

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

1. GRANT/AGREEMENT NO. NRC-38-10-969	2. MODIFICATION NO.	3. PERIOD OF PERFORMANCE FROM: 7/1/2010 TO: 6/30/2011	4. AUTHORITY Pursuant to Section 31b and 141b of the Atomic Energy Act of 1954, as amended
5. TYPE OF AWARD <input checked="" type="checkbox"/> GRANT <input type="checkbox"/> COOPERATIVE AGREEMENT	6. ORGANIZATION TYPE Public State-Controlled Institution of Higher ED DUNS: 053599908	7. RECIPIENT NAME, ADDRESS, and EMAIL ADDRESS Oregon State University 308 Kerr Administrative Building Corvallis, Oregon 97331	
8. PROJECT TITLE: Curriculum Enhancement through Development of Interdisciplinary Courses in Nuclear Science and Engineering			
9. PROJECT WILL BE CONDUCTED PER GOVERNMENT'S/RECIPIENT'S PROPOSAL(S) DATED See Program Description AND APPENDIX A-PROJECT GRANT PROVISIONS	10. TECHNICAL REPORTS ARE REQUIRED <input checked="" type="checkbox"/> PROGRESS AND FINAL <input type="checkbox"/> FINAL ONLY <input type="checkbox"/> OTHER (Conference Proceedings)	11. PRINCIPAL INVESTIGATOR(S) NAME, ADDRESS and EMAIL ADDRESS Oregon State University Attn: Alena Paulenova Email: alena.paulenova@oregonstate.edu 541-737-7070	
12. NRC PROGRAM OFFICE (NAME and ADDRESS) NRC Attn: Randi Neff Office of Human Resources MS: GW5A6 (301) 492-2301 11545 Rockville Pike Rockville, Maryland 20852	13. ACCOUNTING and APPROPRIATION DATA APPN. NO: 31X0200 B&R NO: 0-8415-5C1116 JOB CODE: T8453 BOC NO: 4110 OFFICE ID NO: RFPA: HR-10-969	14. METHOD OF PAYMENT <input type="checkbox"/> ADVANCE BY TREASURY CHECK <input type="checkbox"/> REIMBURSEMENT BY TREASURY CHECK <input type="checkbox"/> LETTER OF CREDIT <input checked="" type="checkbox"/> OTHER (SPECIFY) Electronic ASAP.gov (See Remarks in Item #20 "Payment Information")	
15. NRC OBLIGATION FUNDS THIS ACTION \$100,000.00 PREVIOUS OBLIGATION _____ TOTAL \$100,000.00	16. TOTAL FUNDING AGREEMENT NRC \$100,000.00 RECIPIENT \$ 28,856.00 TOTAL \$128,856.00 This action provides funds for Fiscal Year in the amount of See Page Two		
17. NRC ISSUING OFFICE (NAME, ADDRESS and EMAIL ADDRESS) U.S. Nuclear Regulatory Commission Div. of Contracts Attn: Sheila Bumpass Mail Stop: TWB-01-B10M Rockville MD 20852			
18. Signature Not Required	19. NRC CONTRACTING OFFICER <u>Sheila Bumpass</u> 7/1/2010 (Signature) (Date) NAME (TYPED) Sheila Bumpass TITLE Contracting Officer TELEPHONE NO. 301-492-3484		
20. PAYMENT INFORMATION Payment will be made through the Automated Standard Application for Payment (ASAP.gov) unless the recipient has failed to comply with the program objectives, award conditions, Federal reporting requirements or other conditions specified in 2 CFR 215 (OMB Circular A110).			
21. Attached is a copy of the "NRC General Provisions for Grants and Cooperative Agreements Awarded to Non-Government Recipients. Acceptance of these terms and conditions is acknowledged when Federal funds are used on this project.			
22. ORDER OF PRECEDENCE In the event of a conflict between the recipient's proposal and this award, the terms of the Award shall prevail.			
23. By this award, the Recipient certifies that payment of any audit-related debt will not reduce the level of performance of any Federal Program.			

SUNSI REVIEW COMPLETE

TEMPLATE - ADM001

ADM002

ATTACHMENT A - SCHEDULE

A.1 PURPOSE OF GRANT

The purpose of this Grant is to provide support to the "Curriculum Enhancement through Development of Interdisciplinary Courses in Nuclear Science and Engineering" as described in Attachment B entitled "Program Description."

A.2 PERIOD OF GRANT

1. The effective date of this Grant is July 1, 2010. The estimated completion date of this Grant is June 30, 2011.
2. Funds obligated hereunder are available for program expenditures for the estimated period: July 1, 2010 – June 30, 2011.

A. GENERAL

1. Total Estimated NRC Amount: \$100,000
2. Total Obligated Amount: \$100,000
3. Cost-Sharing Amount: \$ 28,856
4. Activity Title: Curriculum Enhancement through Development of Interdisciplinary Courses in Nuclear Science and Engineering
5. NRC Project Officer: Randi Neff
6. DUNS No.: 053599908

B. SPECIFIC

- RFPA No.: HR-10-969
FFS: N/A
Job Code: T8453
BOC: 4110
B&R Number: 0-8415-5C1116
Appropriation #: 31X0200
Amount Obligated: \$100,000

A.3 BUDGET

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

	Year 1
Direct Participant Cost	\$84,190.00
Indirect Cost	<u>\$15,810.00</u>
Yearly Total	\$100,000.00

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

A.4 AMOUNT OF AWARD AND PAYMENT PROCEDURES

1. The total estimated amount of this Award is \$100,000 for one year period.

2. NRC hereby obligates the amount of \$100,000 for program expenditures during the period set forth above and in support of the Budget above. The Grantee will be given written notice by the Contracting Officer when additional funds will be added. NRC is not obligated to reimburse the Grantee for the expenditure of amounts in excess of the total obligated amount.

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

Attachment B – Program Description

Curriculum Enhancement through Development of Interdisciplinary Courses in Nuclear Science and Engineering

The purpose of this proposal is to enhance the current undergraduate and graduate curriculum in Nuclear Engineering and Radiation Health Physics (NERHP) and to expand the degree options at Oregon State University (OSU). The main objective of the proposed courses is to advance the educational infrastructure at the department and allow education of new generation of nuclear engineers and scientists that are needed to allow the Nation to safely move its nuclear energy initiatives forward.

NERHP currently offers undergraduate (B.S.) and graduate (M.S., MEng, MHP*, and PhD) degrees in both nuclear engineering and radiation health physics. The objective of the proposal is the development of a cluster of courses in Radiochemistry which enhances and expands subject matter presented in traditional nuclear engineering and radiation health physics curriculum. These courses will be made available to both onsite and distance learners as "selected special topics" courses. The course material will be designed to be accessible to students from other disciplines, such as Chemistry or Chemical Engineering. Selected aspects will also be packaged as stand-alone material that can be integrated into other courses or professional training efforts.

This proposal seeks to leverage our existing course offerings, increase diversity in disciplines and utilize our faculty research expertise in radiochemistry and experimental facilities of the Radiation Center (RC). We intend to create two new radiochemistry courses that will complement our current (and only) course in radiochemistry, and several courses in the departmental curriculum. Interdisciplinary by their nature, these courses are designed for students of several majors (RHP, Chemistry, Chemical Engineering and Pharmacy). Based on current enrollment, the "Chemistry of Nuclear Fuel Cycle" course is expected to engage about 70 students/year, including about 35 undergraduate students, 15 graduate onsite students and 20 e-distance graduate students.

The second course "Radionuclides in the Life Sciences" will be accessible to multiple disciplines across the university; class enrollment is anticipated to be 20 to 30 students/ year. The "Radiochemistry", currently offered in the lecture/laboratory format as our only radiochemistry course serves to approximately 35-40 graduate students annually, Based on our preliminary survey, we believe that the "Radionuclides in the Life Sciences" course will be attractive for many students on campus, In summary, at least 100 students per year will benefit from the proposed curricular changes.

Under this proposal, students will experience an intensive hand-on learning environment which supplement and reinforce their classroom experience. The courses will incorporate, to the possible extent the results of radiochemistry research work at OSU and the ongoing research collaboration with national laboratories (currently, four: ANL, INL, PNNL and ORNL).

The proposed courses will also fit within a radiochemistry course cluster that is a foundational part of our long-term strategy toward creating an interdisciplinary graduate program in *Radiochemistry* at OSU. The proposed interdisciplinary graduate program will be available for students in RHP, NE, Chemistry, or Chemical Engineering (students of Pharmacy and other biomedical sciences will also be invited to participate). Students will obtain in-depth understanding of course material identified as "technical area(s) of interest" by the NRC.

This project will be lead by Dr, A. Paulenova who has many years experience in radiochemistry as a teaching instructor and well-recognized scientist. Prof. K. Higley; a recognized expert in environmental transport and radioecology, will participate in the project.

I. PROJECT RATIONALE - Long-term strategy in Radiochemistry

There are tremendous variations in the scope of graduate education in the specialties of Radiochemistry, Radiation Health Physics and Nuclear Engineering disciplines among the U.S. universities. Table 1 displays data collected from a review on the nuclear engineering and science graduate programs at WNSA universities (WNSA stands for Western Nuclear Science Alliance). OSU currently provides undergraduate and graduate education in Nuclear Engineering (BS, MS, PhD) and a range of nuclear sciences such as Radiation Health Physics (BS, MS, PhD), Nuclear Physics (PhD in Physics) and Nuclear and Radiochemistry (MS, PhD in Chemistry or RHP). All cited disciplines are listed in the university catalog as major programs.

However, Oregon State University is one of only a handful of universities nationwide providing graduate education in all three majors at the MS and PhD levels. Most other US Universities have only some portion of these specialties despite an extensive collaboration with a nearby national laboratory. The OSU Radiation Center houses NERHP and its associated research laboratories as well as research laboratories for nuclear chemistry (in the Department of Chemistry), nuclear physics, archaeometry, and other nuclear based research. Students working in this facility are exposed to a rich and diverse application of nuclear sciences. The depth of nuclear science and engineering programs at OSU provides a complementary, robust, and collaborative environment for students to pursue nuclear degrees, particularly in radiochemistry.

II. SCOPE OF WORK

The proposed cluster of radiochemistry courses discussed in this document is intended to leverage the existing course structure within NERHP and utilize OSU's unique experimental facilities to give students an intensive hand-on experience to complement their classroom learning experience. It is anticipated that the curricular improvements implemented from this project will allow OSU to continue to provide to students a cutting edge education vital to the success in endeavors such as the advanced fuel cycle, new fuel, fuel storage, and materials for extreme environments.

	Undergraduates	Graduate
NE	120	26
RHP	32	86
Radiochemistry/ RHP		4 (Enrolled as RHP)
Medical Physics		5
Total at the NERHP department:	152	117

	2003- 2004	2004- 2005	2005- 2006	2006- 2007	2007- 2008	2008- 2009
NE - Undergraduate	15	14	23	19	1	6
RHP Undergraduate	4	3	6	7	9	6
NE+RHP	19	17	2	26	2	12
Total Undergraduate over the past 5 years:				106		
NE Graduate	1	3	7	3	7	8
RHP Graduate	2	4	7	2	3	5
RHP Graduate E-	0	0	0	0	4	6
NE+RHP <i>Graduate</i> lv	3	7	14	5	14	19
Total Graduate over the past 5				59 (M.S. and		
Total NE+RHP programs produced over the past 5				165 (B.S.+M.S.+ PhD.)		

Students pursuing the proposed Radiochemistry program (currently enrolled to program either at Chemistry or Radiation Health Physics) will follow an interdisciplinary curriculum tailored to fit within the requirement of their major degree. The core course list (for example, RHP degree program) allows students to choose up to 1/3 of their total credit number in other courses or related to their radiochemistry research profile (e.g., Analytical, Inorganic, Physical and Environmental Chemistry), and vice-versa, students, majoring in Chemistry, will be enrolled in the Advanced Radiodetection Methods, Dosimetry, Radioecology, Shielding and Waste Management courses taught at the Department of Nuclear Engineering and Radiation Health Physics. Regardless to the degree selected, students wishing to graduate from this program will be required to take all courses in the Radiochemistry course cluster: Radiochemistry and the proposed courses Chemistry of Fuel Cycle and Radionuclides in Life Sciences. These courses will give students the necessary basics to extend the coursework for the major they selected and proceed with their graduate research work in radiochemistry.

Our graduate students are in high demand - our recent radiochemistry graduates were immediately hired by the Argonne and Los Alamos National Labs. It is anticipated that the OSU graduates, by obtaining more interdisciplinary training and completing the additional courses proposed in this effort will be better able to serve the needs of the nation in a multitude of areas from nuclear material design, decommissioning and waste processing, forensics, to academic needs in fundamental disciplines of health physics and radiochemistry.

III. PROPOSED APPROACH

The ultimate goal of our department - development of a cluster of courses in radiochemistry is a multitask departmental effort involving remodeling of the teaching laboratory, acquisition of new instrumentation, revision of current curriculum and existing courses and development of new courses.

This project proposal calls for creation of two new radiochemistry courses: *Chemistry of the Nuclear Fuel Cycle* and *Radionuclides in Life Sciences*. It is expected that addition of these two new courses will enable us to create, in conjunction with other appropriate courses, a robust program in Radiochemistry. These two courses will complement, enhance and deepen understanding of material covered in other courses in the curriculum. It is also envisioned that the knowledge gained in these courses will similarly be used in fostering graduate research. Consequently, the benefits of these classes will extend beyond the boundaries of the proposed curriculum.

The *Chemistry of Nuclear Fuel Cycle* (advanced radiochemistry, in lecture format) will review the nuclear fuel cycles and fuel chemistry during all three usage periods (front. operation, end) with a special attention to the water reactor chemistry, corrosion products, radiation chemistry

and reactor water chemistry control. The second main focus will be given to partitioning and transmutation program, advanced separation methods for waste processing and recycling of minor actinides and waste reprocessing, including new waste forms (zeolites and other frameworks), new fuel and fuel storage materials, mining and repository). The new *Chemistry of Nuclear Fuel Cycle* (advanced radiochemistry) course will serve as a companion to other courses. such as *Fuel Cycle and Waste Management* or *Radioecology*. The waste management problems will be also reviewed, without repeating or overlapping with the material of the Waste

frameworks), new fuel and fuel storage materials, mining and repository). The new *Chemistry of Nuclear Fuel Cycle* (advanced radiochemistry) course will serve as a companion to other courses. such as *Fuel Cycle and Waste Management* or *Radioecology*. The waste management problems will be also reviewed, without repeating or overlapping with the material of the Waste Management course (RHP 540), see Figure 1,

Courses in Radiochemistry Cluster

Management course (RHP 540), see Figure 1,

methods for separation of radionuclides for medical use, including new isotopes for medical application. Using specifically targeted laboratory experiments, students will examine some of the basic issues surrounding radiolabeling, transport and interaction of radionuclides in biological systems. It is anticipated that this course will require the acquisition of specific equipment dedicated for classroom use. This course is designed to develop the hands-on skills necessary for safe handling of unsealed radioactive solid and liquid sources. Entrance requirements for this course will be designed so that the maximum number of students from a variety of disciplines can benefit from taking the course.

IV. PROJECT MILESTONES (Objectives)

IV. 1. Objective 1. "Chemistry of Nuclear Fuel Cycle" Course

The first objective of this educational proposal is to develop a new course syllabus with the aim to address the current issues of nuclear energy: closed fuel cycle, separations for advanced fuel cycle, partitioning and transmutation, fabrication of new fuels and new waste forms. Some of these issues are marginally discussed in the graduate student seminar (lead by the PI of this proposal), but a seminar is unsatisfactory level for graduate and senior students in NE, RHP or Chemistry. Despite an intensive research program at OSU in the field of nuclear engineering and radioseparation chemistry, currently there is no radiochemistry course dedicated to fuel cycle and reactor chemistry. The only course related to fuel cycle is the Waste Management course (focused on transport; short term/long term storage, etc.). Based on current enrollment, the course will involve approximately 70 students (35 undergraduate, 15 graduate and -20 from e-campus) annually. The proposed Chemistry of the Nuclear Fuel Cycle course will be a required and/or elective course at 400/500 level for undergraduate/graduate students with the Nuclear Engineering major.

The development of the *Chemistry of Nuclear Fuel Cycle* course is the most important objective of this proposal. The innovation will ensure that the *Chemistry of Nuclear Fuel Cycle* course material pertinent to chemistry during all three fuel periods (front end - the preparation and fabrication of the fuel, service period - fuel during reactor operation, and back end - dealing with spent nuclear fuel; separations of short and long lived radionuclides, basic chemistry of actinides and fission products, other nuclear materials). A great attention will be given to the reactor chemistry - all important factors like corrosion, activation of corrosion products, radiation

The new course *Radionuclides In Life Sciences* (lecturelaboratory format) will be offered as a campus-wide elective course. It will serve as a companion to other courses in Medical Physics (a new major at our department developed together with the Department of Oncology at Oregon Health State University) and other courses (Radiobiology, Radioecology) offered at our department, see Figure 1. Focus will be given on introducing the new radiochemical

chemistry, water control, poisoning, etc., will be adequately examined.

The bulk of the course will discuss all forms and stages of on the fuel and spent nuclear fuel; however, it is desired to shift the focus of this course from the traditionally taught open cycle to presentation of both open and closed cycles, teach fundamentals of radioseparation chemistry and some chapters on corrosion and radiation chemistry. The course will be focused on reprocessing, recycling and new technologies. Both separation options solvent extraction and pyroprocessing will be presented. Recent achievements of advanced separation methods UREX+ (PUREX, TRUEX, FPEX, etc.) (US), DIAMEX, SANEX and SESAME (France), UNEX (Russia). CRIPIE (Japan) and other processes, proposed for reprocessing of spent nuclear and addressing the closed fuel cycle program will be reviewed and their chemical principles explained, including the molten salt process and electrorefining.

The course will give also an insight into the power plant chemistry, since the water chemistry and corrosion processes are of greatest interest for nuclear engineers at BWRIPWR power plants. Introduction of chemistry of actinides and fission products and fundamentals of advanced separation methods will benefit our graduates. The new course will serve as a key course in nuclear fuel chemistry, and it is expected that this course will have a greatly positive effect on our departmental curriculum.

Other important issues related to reactor physics or waste management of spent nuclear fuel will be also briefly reviewed; however, it is taught in great details in other special courses, e.g. *Waste Management* (e.g., type of wastes, health physics concerns, radiotoxicity, decay heat, transport, repository projects, deposition (in geologic formations, dispersion into sea and air; disposal into space; remote deposition), properties of geologic formations, transportation, economics of enriching uranium, licensing, economics of transmutation, nuclear nonproliferation issues, etc.) or *Reactor Physics* (physical properties, burnup, decay heat, physics of transmutation, A TW).

The material of this course will be based on recently published research literature related to these problems, and will be also related to the material of the recent workshop/short course "Introduction to Nuclear Chemistry and Fuel Cycle Separations" organized by CRESP at the Vanderbilt University in December 2008 and the book "Radiochemistry in Nuclear Power" Reactors, the National Academic Press (1996).

Expected annual enrollment: -70 students in two sections, on-campus and e-campus

OUTLINE of the "CHEMISTRY OF NUCLEAR FUEL CYCLE" course (4 cr)

Part I. REACTOR CHEMISTRY *Primary*

Coolant Chemistry

Radioactivity Productions in Nuclear Reactors Fission

Products

Corrosion

Controlled Water Chemistry Activated

Corrosion Products

Water And Impurity Activation Products Radiation

Chemistry in Reactor Coolant Assay of Radiactive

Waste Decontamination

Reactor chemistry for other reactor types (incl. gen. I V)

Part II. PARTITIONING AND TRANSMUTATION OF USED NUCLEAR FUEL *Actinides and fission products chemistry*

Solvent Extraction and Pyroprocessing

Separation scheme of PUREX and UREX+

Review of radioseparation chemistry for TRU elements and fission products Beneficial utilization of nuclear wastes (separation of medical radionuclides) Transmutation (Tc,

minor actinides)

Targets, preparation, chemistry

Recycling of uranium and plutonium (MOX and APA fuels) New nuclear materials (TRISO fuel; Cermet)

After the course, students shall be able to: describe the chemical processes that are important in today's nuclear reactors with focus on water chemistry and radiolysis (i); apply the above knowledge on the applications of chemical nature that occur in a nuclear reactor, such as corrosion, formation of CRUD, degradation of ion exchangers, etc.(ii); understand the basic differences in the chemistry for different reactor types; describe the chemical problems one is facing when designing a 4th generation nuclear reactor (IV).

IV. 2. Objective 2. "Radionuclides in Life Sciences" Course

Following the fast growing research and application progress in radiooncology and development of new methods and isotopes for medicine, new radiopharmaceuticals and their applications for imaging and therapy, we will approach to bring this information for our students, especially for students interested in medical physics, pharmacy and veterinary medicine. The course will be offered campus-wide, additionally, also students of the OHSU (the Oregon Health State University in Portland, OR) involved in the Medical Physics (MP) program (a graduate program shared by OSU and OHSU) will have opportunity to take this course. Since other courses offered for students in MP program discuss mostly irradiation provided by linear accelerators and are focused on imaging techniques. a course on behavior of radionuclides in living systems will complement these courses.

Expected annual enrollment: -40 students in two sections, on-campus and e-campus

OUTLINE of the "RADIONUCLIDES IN LIFE SCIENCES" (4 cr) a)

LECTURE

- *Review/Fundamentals: Quantities and units; concentrations and activity, Solids and solutions; Dissolution and dilution, Equilibrium and kinetics.*
- *Chemistry of f- elements: Electronic structure and oxidation state of actinides and lanthanides; Redox chemistry of f-elements, effective cationic charge; Complexation with aqueous and organic ligands, hydrolysis*
- *Radiation Chemistry Fundamentals: Interaction of radiation with matter, types of interactions, radiolysis, radical reactions, radiation yield (G), dose calculations*
- *Radiation Chemistry-II: Applied chemical dosimetry: frequently used dosimeters; their principles, limitations and measured doses; liquid and gel chemical dosimetry.*
- *Radionuclides for Internal Applications: Reactor and cyclotron prepared radionuclides, radionuclides for imaging and therapy, secular and transient equilibrium, and isotopic dilution.*
- *Medical Generators; Principle of medical generators, rapid separations for medical generators, solid-phase chromatography, Selected medical generators for imaging (e.g, Mo/Tc) , palliative therapy (Sr/Y; etc.), targeted alpha therapy (e.g. Ac/Bi, Ac/At) and neutron-capture therapy (B and Gd).*
- *Radiolabeled compounds with metal radionuclides; magnetic and radiolabeled nanopartic/es.*
- *Radio/abe/ed compounds with non-metal radionuclides; stability of labeled compounds.*
- *Radioactive poisons and chelation therapy: Po-210, U/Pb, synthetic and natural medical*

chemists, alternative and experimental treatments designed to mitigate the effect on bone marrow.

b) LABORATORY EXERCISES

Laboratory portion will cover the radiodetection and medical nuclide separations, chemical dosimetry, radiochromatography, autoradiography, Dual-label LSC, e.g.:

- Chemical Dosimetry (Gel dosimetry demonstration Fricke and Taplin dosimeter experiment)
- Tc-99m Medical generator
 - Separation of Tc-99m from irradiated Mo-target
 - Radiolabeling
 - Thin layer Chromatography on Sephadex thin plates

After the course, students shall be able to: describe the chemical processes typical for radiotracers in biological and medical matrices, solve radiochemical reactions important in understanding of water chemistry, radiolysis, mobility of radio nuclides, apply their knowledge to applications of selected separation methods to medical generators, radiolabeling of biomolecules and chelation therapy.

V. INNOVATION and PROJECT OUTCOMES

It is apparent that the recent development in science and engineering becomes more interdisciplinary than ever before. Consequently, also graduates in nuclear sciences and engineering need training in related technical fields: radiochemistry and material sciences. Therefore, the department wants to extend the current course work creating a radiochemistry course cluster which will include also preparation and handling open radioactive sources. The two proposed courses will complete the only existing course in Radiochemistry at OSU. Training in radiotracer methods will include: preparation of stock and working solutions, preparation of samples (for LSC, for alpha particle spectroscopy), isotopic dilution (addition of spike or carrier), co-precipitation, chemical yield calculation, solvent extraction, ion-exchange, sorption experiments, and extraction chromatography will be included. Students will practice calculation of: isotopic dilution, activity concentrations of aged and diluted solutions, direct, indirect and combined uncertainties, chemical yields, distribution ratios, solubility, sorption curves, etc. The training in the environmental chemistry of actinides and fission products will include behavior of radionuclides in different chemical matrices (soils, groundwater, aerosols), sorption and hydrolysis, complexation with hydroxocolloids and humic acid and biota debris in soils, microbial transformation, and other factors affecting mobility of radionuclides.

The largest innovation in the laboratory part of the Radiochemistry cluster courses will be training in preparation of counting samples for the liquid scintillation counting (LSC) and alpha-spectroscopy (electrodeposition, co-precipitation and evaporation). A new LSC counter TriCarb 2900 with features allowing the alpha/beta spectrum discrimination and low tritium counting was recently allocated on our funds. However, currently there is no alpha-spectroscopy equipment available for our students. The budget of this proposal includes allocation for both the alpha-spectroscopy and electrodeposition stations.

The NERHP department is currently offers almost 50 courses for three majors (NE, RHP, and medical physics). It is expected that the new curriculum will provide substantial enhancement to material covered in the existing classes. Figure 1 illustrates the relationship of the two proposed courses to the existing/revised course material currently offered at OSU which will be leveraged by introducing the proposed courses.

- Radiochemistry Laboratory(graduate only)
- Radiation Biology (undergraduate and graduate combined)
- Waste Management (undergraduate and graduate combined)
- Radioecology (undergraduate and graduate combined)
- Nuclear Instrumentation (two separate courses: graduate and undergraduate)
- Principles of Nuclear Medicine (graduate only)

This project will affect all our student community: the 400/500 course "Chemistry of Nuclear Fuel Cycle" will be taught for about 35-40 undergraduate students, 15 graduate students and 18-20 e-distance graduate students, totaling in -70 students this year.

The "Radionuclides in Life Sciences" lecture/laboratory course will affect about 40 graduate students each (15 on-campus and 2x12 from e-campus),

VI. DISSEMINATION of the COURSE MATERIALS

In order to effect a more comprehensive treatment of the subject matter, a large part of course materials will be developed based on recently published literature. An in-depth treatment of each of the course parts will be saved for the individual course in which they are applicable. Material for the radiochemistry courses will be taught in a conventional format (e.g., power point slides) and be accessed via the Blackboard "portal" at OSU. When applicable, videos (e.g. an example of a reprocessing laboratory) will be included. Correspondences, discussions, and quizzes can be done through Blackboard. Video modules will be incorporated into lecture materials. Where appropriate, material will be delivered online via streaming media to make it accessible for e-campus students. In addition to the new course development (*Chemistry of Nuclear Fuel Cycle*) and a teaching guide encompassing the entire radiochemistry course cluster will be developed.

VII. EVALUATION OF SUSTAINABILITY OF THE PROGRAM

Quantifiable criteria for demonstrating that the program is sustainable will be two surveys during the semester and the final evaluation of the course topics by students (i) and by other faculty (ii).

- "Key Performance Indicators" will be the student score showing improvement of their skills in lab and deeper knowledge of the material. The next course in the departmental schedule is for example, Radioecology where students will demonstrate a better, deeper understanding of behavior of pollutants in soils and groundwater. Similarly, the course on "Fundamental of Nuclear Medicine" will be the measure of students' progress. The faculty teaching these courses (Prof. Higley), will provide entry quiz to evaluate students knowledge. The critical success factor will be the comparison with grades from previous years.

VIII. COMMITMENT of the DEPARTMENT

- The Department of Nuclear Engineering and Radiation Health Physics is fully committed to the Radiochemistry program at OSU, (See the letter of endorsement attached.)
- The Department is in the process of transferring into "School of Nuclear Engineering and Sciences", and Radiochemistry is one of education and research programs proposed for the new school in the OSU campus.
- Department recently hired an internationally-recognized radiochemist as a tenure-track faculty with the aim to lead the Radiochemistry program at OSU (PI of this project).
- Department recently scheduled remodeling of radiochemistry teaching laboratory (called "wet lab" in this text) during summer 2010

- Recent departmental purchases addressing the development of the Radiochemistry program were the new TriCarb LSC counter with AIB discrimination (Perkin Elmer, 2009), Keyence microscope (2009) for nuclear material science (solid state radiochemistry) and FT Infra-Red Spectroscopy (Thermo Fisher Scientific)
- Department provides matching funds for purchase of an ultrafiltration unit and alpha-electroplating station which are necessary to complete the alpha spectroscopy station, budgeted in this proposal.

IX. ROLE of PRINCIPAL INVESTIGATORS

This project will be lead by A. Paulenova who is a well-recognized radiochemist and has a considerable research program in this area. Prof. K. Higley has a wide experience in environmental transport and radioecology. Both Pis have also many years experience as teaching instructors. Time and effort provided by Prof. Higley will be not covered by this grant; the salary of 0.1 FTE of her time will be covered by the NERHP department and considered as the OSU Matching funds.

X. COLLABORATION

Dr. Paulenova, the Plan this project and Dr. Higley as well have established national and international collaboration and recognition. It is expected that collaborating research partners from national laboratories (PNNL, ANL, and INL) will assist in preparation of the course materials related to "Fuel Cycle Chemistry"; and, and other partners (College of Veterinary Medicine of OSU) will assist with interesting materials (pictures, biomolecules structures, videos) for the course "Radionuclides in Life Sciences". The goal is to bring materials not available in textbooks yet: new experimental results, description and a demonstration video of an operating rare equipment not available routinely at university (hot cell, synchrotron, etc.); when available. giving invited lectures for this class.

XI. NECESSITY AND REASONABLENESS OF COST TO CARRY OUT PROJECT ACTIVITIES AND ACHIEVE PROJECT OBJECTIVES:

As it was explained in the paragraphs above, the department is fully committed to the development of radiochemistry course cluster, Last year the department spent approximately \$100k on new LSC counter, \$50 on the FTIR spectroscopy and about \$20 on updating the radiodetection classroom. The remodeling of the outdated wet laboratory (only one hood for 12 student in the laboratory sequence) is an absolute necessity since the class load will increase the next year; hence, the department scheduled the teaching laboratory remodeling during this summer,

To achieve the project objectives and introduce two new radiochemistry courses, one a lecture in "Fuel cycle chemistry" and the second one a new Jecture laboratory course on "Radionuclides in life sciences" I which involves working with open radioactive sources, it is absolutely necessary to update both the radiochemistry and radiodetection teaching laboratories, and develop new teaching guides, laboratory manuals and lecture materials.

The largest innovation in the laboratory part of the Radiochemistry cluster courses will be training in preparation of counting samples for the liquid scintillation counting (LSC) and alpha-spectroscopy (electrodeposition, co-precipitation and evaporation). A new LSC counter TriCarb 2900 with features allowing the alpha/beta spectrum discrimination and low tritium counting was recently allocated on our funds, However, currently there is no alpha-spectroscopy equipment available for our students, The budget of this proposal includes allocation for both the alpha-spectroscopy and electrodeposition stations,

The acquisition of the alpha-spectrometry station (this award) and electroplating ultrafiltration

unit (OSU) and alpha- electroplating station (OSU) are for both the new laboratory course and existing course crucial. The budgeted dollars are reasonable; the attached quotes were selected from several bids obtained recently from recognized radiodetectors manufacturers on the US market. .

The budgeted costs covering the extra time and effort of Plon the development of the teaching materials for two new courses are reasonable since this work is not considered by OSU as routine faculty responsibilities.

XII. CAPABILITIES and FACILITIES;

- The 45,000-square-foot Radiation Research Center is located in the Oregon State campus. OSU Radiation Center is housing TRIGA 1.1 MW Reactor and Co-60 gamma irradiator.
- Department of Nuclear Engineering and Radiation Health Physics occupies the facility with room for 10 faculty, 120 undergraduate and 50 graduate students. Each student is assigned to a carrel with an Internet connection and also has access to a University computer lab
- The facility houses 16 specialized research laboratories and three instructional (one "wet" laboratory designated for the Radiochemistry laboratory course and two "dry" for Radiodetection courses, both at the graduate and undergraduate level),
- Two lecture classrooms, several computer laboratories, local library, copy room, student launch, canteen, student and faculty offices, and research and teaching laboratories are located in the building.
- Research laboratories of Nuclear Chemistry and Nuclear Physics are housed in the Radiation Research Center, too.
- The OSU Radiation Center has recently finalized the outdoor green house adjunct and the neutron autoradiography facility that both can be used for environmental studies.
- The Radiation Center also houses other research support areas including a darkroom, constant-temperature room, and machine shop.

XIII. MILESTONES (Schedule)

Year 1 - Development of the curriculum for two courses Chemistry of Fuel Cycle and Radionuclides in Life Sciences, syllabi, lecture slides, laboratory manuals, video clips and teaching text. Delivery of the course "Radionuclides in Life Sciences" planned in the term Spring 2011. The Category 2 proposal for scheduling the "Chemistry of Fuel Cycle" to the OSU Registrar Office will be submitted by the middle of this project.

XIV. DELIVERABLES and REPORTING

Two new radiochemistry courses will be delivered by the end of the funding period. Quarterly, semiannual and Final reports based the course assessment, both the other faculty and student reviews Will be delivered upon as requested.

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 these URLs to the Office of Management and Budget Cost Circulars are included for reference:

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

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

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

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

I. Mandatory General Requirements

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

1. Applicability of 2 CFR Part 215

a. All provisions of 2 CFR Part 215 and all Standard Provisions attached to this grant/cooperative agreement are applicable to the Grantee and to sub-recipients which meet the definition of "Grantee" in Part 215, unless a section specifically excludes a sub-recipient from coverage. The Grantee and any sub-recipients must, in addition to the assurances made as part of the application, comply and require each of its sub-awardees employed in the completion of the project to comply with Subpart C of 2 CFR 215 Part 180 and include this term in lower-tier (subaward) covered transactions.

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

2. Award Package

Grant Performance Metrics:

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

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

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

§ 215.41 Grantee responsibilities.

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

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

Subgrants

Appendix A to Part 215—Contract Provisions

Sub-recipients, sub-awardees, and contractors have no relationship with NRC under the terms of this grant/cooperative agreement. All required NRC approvals must be directed through the Grantee to NRC: See 2 CFR 215.180 and 215.41.

Nondiscrimination

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

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

Title VI of the Civil Rights Act of 1964 (42 USC §§ 2000d et seq)

Title IX of the Education Amendments of 1972 (20 USC §§ 1681 et seq)

Section 504 of the Rehabilitation Act of 1973, as amended (29 USC § 794)

The Age Discrimination Act of 1975, as amended (42 USC §§ 6101 et seq)
The Americans with Disabilities Act of 1990 (42 USC §§ 12101 et seq)
Parts II and III of EO 11246 as amended by EO 11375 and 12086.
EO 13166, "Improving Access to Services for Persons with Limited English Proficiency."
Any other applicable non-discrimination law(s).

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

Modifications/Prior Approval

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

Lobbying Restrictions

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

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

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

§ 215.13 Debarment And Suspension.

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

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

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

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

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

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

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

'Debarment, Suspension, Ineligibility, and Voluntary Exclusion

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

Drug-Free Workplace

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

Implementation of E.O. 13224 -- Executive Order On Terrorist Financing

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

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

Procurement Standards. § 215.40

Sections 215.41 through 215.48 set forth standards for use by Grantees in establishing procedures for the procurement of supplies and other expendable property, equipment, real property and other services with Federal funds. These standards are furnished to ensure that

such materials and services are obtained in an effective manner and in compliance with the provisions of applicable Federal statutes and executive orders. No additional procurement standards or requirements shall be imposed by the Federal awarding agencies upon Grantees, unless specifically required by Federal statute or executive order or approved by OMB.

Travel

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

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

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

Property Management Standards

Property standards of this award shall follow provisions as established in [2 CFR 215.30](#).

Equipment procedures shall follow provision established in [2 CFR 215.34](#).

Procurement Standards

Procurement standards of this award shall follow provisions as established in [2 CFR 215.40](#).

Intangible and Intellectual Property

Intangible and intellectual property of this award shall generally follow provisions established in [2 CFR 215.36](#).

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

Patent Notification Procedures- Pursuant to [EO 12889](#), NRC is required to notify the owner of any valid patent covering technology whenever the NRC or its financial assistance Grantees, without making a patent search, knows (or has demonstrable reasonable grounds to know) that technology covered by a valid United States patent has been or will be used without a license from the owner. To ensure proper notification, if the Grantee uses or has used patented technology under this award without license or permission from the owner, the Grantee must notify the Grants Officer. This notice does not necessarily mean that the Government

authorizes and consents to any copyright or patent infringement occurring under the financial assistance.

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

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

Records retention and access requirements for records of the Grantee shall follow established provisions in 2 CFR 215.53.

Organizational Prior Approval System

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

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

Conflict Of Interest Standards of this award shall follow provisions as established in 2 CFR 215.42 Codes of Conduct.

Dispute Review Procedures

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

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

- c. The Grants Officer will promptly acknowledge receipt of the request for review and shall forward it to the Director, Office of Administration, who shall appoint a review committee consisting of a minimum of three persons.
- d. Pending resolution of the request for review, the NRC may withhold or defer payments under the award during the review proceedings.
- e. The review committee will request the Grants Officer who issued the notice of termination or adverse action to provide copies of all relevant background materials and documents. The committee may, at its discretion, invite representatives of the Grantee and the NRC program office to discuss pertinent issues and to submit such additional information as it deems appropriate. The chairman of the review committee will insure that all review activities or proceedings are adequately documented.
- f. Based on its review, the committee will prepare its recommendation to the Director, Office of Administration, who will advise the parties concerned of his/her decision.

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

Monitoring and Reporting § 215.51

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

- Payment – 2 CFR 215.22
- Cost Share – 2 CFR 215.23
- Program Income – 2 CFR 215.24
 - Earned program income, if any, shall be added to funds committed to the project by the NRC and Grantee and used to further eligible project or program objectives.
- Budget Revision – 2 CFR 215.25
 - In accordance with 2 CFR 215.25(e), the NRC waives the prior approval requirement for items identified in sub-part (e)(1-4).
 - The Grantee is not authorized to rebudget between direct costs and indirect costs without written approval of the Grants Officer.
 - Allowable Costs – 2 CFR 215.27

b. Federal Financial Reports

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

http://www.whitehouse.gov/omb/fedreg/2008/081308_ffr.pdf

http://www.whitehouse.gov/omb/grants/standard_forms/ffr.pdf

http://www.whitehouse.gov/omb/grants/standard_forms/ffr_instructions.pdf

The Grantee shall submit a "Federal Financial Report" (SF-425) on a quarterly basis, for the periods ending 3/31, 6/30, 9/30 and 12/31, or any portion thereof, unless otherwise specified in a special award condition. Reports are due no later than 30 days following the end of each reporting period. A final SF-425 shall be submitted within 90 days after expiration of the award.

Period of Availability of Funds 2 CFR § 215.28

- a. Where a funding period is specified, a Grantee may charge to the grant only allowable costs resulting from obligations incurred during the funding period and any pre-award costs authorized by the NRC.
- b. Unless otherwise authorized in 2 CFR 215.25(e)(2) or a special award condition, any extension of the award period can only be authorized by the Grants Officer in writing. Verbal or written assurances of funding from other than the Grants Officer shall not constitute authority to obligate funds for programmatic activities beyond the expiration date.
- c. The NRC has no obligation to provide any additional prospective or incremental funding. Any modification of the award to increase funding and to extend the period of performance is at the sole discretion of the NRC.
- d. Requests for extensions to the period of performance shall be sent to the Grants Officer at least 30 days prior to the grant/cooperative agreement expiration date. Any request for extension after the expiration date shall not be honored.

Automated Standard Application For Payments (ASAP) Procedures

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

Audit Requirements

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

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

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

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

III. Programmatic Requirements

Performance (Technical) Reports

a. The Grantee shall submit performance (technical) reports electronically to the NRC Project Officer and Grants Officer as specified in the special award conditions in the same frequency as the Federal Financial Report unless otherwise authorized by the Grants Officer.

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

Unsatisfactory Performance

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

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

Other Federal Awards With Similar Programmatic Activities

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

Prohibition Against Assignment By The Grantee

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

Site Visits

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

IV. Miscellaneous Requirements

Criminal and Prohibited Activities

- a. The Program Fraud Civil Remedies Act (31 USC §§ 3801-3812), provides for the imposition of civil penalties against persons who make false, fictitious, or fraudulent claims to the Federal government for money (including money representing grant/cooperative agreements, loans, or other benefits.)
- b. False statements (18 USC § 287), provides that whoever makes or presents any false, fictitious, or fraudulent statements, representations, or claims against the United States shall be subject to imprisonment of not more than five years and shall be subject to a fine in the amount provided by 18 USC § 287.
- c. False Claims Act (31 USC 3729 et seq), provides that suits under this Act can be brought by the government, or a person on behalf of the government, for false claims under federal assistance programs.
- d. Copeland "Anti-Kickback" Act (18 USC § 874), prohibits a person or organization engaged in a federally supported project from enticing an employee working on the project from giving up a part of his compensation under an employment contract.

American-Made Equipment And Products

Grantees are hereby notified that they are encouraged, to the greatest extent practicable, to purchase American-made equipment and products with funding provided under this award.

Increasing Seat Belt Use in the United States

Pursuant to EO 13043, Grantees should encourage employees and contractors to enforce on-the-job seat belt policies and programs when operating company-owned, rented or personally-owned vehicle.

Federal Employee Expenses

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

Minority Serving Institutions (MSIs) Initiative

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