



Nuclear Criticality Safety Curriculum for Engineering Students

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Objectives

NCS Fundamentals

- Definitions
- Criticality Control Techniques

NCS Importance

- Criticality Accidents
- Consequences

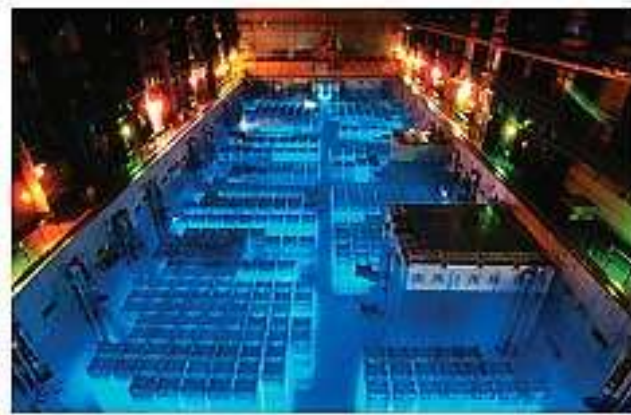
UI NCS Program

- Evaluation of NE programs
- Format
- NRC Grant
- Assessment

NCS Fundamentals



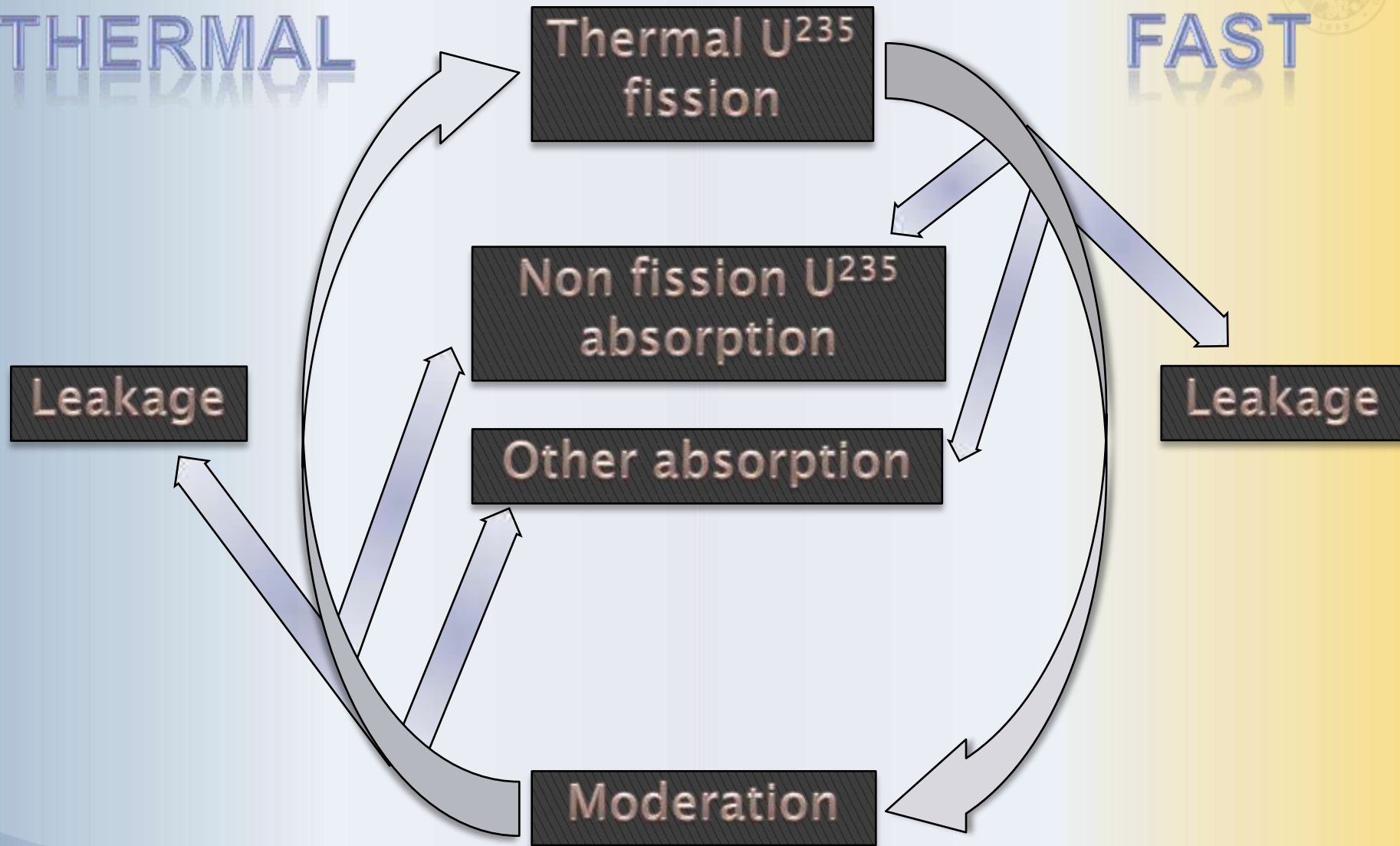
- ▶ The discipline of preventing unintended nuclear chain reactions
- ▶ $k_{\text{eff}} < 1$ (typically < 0.95)





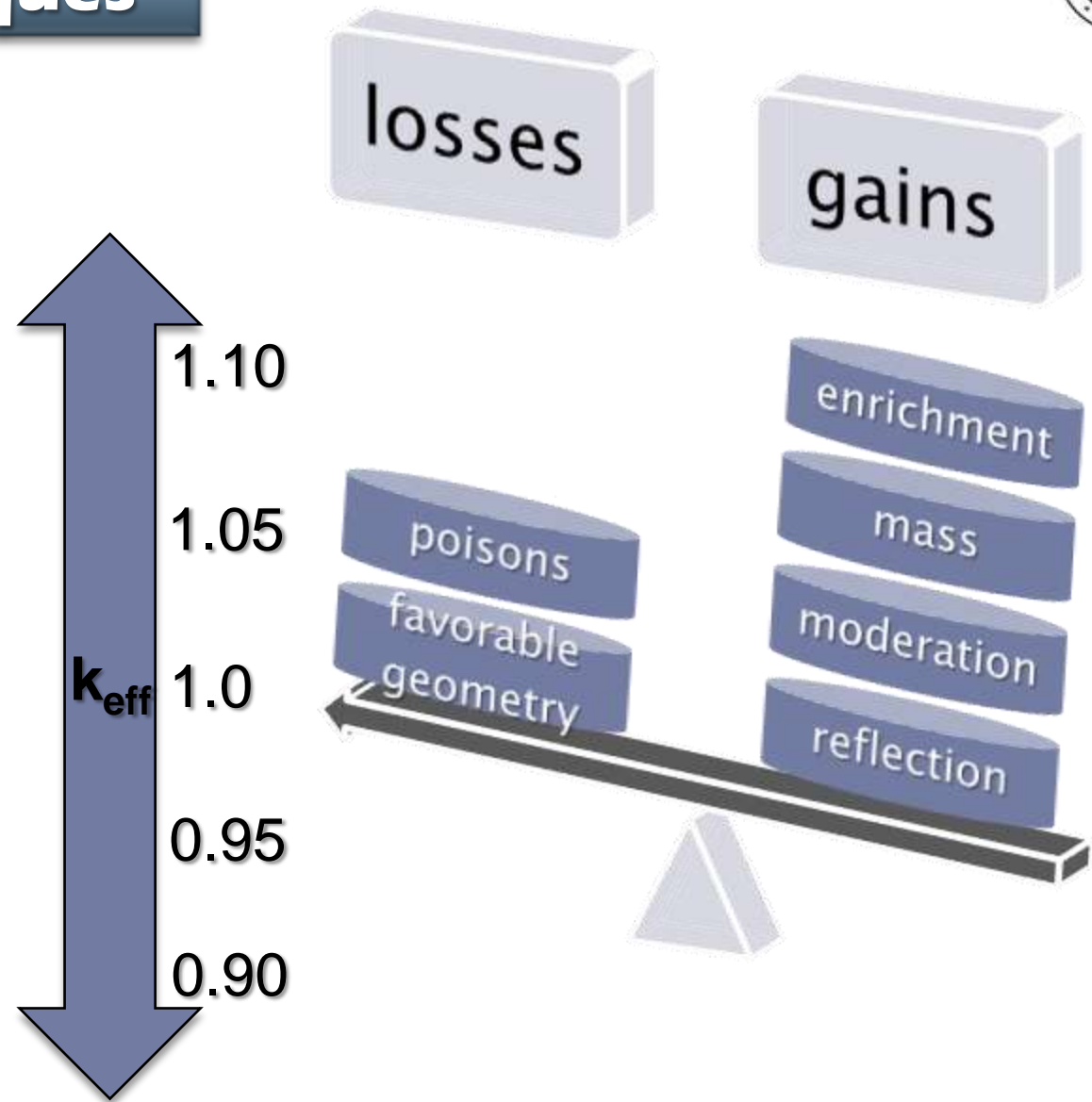
THERMAL

FAST





NCS Techniques



NCS Importance

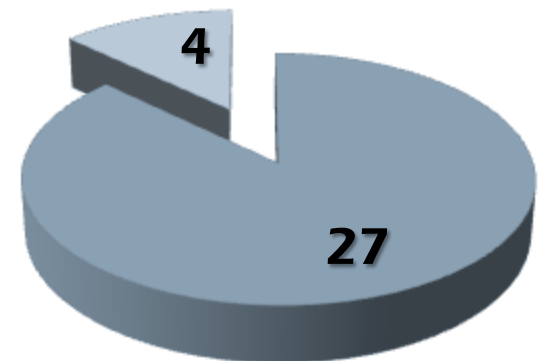
- Fissile material processing applications present different risk scenarios than operating reactors
- 60 accidents worldwide
 - 10^{15} to 10^{17} fissions
 - 21 fatalities
 - Overexposures
 - Up to 12,000 rem





NCS University Education

- **NCS is a core knowledge requirement for many practicing nuclear engineers**
- **Of 31 US universities offering programs in NE only 4 offer a course in NCS**
 - **None make it a core requirement**
 - **Only 13% of engineers even have a chance to be exposed to NCS**



UI NCS Program

- ▶ **4 course program**
- ▶ **Can be part of the MS NE curriculum**
- ▶ **Also for non-nuclear engineers/scientists**





UI NCS Curriculum

► Courses:

- NE 450: Intro to Nuclear Engineering
- NE 535: Nuclear Criticality Safety I
- NE 565: Monte Carlo Analysis
- NE 555: Nuclear Criticality Safety II



DOE STANDARD
GUIDANCE FOR NUCLEAR CRITICALITY
SAFETY ENGINEER TRAINING AND
QUALIFICATION





Format

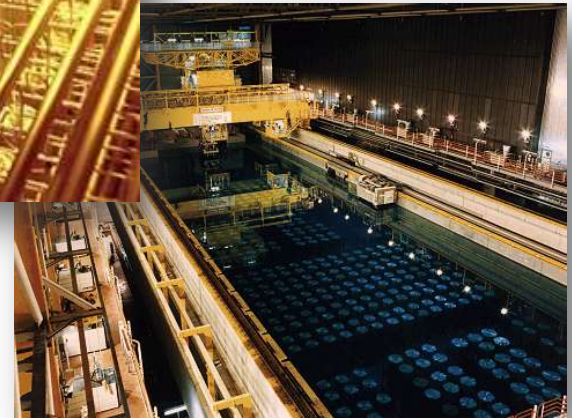
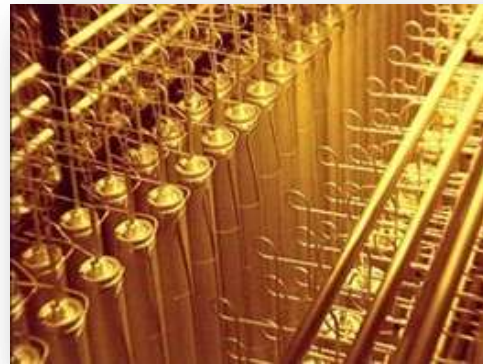
- ▶ **Courses available in a classroom setting**
- ▶ **By real-time compressed video and via DVD**
- ▶ **Electronic blackboards for student-instructor, and student-student dialog**



University of Idaho

Funding

- ▶ **Regular and Affiliate Faculty**
- ▶ **FY2008 NRC Education Grant for nuclear safety education programs**



UI NE Status



- ▶ **45 MS students, 12 PhD students: 5 via distance**
- ▶ **About 30 students/semester taking graduate nuclear courses for professional development (non degree seeking): 12 exclusively via DVD**



Program Status

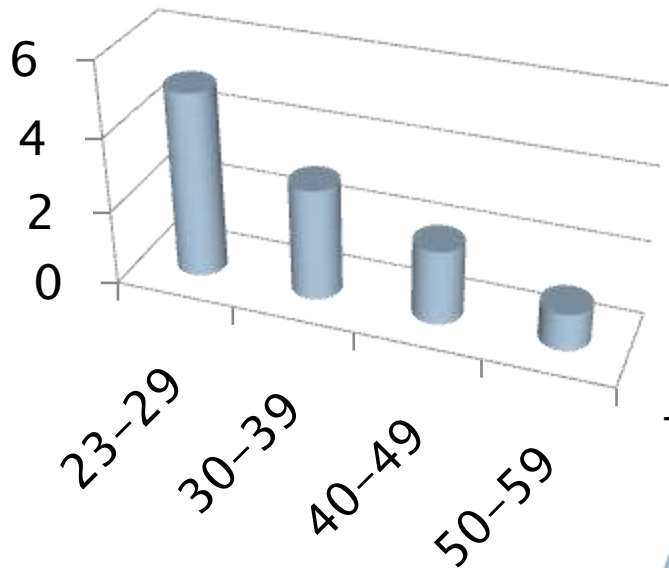


| Course | Status |
|----------------------|------------------------|
| Intro to NE | Completed (Spring '08) |
| NCS-I | Completed (Spring '09) |
| Monte Carlo Analysis | Completed (Summer '09) |
| NCS-II | Current (Spring '09) |

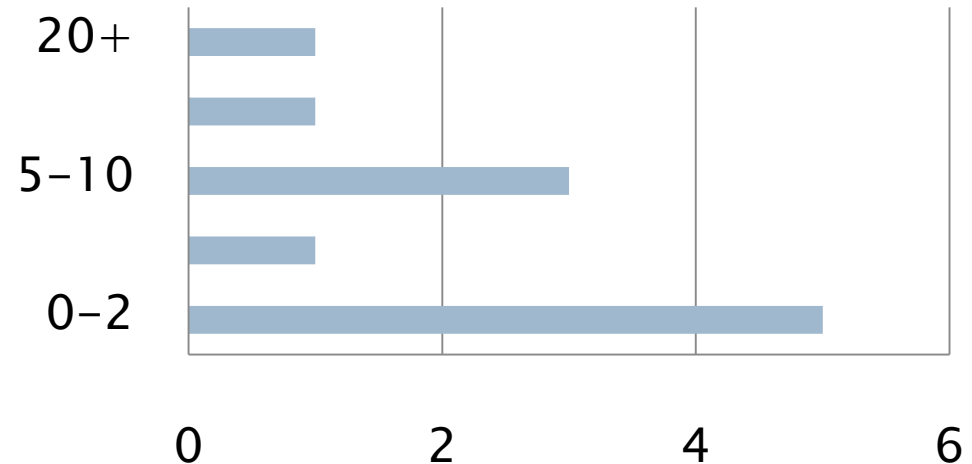


Demographics

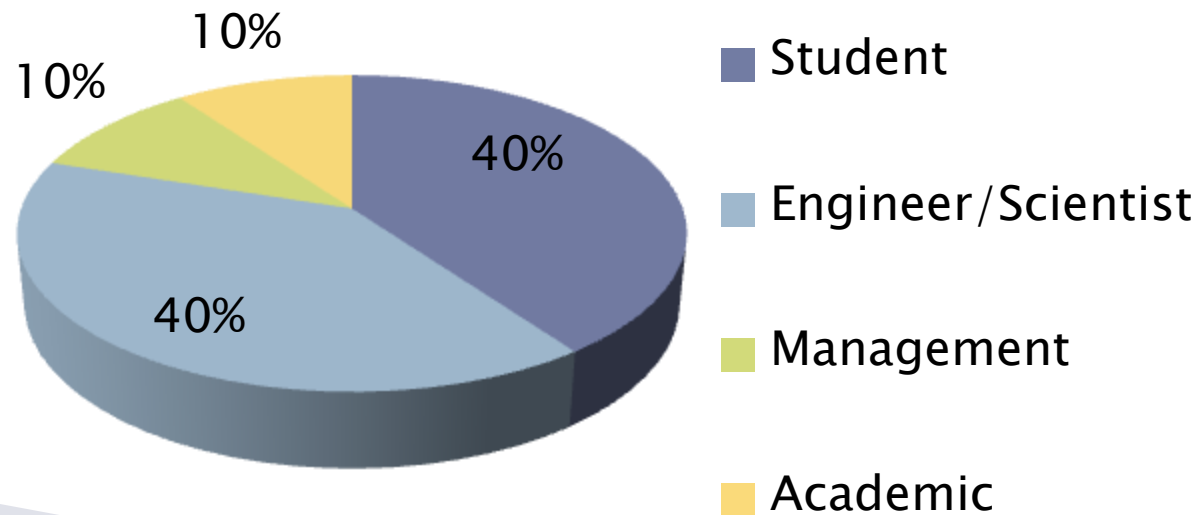
Age



Work Experience



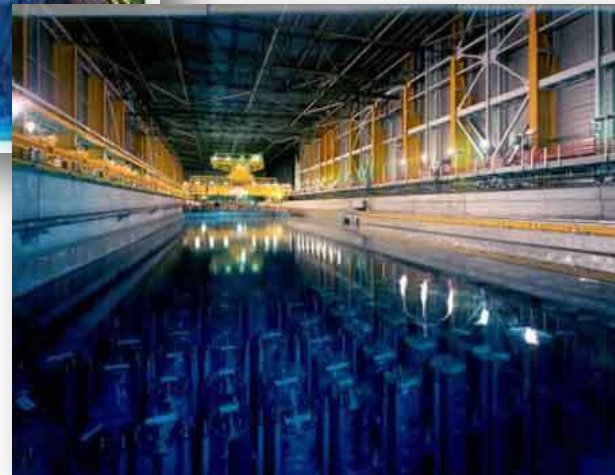
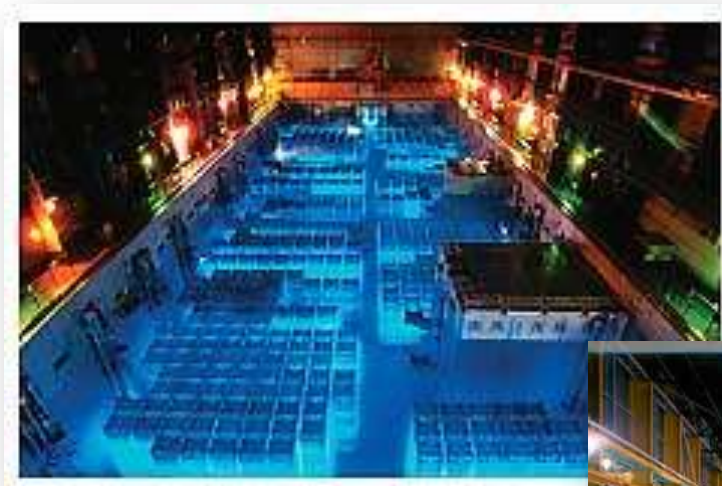
Career



Assessment



- Pre/post course assessments
- Student feedback



Next Steps



- ▶ **Development of commercial examples**
- ▶ **Additional short courses**
- ▶ **Additional guest speakers**
- ▶ **Develop a 'human factors for nuclear engineering' course**
- ▶ **Improve the multimedia and distance learning elements of the program**



Review

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Questions?