University of Nevada, Reno
Graduate Certificate in Nuclear Packaging

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Funded by DOE Packaging Certification Program
Nuclear and Other Radioactive Materials

• Are used for large-scale electricity generation, medical treatments, food sterilization, and advanced measurement technologies.

• **Packaging** that protects the public and environment during their transport, must
  • Meet all relevant Federal regulations and safety standards, and
  • Be designed, analyzed, approved by a regulatory authority, fabricated, and used safely.
Radioactive Material Packaging

- Federal regulations in 10 CFR 71 require them to provide containment, shielding and critically-safety under normal and hypothetical-accident conditions
  - For large packages, the accidents consist of a sequential 9-m drop onto an unyielding surface, 1-m drop onto a puncture bar, 30-minute engulfment in 800°C-fire, and water submersion
- Packaging System Engineers, Analysts and Reviewers must produce and assess a 9-chapter Safety Analysis Report for Packaging (SARP) that demonstrates that the package will meet all regulations and requirements for issuance of a Certificate of Compliance (CoC)
- Package Users must follow the Operating Procedures, Acceptance Tests, Maintenance, and Quality Assurance practices specified in the SARP and the Conditions of Approval in the CoC
- These Engineers and Users require domain-specific knowledge and skills
DOE Packaging Certification Program (PCP)

- Has for many years supported Nuclear Material Packaging & Transportation Safety courses
  - Three to ten day classes taught by technical experts at several national laboratories
  - Attended by domestic and international professionals from government agencies, industries, and national labs.
  - Presented in small classroom settings, with group activities and hands-on demonstrations
- Due to attrition and projected retirements, there is a need to proactively increase training opportunities
The University of Nevada, Reno (UNR)

- Is a natural home for an **academic** program since it has
  - Conducted experimental and computational research on nuclear packaging safety under normal and fire accident conditions with DOE, NRC and State of Nevada support since 1993, and
  - Has received NRC funding to support
    - US Citizens pursuing MS and Ph.D. degrees in nuclear safety topics
    - Development of nuclear-safety related courses
In 2013, DOE PCP funded UNR to

• Work with three National Labs to organize existing PCP course content into six 1- and 2-credit courses
  • The student learning outcomes were formalized to allow the courses to be a part of the UNR Mechanical Engineering Graduate Program
  • These courses are taught at, and by, the labs over 1 and 2 week periods

• Create a 9-credit **Graduate Certificate in Nuclear Packaging (GCNP)** curriculum, consisting of
  • 4 credits of required courses (Provide foundational material)
  • 5 credits of electives (For depth and breadth, chosen from Lab and UNR courses)

• The Program was accredited by the Northwest Commission of Colleges and Universities in December 2015
Program Educational Objectives

• Based on needed knowledge and skills

  • *Packaging system engineers/managers*
    • Relevant Federal Regulations for transport and storage packages, using a graded approach on structures, systems and components (SSCs), in accordance with importance to safety (Defines design goals)
    • The ASME Boiler and Pressure Vessel Code related to nuclear packaging (Foundation for design, analysis, fabrication, examination)
    • Quality Assurance requirements (Guarantee designs & procedures are enacted)
    • Knowledge of all SARP technical areas, because they interact.

  • *Package Function-Designers, Reviewers or Analysts*
    • *In-depth* knowledge of that function
    • General knowledge of other technical areas, because they all interact.

  • *Packaging Users*
    • Insure that all Operating Procedures, Acceptance Tests, Maintenance, and Quality Assurance practices prescribed in the SARP are precisely enacted.
### Relationship of SARP Chapters to the 10 Lab Courses

<table>
<thead>
<tr>
<th>SARP Chapter Topic</th>
<th>Required (4 credits)</th>
<th>Elective (choose 5 credits)</th>
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<tbody>
<tr>
<td></td>
<td>Course Topic</td>
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<td>Credits</td>
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<td>Lab</td>
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<td>2</td>
<td>Structural Evaluation</td>
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<td>3</td>
<td>Thermal Evaluation</td>
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<td>4</td>
<td>Containment Evaluation</td>
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<td>6</td>
<td>Criticality Evaluation</td>
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<td>7</td>
<td>Operating Procedures</td>
<td>X</td>
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<td>8</td>
<td>Acceptance Tests &amp; Maintenance</td>
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<td>9</td>
<td>Quality Assurance</td>
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<td>Transport Security</td>
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<td>Professionalism</td>
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**Notes:**
- SARP represents the Safety Assessment and Review Process.
- The table above outlines the relationship between SARP chapters and the 10 required lab courses and elective options.
- Credits for each lab are indicated in the respective columns.
- The labs are from various national laboratories, including Argonne National Laboratory, Lawrence Livermore National Laboratory, and Sandia National Laboratories.
Benefits

• Help engineers and managers obtain needed knowledge and skills to be successful in nuclear packaging or related fields, so they can qualify for
  • Employment and
  • Advancement

• Help nuclear regulatory and industry organizations
  • Train new employees, and
  • Gain credibility with clients

• University students and professional take classes together

• For continuous improvement, an Advisory Board
  • Consisting of Industry and Government Packaging Experts and Employer
  • Will review the curriculum annually to assure relevance and quality
Nuclear Packaging Internship

• Supervised independent use of engineering skills for professional project planning, performance, and communications at a DOE or Industry Site.
  • 3 credits, requires 140 to 270 hours of student involvement
  • 4 to 12 weeks in residence at a Site
  • Attending regular meeting, following organizational protocols, ...

• Intended to develop professionalism in undergraduate or graduate university students, and introduce them to the packaging profession

• DOE, national labs and many companies offer competitive internship-for-pay and summer employment opportunities, which can support this internship-for-credit
GCNP Status

• 47 students have taken GCNP courses since 2015
  • The first Certificate was awarded in 2017

• Internship
  • 6 university students completed internships last summer
    • At Argonne, Savannah River, and Orano (formerly AREVA)
    • The students were from UNR, Texas A&M, Virginia Tech, Missouri Univ. of Science & Tech, Univ. of South Carolina, Aiken

• Current Electives choices
  • Six 1-credit National Laboratory classroom courses
    • New ones are currently being developed
  • Six 3-credit UNR courses
  • A 3-credit internship
Nuclear Packaging Summer School

• Two required courses will be offered at a UNR campus in Reno, Nevada (35 minutes from Lake Tahoe) during consecutive weeks in June 2019
  • June 3-7, 2019, ASME Pressure Vessel Code for Nuclear Transport and Storage
  • June 10-15, 2019, Quality Assurance for Nuclear Packaging

• The remaining required 2-credit (two week) course will be offered in Pleasanton, CA (60 minutes from San Francisco)
  • August 13-16 & 19-22, 2019, SARP Review and Confirmatory Analysis
New: Graduate Certificate in Transport Security & Safeguards

• The DoE PCP recently funded UNR to begin work with national laboratories to develop a new 9-credit graduate certificate

• 4 required 1-credit courses
  • ASME Code for Nuclear Transport and Storage
  • Domestic (or International) Transport Security
  • Nuclear Security Fundamentals (Oak Ridge NL)
  • Nuclear Safeguards Fundamentals (Sandia NL)

• 5 elective credits, chosen from
  • International (or Domestic) Transport Security
  • 3-credit Internship
  • Other existing and new courses
Summary

• The University of Nevada, Reno offers a 9-credit Graduate Certificate in Nuclear Packaging, that provides engineers and managers needed knowledge and skill to be successful in the nuclear packaging industry

• The GCNP consists of four required credits, and five elective credits, chosen by students to support their interests and needs, including an optional for 3-credit internship

• 47 students have taken GCNP courses since 2015, and the first Certificate was awarded in 2017

• In 2019, the required courses will be offered in Summer Schools near Lake Tahoe in June, and near San Francisco in August

• UNR is currently developing a new Graduate Certificate in Transportation Security and Safeguards

• Questions? greiner@unr.edu
Extra Slides
Instructional Settings

• Classroom courses
  • 1 or 2 credits, 45-90 hours of student involvement, one or two week sessions
  • Presented in small classroom settings, with group activities and demonstrations
  • Ideal for delivering and reinforcing large amounts of structured information and skills
  • Generally requires travel and short-term lodging
  • Generally funded by employer, requires time away from work
  • Typical of high-quality professional/graduate education
Internship Format

• Before enrollment, Intern works with a committed Site Supervisor to
  • Design Internship Project that will be conducted at an Internship Site
  • Identify a UNR Faculty Member who assesses achievement of student learning outcomes

• Internship Proposal (10% of grade)
  • Establishes goals, schedule milestones, resources, contingency plans

• Midterm Report (35%)
  • Progress and any needed Revisions

• Final Report (55%)
  • Written or Presented, demonstrating competencies
Competencies

• Nuclear Packaging Competencies
  • Depth of knowledge of “essential” technical or management areas, and/or breadth of knowledge of an overall packaging system and its operation
  • Assessed primarily by Site Supervisor

• Professionalism Competencies: Validates the student’s ability to:
  • Communicate effectively
  • Understand the impact of engineering solutions in a global context
  • Gain information and skills independently
  • Identify issues that have yet to be resolved
  • Determine problems that need to be solved, and then find ways to solve them
  • Assessed by UNR Faculty Member with support from Site Supervisor
UNR Electives

- Six, 3-credit nuclear and packaging-safety-related classes that are primarily available to UNR graduate students
  - Introduction to Combustion (ME 675)
  - Corrosion of Metals (MSE 601)
  - Nuclear Power Fundamentals (MSE 665)
  - Nuclear Fuel Cycle (MSE 666)
  - Radiation Detection and Measurement (MSE 667)
  - Nuclear Materials (MSE 668)
Miles Greiner Bio

• Received his Ph.D. from MIT in 1986 and joined the University of Nevada, Reno Mechanical Engineering Department that same year.

• He is currently a Foundation Professor and Department Chair of Mechanical Engineering

• He has conducted nuclear packaging safety heat transfer research since 1993

• He is the Principal Educator for the UNR Graduate Certificate in Nuclear Packaging.