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

1. GRANT/AGREEMENT NO.	2. MODIFICATION NO.	3. PERIOD OF PERFORMANCE	4. AUTHORITY
NRC-38-10-962		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:832127323	The Ohio State University 1960 Kenny Road Columbus, OH 43210-1063

8. PROJECT TITLE:
Innovative Nuclear Engineering Materials and Corrosion Modules for Enhancement and Expansion

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)	The Ohio State University Attn: Carol Smidts Email: smidts.1@osu.edu 614-292-6727

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-10-962	[ ] 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	$180,000	NRC	$180,000	This action provides funds for Fiscal Year in the amount of See Page Two
PREVIOUS OBLIGATION		RECIPIENT		
TOTAL	$180,000	TOTAL	$180,000	

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 (Signature) JUL 1 2010 (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

ACQUISITION SUMMARY

Grantee:	Ohio State University
Grant No:	NRC-38-10-962
RFPA No.:	HR-10-962
CFDA Number:	77.008
Grant Period:	July 1, 2010 - June 30, 2011
NRC Program Cost:	$180,000
Cost Share:	$28,986
Total Estimated Program Cost:	$208,986
Obligation This Action:	$180,000
Activity:	Office of Human Resources 2010 Faculty Development Program
Project Officer:	John Gutteridge HR/HRTD/EGT
Contract Specialist:	Jerry Purcell Jr.
Grants Officer:	Sheila Bumpass

Authority: Atomic Energy Act of 1954, as amended

Purpose:
The purpose of this activity is to provide grant support for undergraduate scholarship. Graduate fellowships, trade school and community college scholarships, and faculty development research grants in FY 2010, in amounts totaling $15 million. A technical assessment-review, determined that the purpose of the grant is within the statutory purpose of the grant funding.

Discussion:
Eligible educational institutions submitted grant applications in response to the appropriate funding announcements posted on Grants.Gov. In accordance with the announcement, applications were review through a peer review process. (See file for a copy of the evaluation) Applications satisfying the minimum criteria, including leverage funding (cost share) were submitted to the Division of Contracts (DOC) for funding. 110 applications were received. 59 applications were recommended for funding. Notification of further grant consideration was submitted to applicants on March 15. Applications not selected for funding were notified after grant award, on or about May 3. DOC received RFPAs for the 59 on March 15. The SBCR Compliance memo was submitted over several days (3/15 - 17/2010).

1. Choice of Instrument. The purpose of this Grant is to provide support and assistance to qualified educational institutions for support of their nuclear educational initiative (program development, scholarship, or faculty development). Thus the purpose is to provide support and provide assistance to the grantee's program, as opposed to acquiring goods and services; thus an assistance instrument rather than a contract is the most appropriate acquisition vehicle. A grant was selected as the appropriate instrument because the need for "substantial involvement" by NRC personnel was not determined to be necessary.

2. Exception to Competition. The application for support was submitted in response to one of the following funding announcements: HR-FN-1009-NED01; HR-FN-1009-NED02; or HR-FN-1009-NED03 (The cognizant announcement is in the file). The applications were selected under the stated competitive process.

3. Grants Officer Authority. Grants Officers award grants on behalf of NRC under a duly authorized warrant issued by the Director Office Contracts. Every Grants Officer is responsible for ensuring NRC exercises prudent management over assistance funds through strict adherence to the comprehensive procedures and determinations found in MD Handbook 11.6 and applicable OMB circulars.

4. Responsibility. Ohio State University is not on the List of Parties Excluded from Federal Procurement or Non Procurement Programs as of May 1, 2010 (results in the file). Neither the Grants Officer nor the NRC Project Officer has any knowledge of adverse information about the grantee's capacity to technically perform the program and comply with the financial requirements.

6. Budget. Ohio State University submitted budget justifications on December 22, 2009.

Cost Breakdown:

	Year 1
Personnel	$95,784.00
Fringe	$13,836.00
Travel	$12,380.00
Equipment	$2,374.00
Supplies	$2,107.00
Contractual	$6,500.00
Total Direct Charges	**$132,981.00**
Indirect Costs	$47,019.00
Yearly Totals	**$180,000.00**

Cost Analysis and Cost Realism Analysis:
The costs proposed by Ohio State University are categorized into 7 primary categories: Personnel, Fringe Benefits, Travel, Equipment, Supplies, Contractual, and Indirect Costs. Personnel costs of 3 primary investigators consisted of an annual salary of $53,777 for faculty members. Personnel costs for Graduate Student Stipends are $42,088. The NRC is providing personnel funding for PI salary costs and Graduate Student Stipends in the amount of $95,784. Fringe Benefit rates calculated at standard Ohio State University rates for each employee. Rates vary according to classification. Benefits include medical insurance, retirement contributions, sick leave and vacation allowances, state mandated workers' compensation, and the employer share of medicare and FICA contributions. The NRC will pay a total of $13,836 in Fringe Benefit costs. Funding for travel costs are provided so that faculty members can visit WSC facilities in Frederick, Maryland and for the graduate student to attend programming classes on the WSC simulator platform. Travel costs include gas, hotel and a per diem rate of $40/day. The NRC will pay total of $12,380 for travel and associated costs. Equipment costs consist of the purchase of hardware and software to run the simulator platform being donated by WSC and the simulator model to be donated by Westinghouse. The allocation for the equipment is $7,831 in the first year of the project. The NRC will pay a total of $2,374 for equipment costs. Supply costs include reference material, printing of course materials, and other non-standard office supplies totaling $2,107. The NRC will pay $2,107 in supply costs. The contractual (Overhead is based on modified total direct costs) costs consist of the University and Government contracted rate of 36% for non-research activities. The NRC will pay $6,500 in contractual costs.

Responsibility Determination:
In accordance with FAR 9.103(b) contract award may not be made unless the Contracting Officer makes an "affirmative determination of responsibility." FAR 9.104-1, states in part, that a "responsible prospective contractor" must:

(a) have adequate financial resources to perform the contract, or the ability to obtain them;
(b) be able to comply with the required delivery or performance schedule;
(c) have a satisfactory performance record;
(d) have a satisfactory record of integrity and business ethics;
(e) have the necessary organization, experience, accounting and operational controls, and technical skills or the ability to obtain them;
(f) have the necessary production and technical equipment and facilities, or the ability to obtain them; and
(g) be qualified and eligible to receive an award under applicable laws and regulations.

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Adequate Financial Resources: Kansas State University is a major state support university whose accounting system was determined to be adequate for the accumulation, reporting, and billing of costs on a government contract or grant.
Performance Records: Kansas State University has a successful performance record under several Federal Agency grants, including previous NRC grants.
Integrity and Business Ethics: Kansas State University is not listed on the Lists of Parties Excluded from Federal Procurement or Non-Procurement Programs, dated April 27, 2010 per AAMS review. The applicant did not indicate delinquency on a Federal Debt on its SF 424, and there is no indication in its record of owing funds to the federal government.
PreAward Survey A pre-award survey was not requested. There is sufficient information to make a creditable responsibility determination.

Compliance Requirements:

OGC: The Grant application was approved by the Office of General Counsel on _____.
SBCR: The Grant application was approved by the Small Business Civil Rights Office on _____
Congressional Legislative Notice: OCF was notified on April 26, 2010 (see file).

Recommendation:
Based upon the foregoing, the prices proposed by the grantee are considered fair and reasonable. The Kansas State University is determined to be responsible and eligible to receive the proposed grant. Therefore, it is recommended that the Contracting Officer execute the subject grant.

_____ Date

_____
Jerry Purcell Jr.
Contract Specialist

_____ Date

_____
Sheila Bumpass
Contracting/Grants Officer

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ATTACHMENT A - SCHEDULE

A.1 PURPOSE OF GRANT

The purpose of this Grant is to provide support to the "Nuclear Education Grant Program" 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:	$180,000
2. Total Obligated Amount:	$180,000
3. Cost-Sharing Amount:	$ 28,986
4. Activity Title:	Nuclear Sector Technician Education and Placement Project
5. NRC Project Officer:	Randi Neff
6. DUNS No.:	832127323

B. SPECIFIC

RFPA No.:	HR-10-962
FFS:	N/A
Job Code:	T8453
BOC:	4110
B&R Number:	0-8415-5C1116
Appropriation #:	31X0200
Amount Obligated:	$180,000

A.3 BUDGET

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

	Year 1
Direct Participant Cost	$132,981.00
Indirect Cost	$47,019.00
Yearly Total	**$180,000.00**

All travel must be in accordance with the Ohio 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 $180,000 for the (1) year period.

2. NRC hereby obligates the amount of $180,000 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

Nuclear Education Grant Program

The Nuclear Engineering (NE) Program at The Ohio State University (OSU) is an academically free-standing Graduate Program in the Graduate School, and is administratively housed within the Mechanical Engineering Department (50+ full time faculty). The main focus of the NE Program at OSU has historically been the education of students at the Master's and PhD level. The nuclear engineering graduate program counts 30 graduate students. In 2001, the Nuclear Engineering Program initiated an Undergraduate Minor Program, currently having 50 - 70 students and growing with a sharp increase, having doubled in size in the last two years. The minor program has served as a pipeline and been successful in attracting strong domestic students to the graduate degree program. Additionally since 2004, the OSU NE Program has partnered with two HBCUs, Wilberforce University and Central State University, using distance education connections to implement undergraduate minor programs at each school, and two community colleges close to and with close working relationships with nearby nuclear power plants, Lakeland Community College and Terra Community College. The Nuclear Engineering program counts 5 full time faculty (the last two were hired in the last two years, the most recent having started just this January) and 5 part-time faculty with significant time commitment (between 100% and 25%) to the program.

Full-scope nuclear power plant simulators are complete mockups of real control rooms, providing an experience for trainees essentially indistinguishable from operating the real plant. Complete crews are able to enter a control room environment designed to have as close as possible a feeling to the "real thing" as can be accomplished, complete with full panel layouts, ceiling lighting, the same carpeting, and sound effects. In this environment, plant personnel can perform and practice nearly every operation they would perform in the real plant. They are able to communicate outside the control room with instructors skilled in providing realistic responses to inquiries that in the real plant would go to in-plant auxiliary operators, health physics personnel, plant management, and off-site management and agencies. They can find any reference resources that would normally be available to them in the real control room. And very importantly, they can respond realistically to equipment malfunctions and major plant upsets that may be anticipated or hoped never to occur so that if these should ever happen, they will be well prepared to deal with them as though "they had already been there before."
Simulators are major pieces of equipment and powerful simulation environments. To build a full-scope nuclear power plant simulator from scratch requires around 60 to 80 thousand person-hours. Software development costs can range between $5-$7 MUSD. Control room hardware and instrumentation will be an additional $8-$10 MUSD. So a total full-scope nuclear power plant simulator can cost $17MUSD-$20MUSD. Development of the panel graphics, Piping and Instrument Diagram (P&ID) graphic representations, classroom environment features, etc., costs an additional $500k. As computing power has increased, simulators have modeled real plants more accurately and with higher fidelity with every generation. The

requirements for use of a simulator to examine operator license candidates are found in 10CFR55.46. Simulators are also required to fulfill the experience requirements for applicants, and in 10CFR55.59, requirements are stated for use of simulators in operator license requalification programs, including evaluation of already licensed operators by the NRC.

An American Nuclear Society standard, ANSI/ANS 3.5, Nuclear Power Plant Simulators for Use in Operator Training and Examination, establishes the fidelity requirements for simulators. This Standard has been adopted by the Nuclear Regulatory Commission in Regulatory Guide 1.149, Nuclear Power Plant Simulation Facilities for Use in Operator Training and License Examinations. While the NRC has required simulators to be used in plant training environments, it has not stated any requirements for their use in education programs. However, as the NRC has perceived an increasing need for well educated (and trained) university graduates, it has recognized a need for these graduates to have a more complete understanding of how these large plants operate. Actual plant operations are "integrated." Systems in the Secondary Plant, that is, the steam side of the plant, affect the behavior of the systems on the Primary Side. In fact, most Pressurized Water Reactors (PWRs) control reactivity and power level of the reactor core more often using changes in turbine load rather than changes in control rod positions. Little taught functions like this are a major topic of plant systems education in the two Nuclear Power Plant Operations courses taught at Ohio State. Likewise these functions can and will be demonstrated and performed by students, not only in the operations courses, but could in the future (out of scope of this proposal) also be demonstrated in other courses where students investigate the effects of reactivity changes on core neutronics and thermal-hydraulics. Specific accidents (LOCA for instance) can be replicated using a full-scope classroom simulator giving students the feel of actual events and allowing them to experience the actual timing of events, the actual information overload, rising stress levels and the errors which come with incorrectly human factored displays or erroneous signals and contradicting information reinforcing the lessons learned in the human reliability course.

2. Objectives/Goals

The primary goal of the proposed project is to provide a significantly enhanced hands-on experimental environment for students through the employment of a full-scope nuclear power plant (NPP) classroom simulator essentially identical to one in use at an actual nuclear power plant. The second goal is to integrate the classroom simulator into two existing courses and one new course proposed to be developed as tasks within this project. The existing courses into which the simulator experiments will be integrated during this project are Nuclear Power Plant Operations I and II (courses unique to the OSU NE Program). The new course to be developed that will use the NPP simulator is a Human Reliability Analysis course which has never been taught at Ohio State.

Successful implementation of this project also will relieve a major logistical and funding issue currently caused by the success of the Undergraduate Minor in Nuclear Engineering (MINE). The Nuclear Power Plant Operations courses have become two of the most popular optional elective courses for the MINE students. Students also have indicated these courses are a major recruiting tool for the MINE. The large populations in these courses result in overcrowded conditions when weekend trips are made to the nuclear power plant simulators, and also result in significantly increased travel expenses. In the very near future, if the population of students keeps increasing, these trips will no longer be sustainable. In addition, the ROIon these trips per student, expense wise and educationally, has been decreasing since students now get less individual hands-on time on the simulator due to the increased class

sizes. Having the classroom simulator on site at Ohio State will enable a weekly laboratory experience where students will be able to gain greater familiarity with the plant systems to be operated at the plant and thus enable significantly greater efficiency at the plant for students to operate the Control Room simulator. Students will already be familiar not only with system design and operation, but also with the actual panel layouts.

For the to-be developed human reliability course, a full-scope classroom simulator represents a unique opportunity allowing students to experiment with human factor design concepts, reaction times, stress levels, experimenting on actual error types, experience the workload, compute statistics of human errors, etc. It should also be noted that the Ohio State Nuclear Engineering program benefits from a unique environment since it has strong connections with the ISE (Industrial and Systems Engineering) Department which hosts six human factors and cognitive engineering faculty (some very well known for their research and experience in the nuclear field such as Professor David Woods).
To accomplish the goals we have set, the work plan for this project consists of three phases and several tasks. The three phases are (1) installation of the computer hardware and simulator software and generalization of the simulator model, (2) development of teaching modules and the new Human Reliability Analysis (HRA) course, and (3) module incorporation in courses. Phase (1) will be completed primarily in the first half of the first year but continuing through the end of the first year. Phases (2) and (3) are planned for both Years 1 and 2.

3. StrategiC Partnerships

Planning for this project has involved development of strategic partnerships with several industrial and utility partners without which success will not be possible. The key partnership is with Western Services Corporation of Frederick, Maryland. WSC is a major supplier of simulator technology in the world and has numerous US clients. WSC has offered to donate their modeling platform to The Ohio State University. The software platform is WSC's 3KEYMASTER that enables model development, integration, execution, test, visualization, and analysis. Of particular importance to this project are the two elements of the graphical engineering station and real-time operating environment. Applied to an NPP simulator, it includes an industry standard engineering core model. Also important to this development is a partnership with Westinghouse Electric Company. Westinghouse operates a Standard Nuclear Unit Power Plant System (SNUPPS) simulator at their Waltz Mill Training facility southeast of Pittsburgh, Pennsylvania. Though not built on the WSC platform, the SNUPPS simulator design is very similar to the Wolf Creek and Callaway designs. The Wolf Creek simulator is built on the WSC platform, Westinghouse will provide their SNUPPS software for porting to the WSC platform. Also important to the effort is that as a training facility, Waltz Mill staff will assist in assuring that teaching modules not only are important to education principles, but also help students learn engineering fundamentals important to NPP operations. Further, since Waltz Mill is reasonably close to Ohio State, it offers an ideal facility for student field trips and Control Room simulator operation. Finally relative to our partnership with Westinghouse, Waltz Mill has been an annual tour destination for the Nuclear Power Plant Operations courses for more than a decade. The figure below shows a recent Nuclear Power Plant Operations I class at the Waltz Mill SNUPPS Training simulator. There are several methods of developing a generic simulator. The term generic is used here in the sense that as used by students, though referenced to a specific real plant, students will not know which plant, other than by manufacturer, the simulator actually represents. The reason for this approach is to avoid any plant-specific security concerns. The first, most efficient and least costly method is to start with a simulator already on the WSC platform and "sanitize" the simulator model of all company and plant name references. A second, more costly, method is to take a simulator not currently on the WSC

platform and "port" it to the WSC platform. A third method is to use the WSC tools to build a generic plant from scratch. These three methods are listed in order of difficulty and cost. For this project we will need to use a mixture of the three methods, although the method to be used for primary development will be the porting of the Westinghouse SNUPPS simulator. The two strategic partnerships detailed above and as described in the attached support letters will enable us to contain these costs and succeed with this development effort. Another strategic partnership is with FirstEnergy Nuclear Operating Company (FENOC). This long-standing partnership has enabled Ohio State to take classes to both Davis-Besse and Perry for extensive plant tours and full weekend experiences operating the on-site plant simulators, and a fourth strategic partnership is with AEP's (AEP is headquartered in Columbus, Ohio) Donald C. Cook Nuclear Power Plant, also where classes *have* visited for extensive site tours and weekend on-site simulator operation weekends. A fifth strategic partnership is with DTE Energy and its Fermi 2 Nuclear Power Plant. These partnerships will enable the project to identify relevant operating experience, to identify important operating procedure issues to address in the three courses, to assure that human factors issues are addressed in all three courses, and to stay abreast of plant I&C upgrades to consider in future course development and research that will benefit from using the simulator. They also will help for future work when we begin, in a future project, to develop a generic BWR simulator. Finally, we *have* developed a strategic partnership with Idaho National Laboratory. The objective of this partnership as it relates to this project is to help identify important topics and issues to incorporate into the planned simulator experiment modules for inclusion in the OSU courses to assure that students are more effectively prepared to enter the workforce.

4. Task Detail

Task 1 Development of a Generic (Sanitized) NPP Model (Primary responsibility: Smidts and Hajek)

For task 1, one graduate student (a PhD student in his/her first year) and two senior undergraduate students (with declared interest in the OSU PhD graduate program) will be hosted at the WSC facilities in Frederick, Maryland, for two periods of two weeks each to learn the simulator software and to enable them to make changes to the software to assure that plantspecific information will be completely *removed* from the model. In addition, one of the faculty, Professor Smidts, will join the students for a duration of a week to also get familiarized with the simulator software inner-workings and provide long-term sustainability to the project. Using a PhD student as well as undergraduates with interest in the OSU nuclear program will increase the sustainability of the project. PhD students will typically remain for a period of 5 years. It is also expected that the sustainability will be maintained and enhanced through an existing research collaboration which we *have* established with WSC in the area of digital instrumentation verification and validation. Students funded under this DOE funded research project will also use the features of 3KeyMaster and as such are a resource of knowledge which can be brought to bear in this teaching project. Other changes may be made to the model, such as replacing the electrical system with a generic system to further *remove* plant-specificity. Actual model changes will take place on the OSU campus, and will be completed before the simulator is used by students in classes. It should be noted that modifications to an existing plant model in order to *remove* sensitive information would be trivial and consists of identifying plant references throughout the plant model and deleting those references from specifically provided component editing screens. Estimated calendar time for Task 1 is seven months. As noted in the WSC Commitment Letter, this task "can be done in a phased manner, for example, beginning with the primary loop, with boundary drivers for the remaining plant, and later expanding to other areas of plant design." An important advantage of this approach is that

the simulator may be available more quickly for use in courses such as Nuclear Power Plant Operations I that begins in the seventh month of the anticipated schedule for the project. The OSU students and the project PI will participate in classes with personnel from other WSC clients to minimize WSC and OSU costs. Following this training, these students will work on the OSU Main Campus to perform the necessary steps to sanitize/develop the simulator for class use. They also will provide training to one additional graduate student, one additional undergraduate student, and to other Nuclear Engineering faculty (Professors Hajek, Sun (Assistant Professor) and Cao (Assistant Professor)) to assure long-term viability of simulator applications at Ohio State and further use of the simulator in other class activities that are outside the scope of this project. Both Professors Sun and Cao are young professors who will be staying with the nuclear engineering program for years to come. Servers, workstations, and monitors will be purchased. The equipment is specified in the WSC commitment letter. Exact equipment will be a function of market conditions at the time of purchase. The equipment will be installed in a secure facility within Scott Laboratory and in close proximity to Nuclear Engineering faculty and graduate student offices. This facility will be the primary teaching laboratory once the simulators are ready for student use. The deliverable will be a sanitized, full-scope, generic PWR classroom simulator to be completed by the end of Year 1. Additionally, this phase of the project will be funded and designed for completion by one graduate student, assisted by two undergraduate students, resulting in significant learning, segmented by development tasks, and thus resulting in completion of one MS thesis on the way to a PhD by the end of the second project year. Since the purpose of the proposed project is education infrastructure development and education infrastructure enhancement, the thesis may be considered as a bonus for the project.

Task 2· Development of Teaching Modules for Nuclear Power Plant Operations (NPPO) 1 and 2 (NE 735, NE 745), (Primary Responsibility: Hajek) Course Overview: The Ohio State University Nuclear Engineering Program is unique in the Nation in that for over 15 years it has taught a nuclear power plant operations course that includes several student trips to multiple nuclear power plant sites (Donald C. Cook, Davis-Besse, Perry, and Clinton) where students spend as many as five days per course operating the NPP simulators under the direction of NPP trainers. This two-quarter course sequence has been team taught with colleagues from the University of Cincinnati, and for the past five years taught by distance to students at Wilberforce and Central State Universities as part of the Undergraduate Minor in Nuclear Engineering (MINE) begun at those two schools by the OSU NE Program. While two classes per week are held using the respective distance classrooms, all the students come together at the plant sites for the plant simulator experiences. NPPO-1 involves an introduction to applicable regulations and standards governing design and operation of NPPs, and then an introduction to plant systems. Systems are taught in a generiC fashion, with some limited plant-specific emphasis to enable students to spend two days on site actually operating the plant simulators at each plant during the quarter. In the second course, NPPO-2, the emphasis is on malfunctions, abnormal operations, emergency operations, and specifically on Emergency Operating Procedures (EOPs). Students visit two different plants in this quarter, again operating the plant specific simulators for two days each. Major plant malfunctions addressed by the EOPs are demonstrated by the NPP trainers and the course instructor, and then responded to by teams of students. These two courses will be the primary existing courses to benefit from the introduction of a full-scope nuclear power plant classroom simulator. The benefit will be phased due to the complexity of the simulator, the brief time between the anticipated start of the project and the first time the course is offered after the award, and the time required learning to use the simulator and the software upon which it is based. As indicated in the project schedule, the first time the course is taught, the simulator will be incorporated into the course primarily using demonstrations. By the second offering of the course, a complete set of interactive student

laboratories will be available with at least one laboratory for each plant system. AVI Module Applications: In this task, modules will be developed to teach generic design of both water handling systems and electrical systems. Key to this module development is the WSC software capability to use existing simulator loads to produce Audio Video Interleave (AVI) files to provide visual (video with narration) representations of plant systems and operations. This will enable us to use the simulators in a classroom environment even before the sanitization is complete, and also will enable us to show systems for both PWRs and BWRs even though the development effort is initially geared toward the Westinghouse PWR design. This process assures the success of a phased development approach and phased use of the simulator(s) during Year 1. **System Module Development:** Additionally, modules will be developed to enable students to operate the classroom simulator for each system group (such as reactivity control, ECCS, electrical, condensate-feedwater-main steam, nuclear instrumentation, component cooling, etc.) prior to travel to plant sites, thus increasing the effectiveness of site visits.

Task 3 Development of a New Human Reliability Analysis Course, (Primary responsibility: Smidts)

This course will focus on the theory of human reliability and will use simulator scenarios and display and control panel layouts for demonstrating the interaction between the human and the system. Due to the tools available in 3KEYMASTER and the flexibility of the modeling system, exercises can be developed for students to not only modify control board instrument, control, and flow arrangements, but also to measure the effectiveness of these modifications on operator performance. Since analysis is a key objective of this course, availability of the simulator will be an important element of course success. The Human Reliability Analysis course (NE 794.y) is to be introduced at the graduate level for MS and PhD degree seeking students. It will be open for nuclear engineering graduate students and to industrial and systems engineering graduate students with interest in human factors. The course also will be open to senior undergraduate students in the MINE program.

Topics to be covered will include:

• **Human Factors Review:** This course module will provide students with a review of human factors concepts such as human visual functions, visual displays, perception, memory and cognition, anthropometry, skills, motor behavior and manual controls, situation awareness and workload. As a direct application of the concepts being reviewed, this module will feature a critical analysis of simulator displays.
It is expected that students will have completed one or several of the human factors courses offered by the Industrial and Systems Engineering Department at Ohio State University prior to taking the human reliability analysis course. The corresponding course numbers are: ISE 665, ISE 770, ISE 771, ISE 772, ISE 773, ISE 775 and ISE 875.

• **Task Analysis:** This class module will survey existing task analysis methods such as: Hierarchical task analysis; Goals, operators, methods and selection rules; Verbal protocol analysis and Cognitive work analysis.

• **Human Reliability Models:** This class module will provide a survey of existing human reliability models. The module will survey models for procedural tasks as well as models for cognitive tasks. Models considered will include THERP, SLIM, CREAM, SHARP, SPAR-H, ATHEANA, HCR, IDA-IDAC.

• **Data Collection and Analysis:** This class module will focus on the data sources and on the methods of data collection and analysis. Topics covered will include: Accident, Incident Analysis, Use of simulator experiments, Use of data from other industries, Partial data, full data, Design of experiments.

• **Integration into PRA analysis:** This course module will discuss issues related to integration of human reliability models/results into the classical PRA framework (event Smidts-8
tree/ fault tree) versus integration within dynamic reliability environments such as ADS, ADAPT.

• **Licensing Process:** This course module will focus on the use of human reliability models within the Licensing process as defined in NUREG-0711

• **Simulator-Based Laboratory:** This course module will provide students with hands-on experience. Students will learn to implement one of the Emergency Operating Procedures (EOPs) for an accident scenario such as LOCA. Students will collect response time and response type data for the scenario at hand. Prior analysis of the accident will be performed using task analysis and applicable human reliability models.
To improve the level of quality of the course, lecturers from the ISE department will be invited to teach the human factors review portion of the course. We also will use our strategic relationship with **INL** through the Academic Center of Excellence (ACE) in Digital Instrumentation and Control to call upon their human factors and human reliability specialists (such as Dr. D. Gertman or Dr. J. Persensky) to teach specifically relevant modules in the course. Professor Smidts also will be supported by Professor Rich Denning.
Development Schedule: This is a new course at OSU. The first offering of the course will use demonstration simulator-modules and will be taught in Spring 2011. The second offering of the course in Spring 2012 will include interactive simulator- laboratory modules. The deliverables will be the course syllabus, lesson plans, and simulator modules. The course material will be posted on the Ohio State University computer-managed instruction web-site (called Carmen at OSU).

Evaluation Criteria-

The Ohio State University and the Mechanical Engineering Department, in which the Nuclear Engineering Program is administratively housed, use relatively standard Student Evaluation of Instruction instruments. One instrument elicits items of excellence rated on a scale of 1 to 5, and the second elicits written responses or opinions from students on a number of questions. These instruments will be augmented with additional instruments, to be designed, to measure the effectiveness of each of the hands-on simulator exercises/laboratories during their initial use in each of the respective courses. These will be coupled with measures of student performance to identify needed changes and improvements. Evaluations will be used to make modifications in the teaching modules if necessary.

5. Project Organization and Personnel

Professor Carol Smidts and Professor Brian Hajek will co-manage the simulator development and related course module development. Professor Smidts will be primarily responsible for managing the software conversion including interactions with WSC. Professor Hajek will be responsible for managing the reactor operations applications including interactions with nuclear power plant personnel. Professor Smidts and Denning will work on development of

the human reliability course. Professor Hajek will work with each individual faculty member to assure education module development is consistent with actual nuclear power plant operations and the capabilities of the simulator.

6. Schedule

A Gantt Chart is provided to illustrate the project schedule and act as a tool for controlling the schedule. Since this project involves development of new teaching materials, and since the material development and implementation schedule is somewhat a function of the University quarter schedule, we have included teaching of the new material in the Gantt Chart. However, the cost of teaching is not included in the project costs. Adherence to the schedule will be closely monitored on at least a monthly basis and adjusted appropriately to assure that all milestones are met on at least a three-month horizon. Consultation with and reporting to WSC and utility collaborators will be the primary means used to monitor quality of the finished programming tasks. Adherence to schedule and maintenance of operational fidelity are both easily quantifiable. Semi-annual reporting to NRC is included in the schedule. Project reports will be copied to all utility, industrial, and National Laboratory collaborators. Development of materials for the Nuclear Power Plant Operations (NPPO) courses will begin during Task 1 and will continue throughout Project Year 1. After each offering of an NPPO course, modules will be revised as needed to improve their effectiveness. This schedule is shown in the Gantt Chart. First use of AVI and Demonstration modules in the courses will begin Spring Quarter 2011 (Late March 2011). The deliverables will be the teaching modules. Interactive modules will be used in the NPPO-2 course to be taught in Autumn Quarter 2011 starting in September 2011 and in the NPPO-1 course to be taught Spring Quarter 2012 (April 2012). Development of the Human Reliability Analysis course will start in Winter Quarter 2011 and be first offered in Spring Quarter 2011. This first version of the course will include demonstration simulator modules. Development of demonstration and interactive simulator modules will begin in the summer of 2011 and the interactive modules will be ready for the second offering of the course in Spring 2012. Using course evaluation tools as well as the teaching experience of the instructors (Hajek and Smidts) course materials will be revised and updated after each course is taught and before the next offering of each course. Revision periods are detailed in the Gantt Chart. Semi-annual and annual progress reports are included in the Gantt Chart and will include progress reports, sample materials, schedule adherence, and any planning revisions that may be required.

7. Satisfaction of the Review Criteria

Each of the review criteria is addressed specifically below.

7.1. Potential for Supporting or Advancing the Nuclear Safety, Nuclear Security or Nuclear Environmental Protection Educational Infrastructure, and other Fields that the Commission Determines to be Critical to the NRC's Regulatory Mission

This proposal addresses curriculum improvements impacting four of the lead topical areas of interest to the NRC and several of the sub interest areas. In particular, student handson interaction with the full-scope classroom simulator, within the Nuclear Engineering topical area, will enable students to learn through plant operations how plant design affects nuclear plant safety, how procedures are applied and used during normal, off-normal, and emergency operations, how criticality is prevented, achieved, and controlled, and how the thermalhydraulics of the nuclear steam supply system are affected by operations of primary, secondary, and auxiliary plant systems.

The proposed Human Reliability Course besides addressing reliability, risk analysis methods, and human factors modeling, will use the simulator to enable students to measure the effects of various control panel design configurations, and the impact of using variations of analog and digital instrumentation and control systems. Since the modeling software provided by WSC is designed to enable relatively simple panel modifications, various configurations can be provided to students to provide *effective* laboratory experimentation and measurements.

7.2. Proposed Approach and Collaborative Linkages

The Nuclear Engineering Program at The Ohio State University has traditionally been a graduate program offering MS and PhD degrees. Two other Ohio State programs involving undergraduates are important to the proposed courses, and collaborations with four other universities also will benefit from these courses, The Undergraduate Minor in Nuclear Engineering (MINE) requires students to take four core Nuclear Engineering courses and three additional Nuclear Engineering courses as technical electives. The MINE was begun in 2002 and currently has *over* 50 students registered to complete the program. The primary current courses benefitting from this proposal, Nuclear Power Plant Operations I and II, *have* become the most popular elective courses for these students. Thus the MINE will significantly benefit from this project. A second important Ohio State program is the combined BS/MS program. In this program undergraduate students having a minimum 3.6 GPA are able to apply 15 credit hours *(five* courses) to both degrees. The Nuclear Power Plant Operations courses, as popular electives for undergraduate students, are proving to be primary recruiting tools for the graduate programs.

In 2005, the Ohio State University Nuclear Engineering Program partnered with Wilberforce University, the Nation's first HBCU (Historically Black College or University) to create a Minor in Nuclear Engineering on that Campus. Central State University officially joined that effort about a year later. Since its inception, OSU NE faculty *have* assisted in teaching courses at these two schools. The Nuclear Power Plant Operations courses are taught as a single semester in this joint program. As an example of sustained effort (also discussed elsewhere) Nuclear Plant Safety, developed in the first year of the NRC course development awards, also is presented as part of the MINE programs at these two schools.

Another partnership set benefitting from past NRC development programs is a distance learning program presented to Lakeland Community College near the Perry Nuclear Power Plant and Terra Community College near the Davis-Besse Nuclear Power Plant.
The proposed Human Reliability Course will initially be taught in the graduate programs. However, it is anticipated that some undergraduates in the OSU MINE will be interested in this course following their experiences in the Nuclear Power Plant Operations courses. Likewise, the Human Reliability Course can be taught using distance to both HBCU campuses and to the Community College campuses.

This program would not be possible without the commitment of Western Services Corporation providing the simulator modeling software. Likewise, long-term collaborations with the Waltz Mill Westinghouse Training and Operational Services organization and multiple nuclear power plant training organizations will continue to be required for plant modeling and simulator configurations. The Nuclear Power Plant Operations courses use extensive training materials from the Donald C. Cook Nuclear Power Plant, Davis-Besse Nuclear Power Plant, and the Perry Nuclear Power Plant. Relatively new collaborations with the Wolf Creek Nuclear Power Plant, Clinton Nuclear Station, and the Fermi Nuclear Power Plant also will be important to this project.

7.3. Institutional Capability and Capacity Building
Facilities and Directly Related Institutes and Centers at OSU

The Nuclear Engineering Program at OSU benefits from first class facilities as well as from a rich support environment provided by the existing institutions at the Ohio State University and resources which should allow it to complete the project successfully. These are described next. *Scott Laboratory* - Faculty offices and classrooms for the OSU nuclear engineering program are located within the newly constructed Scott Laboratory building. In addition to traditional offices, classrooms, and conference rooms, this facility is equipped with special distance learning resources. These resources include lecture rooms with video cameras, projectors, and screens to simultaneously share lectures with other facilities. This facility has been used and will continue to be used to teach the Nuclear Power Plant Operations courses to the two HBCU partners as well as to the University of Cincinnati. Space has been made available in the Scott Laboratory to host the full-scope classroom simulator for development and teaching. Scott Laboratory building and lecture room equipped with distance learning apparatus. *The Institute for Ergonomics (http://ergonomics.osu.edu)* is dedicated to ensuring safe and effective designs of work environments and consumer products. This is accomplished by determining both the physical and cognitive capabilities and limitations of people, and understanding how one's performance is affected by using different tools, work practices, and support technologies. The institute is part of the ISE department at OSU. The institute, its researchers, faculty, the students and the courses given are a resource which can be used within the context of this proposal (to either populate our course, or to teach human factors sections of the course.).

The Academic Center of Excellence (ACE) in Digital Instrumentation and Control (http://www.nuclear.osu.edu/ace) - funded by DOE and residing within the Nuclear Engineering Program- is dedicated to developing collaborations and workshops in the area of digital instrumentation, control and safety (including human machine interfaces), as well as to the identification of technology gaps and the building of a related research agenda. In the process of exercising its mission the Center has created research collaborations with the Halden Research project in Norway (center of much of the experimental nuclear human factors and human reliability research including the use of the HAMBO full scale simulator of the Forsmark III plant) and the human factors researchers at INL which can be called upon to provide input into meaningful case studies for the human reliability and nuclear operations courses.

Sustainability of Courses Developed and Modified

The strength areas of the Nuclear Engineering Program at The Ohio State University (OSU) are reactor instrumentation, control and safety, with particular emphasis on probabilistic risk assessment. The proposed project will significantly contribute to these strength areas by providing a real-world tool to students that will help them to understand the complex relationship and interaction between nuclear steam supply system and balance of the plant, as well as the importance of hardware/software/process/human interaction in assuring safe and reliable operation of the plant. It will also provide the OSU Nuclear Engineering Program with a unique capability among peer institutions that will enhance the education and training of students for better meeting the needs of the nuclear industry.

Sustainability of the proposed program is an important aspect of long range planning at Ohio State University. As detailed in the Introduction and Background section of this proposal, the Nuclear Engineering Program has an undergraduate Minor with more than 50 students. The graduate program has over 30 students. The course development work is being proposed to

improve two existing courses and to develop one new course to strengthen both the graduate and undergraduate programs.

Long-range institutional (financial) support is based strictly on enrollment figures. Individual Program support is based on the educational merits of courses and their importance to providing a complete educational experience for students entering the Workforce as well as their assistance in providing research development (i.e. providing students with the knowledge base necessary for conducting high quality, high visibility research), The proposed program will support both requirements.

Course numbering is important in the first consideration, and Program integration is important in the second. Both are met by the courses listed in this project. All of the existing courses are important for the Power Option in the Graduate Program and are subscribed well above minimum institutional student levels. Each of the two NPPO undergraduate/graduate courses are subscribed at levels more than two times minimum student enrollments. The new graduate level HRA course currently has sufficient student populations to draw from (30 graduate nuclear engineering students, 10 to 20 senior MINE students, graduate students in ISE) to expect it to be sustainable relative to enrollment levels. We expect the simulator activity in these courses to make them more desirable for students, and thus even more sustainable. The Human Reliability Analysis course will be cross listed in other Departments (i.e. ISE) to further enhance enrollments. The full scale simulator will also provide students with significant cutting edge simulation knowledge which will be used to enhance their further research activities. Other factors influencing sustainability is existence of space, existence of knowledgeable staff, availability of equipment, existence of research programs which will have cross-cutting uses of the simulator, existence of other courses which can make use of the simulator.

Classroom useable space in Scott Laboratory to host the simulator has been guaranteed by our administration.

Staff knowledgeable in the inner-workings of the simulator is guaranteed through our collaboration with WSC and through the personnel assigned to this proposal (1 PhD student with a 5 year term of study, 2 undergraduate MINE students with declared interest in graduate school at OSU, 1 additional graduate student, and 1 additional undergraduate students to act as back-ups, 2 senior and 2 junior faculty who will be trained on the simulator).
The necessary hardware equipment is inexpensive (two computer stations with multiple display screens of the order of $6,000).

Research programs which will help in sustaining the simulator include our research programs funded by DOE in the area of Digital Instrumentation and Control and for which we have established a research relationship with WSC outside the scope of this proposal.

As for long term integration of simulator use in other nuclear engineering courses, several of our instructors have indicated interest for courses such as NE 794J Digital Instrumentation and Control, Heat Transfer Applications in Nuclear Reactor Systems (NE/ME 737), Nuclear Power Plant Dynamics (NE 720), NE 716 Probabilistic Reliability Safety Analysis.

7.4. Key Personnel

Professor Carol Smidts is a full Professor in the Nuclear Engineering Program, Department of Mechanical Engineering at OSU. Her research focuses on reliability and risk

assessment, dynamic reliability, software reliability, software testing and human reliability. She is the author of more than 130 refereed journal and conference publications in these areas. She is the current Director of the Academic Center of Excellence in Instrumentation, Control and Safety. She is a Senior Member of IEEE, an Associate Editor of IEEE Transactions on Reliability, and a member of ANS. She is one of the authors of IDA, a predecessor to the IDAC cognitive model of operator crew behavior now central to NRC's research. While a faculty of the Reliability Engineering Program at the University of Maryland, College Park, she was one of the first to teach and develop the human reliability analysis course. She also participated (as the Belgian team member) to the first Human Reliability Benchmark Exercise organized by JRC Ispra in the late 1980s. Professor Smidts also recently participated in a successful NRCsponsored teaching proposal (awarded in 2008) which led to her co-developing with two other faculty (D. Miller and T. Aldemir) a graduate level course entitled "Digital Instrumentation and Control" which has been taught twice since the award date.

Professor Brian Hajek has an applications and research background in nuclear power plant operations and training. He served for ten years with NRC as an Operator Licensing Examiner, and as the founder of Nuclear Education and Training Services, Inc., provided examination and training services to about half the nuclear power plant sites in the U.S. as well as several International sites. He has been a member of the graduate faculty at Ohio State for nearly 30 years. At Ohio State he teaches the Introduction to Nuclear Science and Engineering course, courses in nuclear power plant operations, and courses in the nuclear fuel cycle. He first developed the NPPO courses about 20 years ago using his in-plant experience and experience as an Operator Licensing Examiner. He was appointed as an Administrative Judge (Technical) on the NRC's Atomic Safety and Licensing Board Panel in 2007. He conceived the Undergraduate Minor in Nuclear Engineering Program at Ohio State in 2002, and similar undergraduate programs at Wilberforce University and Central State University in 2004 and 2005, respectively.

Professor Richard Denning is an internationally recognized expert in the fields of risk analysis, nuclear safety, and severe accident behavior of nuclear reactors. He has managed studies of the safety and risk of a variety of nuclear facilities including commercial nuclear power plants and a number of DOE's non-reactor nuclear facilities. He was a primary contributor to the development of methods for Probabilistic Risk Assessment. He led Battelle's efforts in WASH-1400 for the prediction of severe accident behavior and source terms. He prepared the first draft of the NRC's Severe Accident Research Program. He was a major contributor to NRC's program to develop realistic methods for the analysis of source terms and to NUREG-1150. He wrote two chapters in the NRC's PRA Procedures Guide. Following the Chernobyl accident, Dr. Denning was a member of the NAS Committee to Review the Safety of DOE Reactors and DOE's Advisory Committee on Nuclear Facility Safety 1987-1991. From 1994 to 2006, he participated in the DOE's International Nuclear Safety Program with direct responsibility for providing safety hardware upgrades to Soviet-designed reactors in several FSU countries. He was a member of the NRC's Advisory Committee on Reactor Safeguards from September 2004 to August 2006. He chaired the Nuclear Engineering Program at The Ohio State University on an interim basis from July 1999 to June 2001 and from March 2006 to June 2007. He teaches courses in Reactor Safety and Risk Assessment at OSU and performs research related to the safety and licensing of nuclear power plants. Professor Denning will help focus the course on HRA methods and techniques under consideration in reactor safety and licensing.

7.5. Budget and Cost Effectiveness

The total budget required includes support for: 1) faculty time (C. Smidts (1.5

months/year) and B. Hajek (2.6 months/year), R. Denning (1.5 weeks in Year 2) to be used towards course and simulator development, interactions with collaborators (such as WSC), direction of student and staff activities; 2) student time: one full time graduate student and two undergraduate students committed to training, software installation and changes, simulator module development, adaptation and test runs; 3) limited staff time (2.5 weeks/year) for course notes development and logistic support; 4) travel ($12,260 in Year 1 and $7480 in Year 2) for stays at WSC and visits to industrial collaborator sites; 5) a small amount ($1000) for software tools, books, connectors.

Projections for faculty and student staff time are based upon experience of the Pis in developing other similar course materials, and both experience in managing software development projects, as well as recommendations of the collaborators for staff time requirements. Further, we have directly observed the effort required by experienced (trained) engineers for designing fully interactive NPP control panel mimics and making changes to those mimics. Travel costs include vehicle mileage at current Federal reimbursement rates between the OSU Columbus Campus and WSC, Waltz Mill, and utility NPP sites, and local lodging and per diem.

Industrial collaboration and contributions are difficult to monetize, but exceed the funding requested from NRC by a factor of well *over* 10, and arguably by a factor of more than 100. Westinghouse is providing a simulator model to port into 3KEYMASTER. Much of the Westinghouse model is written in Assembler, requiring technical support. The project budget includes $6500 that will cover a portion of this required support. In addition, cost share is provided by the faculty of the Nuclear Engineering program who will use start-up funds as well as other program resources to cost share hardware equipment and software ($13,000) and tuition fees for the graduate student (around $14,000 per year).

As explained earlier, "the strength areas of the Nuclear Engineering Program at The Ohio State University (OSU) are reactor instrumentation, control and safety, with particular emphasis on probabilistic risk assessment." The proposed educational activities fit directly within this agenda. It should be noted that the proposed project is made highly cost *effective* through: 1) our collaborative linkages such as those with WSC which have guaranteed us a free version of the simulator development environment and free training classes and those with Westinghouse which should allow us minimal simulation module development costs), 2) through educational and research synergies which will ensure sustainability of the simulator environment at a lesser cost, 3) possible amortizing of costs through many educational venues (multiple nuclear engineering courses at OSU beyond the ones which are the focal point of the proposal, and potential use for courses at Willberforce University and Central State University or at the University of Cincinnati.

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."