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

1. GRANT/AGREEMENT NO.	2. MODIFICATION NO.	3. PERIOD OF PERFORMANCE	4. AUTHORITY
NRC-HQ-11-G-38-0056		FROM: 8/22/2011 TO: 8/31/2013	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: 146515460 NAICS:611310	University of Nevada, Reno 1664 North Virginia Street, MailStop 325 Reno, NV 89557

8. PROJECT TITLE:
Enhancement of the Development of Nuclear Materials Engineering and Combustion Courses at the University of Nevada, Reno

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)	Dr. Dev Chidambaram Chemical and Materials Engineering Email: dcc@unr.edu Phone: 775-784-7066

12. NRC PROGRAM OFFICE (NAME and ADDRESS)	13. ACCOUNTING and APPROPRIATION DATA		14. METHOD OF PAYMENT
NRC Attn: Tanya Parwani-Jaimes Office of Human Resources MS: GW5A06 (301) 492-2308 11545 Rockville Pike Rockville, Maryland 20852 Email: Tanya.Parwani-Jaimes@NRC.GOV	APPN. NO: B&R NO: JOB CODE: BOC NO: OFFICE ID NO: FAIMIS	31X0200 2011-84-51-K-134 T8453 4110 RFPA: HR-11-270 GR0059	[ ] 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	$82,916.00	NRC	$82,916.00	This action provides funds for Fiscal Year in the amount of See Page Two
PREVIOUS OBLIGATION		RECIPIENT	$9,966.00	
TOTAL	$82,916.00	TOTAL	$92,882.00	

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

U.S. Nuclear Regulatory Commission
Div. of Contracts
Attn: Shashi Malhotra Email: Shashi.Malhotra@NRC.GOV
Mail Stop: TWB-01-B10M
Rockville MD 20852

18.	19. NRC CONTRACTING OFFICER
Signature Not Required	Sheila Bumpass (Signature) 8/22/11 (Date) NAME (TYPED) Sheila Bumpass TITLE Contracting Officer TELEPHONE NO. 301-492-3484

20. PAYMENT INFORMATION

Payment will be made through the Automated Standard Application for Payment (ASAP.gov) unless the recipient has failed to comply with the program objectives, award conditions, Federal reporting requirements or other conditions specified in 2 CFR 215 (OMB Circular A110).

21. Attached is a copy of the "NRC General Provisions for Grants and Cooperative Agreements Awarded to Non-Government Recipients. Acceptance of these terms and conditions is acknowledged when Federal funds are used on this project.

22. ORDER OF PRECEDENCE

In the event of a conflict between the recipient's proposal and this award, the terms of the Award shall prevail.

23. By this award, the Recipient certifies that payment of any audit-related debt will not reduce the level of performance of any Federal Program.

TEMPLATE - ADM001

SUNSI REVIEW COMPLETE

ADM002

ATTACHMENT A - SCHEDULE

A.1 PURPOSE OF GRANT

The purpose of this Grant is to provide support to the "Enhancement of the Development of Nuclear Materials Engineering and Combustion Courses at the University of Nevada, Reno" as described in Attachment B entitled "Program Description."

A.2 PERIOD OF GRANT

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

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

A. GENERAL

1. Total Estimated NRC Amount:	$82,916.00
2. Total Obligated Amount:	$82,916.00
3. Cost-Sharing Amount:	$9,966.00
4. Activity Title:	Enhancement of the Development of Nuclear Materials Engineering and Combustion Courses at the University of Nevada, Reno
5. NRC Project Officer:	Tanya Parwani-Jaimes
6. DUNS No.:	146515460

B. SPECIFIC

RFPA No.:	HR-11-270
FFS:	N/A
Job Code:	T8453
BOC:	4110
B&R Number:	2011-84-51-K-134
Appropriation #:	31X0200
Amount Obligated:	$82,916.00

A.3 BUDGET

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

Personnel	$37,141.00
Fringe Benefits	1,913.00
Equipment	13,374.00
Supplies	3,000.00
Contractual	4,000.00
Total Direct Cost	59,428.00
Indirect Cost	23,488.00
Total	$82,916.00

A.4 AMOUNT OF AWARD AND PAYMENT PROCEDURES

1. The total estimated amount of this Award is $92,882.00 for the two-year period.
2. NRC hereby obligates the amount of $82,916.00 for program expenditures during the period set forth above and in support of the Budget above. The Grantee will be given written notice by the Contracting Officer when additional funds will be added. NRC is not obligated to reimburse the Grantee for the expenditure of amounts in excess of the total obligated amount.

3. Payment shall be made to the Grantee in accordance with procedures set forth in the Automated Standard Application For Payments (ASAP) Procedures set forth below.

Attachment B – Program Description

PROGRAM DESCRIPTION

Project Objectives and Benefits:
The objective of this proposal is to develop two courses on topics critical to the regulatory mission of the NRC that have not been taught at the University of Nevada, Reno in the past. These courses are "Nuclear Materials Engineering" and "Introduction to Combustion." These courses will be *sustained* because the College of Engineering has the resources to offer them on a regular basis after they are developed, and both are expected to serve roughly 15 undergraduate and graduate students each time they are taught. This work will be accomplished *effectively* because the courses will be developed by faculty members who conduct research in these areas. These courses will be *innovative* because they will incorporate methods and data developed from research at UNR. The Nuclear Materials Engineering course will also include a unique laboratory component. If the proposal is funded, the College of Engineering will commit *voluntary matching funds of $9,966* to have an adjunct professor teach a course in "Nuclear Power Fundamentals," which will provide a context for students taking the courses being developed under this proposal. These courses are expected to stimulate the interest of students and motivate them to pursue employment and graduate study in nuclear-related engineering fields

1. Advancing Nuclear Educational Infrastructure of Fields Critical to NRC's Mission
1.1 Institutional Background and Long-Range Goals
To fulfill its regulatory mission, the Nuclear Regulatory Commission (NRC) must assess methods to reduce the risk and consequence of fires within nuclear power plants and in fuel cycle facilities (such as spent fuel transportation systems). In order to achieve this, analysts must be trained to predict fire behavior in a variety of environments, and the response of equipment to heat transfer from those fires. The NRC and the nuclear industry also require analysts who can accurately predict the long-term reliability and corrosion behavior of advanced materials and weldments in high temperature reactor environments. These two topic areas are of immediate importance with the aging of current light water reactors, the proposed developments of liquid-sodium cooled fast neutron reactors, and the need for transport systems to and from centralized separation, fabrication and storage facilities.
For the past 17 years, research has been conducted at the University of Nevada, Reno (UNR) in Spent Nuclear Fuel Transportation Fire Safety, and in Nuclear Materials Reliability. This research has been funded by the NRC, the Department of Energy, the State of Nevada, and a private corporation. The fire safety work has been conducted in the Mechanical Engineering (ME) Department by a research group headed by Co-Principal Investigator (Co-PI) M. Greiner. To our knowledge, this is the only academic group currently conducting research in spent nuclear fuel transportation fire safety (research at MIT and University of Texas, Austin ended in the 1990's). The nuclear materials research has been performed in the Materials Science and

Engineering (MSE) Program within the Chemical and Materials Engineering (CME) Department, by a group of five professors: Drs. D. Chidambaram, M. Misra, N. Tsoulfanidis, D. Chandra and K. S. Raja. D. Chidambaram, the PI on this proposal, is the most recent tenure-track faculty to join the MSE program and is a member of that group.

Long range planning by ME and CME Departments (see Attachments 1 and 2) show those departments will benefit by increasing their instructional offerings in nuclear-power-related engineering. That conclusion is based on (a) projected demand for engineers in the nuclear power sector, (b) interest among students to develop careers in non-fossil fuel based energy generation, (c) the experience and expertise of faculty members in the departments, (d) a need to serve the needs of local professional engineers, and (e) an effort to support the educational needs of current students at UNR who are performing funded research in these areas. It should be noted that ME and CME departments have well established research programs with annual awards (in 2010) totaling ~$2.1 and ~$3.8 Million, respectively. Further, UNR is the only university located in Northern Nevada that is capable of providing engineering training.

In the Fall 2009 semester, the MSE program initiated a Nuclear Materials Emphasis. This is UNR's only nuclear-related educational program. The Nuclear Materials Emphasis will include courses such as Nuclear Power Fundamentals, Nuclear Fuel Cycle, and Corrosion Degradation of Nuclear Materials, among others. In May 2010 the NRC awarded UNR a $400,000 Fellowship Program in Materials and Thermal Science for Nuclear Power. The objective of that program is to develop a workforce with advanced degrees that is able to support the design, construction, operation and regulation of nuclear facilities, and the safe handling of nuclear materials. *Fellowships were awarded to two outstanding graduate students at the beginning of the Fall 2010 semester.* Both of these students are now performing research under the supervision of the PI and Co-PI. This fellowship program is being marketed to students from UNR and other universities. In 2009 and 2010, UNR continued to develop its nuclear-related engineering research and educational programs by submitting applications to the NRC Faculty Development grant program to support Professor Chidambaram.

The CME and ME departments aim to grow the number of nuclear-power-related course offerings both quickly and practically. To this end, the two departments are developing new courses and at the same time, the two departments are willing to, and UNR has the capacity to, have UNR students take course from other universities, and share our unique courses with other institutions. The CME and ME departments at UNR are working with the University of Nevada, Las Vegas (UNLV), which has a Ph.D. program in Radiochemistry, and the University of Utah (U of U), which has a new Nuclear Engineering Minor, to develop an internet-based system and administrative procedures to share unique courses and special seminars. The UNR College of Engineering has an Instructional Designer who is facilitating web-based educational-network development. We feel that a mix of distance and local classes and seminars, along with development of new local courses, is the fastest and most effective method to provide our students with increased nuclear-energy-related engineering content.

1.2 Problem Identification, Innovation, and Solution Effectiveness

The overarching goal of the PI and Co-PI is to develop elective courses within the ME and CME Departments that will:

(a) Help our students develop interests and skills in nuclear-related fields,

(b) Motivate students to consider pursuing graduate degrees in nuclear related fields,

(c) Give students an advantage when applying for those professional and graduate school opportunities,

(d) Provide current engineers in our community an opportunity to develop new skill in the nuclear area, and

(e) Enhance the educational breadth and depth of current UNR students performing research in nuclear related areas.

This will produce graduates who are highly competitive for leadership positions in nuclear-related employment at National Labs, the NRC and in industry.
To accomplish this task we plan to develop two classes in the areas of Fire Safety Engineering and Nuclear Materials Engineering, which are critical the NRC's regulatory mission. The two courses namely "Nuclear Materials Engineering" and "Introduction to Combustion" will be taught by Professors D. Chidambaram (MSE) and M. Greiner (ME), respectively. These two topic are chosen to take advantage of existing faculty expertise, equipment, and collaborations with technical staff at National Laboratories and the NRC, most of which have been acquired as the result of funded research programs in these areas.
This work will be conducted *effectively* because both courses will be developed by faculty members who currently perform research in these areas. These courses will be *innovative* because they will incorporate data, methods and experience developed from research at UNR, and they will incorporate materials from research collaborators at National Labs and the NRC. The Nuclear Materials Engineering course will include a unique laboratory component. The courses will also be available to students outside the UNR via a web-based network. Both of these courses will be *sustained* after they are developed based on the needs and goals of the two departments (See Attachments 1 and 2). Because the PI's are tenured and tenure-track faculty, this course development will add to UNR's long-term capabilities. The *effectiveness* of this program will be measured in terms of the number of students who complete these courses, student course evaluations, and the number who pursue advanced degrees or careers in nuclear-related engineering (determined based upon departmental exit interviews of graduating seniors and follow up job placement information).
If the current proposal is funded by the NRC, the College of Engineering has committed matching funds (See attachment 3) for Adjunct Professor N. Tsoulfanidis to teach the course entitled "Nuclear Power Fundamentals." This course will provide an excellent context for students who take the classes being developed under this proposal (it can also be taken as an elective by any student in the College of Engineering).

2. Approach and Collaborative Linkages

2.1 Approach

This section describes the objectives, methodologies, operating plans, timetable, products, evaluation and dissemination of the two courses being developed.
2.1.1 Nuclear Materials Engineering Several students in the MSE program have conducted/conducting graduate research on nuclear materials under the guidance of the departmental faculty Drs. D. Chidambaram, M. Misra, N. Tsoulfanidis, D. Chandra, and K. S. Raja. However, to date neither the MSE program nor the CME Department has offered a Nuclear Materials course. *Therefore, Dr. D. Chidambaram is proposing to develop a course titled "Nuclear Materials Engineering" for the benefit of the students.* It will be a 3 credit course available to undergraduate seniors and first year graduate students and will include a laboratory component. This course will be a part of the core curriculum for the Nuclear Materials Emphasis. Further, the proposed course will require "MSE 250: Elements of Materials Science" and "MSE 460: Physical Metallurgy" courses as prerequisites. *In essence, the proposed "Nuclear Materials Engineering" will be an instructional Nuclear Materials class that will include laboratory work (both hands on and demonstrations).*
The following topics will be discussed in the "Nuclear Materials Engineering" course:
Instructional component:
- Introduction to fission reactors and reactor design
- Materials needed (fuel, cladding, pressure vessel, structural materials etc)
- Environmental conditions in which materials will have to perform (radiation, coolant

temperature and flow)
• Length of service and energy production (2 year cycles but every assembly will stay for 3 cycles; total 6 years; burnup (BU) ~ 55,000 MWd/tU)
• Material properties requirements
• Expected problems [mechanical (expansion), chemical (corrosion), radiation]
• Radiation Interactions, Collision Theory
• Radiation Damage and Swelling
• Stress Analysis
• Creep, Hardening and Toughness
• Corrosion thermodynamics, kinetics, testing and characterization
• Densification, Rod Bowing, Clad Collapse
• Fuel Fabrication, Performance and Failure – U and Pu
• Fission Products and Thermal Conductivity
• Microstructures
• Steels, Zirconium, and Ni alloys

Laboratory component:
• Mechanical Testing: Creep, Hardening and Toughness
• Corrosion testing and characterization

Graduate students:
Graduate students in the class will have to write a term paper and present it in addition to the assignments performed by the undergraduates.
Course Materials:
While there is no standard 'textbook' for use in this class and the course materials will primarily consist of notes and review articles, the following two books will be used for parts of the course:
Chapter 7 from 'Fundamentals of Nuclear Science and Engineering' by J. K. Shultis, and R. E. Faw; CRC Press; ISBN: 978-1420051353
Chapter 5 from 'Fundamental Aspects of Nuclear Reactor Fuel Elements' by D. R. Olander; University of Michigan Library
Multiple chapters (primarily part III) from 'Fundamentals of Radiation Materials Science: Metals and Alloys' by G. S. Was; Springer; ISBN: 978-3540494713
Multiple chapters (chapters 8, 13 and 22) 'Aging and Life Extension of Major Light Water Reactor Components' by V.N. Shah and P.E. MacDonald; Elsevier; ISBN: 978- 0444894489
Grading:
The course will consist of 33 lectures, 6 hands-on and demonstration experiments, 8 homework assignments, two midterm exams, and a final.
Course Description:
In the standard topics listed above, the course will also include discussions on the latest materials problems and experimental data as examples. For example, hydriding of zircalloys, and material radiation damage observed at some commercial nuclear reactors will be discussed. Drs. Stuart Maloy (Program Manager of the Advanced Nuclear Energy Programs at Los Alamos National Laboratory) and Michael Billone (Manager, Irradiation Performance Section, Argonne National Laboratory) have offered to supply guest lectures on topics such as radiation damage and hydriding of zircalloys (Letters of Support are included in Attachments 4 and 5). Further, discussions are underway with Dr. Billone to have a video tour of the irradiation facility and research given to the students during one of the lectures. Dr. Billone has also indicated his willingness to review the course materials throughout the development of the course (See attachment 5). Based on time constraints of the speakers, these lectures will be given either in person or over the internet.
In the first year of course offering, certain sections of the course (Radiation Interactions,

Collision Theory; Radiation Damage and Swelling; Length of service and energy production; Fuel Fabrication, Performance and Failure) will be taught by Dr. N. Tsoulfanidis. Dr. Chidambaram will teach the course in its entirety from the second instance of course offering. Adjunct Professor N. Tsoulfanidis is serving as the mentor of Dr. Chidambaram's education program in nuclear materials. The co-teaching of the course will help Dr. Chidambaram learn the aspects of teaching a nuclear engineering course from an experienced teacher. The course is planned to be offered on a regular basis and is anticipated to have an enrollment of 15 students per offering.
A part of the course will feature hands-on demonstrations and laboratory work by the students. Laboratory component will include hands-on experience in measurement of mechanical properties and corrosion characteristics of the materials. The CME Department has state-of-the-art research equipment such as universal testing machines and electron microscopes that will be used for the course. Funds are requested for the purchase of a portable electrochemical potentiostat (Gamry REF series) for use in this course. Corrosion characteristics of a material play a crucial part in the selection of materials for nuclear reactors and thus it will help the students in understanding these important topics. Further, the PI is developing a Nuclear Materials Teaching laboratory and plans to build up the infrastructure so as to enable him to offer a Nuclear Materials Characterization Laboratory course in the future. The potentiostat will be one of the first instruments in that laboratory. Gamry REF series potentiostats offer a very simple and portable USB based potentiostat. This potentiostat would enable it to be moved it to other locations for the purpose of teaching off-site, such as the Advanced Test Reactor User Facility. This is a topic that will be considered in the future based on student interest.

2.1.2 Introduction to Combustion While the ME Department has an established research program in Spent Nuclear Fuel Transportation Fire Safety Engineering, the University does not currently offer any courses on Combustion, Fire Dynamics, or Fire Protection. The objective of this part of the proposal is for ME Professor M. Greiner to develop a sustainable Introduction to Combustion lecture course. It will be a three-credit elective available to senior undergraduates and first-year graduate students who have completed introductory heat transfer, fluid mechanics and thermodynamics classes.
The course will cover chapters 2-10 and 14 of the textbook *An Introduction to Combustion* by S.R. Turns. The following topics will be discussed:

- Combustion and Thermo-chemistry
- Mass Transfer
- Chemical Kinetics
- Chemical Mechanisms
- Coupled Chemical/Thermal Reacting System Analysis
- Reacting Flow Conservation Equations
- Laminar Premixed Flames
- Laminar Diffusion Flames
- Droplet Evaporation and Burning
- Burning of Solids

The course will consist of 39 lectures, 9 homework assignments, two midterm exams, and a final. Graduate students in the class will perform a project in addition to the assignments performed by the undergraduates.
The course will be innovative in that experimental data, simulation results, methods and experience obtained from spent fuel transportation safety research conducted at UNR will be discussed and used as examples. This will include prediction and measurement of heat flux from large fires to thermally-massive engulfed and nearby objects. It will also include methods for predicting the response of transport casks to that heat flux.

Argonne and Sandia National Laboratories have offered to supply guest lectures on topics such as federal fire testing requirements for spent fuel and other nuclear material packages, and large-scale fire testing program (Letters of Support are included in Attachments 6 and 7). These lectures will be given in person (if resources are available), or using an internet-based connection.

After the course is developed it will be offered on a regular basis and is anticipated to have an enrollment of 15 students per offering. Future proposals will address adding laboratory experiences to this course, and the development of higher level fire safety engineering courses, for which Introduction to Combustion will be a prerequisite.

2.1.3 Products and Results This work will result in the development of two new courses at UNR, Nuclear Materials Engineering, and Introduction to Combustion, which train students in areas that are critical to the NRC's regulatory mission. Roughly 15 students are estimated to be trained per course during each offering. Once these courses are developed under NRC funding, they will be taught on a regular basis by Professors Chidambaram and Greiner. The course materials will also be available to other instructors at UNR.

The two courses will be evaluated in terms of the number of students who enroll in and pass them, student course evaluations (which are performed in all UNR Engineering classes), and the number of students who develop interests in perusing nuclear-related engineering careers (this will be determined based on exit interviews follow-up of their job placements). These results will be compared to other elective courses offered in the College of Engineering.

2.2 Linkages and Collaborations

Attachments 4 and 5 contain letters of support from Drs. Stuart Maloy (Program Manager of the Advanced Nuclear Energy Programs at Los Alamos National Laboratory) and Michael Billone (Manager, Irradiation Performance Section, Argonne National Laboratory) indicating their strong support for the Nuclear Materials Engineering at UNR and their willingness to provide supplementary materials for such a course. Attachments 6 and 7 contain letters of support from Sandia and Argonne National Laboratories. They indicate that each institution has a vested interest in fire safety engineering, and that each has funded work in this area at UNR. Moreover, both have shown interest in providing materials for the course. These materials will be provided either via an in-person guest lecture or using a web-based distance education network. Finally, the letter from Sandia (Attachment 6) indicates that interactions such as these are good ways to lead to future collaborations.

3. Existing and Building of Institutional Capability

UNR is a 135 year old land-grant university and is the oldest in the State of Nevada. The university is classified by the Carnegie Foundation for the Advancement of Education as a Comprehensive Doctoral (institution) with medical and/or veterinary medicine. UNR has a student enrollment of ~17,000, including ~3,200 graduate students and provides a broad range of programs and degree options, ranging from baccalaureate degrees in more than 75 disciplines to more than 100 graduate-degree programs at the master's and doctoral level.

3.1 Institutional Capabilities in Areas Critical to NRC

3.1.1 Fire Safety Engineering Since 1993, a research group in the ME Department led by Co-PI M. Greiner has developed methods to predict the response of spent nuclear fuel transport casks under fire accident conditions. This research has been funded by the NRC, the Department of Energy, the State of Nevada, and a private corporation. The group has performed large-scale fire tests and used the resulting data to benchmark and adjust the Container Analysis Fire Environment (CAFE) computer code (see figures on following page). CAFE was developed at Sandia National Laboratories for transportation risk assessment studies. It links a computational fluid dynamics fire simulator to finite element cask models. The

group has also used CAFE to predict the fire response of transport casks for a variety of wind conditions and cask placements relative to the fuel source.
This research program has graduated eleven masters degree and one Ph.D. student (one Ph.D. student is currently completing his degree), published 40 refereed conference papers, and 17 archival journal papers. This work has helped the group develop close working relationships with technical staff in the Division of Spent Fuel Storage and Transport at the NRC, the Advanced Nuclear Fuel Cycle Technologies Department of Sandia National Laboratories, and the Decision and Information Sciences Division at Argonne National Laboratories.

3.1.2 Materials Engineering MSE Program has been extensively involved in nuclear materials and materials reliability research for over 15 years, with total research funding exceeding $20M. Five faculty members in MSE are active in Nuclear Materials research, namely, Drs. M. Misra, N. Tsoulfanidis, D. Chandra, K. S. Raja, and D. Chidambaram. Two research faculty members with emphasis on nuclear materials have been hired in the last few years. Examples of nuclear research projects at UNR include: Advanced Research and Development in Materials Reliability for Nuclear Materials, DOE-Advanced Fuels Cycle Initiative, Yucca Mountain Corrosion-Task 14, Environmental Effects on Corrosion Properties of Alloy 22, Materials Evaluation, Degradation, and Modeling of nuclear materials. Recently, Dr. Chidambaram is in discussions with relevant personnel for the use of the ATR for his research.
UNR has invested significant amounts of resources into the strengthening its Nuclear Materials program. The MSE program has dedicated facilities for conducting radioactive materials development, materials testing and analysis, and corrosion studies. State-of-the-art transmission and electron microscopes are also available in the CME department to study microstructures. Recently, a $300,000 research grant awarded by the DOE helped establish a friction stir welding facility in CME Department. Furthermore, the department has an active outreach program and is currently in discussions with GE-Hitachi for the installation of a large-component testing facility at UNR to study nuclear materials for GE-Hitachi modular reactors. The University Provost and the Dean of the College of Engineering provided a fully funded faculty-line for the hiring of co-PI Dr. Chidambaram. The Vice-President for Research (VPR) provided a generous start-up.

3.2 Building of Institutional Capability
The research programs described in the last sections have given faculty members at UNR experience working in Fire Safety Engineering and Materials Engineering, and make them qualified to teach the proposed courses. The ME and CME departments have the *capacity* to offer these classes because they (a) have a sufficient number of faculty to increase the number of elective courses they offer (and they have need to do so), and (b) offer the course prerequisites on a regular basis. Moreover, the CME Department has the equipment needed for the Materials Laboratory from earlier funded research projects. The primary resource needed to create these new courses is the time for the faculty members to develop them.
These two new courses will strengthen the university by providing instruction in fields of interest to its students, the NRC, National Labs, and other employers. The professors will also develop new teaching capabilities. The Mechanical Engineering and Chemical and Materials Engineering Departments will provide support by offering the classes on a regular basis, and providing appropriate space for the Materials Laboratory.
There is a high likelihood that this project will enhance UNR's capacity in Materials and Fire Safety Engineering after NRC funding has ended. This is based on UNR's ability to attract funding from external sources in these areas in the past. The courses will enhance student education experience in Fire Safety and Material Engineering, and this will make UNR more competitive for future research funding in these areas.

4. Key Personnel

The principal investigator is Chemical and Materials Engineering Assistant Professor Dev Chidambaram, and the Co-PI is Mechanical Engineering Professor Miles Greiner. They will develop and teach the two courses separately, and they will jointly administer the grant. Both principals have experience developing and teaching courses, and administering grants, as described in the following sections. After the PI's have developed and taught the proposed courses, other faculty member will be able to use those materials to teach the classes. This will be important when the Co-PI's go on sabbatical leave.

The participant, Adjunct Professor N. Tsoulfanidis, is an experience nuclear engineering researcher and professor. He will assist Dr. Chidambaram in developing materials for the Nuclear Materials Engineering, and will teach the Nuclear Power Fundamentals course with UNR matching funds if this proposal is funded.

Dr. Miles Greiner (Co-PI) received his Ph.D. in 1986 from MIT and joined the faculty of UNR that same year. He is currently Professor of Mechanical Engineering and a Fellow of the ASME. He has taught graduate and undergraduate thermal science courses, engineering mathematics, freshman design, and has developed innovative, low cost methods of teaching instrumentation and experimentation. He was recognized as a Senior Mentor in 1989 and 2001. Professor Greiner has performed large-scale experiments and computational studies of heat transfer to massive objects engulfed in pool fires. This work has focused on the interaction between fires, the surrounding wind conditions and the engulfed object. It has led to an understanding of the radiation properties of fires as well as the accuracy of inverse conduction techniques used to measure heat flux in fires. He has used this work as a basis to estimate the response of truck and rail sized nuclear waste transport packages under severe accident conditions. The Nuclear Regulatory Commission, Department of Energy, Sandia and Argonne National Laboratories, the Nevada Nuclear Waste Project Office, and Innovative Technologies Solutions Corporation have funded this work. He has also advised the Nuclear Regulatory Commission and the State of Nevada on nuclear waste package testing. Based on work he performed in this area he received an award for co-authoring the Outstanding Operations, Applications, and Components Technical Paper at the 2003 ASME Pressure Vessel and Piping Conference, and the G.E.O. Widera Literature Award for co-authoring the Outstanding Technical Paper in the 2004 *Journal of Pressure Vessel Technology*.

In addition to these topics, Dr. Greiner performed experimental and computational research on heat transfer augmentation with support from the National Science Foundation, the Gas Research Institute, and the United Technologies Research Center. He has also has performed proprietary research in the areas of gas turbine engine film cooling for Pratt Whitney, and advanced hydrogen reformer design for Hydrogen Burner Technologies Corporation.

Dr. Dev Chidambaram (Co-PI) joined the CME department as a tenure-track faculty in Fall, 2009. Dr. Chidambaram, with a very strong background in Materials Science (MS, PhD) and Electrochemical Engineering (BS), was previously working at Brookhaven National Laboratory (BNL) for 5 years; starting as a Goldhaber Distinguished Fellow and had been promoted recently to an Associate Materials Scientist at BNL. He has a broad background in materials characterization techniques including various synchrotron-based techniques. He is also the spokesperson for the X11A & X11B synchrotron X-ray absorption beamlines at the NSLS, BNL. He has conducted extensive research in corrosion and alloys, including passivity of alloys, uranium alloys, metal hydrides, thermal sprayed coatings for challenging environments, and nuclear fuel container materials. He has received numerous awards including the Morris Cohen Award from the Electrochemical Society and the Hans-Jurgen Engell Prize from the International Society of Electrochemistry. Dr. Chidambaram has published over 30 articles. His most recent publication was in the esteemed *Proceedings of the National Academy of Sciences* (v106, p14201-06, 2009). Further, he has mentored several undergraduate and graduate

students. Dr. Chidambaram is therefore an established scientist and educator with extensive background in materials science and nuclear materials.
A successful Nuclear Science research program requires collaborations outside of one's field of expertise. Dr. Chidambaram has a proven track record of collaborating with researchers from various disciplines. In the short time, he has been at UNR he has already started building collaborations with faculty in Mechanical Engineering, Chemistry and Computer Science Departments. Further, he has strong ties with research at the National Synchrotron Light Source and the Center for Functional Nanomaterials at Brookhaven National Laboratory and surface spectroscopists at the State University of New York at Stony Brook. **Dr. Nick Tsoulfanidis (Participant)**. Dr. Nicholas Tsoulfanidis received a B.S., Physics, University of Athens, Greece, 1960 a M.S., in Nuclear Engineering (NE), University of Illinois, 1965 and a Ph.D., in NE, University of Illinois, 1968. In 1968 he joined the faculty of the NE program University of Missouri-Rolla, There, he served until 2004 as a faculty member, Chairman of the Department, Interim Vice Chancellor for academic Affairs (one year), and Associate Dean of the School of Mines and Metallurgy for Graduate Studies and Research for more than 10 years. He is the co-author of the book "The Nuclear Fuel cycle: Analysis and Management", now in its 2nd Edition and of the book "Measurement and Detection of Radiation", 3rd Edition to be published shortly (End of 2010).
Since June 1997, Dr. Tsoulfanidis is serving the Editor of Nuclear Technology, an international technical Journal published by the American Nuclear Society. During the period July 1 2005-July 31 2007 he served as Interim Chair of the Chemical & Metallurgical Engineering Department at the University of Nevada–Reno. He is now an Adjunct Professor at UNR and also serves as a part-time Technical Judge for the Atomic Safety and Licensing Board (ASLB) of the NRC. Dr. N. Tsoulfanidis is the mentor for Dr. Chidambaram's educational program in Nuclear Materials and thus will provide guidance and help Dr. Chidambaram, a young tenure-track faculty member in establishing himself as an educator in nuclear materials.

5. Budget Effectiveness

The primary expenses for this proposal are for summer salary for the Co-PIs, and for a graduate teaching assistantship (stipend and tuition). The Co-PIs time will be spent developing course lectures, assignment, project and exams. Both Co-PIs are experienced in conducting research in the topic of the courses, and have administered externally-funded grants in the past. These experiences will allow them to be more effective in developing the proposed courses than instructors who do not have those experiences. Dr. Chidambaram will be working with a part-time graduate teaching assistant to develop the laboratory component of the Nuclear Materials course. Working with a graduate student is much less expensive and hence more financially effective than if he performed all the work himself. Further, it will also indirectly familiarize and prepare another graduate student in nuclear materials research. Funds are also requested for necessary materials and electron-microscope services for the Nuclear Materials course, as well as for fringe benefits and university overhead. All expenses are described in section F "Detailed Budget Narrative."

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 this URL to the Office of Management and Budget Cost Circulars is included for reference to:
A-21 (now 2 CFR 220)
A-87 (now 2 CFR 225)
A-122 (now 2 CFR 230
A-102:

http://www.whitehouse.gov/omb/circulars_index-ffm

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

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

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

1. Applicability of 2 CFR Part 215

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

b. Grantees must comply with monitoring procedures and audit requirements in accordance with OMB Circular A-133. <
http://www.whitehouse.gov/omb/circulars/a133_compliance/08/08toc.aspx >

2. Award Package

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

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

Subgrants
Appendix A to Part 215—Contract Provisions

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

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

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

Title VI of the Civil Rights Act of 1964 (42 USC §§ 2000d et seq)
Title IX of the Education Amendments of 1972 (20 USC §§ 1681 et seq)
Section 504 of the Rehabilitation Act of 1973,as amended (29 USC § 794)
The Age Discrimination Act of 1975, as amended (42 USC §§ 6101 et seq)
The Americans with Disabilities Act of 1990 (42 USC §§ 12101 et seq)
Parts II and III of EO 11246 as amended by EO 11375 and 12086.
EO 13166, "Improving Access to Services for Persons with Limited English Proficiency."
Any other applicable non-discrimination law(s).

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

perform work connected with the carrying on by such corporation, association, educational institution, or society of its activities.

Modifications/Prior Approval

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

Lobbying Restrictions

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

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

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

§ 215.13 Debarment And Suspension.

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

(1) Are presently excluded or disqualified from covered transactions by any Federal department or agency;

(2) Have been convicted within the preceding three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State, or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, tax evasion, receiving stolen property, making false claims, or obstruction of justice; commission of any other offense indicating a lack of business integrity or business honesty that seriously and directly affects your present responsibility;

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

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

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

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

'Debarment, Suspension, Ineligibility, and Voluntary Exclusion

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

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

Implementation of E.O. 13224 -- Executive Order On Terrorist Financing
The Grantee is reminded that U.S. Executive Orders and U.S. law prohibits transactions with, and the provision of resources and support to, individuals and organizations associated with terrorism. It is the legal responsibility of the Grantee to ensure compliance with these Executive Orders and laws. This provision must be included in all contracts/sub-awards issued under this grant/cooperative agreement.

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

Procurement Standards. § 215.40-48
Sections 215.41 through 215.48 set forth standards for use by Grantees in establishing procedures for the procurement of supplies and other expendable property, equipment, real property and other services with Federal funds. These standards are furnished to ensure that such materials and services are obtained in an effective manner and in compliance with the provisions of applicable Federal statutes and executive orders. No additional procurement standards or requirements shall be imposed by the Federal awarding agencies upon Grantees, unless specifically required by Federal statute or executive order or approved by OMB.

Travel
Travel must be in accordance with the Grantee's Travel Regulations or the US Government Travel Policy and Regulations at: www.gsa.gov/federaltravelregulation and the per diem rates set forth at: www.gsa.gov/perdiem, absent Grantee's travel regulation. Travel costs for the

grant must be consistent with provisions as established in Appendix A to 2 CFR 220 (J.53). All other travel, domestic or international, must not increase the total estimated award amount.

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

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

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

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

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

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

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

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

Patent Notification Procedures- Pursuant to EO 12889, NRC is required to notify the owner of any valid patent covering technology whenever the NRC or its financial assistance Grantees, without making a patent search, knows (or has demonstrable reasonable grounds to know) that technology covered by a valid United States patent has been or will be used without a license from the owner. To ensure proper notification, if the Grantee uses or has used patented

technology under this award without license or permission from the owner, the Grantee must notify the Grants Officer. This notice does not necessarily mean that the Government authorizes and consents to any copyright or patent infringement occurring under the financial assistance.

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

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

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

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

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

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

Dispute Review Procedures
a. Any request for review of a notice of termination or other adverse decision should be addressed to the Grants Officer. It must be postmarked or transmitted electronically no later than 30 days after the postmarked date of such termination or adverse decision from the Grants Officer.

b. The request for review must contain a full statement of the Grantee's position and the pertinent facts and reasons in support of such position.

c. The Grants Officer will promptly acknowledge receipt of the request for review and shall forward it to the Director, Office of Administration, who shall appoint an intra-agency Appeal Board to review a grantee appeal of an agency action, if required, which will consist of the program office director, the Deputy Director of Office of Administration, and the Office of General Counsel.

d. Pending resolution of the request for review, the NRC may withhold or defer payments under the award during the review proceedings.

e. The review committee will request the Grants Officer who issued the notice of termination or adverse action to provide copies of all relevant background materials and documents. The committee may, at its discretion, invite representatives of the Grantee and the NRC program office to discuss pertinent issues and to submit such additional information as it deems appropriate. The chairman of the review committee will insure that all review activities or proceedings are adequately documented.

f. Based on its review, the committee will prepare its recommendation to the Director, Office of Administration, who will advise the parties concerned of his/her decision.

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

Monitoring and Reporting § 215.50-53

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

- Payment – 2 CFR 215.22
- Cost Share – 2 CFR 215.23
- Program Income – 2 CFR 215.24
    - Earned program income, if any, shall be added to funds committed to the project by the NRC and Grantee and used to further eligible project or program objectives or deducted from the total project cost allowable cost as directed by the Grants Officer or the terms and conditions of award.
- Budget Revision – 2 CFR 215.25
    - The Grantee is required to report deviations from the approved budget and program descriptions in accordance with 2 CFR 215.25,and request prior written approval from the Program Officer and the Grants Officer.
    - The Grantee is not authorized to rebudget between direct costs and indirect costs without written approval of the Grants Officer.
    - The Grantee is authorized to transfer funds among direct cost categories up to a cumulative 10 percent of the total approved budget. The Grantee is not allowed to transfer funds if the transfer would cause any Federal appropriation to be used for purposes other than those consistent with the original intent of the appropriation.
    - Allowable Costs – 2 CFR 215.27

b. **Federal Financial Reports**

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

Period of Availability of Funds 2 CFR § 215.28

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

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

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

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

Automated Standard Application For Payments (ASAP) Procedures

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

Audit Requirements

Organization-wide or program-specific audits shall be performed in accordance with the Single Audit Act Amendments of 1996, as implemented by OMB Circular A-133, "Audits of States, Local Governments, and Non-Profit Organizations." http://www.whitehouse.gov/omb/circulars/a133/a133.html Grantees are subject to the provisions of OMB Circular A-133 if they expend $500,000 or more in a year in Federal awards.

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

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

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

III. Programmatic Requirements

Performance (Technical) Reports

a. The Grantee shall submit performance (technical) reports electronically to the NRC Project Officer and Grants Officer on a semi-annual basis unless otherwise authorized by the Grants Officer. Performance reports should be sent to the Program Officer at the email address indicated in Block 12 of the Notice of Award, and to Grants Officer at: Grants_PPR.Resource@NRC.GOV. ***(NOTE: There is an underscore between Grants and PPR).***

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

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

d. Grant Performance Metrics:

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

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

Curriculum Development Awards

1. Overall number of new courses developed in NRC designated STEM areas;
2. Number of students enrolled in new STEM courses;
3. Number of these enrolled students retained in STEM major.

Unsatisfactory Performance

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

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

Other Federal Awards With Similar Programmatic Activities

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

Prohibition Against Assignment By The Grantee

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

Site Visits

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

IV. Miscellaneous Requirements

Criminal and Prohibited Activities

a. The Program Fraud Civil Remedies Act (31 USC §§ 3801-3812), provides for the imposition of civil penalties against persons who make false, fictitious, or fraudulent claims to the Federal government for money (including money representing grant/cooperative agreements, loans, or other benefits.)

b. False statements (18 USC § 287), provides that whoever makes or presents any false, fictitious, or fraudulent statements, representations, or claims against the United States shall be subject to imprisonment of not more than five years and shall be subject to a fine in the amount provided by 18 USC § 287.

c. False Claims Act (31 USC 3729 et seq), provides that suits under this Act can be brought by the government, or a person on behalf of the government, for false claims under federal assistance programs.

d. Copeland "Anti-Kickback" Act (18 USC § 874), prohibits a person or organization engaged in a federally supported project from enticing an employee working on the project from giving up a part of his compensation under an employment contract.

American-Made Equipment And Products
Grantees are 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 Leadership of Reducing Text Messaging While Driving
Pursuant to EO 13513, Grantees should encourage employees, sub-awardees, and contractors to adopt and enforce policies that ban text messaging while driving company-owned, rented vehicles or privately owned vehicles when on official Government business or when performing any work for or on behalf of the Federal Government.

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

Minority Serving Institutions (MSIs) Initiative
Pursuant to EOs 13256, 13230, and 13270, NRC is strongly committed to broadening the participation of MSIs in its financial assistance program. NRC's goals include achieving full participation of MSIs in order to advance the development of human potential, strengthen the Nation's capacity to provide high-quality education, and increase opportunities for MSIs to participate in and benefit 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."

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

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

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

Award Term

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

Reporting Subawards and Executive Compensation.

a. *Reporting of first-tier subawards.*

1. *Applicability.* Unless you are exempt as provided in paragraph d. of this award term, you must report each action that obligates $25,000 or more in Federal funds that does not include Recovery funds (as defined in section 1512(a)(2) of the American Recovery and Reinvestment Act of 2009, Pub. L. 111–5) for a subaward to an entity (see definitions in paragraph e. of this award term).

2. *Where and when to report.*

i. You must report each obligating action described in paragraph a.1. of this award term to *http://www.fsrs.gov.*

ii. For subaward information, report no later than the end of the month following the month in which the obligation was made. (For example, if the obligation was made on November 7, 2010, the obligation must be reported by no later than December 31, 2010.)

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

b. *Reporting Total Compensation of Recipient Executives.*

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

i. the total Federal funding authorized to date under this award is $25,000 or more;

ii. in the preceding fiscal year, you received—

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

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

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

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

i. As part of your registration profile at *http://www.ccr.gov.*

ii. By the end of the month following the month in which this award is made, and annually thereafter.

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

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

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

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

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

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

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

i. To the recipient.

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

d. *Exemptions*

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

i. Subawards,

and

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

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

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

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

ii. A foreign public entity;

iii. A domestic or foreign nonprofit organization;

iv. A domestic or foreign for-profit organization;

v. A Federal agency, but only as a subrecipient under an award or subaward to a non-Federal entity.

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

3. *Subaward:*

i. This term means a legal instrument to provide support for the performance of any portion of the substantive project or program for which you received this award and that you as the recipient award to an eligible subrecipient.

ii. The term does not include your procurement of property and services needed to carry out the project or program (for further explanation, see Sec. __ .210 of the attachment to OMB Circular A–133, "Audits of States, Local Governments, and Non-Profit Organizations").

iii. A subaward may be provided through any legal agreement, including an agreement that you or a subrecipient considers a contract.

4. *Subrecipient* means an entity that:

i. Receives a subaward from you (the recipient) under this award; and

ii. Is accountable to you for the use of the Federal funds provided by the subaward.

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

i. *Salary and bonus.*

ii. *Awards of stock, stock options, and stock appreciation rights.* Use the dollar amount recognized for financial statement reporting purposes with respect to the fiscal year in accordance with the Statement of Financial Accounting Standards No. 123 (Revised 2004) (FAS 123R), Shared Based Payments.

iii. *Earnings for services under non-equity incentive plans.* This does not include group life, health, hospitalization or medical reimbursement plans that do not discriminate in favor of executives, and are available generally to all salaried employees.

iv. *Change in pension value.* This is the change in present value of defined benefit and actuarial pension plans.

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

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