactions with matter, cross-sections
- Energy loss in scattering collisions. Moderation. Lethargy.
- Fission
- Multiplication factor
- Burnup
- Pressurized water reactors (PWR), boiling water reactors (BWR)
- Fick's law
- Diffusion equation and various solutions
- Group-diffusion method
- One-group reactor equation and various solutions
- One-group critical equation, calculation of critical mass/geometry
- Four-factor and six-factor formulas
- Reflected reactors
- Reactor kinetics
- Control rods and chemical shim
- Temperature effects on reactivity
- Fission product poisoning and transients

Text: Lamarsh, J.R., & Baratta, A.J. Introduction to Nuclear Engineering (3rd ed.). New Jersey: Prentice-Hall, Inc., 2001.

2) Radiation Detection and Shielding

Description: Radioactive decay, interaction of charged particles and photons with matter, methods of radiation detection and radiation dosimetry, counting statistics, biological effects of radiation, radiation protection criteria and exposure limits, external radiation protection using time, distance and shielding. (3H,3C)

- Radioactive decay
- Interaction of charged particles and photons with matter
- Methods of radiation detection
    - Ionization and gas-filled detectors
    - Semiconductors
    - Scintillation detectors
    - Photographic film
    - Thermoluminescence

- Other methods
- Neutron detectors

- Counting statistics
- Radiation dosimetry
- Radiation protection criteria and exposure limits
- External radiation protection using time, distance and shielding
- Shielding calculations

Text: Turner, James E. Atoms, radiation. and radiation protection (3rd ed.). Weinheim Germany: Wiley-VCH Verlag GmbH & Co. KGaA, 2007.

3) Nuclear Reactor Analysis

Description: Nuclear reactions and fission process. The fission chain reaction. Neutron diffusion and moderation. One-speed diffusion model of a nuclear reactor. Neutron slowing and multigroup theory. Nuclear reactor kinetics. Introduction to reactor core physics design.

- Nuclear reactions and fission
- Fission chain reaction and reactor design
- One-speed diffusion theory model
- Reactor criticality calculations
- Point reactor kinetics model
- Reactor dynamic behavior
- Multigroup diffusion theory
- Neutron slowing down theory
- Resonance absorption
- Fast spectrum calculations and fast group constants
- Thermal spectrum calculations and constants
- Cell calculations and lattice effects
- Introduction to reactor core design

Text: Duderstadt, James J. and Hamilton, Louis J., Nuclear reactor analysis. New York, NY: John Wiley &Sons, 1976.

Supplementary Text: Stacey, Weston M. Nuclear reactor physics (2nd ed.). Weinheim Germany: Wiley-VCH Verlag GmbH & Co. KGaA, 2007.

4) Nuclear Fuel Cycle

Description: The uranium nuclear fuel cycle from mining the uranium, to conversion, enrichment, fuel manufacturing, in-core fuel management and refueling, spent fuel storage, and reprocessing/recycling. Emphasis is placed on nuclear safeguards and nonproliferation aspects of the fuel cycle.

- Introduction and overview of the nuclear fuel cycle
- Nuclear fuel resources, uranium mining and milling
- Licensing of uranium recovery facilities / source material

- Nuclear safeguards and nonproliferation
  - Nonproliferation Treaty
  - Traditional international safeguards
  - Material control and accountability
  - Role of IAEA
  - The Additional Protocol
  - Role of NRC
- Conversion and enrichment
  - Conversion to uranium hexafluoride
  - Enrichment by gaseous diffusion, centrifuge, laser separation
  - Licensing of enrichment facilities
  - Safeguards for enrichment facilities
  - Special nuclear material
- Reactor Fuel Design and Fabrication
- In-core fuel management
  - Multi-batch core loading
  - Fuel loading patterns
  - Extended burnup and longer cycle lengths
  - Refueling activities
- Reprocessing and recycling
  - Reprocessing
  - Plutonium and uranium recycling in LWRs, MOX fuel
  - Safeguards for reprocessing and recycling facilities

Text: Cochran R.G. and Tsoulfanidis, N. The Nuclear Fuel Cycle: Analysis and Management (2^{nd} ed.). La Grange Park, IL: American Nuclear Society, 1999.

Supplemented by instructor notes for Licensing and Nuclear Safeguards and Nonproliferation.

Supplementary text: Doyle, J.E. Nuclear Safeguards, Security, and Nonproliferation. Oxford, UK: Butterworth-Heinemann, Elsevier, 2008.

5) Engineering Mathematics Refresher

Description: A non-credit mathematics preparation course for graduate engineering degrees. Mathematics fundamentals for engineering with applications oriented toward nuclear engineering.

- Exponentials and logarithms
- Vector analysis and linear algebra
- Matrices
- Multivariable calculus
- Ordinary differential equations
- Bessel functions
- Transform methods
- Partial differential equations
- Numerical methods

Text: None required. Modules will be self-contained.

As indicated above in the description, this Nuclear Fuel Cycle course is unique in that it also incorporates a background in nuclear safeguards and nonproliferation. Nuclear safeguards are emphasized at each step of the nuclear fuel cycle. As the number of nuclear power plants increases on a worldwide scale, it is particularly important to prevent further proliferation of nuclear weapons from the intended peaceful use of nuclear energy.

Furthermore, it is noted that the list of technical areas that the NRC supports for curriculum development does not include the term mathematics --yet mathematics undergirds almost all of the technical areas listed. The use of advanced mathematics in the graduate-level nuclear engine~ring courses often provides a heavy fear-factor for prospective students in considering whether to return to graduate school. In fact, the question most asked by prospective students is how mathematically intense the nuclear engineering courses will be and whether they are prepared to take the courses. Thus, in order to increase the reach of nuclear engineering courses to as many students as possible, especially at the graduate level, it is important to make available an optional engineering mathematics refresher course for those students who feel they need it. This online course will do just that.

b. Project Emphasis

As can be seen in the above description, the project's emphasis is on completing an online graduate-level nuclear engineering certificate through development of the final two online nuclear engineering courses and a non-credit engineering mathematics refresher.

c. How Project Will Improve the Educational Infrastructure

There is increased interest in nuclear power due to growing energy needs while at the same time trying to minimize the impact on global warming. By 2030, the projected increase in electricity demand in the United States is 25% and the world net electricity generation is projected to double [1]. The amount of electricity generated by nuclear power plants is expected to increase by 72% to meet this demand [2]. One of the challenges of this nuclear renaissance is the workforce crisis. To maintain the current nuclear work force, the industry will need to hire as many as 25,000 workers in the next five years. In addition, each new reactor will employ 1,400 to 1,800 people during construction [3].

Virginia Tech responded to the industry's immediate needs by restarting its nuclear engineering program in August 2007 and teaching undergraduate and graduate nuclear engineering courses. Current enrollment for the fall 2009 semester was 217 students consisting of 161 undergraduate students and 56 graduate students. The majority of the graduate students is located off-campus and is employed in the nuclear industry at various sites within Virginia.

The Virginia Tech graduate program in nuclear engineering is currently offered via distance learning across Virginia through the Commonwealth Graduate Engineering Program (CGEP). This includes, as a minimum, the following locations in addition to the Blacksburg campus: Northern Virginia, Richmond, Lynchburg, Danville, Virginia Beach, and the Northrop Grumman Shipbuilding Newport News division VASCIC center. The various sites target employees from AREVA NP, Inc., The Babcock and Wilcox Company (formerly BWXT), Dominion Generation, Northrop Grumman Newport News Shipyard, and government personnel. Graduate students taking these distance learning offerings can obtain a Master's of Engineering (or Science) in Mechanical Engineering, Electrical Engineering, Systems Engineering, or Civil & Environmental Engineering with a graduate certificate in Nuclear Engineering. Some industry personnel are

only enrolled for the nuclear engineering certificate and will not pursue a Master's degree. We are also in the process of developing a Master's and Ph.D. in Nuclear Engineering expected to be approved by the state in fall 2010. At that time, a Master's in Nuclear Engineering will be available via distance learning to the industry.

The nuclear engineering distance learning courses are currently offered via live video teleconferencing to the remote sites. Students therefore need to be available to attend the classes when scheduled. In general, while the classes are recorded for later viewing, students who have an extensive travel schedule or a heavy work load during the week are unable to take these classes. This has limited some employees from taking any kind of graduate course. Even for those who can attend classes, there is significant stress in balancing classroom and homework deadlines with family and work obligations. In addition, we get many frequent requests to transmit the classes to sites that cannot support the high resolution live video teleconferencing or to many other sites out of state. Thus, there is motivation to create an asynchronous or online option for the nuclear engineering graduate certificate. One of the appeals of asynchronous technologies is that learners can access materials, complete assignments, participate in discussions, and take exams according to schedules that they largely determine themselves. In addition, the hypermedia learning environment offers particular advantages to adult learners who are inherently self-directed [4]. Finally, the online, asynchronous nature of this program is in line with the mission of Virginia Tech, a Land Grant university, to fulfill its obligation to meet the needs of citizens who cannot attend classes on campus due to various job obligations or lack of access to an extended campus site.

While a graduate-level nuclear engineering certificate consists of only four courses versus the ten courses required for a Master's degree, the certificate has a much greater demand in the workforce. The nuclear industry hires many different types of engineers. More than half of the new hires tend to be mechanical engineers, followed by electrical engineers, structural civil engineers, materials engineers, chemical engineers, and finally, only about 10%, nuclear engineers. For example, a mechanical engineer will be focused on the mechanical systems and structures of a nuclear power plant. Since the engineer may not have had any training in the nuclear area, the company must now train them. Some of these training programs are formal and intensive; others are informal and consist of on-the-job training. As a result, it would benefit the company to have their non-nuclear engineers obtain a graduate certificate in nuclear engineering to help give them some of the necessary theoretical background in nuclear energy and to provide a framework for application of their engineering specialty. Then there is the case where an engineer may already have a Master's degree in his non-nuclear specialization. It may not make sense for that person to obtain another Master's degree in nuclear engineering. They can obtain a nuclear engineering certificate instead at lower cost and earlier completion. Finally, there are many engineers working at non-nuclear companies who may see an opportunity to switch careers into the nuclear field. Obtaining a graduate nuclear engineering certificate would show they are serious and would make them more highly sought after by nuclear firms even though they may have little experience in that field. In fact, about half of our industry distance-learning students are interested in only obtaining a graduate certificate and not continuing on to a Master's degree of any kind. In addition, we have had a large demand for these classes in just the short period since we started the program. This is our motivation to put the certificate program in the online, asynchronous format. Thus, the certificate can be seen as an enticement for transition into the nuclear field or for promotion within.

As indicated above, we are limited to sending live video teleconferencing to a limited number of sites. The students must be geographically available to attend those sites in person. By putting

the certificate courses online and using an asynchronous format, we will be able to market the nuclear engineering courses to a much broader audience to include not only the entire Commonwealth of Virginia but also the entire United States. This will rapidly open the door to increased opportunity to enhance the skills of the existing nuclear workforce and to improve the mobility of non-nuclear engineers into the nuclear workforce.

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 CRF 220, 2 CFR 225, and 2 CFR 230 these URLs to the Office of Management and Budget Cost Circulars are included for reference:

A-21 (now 2CFR 220): http://www.whitehouse.gov/omb/circulars/a021/print/a021.html
A-87 (now 2CFR 225): http://www.whitehouse.gov/omb/circulars/a087/print/a087-all.html
A-122 (now 2CFR 230): http://www.whitehouse.gov/omb/circulars/a122/print/a122.html
A-102, SF 424: http://www.whitehouse.gov/omb/circulars/a102/print/a102.html
Form 990: http://www.irs.gov/pub/irs-pdf/i990-ez.pdf

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.

By drawing funds from the Automated Standard Application for Payment system (ASAP), the recipient agrees to the terms and conditions of an award.

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 Part 180 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 >

2. Award Package

Grant Performance Metrics:

The Office of Management and Budget requires all Federal Agencies providing funding for 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 curriculum development 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:

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.

§ 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 215.180 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 VII 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 VII, 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 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 must 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, termination of the award, 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.

Procurement Standards. § 215.40
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 is an appropriate charge to this award and prior authorization for specific trips are not required, as long as the trip is identified in the Grantee's original program description and original budget. All other travel, domestic or international, must not increase the total estimated award amount. Trips that have not been identified in the approved budget require the written prior approval of the Grants Officer.

Travel will be in accordance with the US Government Travel Regulations at: www.gsa.gov/federaltravelregulation and the per diem rates set forth at: www.gsa.gov/perdiem.

Travel costs to the grant must be consistent with provisions as established in Appendix A to 2 CFR 220 (J.53)

Property Management Standards
Property standards of this award shall follow provisions as established in 2 CFR 215.30.

Equipment procedures shall follow provision established in 2 CFR 215.34.

Procurement Standards
Procurement standards of this award shall follow provisions as established in 2 CFR 215.40.

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 title and retain ownership 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 of this award shall follow provisions as established in 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 a review committee consisting of a minimum of three persons.

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,

Monitoring and Reporting § 215.51

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.
- Budget Revision – 2 CFR 215.25
  - In accordance with 2 CFR 215.25(e), the NRC waives the prior approval requirement for items identified in sub-part (e)(1-4).
  - The Grantee is not authorized to rebudget between direct costs and indirect costs without written approval of the Grants Officer.
  - Allowable Costs – 2 CFR 215.27

b. **Federal Financial Reports**

Effective October 1, 2008, NRC transitioned from the SF–269, SF–269A, SF–272, and SF–272A to the Federal Financial Report (SF-425) as required by OMB:

http://www.whitehouse.gov/omb/fedreg/2008/081308_ffr.pdf
http://www.whitehouse.gov/omb/grants/standard_forms/ffr.pdf
http://www.whitehouse.gov/omb/grants/standard_forms/ffr_instructions.pdf

The Grantee shall submit a "Federal Financial Report" (SF-425) on a quarterly basis, for the periods ending 3/31, 6/30, 9/30 and 12/31, 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 shall be submitted within 90 days after expiration of the award.

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 shall 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 shall 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 as specified in the special award conditions in the same frequency as the Federal Financial Report unless otherwise authorized by the Grants Officer.

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.

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 herby 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 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 form 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."