



**UNITED STATES
NUCLEAR REGULATORY COMMISSION**
WASHINGTON, D.C. 20555-0001

September 30, 2014

Dr. Victor Saouma, PhD
The Regents of the University of Colorado
3100 Marine Street, Room 481 572 UCB
Boulder, Colorado 80303

VIA Electronic Mail
victor.saouma@colorado.edu

SUBJECT: GRANT NO: NRC-HQ-60-14-G-0010

Dear Dr. Saouma:

Pursuant to the authority contained in the Federal Grant and Cooperative Grantee Act of 1977 and the Atomic Energy Act of 1954, the Nuclear Regulatory Commission (NRC) hereby awards to The Regents of the University of Colorado (hereinafter referred to as the "Grantee" or "Recipient"), the sum of \$653,197.00 to provide support for "Experimental and Numerical Investigation of Alkali Silica Reaction in Nuclear Reactors" entitled "Program Description."

This award is effective as of the date of this letter and shall apply to expenditures made by the Grantee furtherance of program objectives during the period beginning with the effective date of September 30, 2014 and ending September 29, 2017.

This award is made to the Recipient on condition that the funds will be administered in accordance with the terms and conditions as set forth in Attachment A (the Schedule); Attachment B (the Program Description); and Attachment C (the Standard Provisions); all of which have been agreed to by your organization.

Based on the pre-award compliance review conducted by NRC's Small Business and Civil Rights Office (SBCR), your institution is placed in a periodic status pending resolution of concerns raised during the review. Within 60 days, SBCR will conduct a periodic review to ensure compliance with applicable Civil Rights statutes. Your cooperation with SBCR is essential. The continued eligibility of Federal financial assistance is conditioned upon compliance with anti-discrimination regulations.

Please ensure individuals selected as beneficiaries of support under this grant meet the legal requirements consistent with recent Supreme Court Decisions including *Fisher*, *Gratz*, and *Grutter*.

Please sign the enclosed grant to acknowledge your receipt of the award, and return as a pdf file to Ms. Gordana Zuber by email at Gordana.Zuber@nrc.gov.

Sincerely yours,

Erika Eam

Erika Eam
Grants Officer
Resources & Grants Team
Acquisition Management Division (AMD)

Attachments:

Attachment A – Schedule
Attachment B – Program Description
Attachment C – Standard Terms and Conditions


Grant and Cooperative Agreement

CHOOSE ONE:

- ☐ COOPERATIVE AGREEMENT
- ☒ GRANT

CHOOSE ONE:

☐ EDUCATION☐ FACILITIES☒ RESEARCH☐ SDCR☐ TRAINING

1. GRANT/COOPERATIVE AGREEMENT NUMBER NRC-HQ-60-14-G-0010		2. SUPPLEMENT NUMBER		3. EFFECTIVE DATE 09/30/2014		4. COMPLETION DATE	
5. ISSUED TO NAME/ADDRESS OF RECIPIENT (No., Street, City/County, State, Zip) Regents Of The University Of Colorado, The 3100 MARINE ST Rm 481, 572 UCB BOULDER CO 803090574				6. ISSUED BY U.S. NRC - HQ Mailing Address: Acquisition Management Division Mail Stop: 3WFN-05-C64MP Washington DC 20555-0001			
7. TAXPAYER IDENTIFICATION NO. (TIN) 84-6000555				9. PRINCIPAL INVESTIGATOR/ORGANIZATION'S PROJECT OR PROGRAM MGR. (Name & Phone) Victor Saouma Ph.D Email: victor.saouma@colorado.edu; Ph:303-492-1622			
8. COMMERCIAL & GOVERNMENT ENTITY (CAGE) NO.							
10. RESEARCH, PROJECT OR PROGRAM TITLE Experimental and Numerical Investigation of Alkali Silica Reaction in Nuclear Reactors							
11. PURPOSE See Schedule							
12. PERIOD OF PERFORMANCE (Approximately) 09/30/2014 through 09/29/2017							
13A.		AWARD HISTORY		13B.		FUNDING HISTORY	
PREVIOUS		\$0.00		PREVIOUS		\$0.00	
THIS ACTION		\$653,197.00		THIS ACTION		\$413,524.00	
CASH SHARE		\$0.00		TOTAL		\$413,524.00	
NON-CASH SHARE		\$0.00					
RECIPIENT SHARE		\$0.00					
TOTAL		\$653,197.00					
14. ACCOUNTING AND APPROPRIATION DATA 2014-X0200-FEEBASED-60-60D001-11-6-213-1058-4110							
PURCHASE REQUEST NO.		JOB ORDER NO.		AMOUNT		STATUS	
RES-14-0476							
15. POINTS OF CONTACT							
	NAME	MAIL STOP	TELEPHONE	E-MAIL ADDRESS			
TECHNICAL OFFICER	SARAH B. SHAFFER		301-251-7942	SARAH.SHAFFER@NRC.GOV			
NEGOTIATOR							
ADMINISTRATOR	GORDANA ZUBER		301-287-0900	gordana.zuber@nrc.gov			
PAYMENTS							
16. THIS AWARD IS MADE UNDER THE AUTHORITY OF: Pursuant to Section 31b and 141b of the Atomic Energy Act of 1954, as amended							
17. APPLICABLE STATEMENT(S), IF CHECKED: <input type="checkbox"/> NO CHANGE IS MADE TO EXISTING PROVISIONS <input type="checkbox"/> FDP TERMS AND CONDITIONS AND THE AGENCY-SPECIFIC REQUIREMENTS APPLY TO THIS GRANT				18. APPLICABLE ENCLOSURE(S), IF CHECKED: <input type="checkbox"/> PROVISIONS <input type="checkbox"/> SPECIAL CONDITIONS <input type="checkbox"/> REQUIRED PUBLICATIONS AND REPORTS			
UNITED STATES OF AMERICA				COOPERATIVE AGREEMENT RECIPIENT			
CONTRACTING/GRANT OFFICER ERIKA EAM 		DATE 09/25/2014		AUTHORIZED REPRESENTATIVE		DATE	

Grant and Cooperative Agreement

ITEM NO. (A)	ITEM OR SERVICE (Include Specifications and Special Instructions) (B)	QUANTITY (C)	UNIT (D)	ESTIMATED COST	
				UNIT PRICE (E)	AMOUNT (F)
	<p>CFDA Number: 77.009</p> <p>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).</p> <p>The Technical Analyst for this grant is: Madhumita Sircar Email: Madhumita.Sircar@nrc.gov Phone: 301-251-3307 Payment: ASAP GRANT FUNDS REIMBURSEMENT SYS US TREASURY Period of Performance: 09/30/2014 to 09/29/2017</p>				

ATTACHMENT A - SCHEDULE

A.1 PURPOSE OF GRANT

The purpose of this Grant is to provide support to the "Experimental and Numerical Investigation of Alkali Silica Reaction in Nuclear Reactors" as described in Attachment B entitled "Program Description."

A.2 PERIOD OF GRANT

1. The effective date of this Grant is September 30, 2014. The estimated completion date of this Grant is September 29, 2017.
2. Funds obligated hereunder are available for program expenditures for the estimated period: September 30, 2014 – September 29, 2017.

A. GENERAL

1. Total Estimated NRC Amount: \$653,197.00
2. Total Obligated Amount: \$413,524.00
3. Cost-Sharing Amount: \$0.00
4. Activity Title: Experimental and Numerical Investigation of Alkali Silica Reaction in Nuclear Reactors
5. NRC Project Officer: Sarah Shaffer
6. NRC Technical Analyst: Madhumita Sircar
7. DUNS No.: 007431505

A.3 BUDGET

Revisions to the budget shall be made in accordance with Revision of Grant Budget in accordance with [2 CFR 215.25](#).

Category	Year 1	Year 2	Year 3	Total
Personnel	\$87,420.00	\$90,042.00	\$88,500.00	\$265,962.00
Fringe Benefits	\$20,191.00	\$20,797.00	\$21,370.00	\$62,358.00
Travel	\$4,950.00	\$4,950.00	\$4,950.00	\$14,850.00
Other	\$32,169.00	\$32,778.00	\$33,416.00	\$98,363.00
Indirect Charges	\$69,594.00	\$71,289.00	\$70,781.00	\$211,664.00
Total	214,324.00	\$219,856.00	\$219,017.00	\$653,197.00

All travel must be in accordance with the Regents of the University of Colorado Travel Regulations or the US Government Travel Policy absent Grantee's travel regulation.

A.4 AMOUNT OF AWARD AND PAYMENT PROCEDURES

1. The total estimated amount of this Award is \$653,197.00 for the three year period.
2. NRC hereby obligates the amount of \$413,524.00 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 Grants 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

1 Introduction

- **Motivation:** The impetus for this proposal stem from the apparent challenge confronting the NRC in assessing safety issues pertaining to the Seabrook nuclear power plant which suffers from Alkali Silica Reaction (ASR), and in particular NRC request that the licensee determines the long term safety of the plant within the framework of ML121250588 (2012).
- **Objectives:** of this proposal are to conduct a holistic approach which will answer three key questions:
 1. What is the effect of ASR on the shear strength?
 2. Can we predict the future expansion of an alkali silica reaction and its kinetics?
 3. What is the impact of ASR on the safety and serviceability of a nuclear power plant?
- **Qualifications:** The Principal Investigator (P.I.) considers himself uniquely qualified to undertake this research for reasons explained in Section 4.4.

2 Alkali Silica Reaction; Unresolved Questions

- **Finite element simulation:** Following the pioneering work of the French, (Larive, 1998) we have moved from a heuristic to a science based paradigm to address ASR. On the computational side, the P.I. and Prof. Sellier (Toulouse, France) put together a document which lists what are be the essential features that a modern finite element code should have for a science based predictive capability (saouma and sellier, 2010). Also included, was a series of increasingly complex benchmark problems whose solution was deemed essential to “validate” a finite element code. A summary of the State of the Art on the computational front, along with the P.I. solutions to these validation problems can be found in the P.I.'s recent book *Numerical Simulation of Alkali Silica Reaction* (Saouma, 2013). The approach will be discussed below.
- **Shear strength:** So far, countless tests have been performed on core-size samples, and a few on beam size components. However, as was found in Seabrook, ASR can affect a portion of the nuclear power plant (NPP) without shear reinforcement. To address this deficiency, large scale beam tests are currently underway at the University of Texas (ML12199A300, 2012). However, in those tests both shear and flexure are prevalent, thus it may be difficult to determine direct causality. It is the P.I. understanding that similar tests may be under way at the University of Toronto.
- **Prognosis for future expansion:** Regretfully, most, if not nearly all research on concrete material has focused on the identification of reactive aggregates and mix designs. Yet, practically no research has been undertaken on the *prediction* of future expansion, and the kinetics of the reaction.

3 Proposed Work

It is hereby proposed to conduct the following work

1. Conduct large scale laboratory tests on concrete panels suffering from ASR and in nearly pure shear to assess the shear strength deterioration due to ASR.
2. Conduct laboratory tests on concrete cores recovered from a structure suffering from ASR and estimate the residual expansion and its kinetics.
3. Perform a 3D nonlinear analysis of a nuclear power plant with portion of the concrete undergoing an ASR expansion, and assess long term safety and serviceability.

3.1 Large Scale Laboratory tests for Shear Degradation

To ensure maximum causality on the effect of ASR on shear strength degradation, it is best to conduct pure shear tests on large scale specimens subjected to compressive confinement. This is a far better alternative to testing large scale beams where flexure and self-weight may overshadow causality, and make it difficult to properly quantify degradation. Furthermore, it is easier to maintain at constant humidity, high temperature (to accelerate the ASR deterioration) of a concrete panel than a large beam. Finally, and contrarily to beams, in such a test the specimen may also be subjected to proper confinement as is the case in a NPP.

The P.I. has previously conducted three such tests (for three different sponsors), and those are described below. The proposed test for this research will be nearly identical with the exception that concrete with ASR will be tested.

- **Confined shear; Monotonic load:** In the first set of tests at the university of Colorado, (Slowik et al., 1998) (sponsored by the Electric Power Research Institute, EPRI) large simulated rock/concrete bi-material specimens were subjected to bi-axial loading in order to derive a constitutive model of the dam/foundation interface (Cervenka et al., 1998). Confinement was applied through two separate and “anti-symmetric” stiff steel cages bolted to the concrete specimen. Constant confinement orthogonal to the joint was applied, while the punctual forces transferred through the stiffened cage as a nearly constant shear stress distribution along the joint. The advantage of the relatively unusual test configuration is that the resultant of the bending moment on the tested surface is zero, as can be determined from a simple free body diagram. In shear tests it is generally difficult to have a uniform distribution of shear stress, or, at least, to separate shear and flexural effects, Fig. 1.
- **Confined shear; Cyclic load:** This test was subsequently refined during the sabbatical leave of the P.I. at the Politecnico di Milano and concrete specimens were subjected to reverse cyclic shear stresses to assess potential shear crack degradation by cyclic (earthquake) load, (Puntel et al., 2006) (Puntel and Saouma, 2008). The concrete panels had a crack surface of 90 * 30 cm (slightly smaller than those in Boulder) and the total height of the specimen was 70 cm. To ensure adequate shear load transfer from the testing machine each end was cast on top of a 2 cm thick aluminum plate with 24 Φ 14 mm threaded bars connected to it to ensure adequate shear transfer. The plate also had 12 Φ 14 mm threaded holes left empty to subsequently connect the specimen to the lateral confining apparatus, Fig. 2.

In this setup (as in the previous one), first, the cage is “wrapped” around the specimen, and then it is pre-compressed through a self-equilibrating system consisting of four jacked dywydag bars. Steel plate ③ transmits the load from the MTS testing machine to the other steel plates to which it is bolted. Steel plates ② (there are 2 of them for each half box) transfer the shear load on the lateral sides of the specimen, from steel plate ③ to steel plate

①. Steel plate ① is bolted to the aluminum plate fixed on the back side of the concrete specimen. At that point, it is safe to lift the specimen and install it in the 2500 kN MTS servo-controlled testing machine.

It should be noted that the connection between the steel frame and the testing machine consists of a hinge allowing rotation in the vertical plane perpendicular to the concrete joint; as such dilation of the specimen is not hindered.

The confining load is applied by two compact hydraulic actuators on one side of the specimen and, on the opposite end by two 120 mm wide semi-spherical hinges. The actuators and the semi-spherical hinges are fixed to four positions on the steel box (plate ①).

We propose thus to duplicate these tests in Boulder to assess the shear degradation due to ASR induced expansion. Given the size of the specimens, casting may be subcontracted to a commercial laboratory to cast 6 specimens: 4 with reactive concrete, and 2 non-reactive. Should there be difficulty in finding reactive aggregates, crushed glass will be used instead (Bazant et al., 2000) (Jin, 1998) (Xie et al., 2002). Samples will be kept at least 95% RH in a chamber and at temperatures of at least 35°C for a minimum of 6 months. Core samples will also be cast and maintained under the same conditions, and expansion readings will be taken regularly until it is deemed that sufficient expansion did occur for tests to initiate. Control tests will be performed in the meantime. The compressive load will be applied by two actuators which will maintain constant compressive stress. Magnitude of this stress could be either determined from the parallel finite element analysis to be undertaken separately, or in consultation with Dr. lePape from the Oak Ridge national Laboratory (see Appendix A with whom the P.I. is currently under contract for a separate (but analogous) project).

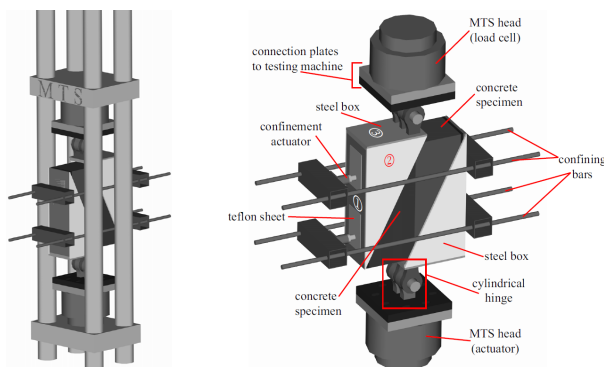


(a) Experimental setup

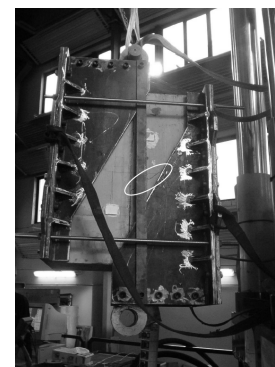


(b) Shear Crack

Figure 1: Direct shear tests conducted in Boulder



(a) Experimental setup



(b) Post-Mortem, shear crack

Figure 2: Details of tests previously conducted by the P.I. and which will be duplicated for proposed research on shear strength of ASR affected panels

3.2 Residual Expansion

The residual expansion of concrete in a structure undergoing ASR is of paramount importance. One need to know for how long will the expansion continue and by how much. Surprisingly, there has been very little work in this area (given the complexity of the task). Whereas some work was done by Smaoui et al. (2004) and Multon et al. (2008), the most appropriate work so far is the one of Sellier et al. (2009) who developed a methodology for estimating the residual expansion in concrete structures. This approach has not yet received wide acceptance, it should be evaluated and possibly improved. This is precisely the second task of this proposal. Two approaches will be followed.

3.2.1 Integrated Field, Laboratory, Finite Element Calibration Method

The essence of the method is succinctly addressed next.

- The smaller aggregates react faster than larger ones, making it possible to define a kinetics parameter for each aggregate size (with small aggregates reacting faster than large aggregates).
- Aggregates recovered from site could be crushed first, followed by the preparation of mortar bars composed of this crushing product. These samples will thus have experienced extensive preexisting reactivity, resulting in a smaller asymptotic value than samples obtained from larger aggregates (with little relative expansion). The residual expansion of a structure can therefore be quantified from such tests.
- The crux of the method consists in comparing residual swelling measured on a mortar made from crushed reactive aggregates with the residual swelling of mortars made from sound crushed aggregate.
- It is assumed that a reactive aggregate of volume V_a can create a maximum gel volume V_g proportional to its own volume $V_g = f V_a$ where f depends on both the reactive silica content of the aggregate and gel texture (Poyet et al., 2007). The stress-free swelling ε can, in turn, be approximated by: $\varepsilon = n^s \langle V_g - V_p \rangle$ where n^s is the number of reactive aggregates of size s per m^3 of concrete and V_p is the pore volume. The final strain will then be

$$\varepsilon(\infty) = n \langle f V_a - V_p \rangle \quad (1)$$

Where n is the number of reactive aggregates per unit volume of mortar.

- Since the reactive aggregates have already undergone partial reaction when extracted from the structure at time $t = T$, we can then express the residual ASR expansion as:

$$\varepsilon^{res} = n \langle f V_a (1 - A(t)) - V_p \rangle \quad (2)$$

and for $A(t) \square 1$, the residual swelling will be close to zero, and conversely for $A(t) \square 0$ the residual swelling will be maximum. The former case corresponds to “old” concrete and the latter case to “young” concrete. The engineer really needs to know the value of $A(t)$. Another unknown to be determined is f .

- The expression for A_r was developed more recently by Gao et al. (2012). It is assumed that the degree of chemical advancement of the reaction (hence gel expansion) is directly related to the degree of silica consumption. For a given aggregate size, we can thus define $A \in [0,1]$ as:

$$A(t) = \frac{Si^{\text{reacted}}(t)}{Si^{\text{reactive}}(t=0)} \quad (3)$$

where Si^{reacted} is the mass of silica consumed at time t , and Si^{reactive} the total reactive silica content.

- The actual ASR strain can be expressed as:

$$\varepsilon^{\text{ASR}} = A(t) \varepsilon^{\infty} \quad (4)$$

and therefore the expansion kinetics $A(t)$ and final expansion ε^{∞} are separately determined.

This method can be carried out through the twelve steps illustrated in Fig. 3:

1. Structural monitoring, which (to the greatest extent possible) should track displacements, cracking, crack opening displacements, temperature and moisture.
2. Recover cores with and without reactive concrete.
3. Acid dissolution of cement through heat treatment by immersing the samples in a Na_2SO_4 solution, followed by at least five cycles of freezing and thawing. This procedure will facilitate the extraction of coarse aggregates. Fine aggregates are then extracted through what the authors refer to as an *organic chemical attack* in order to dissolve them from the cement paste.
4. Recover all the aggregates.
5. Divide all the aggregates in two groups small and coarse.
6. Crush and sift aggregates.
7. Use those in the 0.16-3.15 mm range to prepare two sets of mixes with 1,500 kg/m³ sand content, 8 kg/m³ alkali content and a water-to-cement ratio of 0.5. Each mix is then cast in at least three mortar specimens (20 * 20 * 160 mm)
8. Specimens are cured for 28 days in sealed bags at 20°C, before conducting accelerated tests at 60°C and 95% relative humidity.
9. Plot residual expansion versus time. Derive the free swelling vs. time for each mortar specimen.
10. Through an inverse finite element study, determine $A(t)$ (which is the primary unknown being sought) from Eq. 3.
11. Determine f by fitting the numerical prediction of structural displacement to the observed displacement.

3.2.2 Accelerated Tests and Numerical Calibration

An alternative to the preceding method is one based on accelerated tests of cores recovered. By definition, these cores are still expanding, and the question is what is the residual expansion and what will be the time required to reach this expansion value. These cores would have already undergone a non-negligible ASR expansion and reaction would have already started (for the sake of generalization) at a certain unknown time.

Hence, with reference to Figure 4, we are able to identify three coordinate systems:

- $t_1 - \varepsilon_1$ associated with actual field conditions, whereby the varying ambient temperature is replaced (as an approximation) by the mean equivalent temperature.
- $t_3 - \varepsilon_3$ associated with laboratory tests at high temperature.
- $t_2 - \varepsilon_2$ associated with the (fictitious) origin of the (backward) extrapolation of the laboratory test at high temperature.

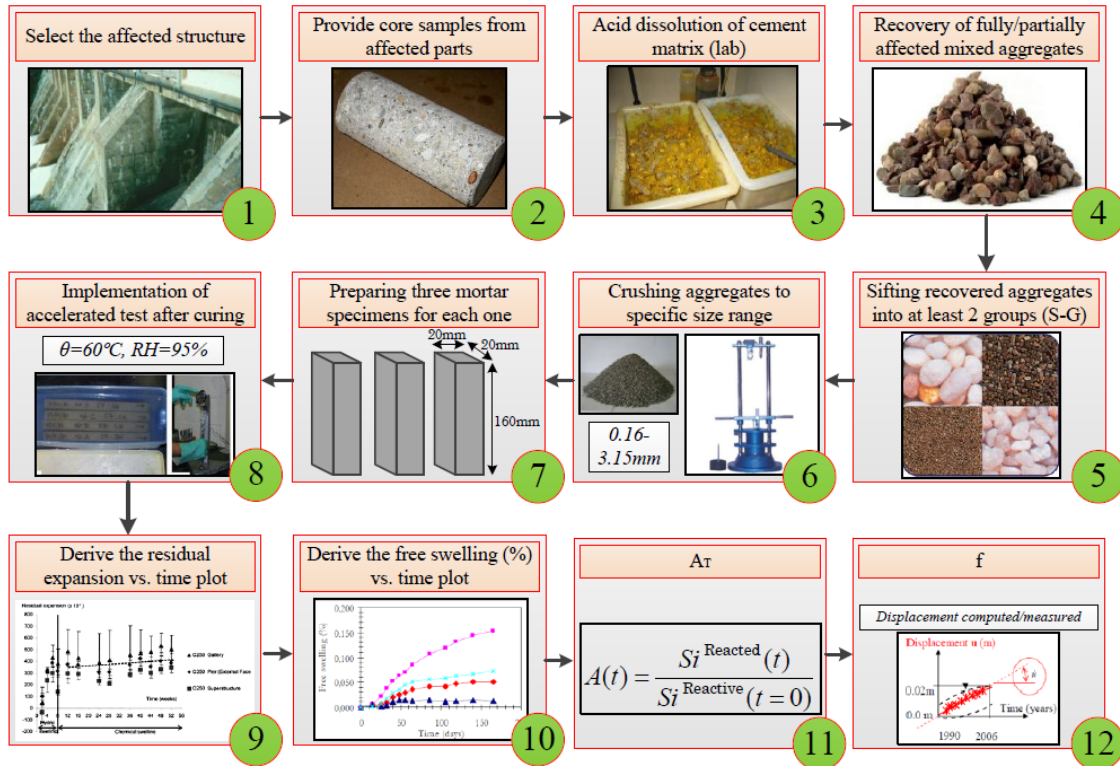


Figure 3: Schematic description of the Sellier et al. (2009) method

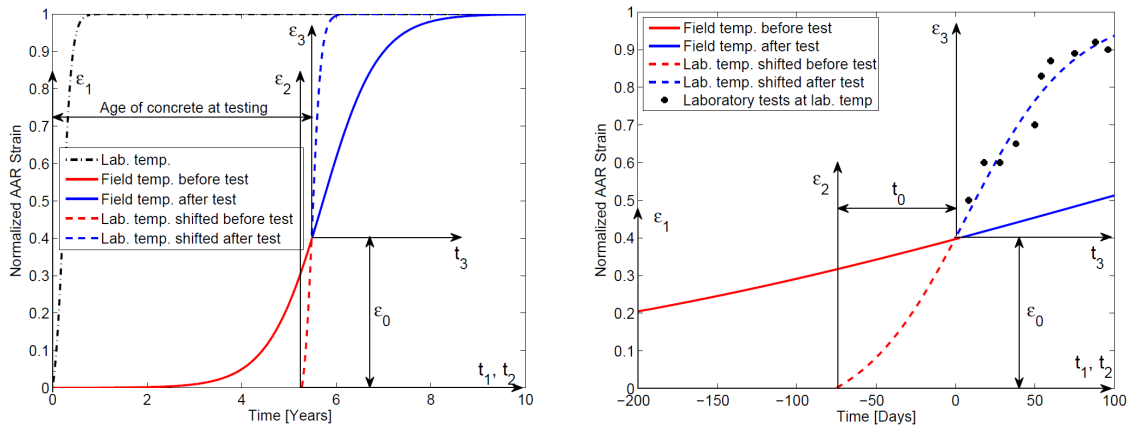


Figure 4: Nonlinear regression from a delayed laboratory test to determine the full expansion curve (Note the time shift in the second figure)

Assuming that the chemical reaction is the same both in the field and at the higher laboratory temperature (this assumption is partially justified by the work of Leemann and Merz (2012)), let's consider concrete expansion in the field and in the laboratory¹.

In the field, expansion starts at $t = 0$ under average temperature $T = T_{field}$. When the expansion has become structurally noticeable (i.e. mapped cracks or irreversible displacements), the core is then extracted (or the mortar bar prepared) and tested in the laboratory at temperature $T = T_{lab}$. At this point, the structure (or, more precisely, the laboratory specimen) has sustained a total expansion of $\varepsilon_0(T_{field})$.

In Figure 4, the field expansion (before and after the test) is shown along with ε_0 . In the laboratory however, the test is performed at a higher temperature, and the same concrete will now expand much more rapidly. Should we extrapolate the same curve to a zero expansion; the temperature-dependent time t_0 can be defined. Hence, t_0 and ε_0 define the origin of the laboratory coordinate system $t_3 - \varepsilon_3$. In turn, $t_2 - \varepsilon_2$ defines the coordinate system of the accelerated laboratory test had it been performed soon after the concrete was poured.

Preliminary studies by the P.I. point out that this method *may* be successful, it clearly hinges on both high temperature tests (to accelerate the reaction) and numerical methods.

3.3 Finite Element Analysis

The objective of this last task is to perform the nonlinear finite element analysis of a sufficiently large 3D model of a NPP with a hypothetical ASR localization and assess the long term structural integrity. However, to assess the impact of localized ASR on the structural integrity of a NPP a 3D finite element analysis of the container is essential. For reliable long term predictions, the code must meet two criterions: a) include a minimum number of essential requirements; and b) be validated.

The author in (Saouma 2013) listed those minimum requirements as being:

1. Spatial and temporal distribution of the structure temperature $T(x, y, z, t)$ and relative humidity $RH(x, y, z, t)$
2. Constitutive models that can accommodate both a linear elastic response (for fast 3D analysis of the entire structure) and nonlinear response to account for cracking and failure.
3. Ability to properly model crack/joints. Vertical expansion is likely to cause either abutment cracking or "lift-off" of the concrete along (V-shaped) abutments or even within the inner center of rock-concrete interfaces (effect compounded by uplift). This is also required to capture the eventual closing of a sliced portion of the structure (as is often performed in dams to relieve stresses).
4. Creep to account for long-term deformation that can reduce ASR expansion.
5. Stress-induced anisotropy: confining stress will reduce expansion in the corresponding direction, but may increase it in orthogonal directions.
6. Ability to display ASR-induced strains (as opposed to the extent of ASR penetration (ξ)).

¹ Though different alkali are being mobilized in the two reactions, primarily Na and K in the laboratory, and Ca in the field.

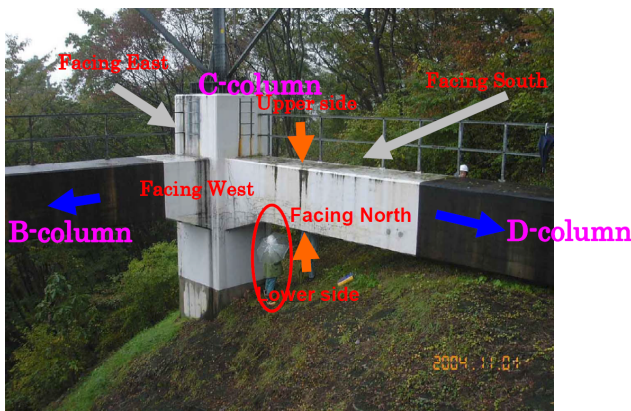
7. Should seismic excitations be of concern, then the ability to perform a “restart” with the existing state of stress and internal degradation of $f'_i(x, y, z, t)$ and $E(x, y, z, t)$.

The P.I. has indeed developed constitutive modes for ASR that meet these requirements (Saouma and Perotti, 2006), and subsequently applied his model to dams and massive reinforced concrete structures (Saouma et al. 2007).

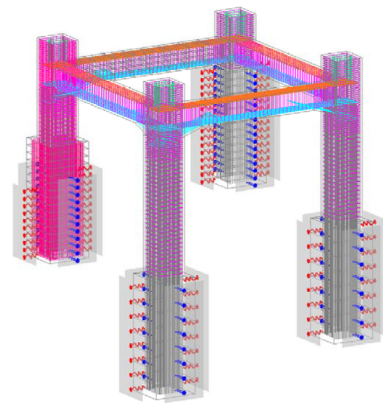
Yet, to assess finite element codes capability to fulfill these requirements, Saouma and Sellier (2007) have proposed a battery of simple validation problems (of increasing complexity) in order to precisely ensure that a given code possesses all the necessary features for proper ASR modeling. To the best of the P.I. knowledge, he is the only one to have published a solution to these problems in his book.

The model has been applied to dams and a massive reinforced concrete structures (foundation of a transmission tower) for the Tokyo Electric Power Company (TEPCO) in Japan which suffers localized ASR degradation. Details of this last analysis can be found in Fig. 5. We note that

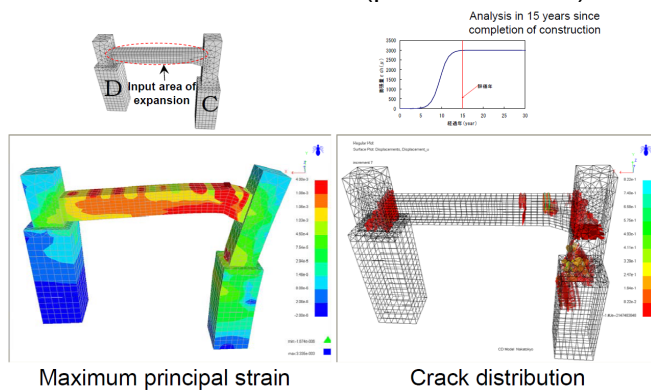
1. Nonlinear 3D model was used, reinforcement explicitly defined, winkler foundation (for structure-soil interaction) adopted.
2. Results captured global response, and surface strains correlated well with the measured one.
3. Following the ASR multi-year simulation, the performance after a seismic excitation (with degraded concrete) was determined.



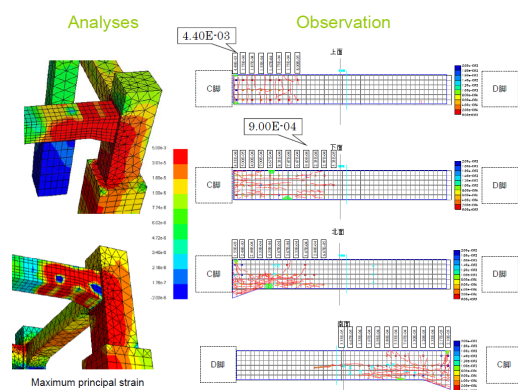
(a) Transmission tower foundation with localized ASR (painted in white)



(b) Finite element model in Merlin



(c) Deformed shape and internal structural cracks



(d) Comparison between recorded surface strains and computed surface strains

ones

Figure 5: Analysis of massive reinforced concrete structure by the P.I.

In light of the experience gained through this study, it is hereby proposed to perform the 3D nonlinear response of a NPP with localized ASR. Such a study will also benefit from the P.I.'s experience in modeling and analyzing the delamination of Crystal River (in his capacity as Consultant to PII) as shown in Fig. 6.

The P.I. will seek from NRC dimensions and characteristics of an actual NPP to be modeled.

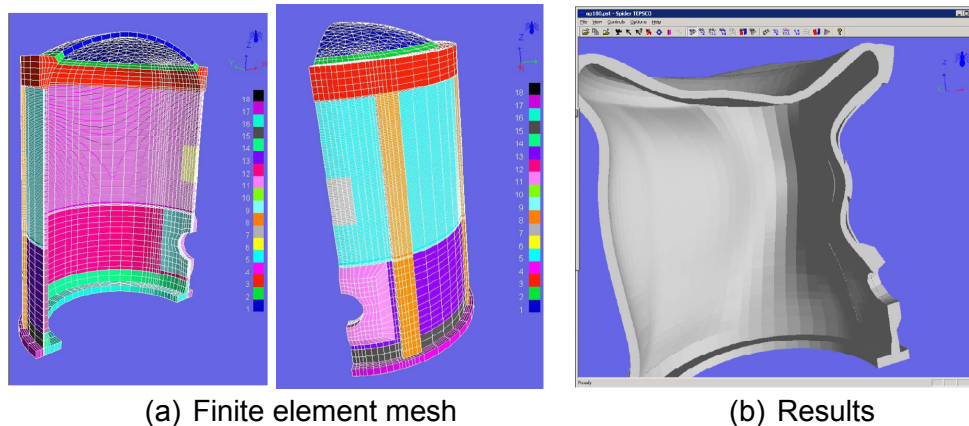


Figure 6: Analysis of Crystal River Delamination by the P.I.

4 Project Execution

4.1 Schedule

Fig. 7 is a tentative schedule for the project. Adjustments will be made as progress is made.

		2015				2016				2017			
		Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
Task 1	Complete design, order parts, assemble frame						X	X					
	Cast 5 reactive specimens and 3 non-reactive	X	X										
	Determine proper confinement stress					X							
	Test non reactive specimens								X	X			
	Extend curing of reactive specimens			X	X	X	X	X	X	X	X		
	Test reactive specimens										X	X	
	Write Report												X
Task 2	Try to obtain reactive cores	X											
	Cast 24 reactive cylinders and 6 non-reactive	X											
	Improve understanding of methods	X	X										
	Develop and test numerical tools		X	X	X								
	Monitor expansions of cylinders		X	X	X	X	X	X	X	X	X	X	
	Testing									X	X	X	
	Data Interpretation; Final report											X	X
Task 3	Seek from NRC physical model, temperature, RH histories, material characteristics	X	X										
	Finite element mesh preparation			X	X	X							
	Analyses						X	X	X				
	Write Report									X	X		

Figure 7: Tentative schedule

4.2 Tangible Deliverable

This project will generate three separate reports which, collectively, will greatly assist NRC to better understand the impact of ASR on NPP. It will be written in simple terms understood by most engineers, and include appendices with details. More specifically three questions will be (hopefully) solved:

1. How concerned should we be about the impact of ASR on the shear strength of concrete?
2. How could we perform tests to determine the residual expansion of a NPP once the reaction has started?
3. What is the overall structural impact of ASR in a NPP does it put at risks serviceability (micro-cracking which may lead to gas diffusion) and strength (would there be a major structural crack).

It should be noted, that the P.I. is submitting a parallel proposal to undertake a Performance Based Seismic Assessment for Nuclear Power Plants. Such a seismic analysis could be performed for degraded concrete should the need arise.

Attachment C – Standard Terms and Conditions

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

Preface

This award is based on the application submitted to, and as approved by, the Nuclear Regulatory Commission (NRC) under the authorization [42 USC 2051\(b\)](#) pursuant to section 31b and 141b of the Atomic Energy Act of 1954, as amended, and is subject to the terms and conditions incorporated either directly or by reference in the following:

- Grant program legislation and program regulation cited in this Notice of Grant Award.
- Restrictions on the expenditure of Federal funds in appropriation acts, to the extent those restrictions are pertinent to the award.
- Code of Federal Regulations/Regulatory Requirements - [2 CFR 215 Uniform Administrative Requirements](#) For Grants And Agreements With Institutions Of Higher Education, Hospitals, And Other Non-Profit Organizations (OMB Circulars), as applicable.

To assist with finding additional guidance for selected items of cost as required in [2 CFR 220](#), [2 CFR 225](#), and [2 CFR 230](#) this URL to the Office of Management and Budget Cost Circulars is included for reference: 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

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.

Grantees must comply with monitoring procedures and audit requirements in accordance with [OMB Circular A-133](#).

2. Award Package

§ 215.41 Grantee responsibilities.

The Grantee is obligated to conduct 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.

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 and obtained from the NRC Grants Officer in advance of the change or obligation of funds. All requests for NRC prior approval, including requests for extensions to the period of performance, should be made, in writing (which includes submission by e-mail), to the designated Grants Specialist and Program Office 30 days before the proposed change. The request should be signed by 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 will 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 \$100,000.00 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 listed as Exclusion on SAM (<http://sam.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.

The Grantee 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 will 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 regulations. 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 will 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](#).

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.

Patent Notification Procedures - If the NRC or its 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, [EO 12889](#) requires NRC to notify the owner. 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 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, such as data, databases or software are determined by [2 CFR 215.36](#). 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

Grantee shall follow established provisions in [2 CFR 215.53](#).

Conflict Of Interest Standards

Conflict of Interest Standards for this award will 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 will follow provisions as established in [2 CFR 215.60-62](#).

Monitoring and Reporting § 215.50-53

Grantee Financial Management systems must comply with the 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, will 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](#)

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 the following:

1. Grants_FFR.Resource@NRC.gov (NOTE: There is an underscore between Grants and FFR);
2. RESGrants.Resource@NRC.gov;
3. Technical Analyst; and
4. Grants Officer.

Period of Availability of Funds 2 CFR § 215.28

If 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.

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.

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.

Automated Standard Application For Payments (ASAP) Procedures

Unless otherwise stated, grantee payments are made using the [Department of Treasury's Automated Standard Application for Payment \(ASAP\) system](#) <http://www.fms.treas.gov/asap/index.html>, through preauthorized electronic funds transfers. To receive payments, 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 is required to make ASAP withdrawals: (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).

II. Audit Requirements**Audits**

Organization-wide or program-specific audits are 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." Grantees are subject to the provisions of [OMB Circular A-133](#) if they expend \$500,000.00 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 are 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 \$500,000.00 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 Progress (Technical) Reports

The Grantee shall submit performance (technical) reports electronically to the NRC Project Officer and Grants Officer on a quarterly 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. The report should be submitted electronically to the following:

1. Grants_PPR.Resource@NRC.gov (NOTE: There is an underscore between Grants and PPR);
2. RESGrants.Resource@NRC.gov;
3. Technical Analyst; and
4. Grants Officer.

Unless otherwise specified in the award provisions, performance progress (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, may result in designation of the Grantee as high risk and the assignment of special award conditions. Further action may be required as specified in the standard term and condition entitled "Termination."

Failure to comply with the award provisions may result in a negative impact on future NRC funding. In addition, the Grants Officer may withhold payments; change the method of payment from advance to reimbursement; impose special award conditions; suspend or terminate the grant.

Other Federal Awards With Similar Programmatic Activities

The Grantee will immediately notify the Project Officer and the Grants Officer in writing if after award, other financial assistance is received to support or fund any portion of the program description stated in the NRC award. NRC will not pay for costs that are funded by other sources.

Prohibition Against Assignment By The Grantee

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

Site Visits

The NRC, through authorized representatives, has the right to make site visits to review project accomplishments and management control systems and to provide technical assistance as 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.

IV. Miscellaneous Requirements

Criminal and Prohibited Activities

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.)

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.

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.

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 encouraged to purchase American-made equipment and products with funding provided under this award.

Increasing Seat Belt Use in the United States

EO 13043 requires Grantees to 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

EO 13513 requires Grantees to 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 barred from accepting funds from a Grantee to pay transportation, travel, or other expenses for any Federal employee unless specifically approved in the terms of the award. Use of award funds (Federal or non-Federal) or the Grantee’s provision of in-kind goods or services, for the purposes of transportation, travel, or any other expenses for any Federal employee may raise appropriation augmentation issues. In addition, NRC policy prohibits the acceptance of gifts, including travel payments for Federal employees, from Grantees or applicants regardless of the source.

Minority Serving Institutions (MSIs) Initiative

Pursuant to EOs [13256](#), [13230](#), and [13270](#), NRC is strongly committed to broadening the participation of MSIs in its financial assistance program. NRC’s goals include achieving full participation of MSIs in order to advance the development of human potential, strengthen the Nation’s capacity to provide high-quality education, and increase opportunities for MSIs to participate in and benefit from Federal financial assistance programs. NRC encourages all

applicants and Grantees to include meaningful participations of MSIs. Institutions eligible to be considered MSIs are listed on the Department of Education website:

<http://www.ed.gov/about/offices/list/ocr/edlite-minorityinst.html>

Research Misconduct

Scientific or research misconduct refers to the fabrication, falsification, or plagiarism in proposing, performing, or reviewing research, or in reporting research results. It does not include honest errors or differences of opinions. The Grantee organization has the primary responsibility to investigate allegations and provide reports to the Federal Government. Funds expended on an activity that is determined to be invalid or unreliable because of scientific misconduct may result in a disallowance of costs for which the institution may be liable for repayment to the awarding agency. The Office of Science and Technology Policy at the White House published in the Federal Register on December 6, 2000, a final policy that addressed research misconduct. The policy was developed by the National Science and Technology Council ([65 FR 76260](#)). The NRC requires that any allegation be submitted to the Grants Officer, who will also notify the OIG of such allegation. Generally, the Grantee organization shall investigate the allegation and submit its findings to the Grants Officer. The NRC may accept the Grantee's findings or proceed with its own investigation. The Grants Officer shall inform the Grantee of the NRC's final determination.

Publications, Videos, and Acknowledgment of Sponsorship

Publication of the results or findings of a research project in appropriate professional journals and production of video or other media is encouraged as an important method of recording and reporting scientific information. It is also a constructive means to expand access to federally funded research. The Grantee is required to submit a copy to the NRC and when releasing information related to a funded project include a statement that the project or effort undertaken was or is sponsored by the NRC. The Grantee is also responsible for assuring that every publication of material (including Internet sites and videos) based on or developed under an award, except scientific articles or papers appearing in scientific, technical or professional journals, contains the following disclaimer:

"This [report/video] was prepared by [Grantee name] under award [number] from [name of operating unit], Nuclear Regulatory Commission. The statements, findings, conclusions, and recommendations are those of the author(s) and do not necessarily reflect the view of the [name of operating unit] or the US Nuclear Regulatory Commission."

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

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

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

EXECUTIVE COMPENSATION REPORTING

[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 \$25,000.00 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 \$25,000.00 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.sam.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 \$300,000.00, 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 \$10,000.00.