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

| 1. GRANT/AGREEMENT NO. | 2. MODIFICATION NO. | 3. PERIOD OF PERFORMANCE | 4. AUTHORITY |
|---|---|---|---|
| NRC-04-09-156 | | FROM: 7/30/2009 TO: 8/21/2010 | 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<br>[ ] COOPERATIVE AGREEMENT | State Supported Higher-Ed | SOUTH CAROLINA RESEARCH FOUNDATION<br>DUNS 111310249<br>901 SUMTER ST STE 511<br>COLUMBIA SC 292080001 |

8. PROJECT TITLE:
Joint Time-Frequency Domain Reflectometry (JTFDR) for Diagnostics/Prognostics of Aging Electric Cables in Nuclear Power Plants

| 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<br>December 8, 2008<br>AND APPENDIX A-PROJECT GRANT PROVISIONS | [X] PROGRESS AND FINAL<br>[ ] FINAL ONLY<br>[ ] OTHER (Conference Proceedings) | Dr. Yong-June Shin<br>Department of Electrical Engineering<br>University of South Carolina<br>301 S. Main St.<br>Columbia SC 29208<br>email: shinjune@engr.sc.edu |

| 12. NRC PROGRAM OFFICE (NAME and ADDRESS) | 13. ACCOUNTING and APPROPRIATION DATA | 14. METHOD OF PAYMENT |
|---|---|---|
| Satish Aggarwal, RES/DE/MEEB<br>21 Church Street MS CSB-5A24M<br>Rockville, MD 20850<br>tel: 301-251-7663 | APPN. NO: 31X0200.960<br>B&R NO: 960-15-111-195<br>JOB CODE: G6674<br>BOC NO: 4110<br>OFFICE ID NO: FFS-RES-C-09570 | [ ] ADVANCE BY TREASURY CHECK<br>[ ] REIMBURSEMENT BY TREASURY CHECK<br>[ ] LETTER OF CREDIT<br>[X] OTHER (SPECIFY) Electronic ASAP.gov<br>(See Remarks in Item #20 "Payment Information") |

| 15. NRC OBLIGATION FUNDS | | 16. TOTAL FUNDING AGREEMENT | |
|---|---|---|---|
| THIS ACTION | $35,000.00 | NRC | $170,000.00 |
| PREVIOUS OBLIGATION | | RECIPIENT | 0.0 |
| TOTAL | $35,000.00 | TOTAL | $170,000.00 |

This action provides funds for Fiscal Year 09 in the amount of $35,000.00

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

U.S. Nuclear Regulatory Commission
Div. of Contracts
Attn:
Mail Stop: TWB-01-B10M
Washington, DC 20555

18.
Acceptance of or objections to the Terms and Conditions of Award must be Emailed to the NRC Issuing Office (Block #17) within three (3) business days following the Award issue date. NRC considers lack of response as acceptance by the grantee of the terms and conditions of award.

19. NRC CONTRACTING OFFICER

Sheila Bumpass 7/30/09
(Signature) (Date)

NAME (TYPED) Sheila Bumpass
TITLE Contracting Officer
TELEPHONE NO. 301-492-3484

20. PAYMENT INFORMATION

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

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

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

23. By [illegible] that payment of any audit-related debt will not reduce the level of performance of any Federal Program.

TEMPLATE ADM001

UNSI REVIEW COMPLETE

ADM002

## ATTACHMENT A - SCHEDULE

### A.1 PURPOSE OF GRANT

The purpose of this Grant is to provide support to the University of South Carolina in support of research to develop an innovative new cable diagnostic and prognostic technique, Joint Time-Frequency Domain Reflectometry (JTFDR) for cable diagnostics and prognostics in nuclear power plants. The objective of the proposed research is to develop JTFDR–based, non-destructive, non-intrusive diagnostics of electric cables to detect and locate faults in nuclear power plants and to extend the efficacy of JTFDR for scientific prognostics of existing cables by measuring faulty impedance as described in Attachment B entitled "Program Description."

### A.2 PERIOD OF GRANT

1. The effective date of this Grant is July 30, 2009. The estimated completion date of this Grant is August 31, 2011.

2. Funds obligated hereunder are available for program expenditures for the estimated period: July 30, 2009 – August 31, 2010.

**A. GENERAL**

| | |
|---|---|
| 1. Total Estimated NRC Amount: | $170,000 |
| 2. Total Obligated Amount: | $35,000 |
| 3. Cost-Sharing Amount: | $0 |
| 4. Activity Title: | Joint Time-Frequency Domain Reflectometry for Diagnostics/ Prognostics of Aging Cables in Nuclear Power Plants. |
| 5. NRC Project Officer: | Satish Aggarwal |
| 6. DUNS No.: | 11-131-0249 |

**B. SPECIFIC**

| | |
|---|---|
| RFPA No.: | RES-09-156 |
| FFS: | RES-C-09-570 |
| Job Code: | G6674 |
| BOC: | 4110 |
| B&R Number: | 960-15-111-195 |
| Appropriation #: | 31X0200.960 |
| Amount Obligated: | $35,000 |

### A.3 BUDGET

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

| | **Year 1** | **Year 2** |
|---|---|---|
| Personnel | $26,403.00 | $35,403.00 |
| Fringe | $1,789.00 | $1,843.00 |
| Research Material &Supplies | $8,636.00 | $8,272.00 |
| Travel | $4,000.00 | $4,000.00 |

| | | |
|---|---|---|
| **Total Direct Charges** | **$ 66,628.00** | **$ 62,717.00** |
| Indirect Costs (45%) | $ 18,372.00 | $ 22,283.00 |
| Tuition | $8,800.00 | $ 13,200.00 |
| Equipment | $17,000.00 | $ 0.00 |
| **Yearly Totals** | **$85,000.00** | **$85,000.00** |

All travel must be in accordance with the Univeristy of South Carolina Travel Regulations or the US Government Travel Polciy absent grantee travel regulation.

## A.4 AMOUNT OF AWARD AND PAYMENT PROCEDURES

1. The total estimated amount of this Award is $170,000.

2. NRC hereby obligates the amount of $35,000 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 recipient 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.

4. Additional funds up to the total amount of the grant shown above may be obligated by NRC subject to the availability of funds and satisfactory progress of the project.

## Attachment B – Program Description

### ABSTRACT

The proposed research aims to develop a non-destructive, non-intrusive diagnostic tool/technique to detect the location and extent of spatial variations in the properties of electric cables in nuclear power plants. In the proposed research, we will focus on XLPE and EPR type cables that serve critical control & instrumentation function in the nuclear reactors and power plants. This tool is essential to achieving new diagnostic and prognostic techniques that will permit informed re-licensing decisions to be made. Furthermore, we will extend the diagnostic technique so that it not only detects imminent failures, but also provides a measure of the health or remaining service life of a cable. Successful completion of the proposed research will provide a worldwide technical guideline and standard for qualified cables in aging nuclear power plants.

### OBJECTIVE

The research proposed here endeavors to develop an innovative new cable diagnostic and prognostic technique, Joint Time-Frequency Domain Reflectometry (JTFDR) [1-2] for cable diagnostics and prognostics in nuclear power plants [2-3]. The objective of the proposed research is to develop JTFDR–based, non-destructive, non-intrusive diagnostics of electric cables to detect and locate faults in nuclear power plants. Furthermore, we will extend the efficacy of JTFDR for scientific prognostics of existing cables by measuring faulty impedance so that we can predict the cables' remaining operational life.

## BACKGROUND

For over fifty years, nuclear reactor technology has been used to generate electric power; currently, more than 100 nuclear power facilities in the United States supply approximately 20 percent of the nation's electricity. In recent years, the nuclear industry has faced new technical challenges due to aging nuclear power infrastructures, because the average life span of the nuclear power plant is about 40 years. The Nuclear Regulatory Commission (NRC), the organization in charge of licensing and monitoring commercial nuclear power plants in the U.S., has questioned the reliability and safety of aging wires and cables in the nuclear power plants where miles of electric cables are used to perform critical operation and safety functions. Defective cables can cause a component to fail or report an inaccurate measurement to the plant operator, resulting in potential safety concerns. Further aggravating the aging process in insulation of the wires and cables in nuclear power plants are exposed to radiation and temperature [3]. While a number of diagnostic and prognostic techniques are currently available, no existing single technical solution can feasibly monitor the condition of electric cables in a nuclear power plant.

## TECHNICAL MOTIVATION

Recently, the NRC and Brookhaven National Laboratory have been working on the diagnostics and prognostics of electric cables with the Broadband Impedance Spectroscopy (BIS) technique developed by Boeing [4]. On an international scale, the OECD Halden Reactor Project in Norway is researching similar issues in monitoring the condition of electric cables; their method is known as Line Resonance Analysis (LIRA) [5]. The purpose of these techniques is to detect and locate defects before they cause a component to fail. Although BIS and LIRA have different names, these two methods both monitor impedance of faults caused by insulation degradation using frequency-domain reflectometry (FDR), primarily due to the extreme challenges involved in accurately measuring fault impedance in the time domain.

Despite these recent research activities, the NRC concluded in its report that additional research is required if we are to more precisely detect and locate ongoing faults [4]. For the complicated cable structure of nuclear power plants, diagnostic techniques should be capable of locating faults if the cables are to be effectively maintained. Furthermore, the NRC needs to be able to assess the current health condition of the cable in order to scientifically predict cable failure for licensing purposes. To emphasize and discuss the limitations of BIS to meet those needs, we quote the follow-on research from the NRC report below [4]; our italicized interpretations follow each quote.

> The "BIS method was not sensitive enough to distinguish between the different severities and size of hot-spots." (A sensitive detection is required.)
>
> "Research on the detection and location of cracking damage in cables using more realistic simulation of the cracking damage..." (An accurate location is also required.)
>
> "The technique should be demonstrated on additional types of cable to determine its usefulness for other materials and cable configurations..." (A diverse feature is required.)

"The technique should be evaluated with different types of loads attached to the cables to determine the impact of loads encountered in a plant environment.... The technique should be demonstrated in an actual plant environment to determine the impact of the various environmental factors." (A robust diagnostic algorithm is required.)

"The technique should be demonstrated on blind test samples in which the type, severity, size, and location of the degradation are unknown." (Prognostics of aging cable is required.)

The above list clarifies the technical challenges and direction of the proposed research. In the proposed research based on the JTFDR technique, we will seek solutions to all of these technical challenges. The technical description of JTFDR will be presented in the next section, along with how the features of JTFDR suitably satisfy the technical requirements and challenges listed above.

## TECHNICAL APPROACH

One of the most prominent techniques for the diagnostics of cables and wires, is reflectometry, which is similar to radar in that it is based on the fundamental transmission line theory. The theory of reflectometry underlies the state of the art for wiring/cable defect detection in commercial off-the-shelf products, which use one of two methods: time domain analysis or frequency domain analysis. In time domain reflectometry (TDR), a DC-type pulse signal is used, whereas in FDR, a sinusoidal signal serves as the reference signal. Each methodology is based on the appropriate analysis of the reference and reflected signals either in the time *or* the frequency domain, but not both. In contrast, the proposed innovative technique, JTFDR, is characterized by the flexible design of a reference signal and the precise measurement of a reflected signal in both the time and frequency domains in a joint manner. Hence, one can **design a reference signal** in JTFDR by determining the "optimal" parameters for the cable being tested. In addition, JTFDR utilizes a **time-frequency cross-correlation function** where the time and frequency information can be used jointly for detection and location, so that the JTFDR technique can operate successfully with a relatively low signal-to-noise ratio (i.e., higher sensitivity and dynamic range) compared to both TDR and FDR.

To illustrate some of the technical limitations of classical TDR and show how they are resolved by JTFDR, a set of experimental results is compared in Fig. 1. One meter of a 10-meter crosslinked polyethylene (XLPE) cable was exposed in a thermal aging heat chamber and was then tested using TDR (Fig. 1a) and JTFDR (Fig. 1b). As shown in Fig. 1a, although the beginning and end of the cable are readily observable, it is difficult to detect and locate the hot spot in the XLPE cable using TDR.

The problems of TDR can be resolved using JTFDR. Fig. 1b shows the preliminary experimental JTFDR results, using the reference signal design and the time-frequency cross-correlation function, under the same experimental conditions of TDR in Fig. 1a. Considering the length of cable and attenuation characteristics, one can derive the center frequency, frequency bandwidth, and time duration of the JTFDR reference signal. The reference signal in the test is characterized by the linear chirp signal with a Gaussian envelope of which the center frequency is 130 MHz, the frequency bandwidth

is 60 MHz, and the duration is 8 ns. The top portion of the figure shows the time-domain incident signal and the reflected signal from the end of the 10 m cable. The lower portion of the figure illustrates how the time-frequency cross-correlation function of the reference and reflected signals can detect, locate, and characterize the defects in the cable. For detection, the time-frequency cross–correlation function quantifies the existence of the signal component associated with the reference signal in terms of time and frequency signature. This function is normalized between 0 and 1 so that one can quantify the detection of the defects within bounded values; i.e., it indicates the probability of reflection from potential defects. Again, it is not easy to observe the reflection from the hotspot in the time-domain signal. However, the time-frequency cross-correlation function at the bottom of Fig. 1b clearly shows the detection and location of the hotspot. In addition, because this function provides the time resolution and reveals the local time center, it can be utilized to locate the defect in the cable.

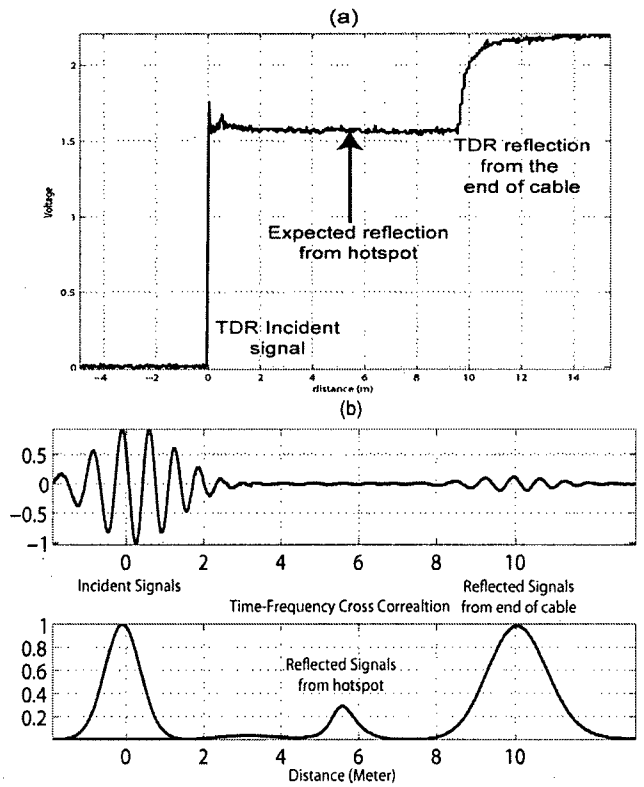


**Figure 1. XLPE cable diagnostics via TDR in (a) and JTFDR in (b)**

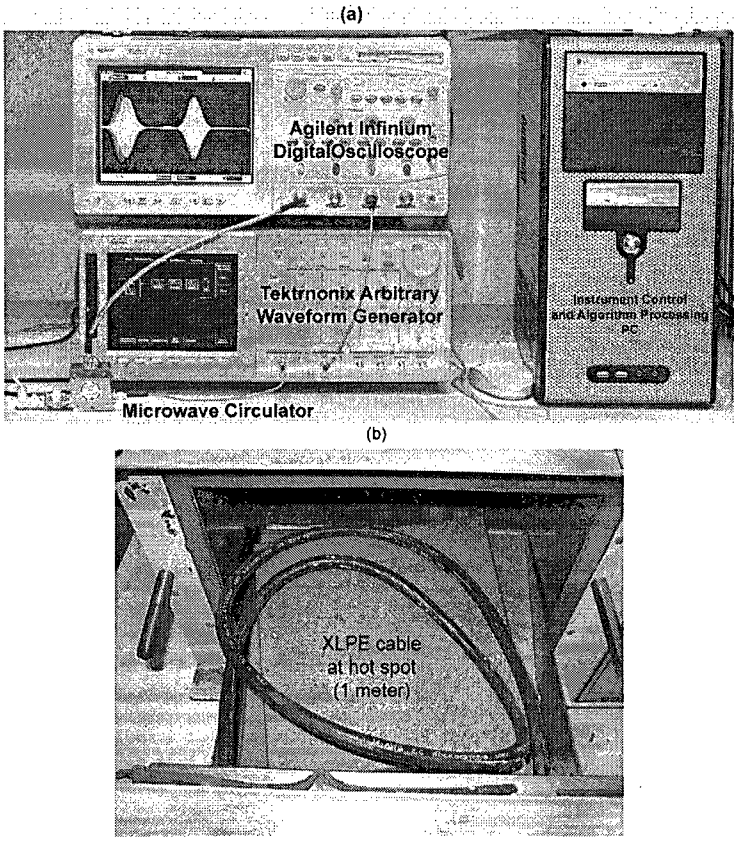


**Figure 2. Experimental JTFDR wiring test bed at USC in (a) and thermal aging heat chamber in (b)**

The PI's carried out preliminary research with the real-world XLPE control cables specimen arranged by NRC and results of JTFDR presented in this proposal. Fig. 2a shows the experimental JTFDR wiring test bed, which is composed of a signal generator (Tektronix Arbitrary Waveform Generator 610), a data acquisition device (Agilent Infinium 54754A), and a control PC. The computer controls the arbitrary waveform generator (AWG) to produce the Gaussian envelope chirp signal, which propagates into the target cable via the circulator. A small fraction of the reference signal is reflected at the fault location and back to the circulator. The circulator redirects the reflected signal to the digital oscilloscope. The computer program controls and synchronizes the arbitrary waveform generator and digital oscilloscope, calculates the time-frequency distribution of the reference signal and reflected signals, and executes the time-frequency cross correlation algorithm for detection, location, and assessment of defects on cable.

Fig. 2b shows the heat chamber used for accelerated thermal aging. Following the experimental guidelines from BNL and the NRC, a 1 m section of the XLPE cable was subjected to a temperature of 150°C (302°F) for 14 hours, a process which produces results corresponding to aging of the cable at 60°C (140°F) for 40 years. After these 14 hours of accelerated thermal aging, the cable was left at room temperature for 5 hours. In order to monitor the progress during accelerated aging, the cable was tested hourly during these 19 hours. In each hourly test, five statistically independent trials were carried out to determine the mean and standard deviation of the parameters. Figs. 3a and 3b illustrate the results from this test.

Fig. 3a presents the time-frequency cross-correlation function at hours 1, 10, and 15 during the thermal aging process. The time-frequency cross-correlation functions at the origin and at the open-end of the cable show a peak value of 1. This value at the beginning and end of the cable do not change with thermal aging; however, the time-frequency cross-correlation exhibits reflections from the hotspot located at 5-6 m away from the cable termination, as shown in Fig. 3a. Notably, the time-frequency cross-correlation value dramatically increased from 0.07 at the 10-hour mark to 0.3 after 15 hours. The analysis of the reflected waveform in the time-frequency domain supplies a variety of meaningful parameters that can be used to quantify the severity of the hotspot, and a value of the local peak of the time-frequency cross-correlation is an example.

Fig. 3b shows the value of the local peak of the time-frequency cross-correlation over time during the thermal aging. During the 14-hour thermal aging of the XLPE cable, the peak values of the time-frequency cross-correlation remain under 0.1, however, the cooling of the cable after hour 14 shows an abrupt increase of the local peak up to 0.2. This preliminary result exhibits the feasibility of JTFDR for assessing thermal aging of XLPE cables. Besides the local peak value of time-frequency cross-correlation function, the progress of the thermal aging can be quantified by computing the area of the time-frequency cross-correlation function or by computing the defect's local impedance via measurement of the phase difference between the incident and reflected signals.

Comparing the JTFDR preliminary results and BIS technique, we find numerous advantages of JTFDR. First, the frequency of interest in BIS varies depending on defect type, whereas JTFDR specifies the frequency of interest. Furthermore, BIS uses a transmission line model to predict impedance and then compares that impedance to the actual value. However, in such small phase ranges (less than a degree), this model would have to be extremely accurate to obtain correct results, an important consideration in light of equipment limitations and possibly automated implementation of the algorithm. Secondly, BIS is not sensitive enough to distinguish among the severities in a variety of hot spots. In addition, the spatial resolution is not sufficient to locate the defect within 10%. We believe JTFDR will be able to determine hot-spot severity based on impedance, area, and/or peaks of the time-frequency cross-correlation function, as shown in Fig. 3b.

An accurate measurement of defect impedance is vital to relate the diagnostics with the aging mechanism so that we can achieve the prognostics of aging in cables and wires. We are interested in the variations of the time-frequency cross-correlation function at the hot spots, specifically how the impedance of the defects obtained from this function are related to the aging process models. In order to find the answers to that critical and evasive question, the results from JTFDR will be compared with those from the frequency domain analysis, i.e. BIS. We expect that JTFDR will enable us to clarify the physical aging process for the purpose of monitoring and prognostics. Owing to its unique reference signal design and reflected signal processing, JTFDR can be used to perform diagnostics with a lower signal-to-noise ratio. This feature of JTFDR would be beneficial for the development of a non-destructive, non-intrusive diagnostic technique.

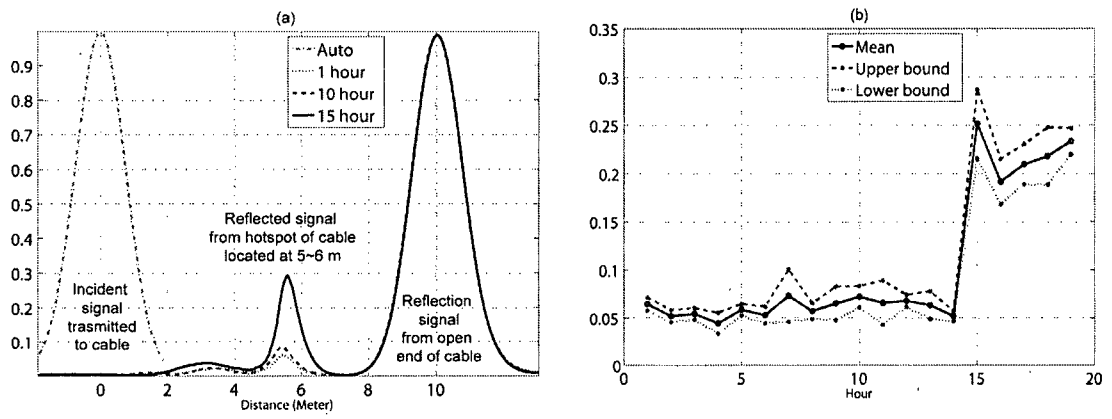


**Figure 3. Time-frequency cross-correlation function with thermal aging in (a) and its peak values over aging time in (b)**

## COLLABORATION with NUCLEAR UTILITIES

As of January 1, 2005, South Carolina has 7 active nuclear reactors and ranked 3rd among the 31 States with nuclear capacity. It has the most nuclear capacity in the southeastern United States. The PI contacted South Carolina Electric & Gas Co. (SCE&G) and Santee Cooper Electric Co. that have joint ownership for pressurized water reactor, V. C. Summer, located 25 miles NW of USC. Mr. Robin White (Nuclear Coordinator of Santee Cooper) and Mr. Steve Cunningham (Nuclear Coordinator of SCE&G) agreed to provide cable samples for proposed research.

In addition, Mr. Gary J. Toman with EPRI (Electric Power Research Institute) Plant Support Engineering at Charlotte, NC (80 miles away from USC) has been involved in cable diagnostics and he showed interests in proposed research and the PI can interact with EPRI for proposed research. Mr. Toman agreed to provide the PI an access to new and aged cable specimens. The cables have approximately 3 foot lengths in 100 feet that were thermally aged to various degrees from relatively lightly to very severe. There are also specimens with cuts and gouges to one and two conductors. These cables are representative of those used in nuclear plants in the 1970s and 1980s.

## WORK PLAN

The proposed research on JTFDR-based cable diagnostics and prognostics will be a two-year plan. The first half of the project will focus on the theoretical research and prototyping of JTFDR; the second half of the project will be devoted to implementing algorithms and developing equipment for nuclear power plant licensing. The plans are summarized in Chart 1.

| | YEAR 1 | | | | YEAR 2 | | | |
|---|---|---|---|---|---|---|---|---|
| **Key Research Issues** | **1** | **2** | **3** | **4** | **1** | **2** | **3** | **4** |
| **Task 1** | | | | | | | | |
| **Task 2** | | | | | | | | |
| **Task 3** | | | | | | | | |
| **Task 4** | | | | | | | | |

| Task 5 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|

**Chart 1: Plans on research and development of JTFDR diagnostics and prognostics**

**Task 1: Investigate the optimal parameters of the reference signal in JTFDR**
The selection of optimal parameters (center frequency, frequency bandwidth, and time duration) of the reference signal enables the successful detection, location, and impedance measurement to be achieved in the next task. All of the initial effort will be focused on simulating JTFDR applied to typical nuclear cable types that have been characterized and modeled with known defect locations and impedances collaborating with SCE&G and EPRI. Each graduate student will focus 100% effort on modeling different cables of interest to include in the simulations. The results of these simulations will indicate which reference signal parameters are most effective for each nuclear cable type of interest. Thus, this investigation will better prepare us for both diagnostics and prognostics. By first fully investigating the cables theoretically, we will be better prepared for challenges that arise in the laboratory. Once these results have been obtained, the optimal parameters can be utilized for initial experimentation.

**Task 2: Develop an algorithm for detection, location and impedance measurement**
Subsequently, effort must be made to customize the time-frequency cross-correlation function for the nuclear power plant applications. The time-frequency cross-correlation subroutine, implemented with the MATLAB Graphical User Interface, is to be utilized for the detection, location, and impedance measurement. Therefore, each graduate student will independently apply all effort into developing various methods for optimizing this process based on the existing algorithm, the parameters of the nuclear cables, and the simulation results. The team will then come together to determine which algorithm adaptation or combination of adaptations best simultaneously maintains accuracy and provides greatest time efficiency. Once the algorithm is optimized, it will be implemented for the instrumentation of Tasks 3-5.

**Task 3: Validate JTFDR with simulated faults**
The parameters determined in Task 1 will be the initial experimental settings for JTFDR. The efficacy of JTFDR will be validated with laboratory-generated defects on the real-world cables. The graduate students will together focus all of their effort on the preparation of the cable samples with the appropriate length. One graduate student will then focus 100% effort on finalizing the preparation of these cable samples with appropriate connectors, fault location, and fault severity. The other graduate student will focus on optimizing the code, improving the interface, and obtaining the experimental results for each prepared cable sample. We will investigate the sensitivity of detection, accuracy of location, and validity of impedance measurement with these cable samples. We believe the severity of the defect (the length and depth of insulation removal) will correlate to the impedance of the defect. The data obtained from experimental JTFDR for detecting and locating a fault and then determining its impedance will be compared to the simulated results to determine if JTFDR is a viable diagnostic tool for nuclear cables. The results of the experiments may also provide insight for improvements to be made to Task 2. Another objective of Task 3 is to formulate the measurement accuracy and resolution limitations for future applications in nuclear power cables.

**Task 4: Validate JTFDR with accelerated aging test**

Simultaneous to diagnostic experimentation, the accelerated aging tests will be carried out with emphasis on thermal aging. One graduate student will apply 50% effort toward determining the proper temperature and exposure time for each cable type and sample to be placed into the accelerated aging thermal chamber to achieve the intended deterioration. The other graduate student will apply 50% efforts on adapting the diagnostic algorithm to constantly monitor the status of the cable in order to provide informative, complete prognostic metrics. The aging process of the cables will be monitored by the JTFDR wiring test bed. We expect that during the thermal aging process, the cables will exhibit variations of defect impedance. These impedance variations will be reflected in the time-frequency cross-correlation function and measured via JTFDR. The JTFDR results will be compared with those from the simulations in Task 1 and with those from the BIS test since both experiments use the same thermal variation profile from a nuclear reactor. Assuming the experimental results of JTFDR are similar to those of the simulation and BIS, JTFDR will be validated as a successful prognostic tool.

**Tasks 5: Evaluate prognostics of aging process and instrumentation of JTFDR**
Assuming that the JTFDR-based cable diagnostic and prognostic methods are successful, it is necessary for us to compare and interpret the results of our laboratory-prepared cables with those that have been physically abused in real-world applications. The Electric Power Research Institute (EPRI) will provide our team with such cables to study and analytically compare to them to our previous samples. Based on the models analyzed in Tasks 1-4, we expect that we can compare the signatures observed by JTFDR on these previously aged cables to formulate a diagnostics and prognostics procedure that guarantees reliability and safety of the cables via JTFDR. This procedure will be used to develop equipment for nuclear power plant licensing. The Task 5 will include efforts to write a project report to NRC.

**Attachment C – Standard Terms and Conditions**

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

**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: http://www.whitehouse.gov/omb/circulars/a021/print/a021.html
A-87: http://www.whitehouse.gov/omb/circulars/a087/print/a087-all.html
A-122: 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 Recipient and to sub-recipients which meet the definition of "Recipient" in Part 215, unless a section specifically excludes a sub-recipient from coverage. The Recipient 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. Recipients 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**

This award is composed of an award face page, which incorporates the recipient's proposal by reference, and the NRC Standard Provisions for U.S. Nongovernmental Recipients. This award constitutes acceptance by the NRC of the Recipient's proposal and budget unless otherwise indicated on the face page, Block 9.

**§ 215.41 Recipient responsibilities.**
The Recipient 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 recipient of the contractual responsibilities arising under its contract(s). The recipient 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 Recipient 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 Recipient 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 recipient 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 Recipient 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 Recipient 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 Recipient 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 Recipient must submit the SF-LLL, including those received from sub-recipients, contractors, and subcontractors, to the Grants Officer.

**§ 215.13 Debarment And Suspension.**

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

'Debarment, Suspension, Ineligibility, and Voluntary Exclusion

The Recipient 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 Recipient 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 Recipient 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 Recipient 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 recipients 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 recipients 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 recipients, 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 recipient'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 University of South Carolina's Travel Guidance, or absent a University Guidance, 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 recipients 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 recipient 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 recipient 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 recipients to use this system to comply with Bayh-Dole and related intellectual property reporting requirements. The system allows for recipients 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 Recipients, 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 Recipient uses or has used patented technology under this award without license or permission from the owner, the Recipient 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 Recipient 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 Recipient 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 Recipient employees may be copyrighted but only the part authored by the Recipient 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 Recipient 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 Recipient 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 recipient 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 recipient 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 recipient'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 recipient 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. Recipient 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 Recipient 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 Recipient 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 Recipient shall submit a "Federal Financial Report" (SF-425) on a semi-annual basis for the periods ending March 31 and September 30, 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 recipient 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, Recipients 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. Recipients 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 Recipients 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 Recipient 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 Recipient 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 Recipient 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 Recipient

The Recipient 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 Recipient or contractor under an award, the Recipient 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

Recipients 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, Recipients 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 Recipient 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 Recipient'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 Recipients 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 Recipients 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 Recipient 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 Recipient organization shall investigate the allegation and submit its findings to the Grants Officer. The NRC may accept the Recipient's findings or proceed with its own investigation. The Grants Officer shall inform the Recipient 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 Recipient 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 Recipient 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 [Recipient 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."