

# Developing a Nuclear Certificate Program

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**Abstract** – To promote awareness of nuclear energy and to prepare workforce to meet the growing demand in the nuclear energy sector, several courses on nuclear energy and nuclear engineering are being developed at North Carolina A&T State University, with a curriculum development grant from Nuclear Regulatory Commission.

In the first year of the grant, an elective on nuclear energy for engineering majors was taught to juniors and seniors. A second elective on nuclear energy was developed for all majors, as part of general education. In the second year, two additional courses are being developed as technical electives: nuclear fluid mechanics and heat transfer and an elective on reliability and risk.

With four elective courses available, an undergraduate Nuclear Certificate program is proposed for engineering majors. The certificate program will raise the profile of the nuclear field on this campus and will give students an edge to compete for nuclear related jobs in industry and government agencies.

*Keywords:* nuclear energy, nuclear engineering

## **NRC NUCLEAR EDUCATION GRANT PROGRAM**

As the demand for power is increasing, concerns about global warming and the costs of fossil fuels are reviving the interest on nuclear energy. The country is on the verge of a building boom for nuclear plants, but after almost three decades of inactivity, those plans are meeting head on with an aging work force, creating the need for thousands of new nuclear industry workers [1].

In the past two years, Nuclear Regulatory Commission has funded many curriculum grants through NRC Nuclear Education Grant Program [2]. In addition to enhancing existing nuclear engineering programs, many grantees are pursuing a nuclear minor or certificate program, as this approach provides a quick-start path to educating engineering students majoring in mechanical, chemical, civil, architectural, and electrical engineering to fundamental nuclear background for careers in nuclear industries and government. The following section highlights a few examples of the funded programs:

- Polytechnic University received a NRC grant to establish an Interdisciplinary Minor in Nuclear Science and Engineering to prepare engineering, computer science and natural science graduates for careers in nuclear industries and government.
- The University of Texas at Austin received a NRC grant to offer Undergraduate Nuclear Certificate for students in engineering and physics. A series of undergraduate courses and one graduate course are being offered for an undergraduate technical option as a Nuclear Certificate.

- University of Puerto Rico received a NRC grant develop a Certificate Program in Nuclear Engineering with up to eight courses.
- Virginia Commonwealth University received a NRC grant to develop a Undergraduate Nuclear Engineering Track within the Department of Mechanical Engineering, ultimately to offer a Bachelor's degree in Nuclear Engineering.
- University of Rhode Island received a NRC grant to launch a new nuclear engineering education program with four new nuclear engineering courses.
- Washington State University received a NRC grant to develop a Nuclear Engineering Emphasis within its College of Engineering and Architecture with a certificate option.
- Wilberforce and Central State Universities received a NRC grant to implement an Undergraduate Nuclear Engineering Minor with help from The Ohio State University.

### **NUCLEAR CERTIFICATE AT A&T**

Four nuclear courses are developed from a NRC grant for the nuclear certificate program. The first course is a general elective, open to all majors, and the other three are engineering electives. The engineering elective on nuclear energy and nuclear engineering is a survey course, and is required for the certificate. Three of these four courses are needed for the nuclear certificate. A short description of these courses is as follows:

- Contemporary Issues in Nuclear Energy
  - This is a general elective on current understanding of nuclear energy, open to all majors. Different reactor designs, economics of nuclear energy and management of nuclear energy will be reviewed. Nuclear power will be compared to other alternative energy sources. Emphasis will be placed upon regulations, environmental issues, health issues and security and safety concerns. Nuclear power and options for the future will be examined.
- Nuclear Energy and Nuclear Engineering
  - Topics include: radiation, nuclear reactors, reactor accidents, next generation reactors, nuclear waste, reactor safety, risk and reliability, and other nuclear applications.
- Nuclear Fluid Mechanics and Heat Transfer
  - This is an applied fluid and hear transfer course with examples and applications drawn from the nuclear industry. Topics include as in-situ mining, cross flow filtration, and the use of pulse jet mixers for solid suspension.
- Reliability and Risk Analysis
  - This course covers reliability and risk analysis with examples drawn from nuclear and other industries. The course will introduce sufficient background knowledge for Probabilistic Risk Analysis (PSA) and then discuss PSA with several examples.

### **NUCLEAR ENGINEERING AND NC A&T**

From mid 1980s till 1990s Mechanical Engineering Department is a part of Oak Ridge Associated Universities (ORAU)/ Oak Ridge Institute for Science and Education (ORISE) Nuclear Engineering Training (NET) Program. The program provides undergraduate scholarship and graduate fellowship to eligible students. A course on Nuclear Engineering is offered every year as part of this program. With the end of the funding more than ten years ago, the nuclear expertise in the university was not retained and renewed.

Because of the size of our university, getting a stand-alone nuclear engineering program at NC A&T University will not be feasible in the foreseeable future. However, there are many potential partners in the vicinity to enhance the nuclear curriculum being offered. The Nuclear Engineering Program at North Carolina State University (NCSU) has the nation's first university nuclear reactor, and is only

100 miles away. Oak Ridge National Lab is 330 miles away, and DOE Savannah River Site is 300 miles to the south. Both DOE labs have strong relationships with our university. Furthermore, there are many nuclear power plants in the region.

In North Carolina, three nuclear power plants are within two-hour drive from the university. The McGuire nuclear Power Plant (I and II) of Duke Energy is in Cornelius, NC, about 1.5 hours away from the campus, and the Shearon Harris Nuclear Power Plant of Progress Energy is in New Hill, NC, about 2 hours away.

Additionally, Brunswick Nuclear Power Plant (I and II) of Progress Energy is near Southport, North Carolina, about 4 hours away. Catawba Plant (I and II) of Duke Energy is near Rock Hill, South Carolina, about 4 hours away. Oconee Nuclear Power Plant (I, II and III) of Duke Energy is near Greenville, South Carolina, about 4 hours away. Surry Nuclear Generating Station (I and II) of Dominion Resources is near Williamsburg, Virginia, about 4 hours away.

Plant tours will be scheduled to these facilities, and engineering staff and managers from these and other nuclear power plants will be invited to make presentations in various classes and seminars.

Other field trip possibilities include the research reactor (PULSTAR 1 MW pool nuclear reactor) at North Carolina State University, about 1.5 hours away from the campus. AREVA's headquarter is in Lynchburg, VA, about 2 hours away, and GE-Hitachi Nuclear Energy has a fuel fabrication facility in Wilmington, NC, about four hours away. We expect to draw on experience from these potential partners and others to enhance our nuclear certificate program.

## **DISCUSSION**

The nuclear certificate program provides a student with the fundamental concepts needed to enter the workforce at a nuclear utility, allied industry, US Nuclear Regulatory Commission, Department of Energy, Department of Defense, Department of Homeland Security, or to pursue a degree in graduate education. The curriculum development program intends to build capacity in both faculty and students in a university without a stand-alone nuclear engineering program. Course materials developed through this grant will be disseminated as a resource for other universities interested in a similar program.

## **REFERENCES**

- [1] Nuclear Industry Looking for a Wave of New Hires, [http://www.washingtonpost.com/wp-dyn/content/article/2008/09/12/AR2008091202724\\_2.html](http://www.washingtonpost.com/wp-dyn/content/article/2008/09/12/AR2008091202724_2.html)
- [2] NRC Nuclear Education Grant Program Awards, <http://www.nrc.gov/about-nrc/grants/awards.html>

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