Nuclear Workforce Issues and Academic Programs

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Infrastructure issues

- Requirement: energy, technology, industry, medicine, national security
- Human capital in nuclear
  - Bi-modal age distributions
  - Education in crisis
  - Training costs, standards
- U.S. R&D facilities declining
  - Universities, National Labs, Industry
Aging/aged workforce

- Nuclear Energy is 50-60 years old
- So much of the workforce is older
- Major retirements imminent
  - 35% of engineers will potentially retire within 5 years
  - Economy may delay retirements
- Next figure illustrates attrition
  - (Bill Burchill, Texas A&M)
Nuclear Generation Engineering Worker [Projected] 5-Year Attrition

47% Attrition plus Retirement

The “Nuclear Renaissance”

- More engineers will be needed
- Design, licensing, construction, start-up, operation
- Factories for Small Modular Reactors
- Fuel cycle facilities
  » Enrichment, fuel production, fabrication, used fuel management
- R&D for recycling used nuclear fuel
Solution:
More NE Education & Training

- But who’s responsible?
  - Atomic Energy Act
- Power industry building T&E programs
  - E.g. training welders
  - 2-year Uniform Curriculum Program
  - Operations, Maintenance, Rad Protection, & Chemistry
- 4-yr education is growing—fast enough?
"# B.S. & M.S. in 2007 is less than annual # in early '70s to early '90s"

Source: "Nuclear Engineering Enrollments and Degrees Survey," 2007 Data, Oak Ridge Institute for Science and Education
University NE programs

- MIT #1
- U Mich & U Wisc #2-3
- Purdue & Texas A&M #4-5
- Only 28 others nationwide
  » UNLV is a recent addition
- BSNE degrees increased from 120 in 2001 to more than 450 in 2008
  » But declined in 2009 (all levels)
Why is this not enough for the nuclear energy renaissance?

- Half of BSNEs & MSNEs stay in college
- Most who don’t go to national security
- Other non-nuclear industries (e.g. medical physics, petroleum, etc.)
- Thus, there are only about 175 grads available to the nuclear industry
  - Demand is for ~350 NE grads per year for nuclear utilities alone
  - another 200 for NRC, DOE, NNSA, etc.
Human infrastructure

Education & Training is key

2007 ANS President’s FINE Committee:

*Nuclear’s Human Element*

*Defining the Federal Government’s Role in Sustaining a Vibrant U.S. University-Based Nuclear Science and Engineering Education System for the 21st Century*
Academic funding >$100 M/yr

- DOE/NE & NNSA
  - National Labs
  - Nuclear Energy University Programs (NEUP)
  - Volatile
- U.S. NRC emerging
- Partnerships/collaborations
  - Academia-Industry-NEI
Examples of Partnerships

- U. Florida, Areva, Siemens, Progress Energy, State of Florida
- U. Missouri, Linn State Tech, AmerenUE, Bartlett Nuclear, Dept. of Labor (DOL)
- Estrella Mountain Community College, Arizona Public Service, Bartlett, DOL
- U. Tennessee-Knoxville, TVA, Oak Ridge National Lab
- Several Others
New Program added in 2001

- Focus: Transmutation of Nuclear “Waste”
  » Because of, but not part of, YMP
- Research & Education
Nuclear degree programs at UNLV

- Departments in three colleges & several research centers
- B.S. and M.S. in Health Physics
- Ph.D. in Radiochemistry (HP & Chemistry joint program)
- M.S. in Materials and Nuclear Engineering
- NE-focused Ph.D. in Engineering
UNLV Radiochemistry program

- Largest program of its kind in the U.S.
- Nexus of scientific research
  - International
  - Industrial
  - National laboratories
  - Academic collaborations

Dr. Ken Czerwinski
Recycling Research Project
(DOE AAA & AFCI ~$4 M/yr)

- established 2001
- >100 faculty, research staff, and students
- 35 competitively funded research projects
- Funded 11 major research facilities
TRP Highlights 2001-2008

- 48 M.S. and 6 Ph.D. degrees granted.
- 2 new academic programs initiated in Fall 2004:
  - Ph.D. in Radiochemistry and
  - M.S. in Materials and Nuclear Engineering
- 13 new faculty and affiliates
- Academic Year 2007-2008: 54 graduate students and 11 undergraduates
- 19 research tasks in ‘08
DOE/NE Support for 11 major research facilities

- Electron Microanalysis and Imaging Lab (Geo), 2001
- Materials Performance Laboratory (ME), 2002
- Machining Center (College of Engineering), 2003
- Trans Electron Microscopy Lab (HRC), 2003
- ICP Atomic Emissions Spectrometer (HRC), 2003
- TC-1 Liquid Metal Loop Interim Facility (ME), 2003
- Sample Preparation Facility (Geo & HRC), 2004
- Actinide Chemistry Laboratories (HRC), 2005
- High Temp Materials Exp. Facility (Chem), 2005
- ODS Lead Calibration Loop (LANL), 2006
- Radiochemistry Laboratories (HRC), 2007 & 2008
Figure 2. Side View of Accelerator Target configuration of the UNLV NMDS at the Idaho Accelerator Center. The system has not yet been enclosed in polyethylene blocks.
UNLV MSNE students couple the UNLV High-Power RACE Target to a linear electron accelerator at the ISU-IAC
Potential for the Univ. of Alaska system

- Getting students is the easy part
2006 Purdue University

- NWR introduced Go Nuclear! car
- Purdue students set up exhibit for “Nuke Week”
- NE students signed up 90 freshmen for the BSNE program in one day!
- Students also joined ANS student section
Potential for the Univ. of Alaska system

- Getting students is the easy part
- Faculty
- Infrastructure
- Research
- Partnerships TBD
  - UNLV?
  - SMR?