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**LOS ALAMOS NATIONAL LABORATORY NUCLEAR CRITICALITY
SAFETY PIPELINE FOR EXPEDITED QUALIFICATION OF PERSONNEL**

Presented at American Nuclear Society Nuclear Criticality Safety Division Topical Meeting
in Carlsbad, NM

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LANL NCS Division Leader



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Additional University Contributors to NCS Pipeline Program

- Dr. Pavel Tsvetkov, Associate Professor at Texas A&M University
- Dr. Sunil Chirayath, Associate Professor at Texas A&M University
- Dr. David Rockstraw, Professor and Department Head at New Mexico State University

Overview

Today's discussion

- **Issue Description**
- **Program Elements**
- **Participating Universities**
- **Program Benefits**
- **Conclusion**

Key Issue #1

- **Attrition of Nuclear Criticality Safety (NCS) Personnel**
 - NCS Profession Heavily Skewed Towards Late Career¹
 - 29.4% with 31+ years of experience
 - 23.5% with 21-30 years experience
 - LANL NCS Experienced Near Complete Attrition from 2008-2012

1 - NCS Division of the American Nuclear Society, "Nuclear Criticality Safety Professionals Compensation Study", p. 3 (2016)

Key Issue #2

- **Extended Qualification Period**
 - Average Qualification Time for BS Nuclear Engineer
 - LANL - 24 Months
 - Consistent with observations/experience at other NCS organizations
 - Note: Security Clearance Wait is Having Impact on Qualification Time

Key Issue #3

- **Lack of Relevant University Coursework/Curricula**
 - Idaho State University²
 - Course that includes principles in NCS
 - NE4446, *Nuclear Fuel Cycle Systems*
 - University of Tennessee³
 - Periodically offers two NCS courses
 - NE421, *Introduction to Criticality Safety*
 - NE543, *Special Topics in Nuclear Criticality Safety*
 - University of Idaho- Idaho Falls⁴
 - Offers a Graduate Certificate

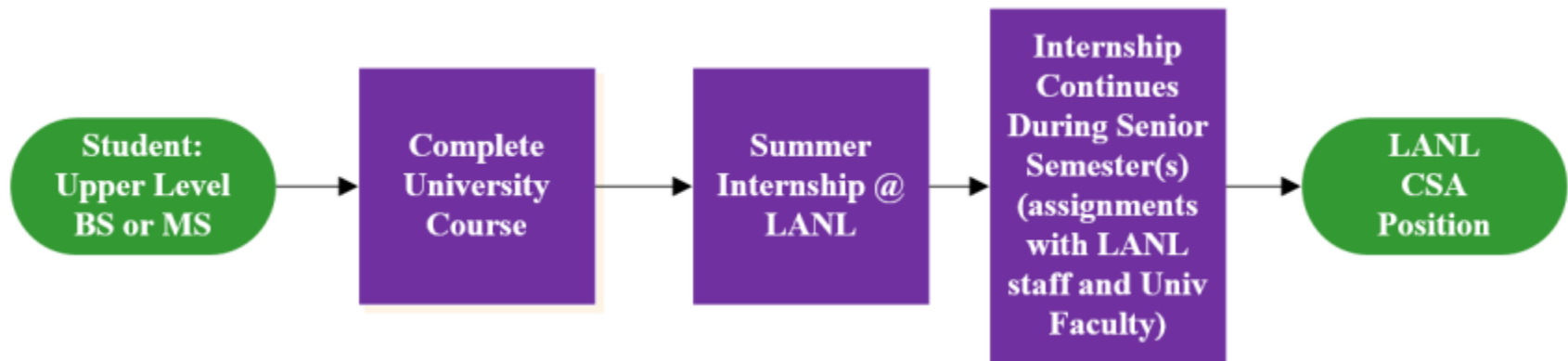
2 - <http://coursecat.isu.edu/undergraduate/allcourses/ne/>

3 - <http://web.utk.edu/~rpevey/>

4 - <https://www.uidaho.edu/idahofalls/academic-programs/engr/ne-cert>

Program Elements Overview

NCS Pipeline Program Process



Program Elements – University Coursework

- **University Coursework**
 - Advanced level academic course
 - Targeting junior or senior level undergraduate students
 - Components
 - Criticality Safety Academic Material
 - Guest Lectures from LANL Staff
 - Criticality Safety Problems
 - NCS Evaluation Development Project
 - Course is tailored to participating universities
 - Texas A&M (Nuclear Engineering Department)
 - Taught by Texas A&M Professors using live instruction
 - Fewer fundamental nuclear engineering concepts
 - Increased coverage of process analysis
 - New Mexico State University (Chemical Engineering Department)
 - Facilitated completely online
 - Increased coverage of nuclear engineering fundamentals

Program Elements – LANL Summer Internship

- **LANL Internship**
 - Targeting Successful Students in University Course
 - Spend summer with LANL NCS Division
 - Summer Internship Components
 - Students assigned mentor within NCS Division
 - Student Projects
 - Primarily consist of Criticality Safety Evaluations
 - Student Training
 - LANL Intensive Criticality Safety Analyst Training (2 Weeks)
 - UNM Short Course (1 Week)
 - UNM Assessments Course (1 Week)
 - Future: DOE NCSP Hands On Training Course?
- **FY17**
 - Jump started program with 6 summer interns

Program Elements – LANL Internship Continued

- **Following Summer Internship**
 - Students Still Interested (Maybe 😊) & Perform Well
 - Offered Continued “Casual Status” with LANL
 - Can Perform Research from Offsite
 - Continue Working on Qualification as Criticality Safety Analyst
 - Start Security Clearance Investigation

Program Elements – Desired End Result

- **Following Graduation from University**
 - Students Hired as Full Time LANL Employees
 - Time to Qualification Reduced
 - Goal is Qualification within 6 Months
 - Students Already Self Selected Into NCS Discipline

Participating Universities

- **Texas A&M University**

- Nuclear Engineering Department

- Dr. Pavel Tsvetkov, Associate Professor at Texas A&M University
 - Dr. Sunil Chirayath, Associate Professor at Texas A&M University



- **New Mexico State University**

- Chemical Engineering Department

- Dr. David Rockstraw, Professor and Department Head at New Mexico State University



- **Potential University Partnerships In Discussion**

- University of California, Berkeley
 - University of New Mexico

NCS Pipeline Program Benefits 1

- **Benefits to Students**
 - Collaborate, Cutting-edge, and progressive learning opportunity
 - Resume Building Experiences and Professional Development
 - Access to Technical Subject Matter Experts
 - Career Opportunities
- **Benefits to Participating Universities**
 - Minimal Cost Elective Course
 - Increased Access/Collaboration with National Laboratory
 - Opportunity for Students to Obtain Full Time Employment
 - May Increase Enrollment and Distinction of Department

NCS Pipeline Program Benefits 2

- **Benefits to LANL**
 - Significantly Reduced Training Time/Cost
 - Increased Likelihood of Retaining Full Time Employee
 - Increased Access to Larger Pool of Recruits
- **Benefits to DOE Complex**
 - Prototype of Sustainable Educational Resource
 - NCS Pipeline Program is Scalable to Include Additional Sites/Universities

Conclusion

- **Attrition has a tremendous negative impact on the continuity and success of any organization**
 - Been especially impactful at LANL's NCS Division over the last decade
- **NCS Pipeline Program is LANL's approach for cultivating a new resource in a shorter amount of time than previously possible.**
- **Program is capable of repetition and replication at similar facilities throughout the complex**
- **Once launched, program sponsors fully anticipate expansion to other universities and potentially other disciplines**
- **May serve as a model for implementation throughout the DOE complex.**
- **Positive impact has yet to be fully defined and may suggest further growth opportunities**