

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

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|---|--|--|--|--|--|---|--|
| 1. GRANT/AGREEMENT NO. NRC-HQ-12-G-38-0060 | | 2. MODIFICATION NO. M001 | | 3. PERIOD OF PERFORMANCE FROM: 6/7/2012 TO: 6/6/2014 | | 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 State Controlled Institution of Higher Learning DUNS: 098377336 NAICS: 611310 | | 7. RECIPIENT NAME, ADDRESS, and EMAIL ADDRESS University of Nevada, Las Vegas 4505 S. Maryland Parkway Las Vegas, NV 89154-1055 | | | |
| 8. PROJECT TITLE: Development of a Nuclear Criticality Safety Education and Training Program at UNLV | | | | | | | |
| 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 University of Nevada, Las Vegas Research Professor of Nuclear Engineering Attn: Denis Beller Email: bellerd@unlv.nevada.edu | | | |
| 12. NRC PROGRAM OFFICE (NAME and ADDRESS) NRC Attn: Tanya Parwani-Jaimes Office of Human Resources MS: GW5A06 (301) 492-2308 11545 Rockville Pike Rockville, Maryland 20852 Email: Tanya.Parwani-Jaimes@NRC.GOV | | 13. ACCOUNTING and APPROPRIATION DATA APPN. NO: 31X0200 B&R NO: 2012-84-51-K-164 JOB CODE: T8458 BOC NO: 4110 OFFICE ID NO: RFPA: HR-12-400 | | 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 <u>\$0.00</u> PREVIOUS OBLIGATION <u>\$198,660.00</u> TOTAL <u>\$198,660.00</u> | | 16. TOTAL FUNDING AGREEMENT NRC <u>\$198,660.00</u> RECIPIENT <u>\$0.00</u> TOTAL <u>\$198,660.00</u> 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: Shashi Malhotra Email: Shashi.Malhotra@NRC.GOV Mail Stop: TWB-01-B10M Rockville MD 20852 | | | | | | | |
| 18. Signature Not Required | | | | 19. NRC CONTRACTING OFFICER <u>Shashi Malhotra</u> <u>09/12/2012</u> (Signature) (Date) NAME (TYPED) <u>Shashi Malhotra</u> TITLE <u>Grants/Contracting Officer</u> TELEPHONE NO. <u>301-492-3604</u> | | | |
| 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. | | | | | | | |

The purpose for modification number 001 is to:

- A. Revise: ATTACHMENT B – PROGRAM DESCRIPTION, delete in its entirety and replace with the following:

“Course Description -UNLV Nuclear Criticality Safety (NCS) Certificate

The proposed nuclear criticality safety education and training program at the University of Nevada, Las Vegas (UNLV) will aim at supporting the professional nuclear criticality safety engineer and the nuclear industry. This program is geared towards graduate studies, and can be taken either as part of the MS program or separately towards a NCS certificate. To achieve a NCS certificate, 4 courses (12 credits) will need to be successfully completed. The emphasis of this project will be to develop individual courses that will provide the practicing NCS engineer (and their employer) with components that will help train and maintain a well qualified workforce. In addition, many of the topic areas, e.g., Monte Carlo methods, Introduction to Nuclear Criticality Safety, etc., are also appropriate subjects for a graduate student (i.e., a non-practicing NCS engineer). Therefore, it is anticipated that the courses developed as part of the UNLV NCS Certificate program will reach a broad audience with an estimated attendance of 5-10 students per course. Furthermore, the developed course will be a combination of permanent and elective courses, as described below.

Course Descriptions

There will mainly be one required prerequisite course, or equivalent, that can be taken as either an undergraduate or graduate level course in order to proceed with the NCS certificate. This course, *Introduction to Nuclear Engineering*, is currently being taught at UNLV and is intended to remain as a permanent course.

Introduction to Nuclear Engineering (3 credits; Permanent Course; Undergraduate or Graduate Level)

This course provides an introduction to basic nuclear and atomic processes including radioactive decay, binding energy, radiation interactions, cross sections, reactor physics and neutron diffusion, radiation sources, health physics, types of reactors, and nuclear fuel cycle.

To earn the NCS certificate, students will choose from the following list of courses:

Introduction to Nuclear Criticality Safety (3 credits; Permanent Course; Undergraduate or Graduate Level)

This course provides an overview of the physics of criticality, factors that affect reactivity, hand calculation techniques, experiments and the development of subcritical limits, criticality accidents, standards and regulations, evaluations.

Monte Carlo Methods in Nuclear Criticality (3 credits; Elective Course; Graduate Level).

This course reviews applications of the Monte Carlo method to neutron transport calculations from introductory concepts to advanced simulations of criticality in fissile materials.

Nuclear Criticality Safety Engineering (3 credits; Permanent Course; Graduate Level).

This course includes aspects of nuclear engineering and preparation of an NCS evaluation for criticality safe processes and facilities: In-depth physics of criticality, hand calculation

techniques, Monte Carlo applications, experiments and the development of subcritical limits; nuclear criticality accidents, anomalies and case studies; nuclear data and benchmarking, and standards, regulations, and guides.

Elective Course (3 credits; Graduate Level)

The student can choose one elective course, including but not limited to the following:

- *Selected Topics in Nuclear Criticality Safety*-a course that allows UNLV to tailor its contents to meet the student's need (e.g., for NCS professionals, it will include components to help meet their employer's NCS qualification program and/or professional development requirements). In addition, it will contain an experiential portion/learning segment.
- *Independent Study* (e.g., *Selected Topics in Nuclear Criticality Safety; Integral Data and Criticality Benchmark Evaluation; NCS Engineering Design; Advanced NCS Topics* [e.g. *Anomalies of Nuclear Criticality, Applications of criticality safety techniques to facility design and review, etc.*]);
- *Radiation Detection & Shielding; or*
- *Reactor Theory.*

As stated previously, these courses will be offered as both 'in-house' course as well as distance learning. The courses will be offered in such a way that the students will be able to complete the NCS certificate in 1.5 years. UNLV proposes to offer the courses in the following 'order':

Fall Semester (Aug 2012) *Fundamentals of Nuclear Engineering Nuclear Criticality Safety Engineering*

Winter Semester (Jan 2013)

Monte Carlo Methods in Nuclear Criticality Introduction to Nuclear Criticality Safety (fully on-line course)

Summer Term(s)

Independent Study (can be selected at anytime at the student's convenience) Introduction to Nuclear Criticality Safety (fully on-line course)

Fall Semester (Aug 2013 and beyond) *Fundamentals of Nuclear Engineering Nuclear Criticality Safety Engineering Elective Course*

Winter Semester (Jan 2014 and beyond)

Introduction to Nuclear Criticality Safety (fully on-line course) Monte Carlo Methods in Nuclear Criticality (fully on-line or hybrid course) Elective Course

Institutional Capability

Programs

UNLV's existing degree programs include a Ph.D. in Radiochemistry and a M.S. in Materials and Nuclear Engineering (M.S. M&NE). The Radiochemistry Ph.D. program, which is directed by Prof. Ken Czerwinski, formerly of UC Berkeley and MIT, is a collaboration between the Chemistry and Health Physics Departments. The PI of this NRC proposal is the coordinator of the new M.S. M&NE program in the Mechanical Engineering Department, which has already graduated two M.S. nuclear engineers. In addition, the Health Physics program

offers B.S. and M.S. degrees, and students have recently been awarded Ph.D. in Engineering degrees for nuclear engineering educations and research. To support these degree programs, nuclear chemistry, physics, engineering, and detection courses are taught through the Departments of Chemistry, Physics, Mechanical Engineering, and Health Physics in three UNLV colleges. Faculty, student, and staff researchers work in all of these departments and several research centers, plus the Nuclear Science and Technology Division of the HRC. This division manages the TRP and NHI programs as well as conducting other research. The HRC includes a Nuclear Engineering Group, a Radiochemistry Group, and others.

Collaborative Linkages

The most important new collaboration that this grant will facilitate is with the newly created Critical Experiments Facility at the Nevada Test Site. We have met several times with Technical Staff Members, Group Leaders, and Division Directors from Los Alamos. They have expressed a strong desire to integrate their research efforts into this nuclear criticality safety program to educate their employees, and to provide hands-on experience in criticality safety for UNLV students. In addition, managers at the National enrichment Facility (URENCO USA), where criticality studies/education and qualification of their staff are a continuous ongoing effort, have expressed interest in a nuclear criticality safety program to support their staff. We have established a partnership with National Security Technologies, LLC, the support contractor for the Nevada Test Site. NSTec has initiated a program to support nonproliferation, called the National Center for Nuclear Security (NCNS). Under this and other programs, NSTec supports between \$500K and \$1M of annual research through UNLV. In addition, NSTec has pledged to support the development of nuclear science academic programs, including this criticality safety program, and others in nuclear reactor technology and radiochemistry, with at least \$200K additional funding per year for at least three years. Their goal is to increase the Nuclear Engineering capabilities at UNLV so they can recruit top scientists for their work at the National Nuclear Security Site (NNSS) and their increased involvement into nuclear nonproliferation, nuclear criticality safety, and nuclear reactor applications to support the Stockpile Stewardship and National Radiological Emergency Response programs.
safety industry consultant.

Expected outcome and impact:

Adding an additional capability to the existing Nuclear Engineering specialty program at UNLV will fill an important skill set which is proclaimed by LANL, NSTec and others as underrepresented. UNLV is developing an accelerator center in partnership with Varian Medical Systems, Security and Inspection, Inc. (located in Las Vegas). The accelerator center is expected to be completed by December, 2011. In addition, UNLV is in partnership with NSTec to conduct work on the Criticality Experiments Facility (CEF) at the Device Assembly Facility (DAF) located at the NNSS. We have established an agreement with the University of New Mexico to conduct courses in nuclear reactor engineering at their nuclear reactor to fulfill that portion of an NE degree and have successfully completed the first such class. The NSTec management has committed to support the development of a PhD program in a hybrid of HP and NE because of their perception of the need for future scientists with these qualifications. The addition of a nuclear criticality curriculum will not only fill an immediate need recognized within the DOE, but will help develop the future commitment of the UNLV administration to develop a Nuclear Engineering PhD program. "

Base Period: June 7, 2012 – June 6, 2014

Assistance Award Ceiling: \$198,660.00

Total Obligated Amount: \$198,660.00

All other terms and conditions remain the same.