



**Collaboration between the
U.S. Nuclear Regulatory
Commission (NRC) and the
Department of Energy
(DOE)**

**Victor McCree, Executive Director
for Operations, NRC
June 20, 2016**

Agenda

- **Advanced Non-light Water Reactors and Small Modular Reactors – Jennifer Uhle, NRO**
- **Subsequent License Renewal – Bill Dean, NRR**
- **Nuclear Safety Research and Educational Grants, Michael Weber, RES**



Activities and Planning Efforts for Advanced Non-Light Water Reactors and Small Modular Reactors

June 20, 2016

**Jennifer Uhle, Director
Office of New Reactors**

NRC Enhancing Readiness to Review Non-LWR Applications

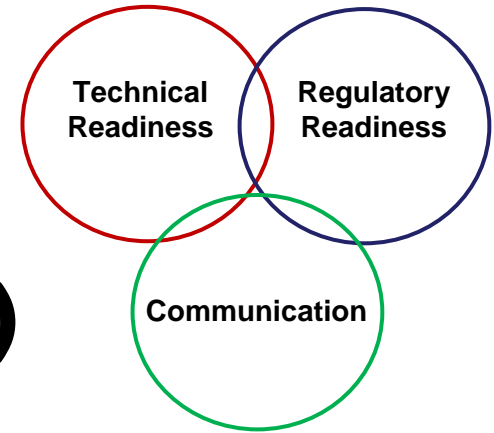


NRC and DOE Have Complementary Goals

- **DOE supporting deployment of two non-LWRs by 2030**
- **NRC vision and strategy supports NRC review readiness by 2025**

NRC Has Three Pronged Approach

- **Enhance technical readiness**
- **Optimize regulatory readiness**
- **Optimize communication**
 - **Near-term (0-5 years)**
 - **Mid-term (5-10 years)**
 - **Long-term (10+ years)**



NRC Developing Implementation Action Plans

- **Development of IAPs will include:**
 - **Identification of detailed tasks to be performed**
 - **Preparation of cost estimates**
 - **Estimated work durations**
 - **Expected participants by organization**

Successful Collaboration with DOE

- **Vision and Strategy documents are complementary**
- **Joint initiative to address the regulatory framework**
 - **Advanced Reactor Design Criteria**
 - **Policy issue resolution**
- **Effective public outreach**

What is the Status of NRC Readiness?

- **NRC regulatory and licensing process could support a non-LWR review today**
- **Enhancing efficiency and predictability of the regulatory process and technical readiness**
- **Pace commensurate with industry plans and readiness**





Small Modular Reactors Are Becoming A Reality

Applicant	Application	Submittal Timeframe
TVA Clinch River	Early Site Permit	May 2016
NuScale	Design Certification	November or December 2016
UAMPS	Combined License	End 1 st Qtr CY 2018
TVA Clinch River	Combined License	Mid-2018

Resolution of Key Policy Issues Proceeding

Issue	No Further Action	Path Forward
Prototype Reactors	✓	
Licensing of Multi-Module Facilities	✓	
Manufacturing License	✓	
Defense-In-Depth	✓	
Key Design Issues	✓	
Control Room Staffing	✓	
Operational Programs	✓	
Installation During Construction	✓	
Facilities Using Process Heat	✓	

Resolution of Key Policy Issues Proceeding (Cont.)

Issue	No Further Action	Path Forward
Security and Safeguards		
Aircraft Impact		
Decommissioning Funding		
SMR Variable Annual Fees		Final Rule published May 24, 2016
Multi-Module Risk		Revising SRP Ch. 19
Mechanistic Source Term		SECY-16-0012 with Commission
Emergency Preparedness		Proceeding with Rulemaking
Insurance and Liability		Future Rulemaking, If Needed

Emphasizing Efficient, Safety-Focused Review

- **Finalizing Design-Specific Review Standard Sections**
- **Developing Safety-Focused Review Process**
- **Emphasizing Quality of Staff Information Requests**
- **Stressing Familiarity with Design**

Enhanced Safety-Focused Review Builds on Risk-Insights



NRO Emphasizing Review Readiness

- **Vision and Strategy for Advanced Reactors Ready to be Implemented**
- **Efficient, Safety-Focused SMR Review Process Being Developed**
- **Preparations for SMR Reviews Coming to Timely Conclusion**

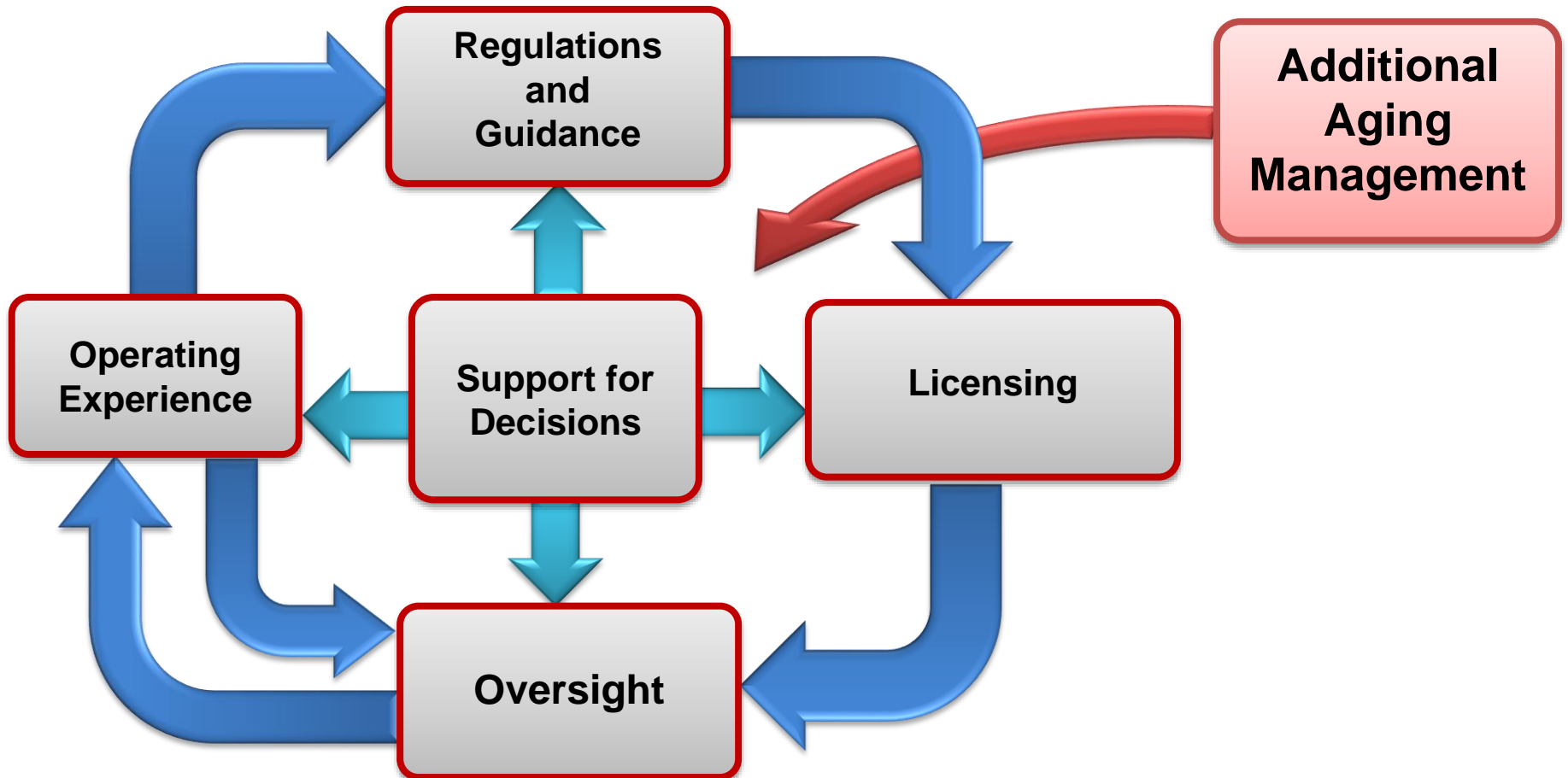


Subsequent License Renewal

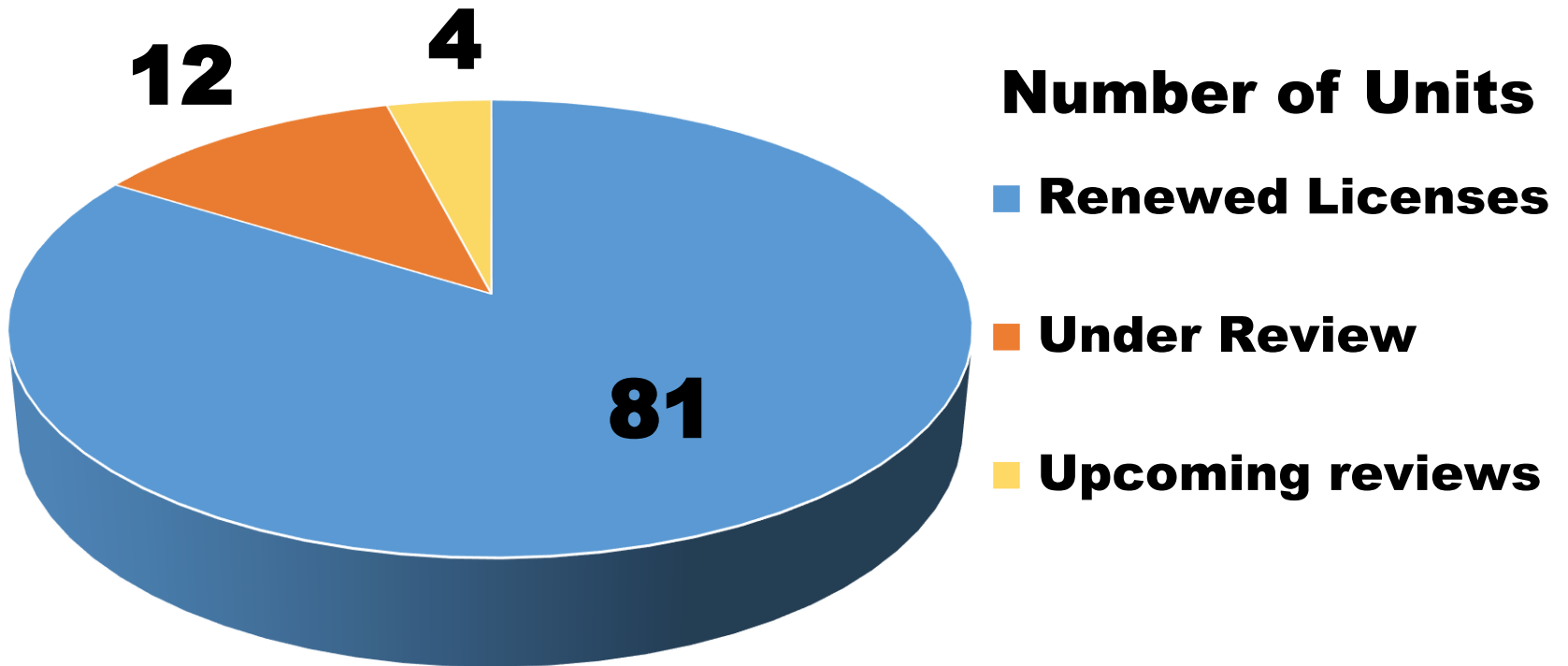
June 20, 2016

**Bill Dean, Director
Office of Nuclear Reactor
Regulation**

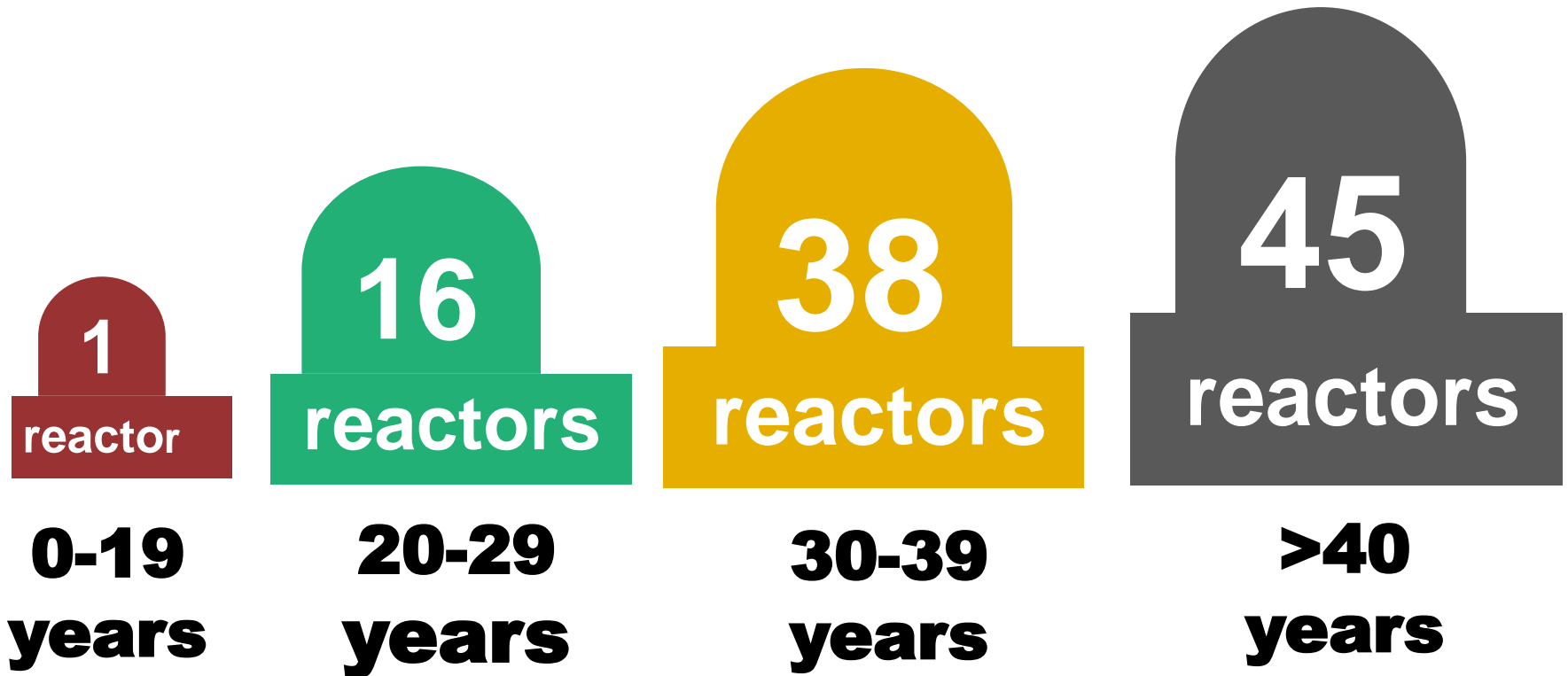
License Renewal Principles Build on Existing Regulatory Process



Most Plants Have Renewed Their Licenses



U.S. Commercial Nuclear Power Reactors: Years of Operation by the End of 2016



Achieving Safety Beyond 60 Years

- **The principles of license renewal would continue to be effective to ensure safety**
- **Optimization of application review process**
- **Technical reviews ensure effective aging management**

Four Key Technical Issues for Operations Beyond 60 Years

- **Reactor embrittlement**
- **Aging of reactor internals**
- **Concrete and containment degradation**
- **Electrical cable aging**

NRC Is Developing SLR Regulatory Guidance

- **Draft GALL-SLR Report and SRP-SLR guidance issued in December 2015 for public comment**
- **Staff currently addressing public comments**
- **Final guidance expected to be issued in July 2017**

NRC Has Issued Interim Staff Guidance for License Renewal

- **Buried and underground piping and tanks**
- **Internal coating/linings**
- **Reactor vessel internals**
- **Steam generators**
- **Stainless steel structures in treated borated water**

Beginning Preparations for Licensing Accident Tolerant Fuels

- **Substantial research remains**
- **DOE and industry selection of candidate designs**
- **Licensing effort depends on departure from existing designs**
- **10 CFR 50.46c provides an appropriate regulatory framework**



Enhancing Nuclear Safety through Research and Educational Grants

June 20, 2016

**Mike Weber, Director
Nuclear Regulatory Research**

Collaboration Topics

- **Ensuring Safety for Subsequent License Renewal (SLR)**
- **Learning from Fukushima-Daiichi**
- **Reviewing Accident Tolerant Fuels**
- **Issuing Educational Grants**

Ensuring Long-Term Safety

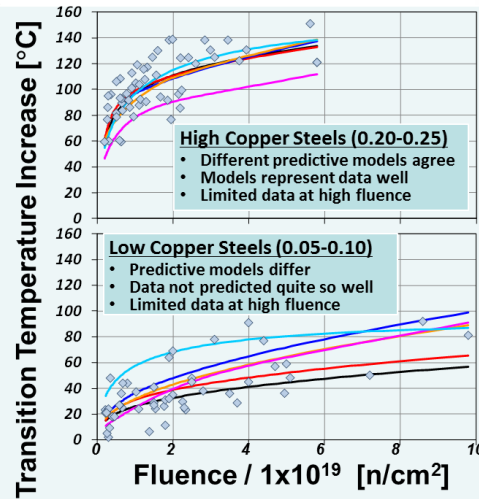
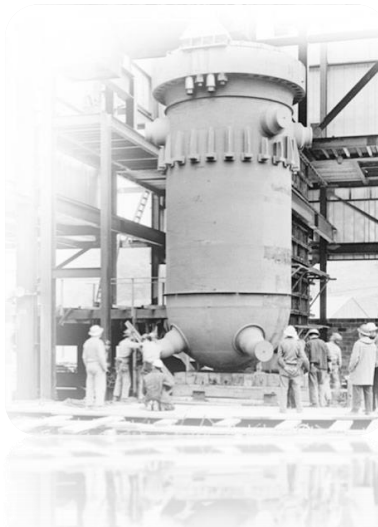
- **Materials degradation phenomena**
- **Light Water Reactor Sustainability program (LWRS)**
- **Expanded Materials Degradation Assessment**



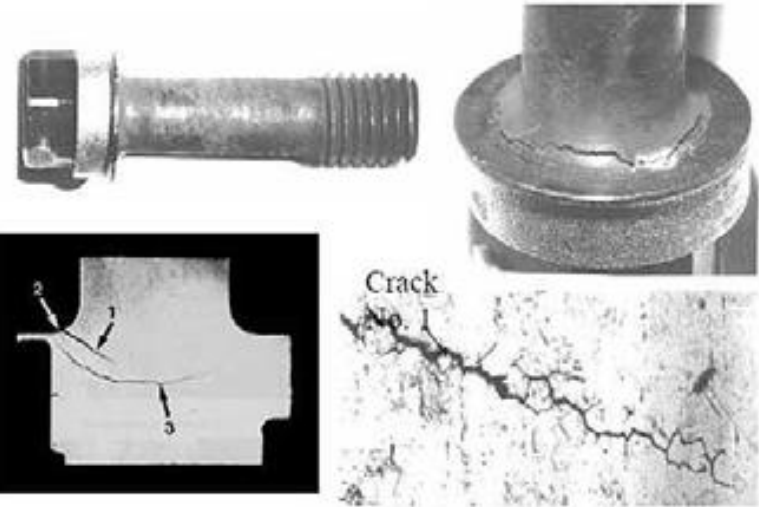
Concrete coring to obtain samples for evaluating effects of aging and environmental stressors.

Resolving Degradation Issues

Reactor Pressure Vessel Embrittlement



Vessel Internals Cracking in a PWR Baffle Bolts



Alkali-Silica Reaction in Concrete



Thermal Aging of Jacketed Cables



Learning from Fukushima-Daiichi

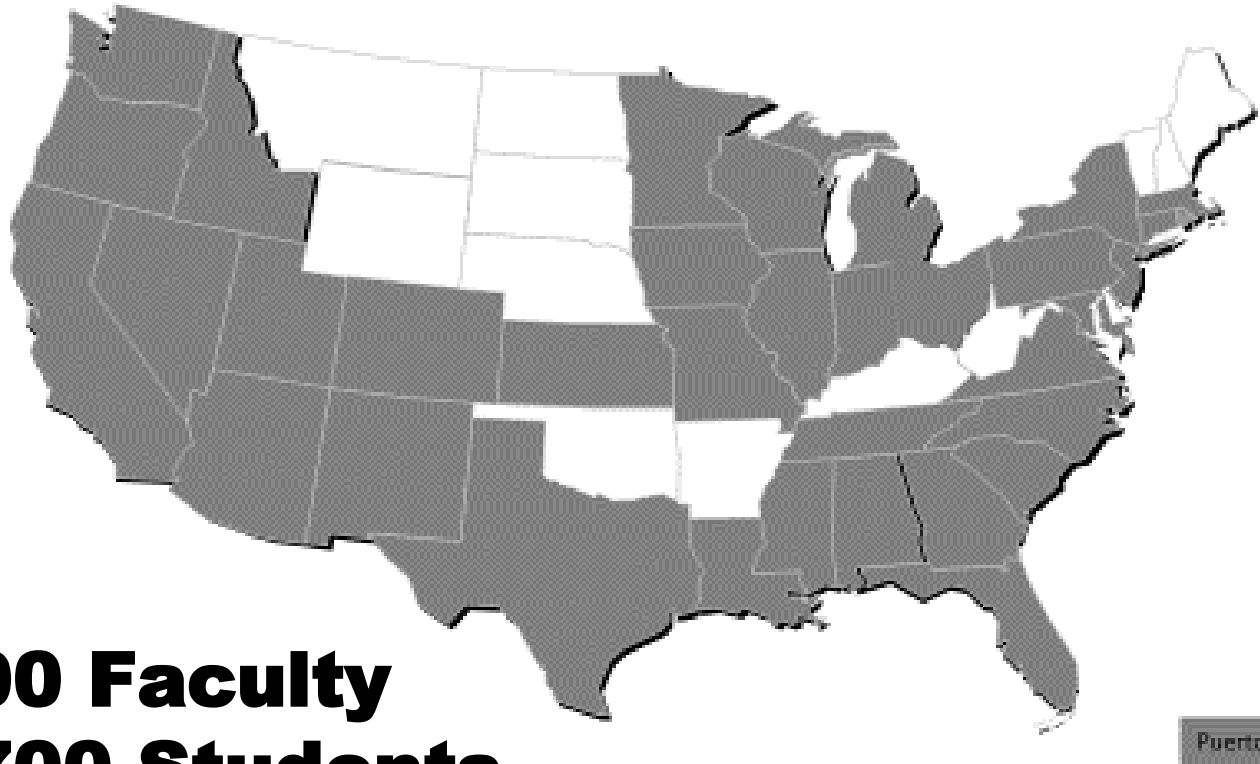
- **Benchmark Study of the Accident at the Fukushima (BSAF)**
- **Senior Expert Group on Safety Research Opportunities Post-Fukushima (SAREF)**
- **U.S.-Japan Civil Nuclear Energy Research and Development Working Group (CNWG)**

Reviewing Accident Tolerant Fuel

- **Advanced Fuel Campaign (AFC) update meetings**
- **Halden Reactor Project (HRP) Program Review Group meetings**
- **Accident Tolerant Fuel (ATF) Working Group**



Developing the Workforce



- **≥ 100 Faculty**
- **≥ 2700 Students**

NRC Grants Program Integrated University Program

Acronyms

- **AFC: Advanced Fuel Campaign**
- **ATF: Accident Tolerant Fuel**
- **BSAF: Benchmark Study of the Accident at the Fukushima**
- **CFR: Code of Federal Regulations**
- **CNWG: U.S.-Japan Civil Nuclear Energy Research and Development Working Group**
- **DCA: Design Certification Application**
- **DOE: Department of Energy**
- **ECCS: Emergency Core Cooling System**

Acronyms

- **GALL Report: Generic Aging Lessons Learned Report**
- **HRP: Halden Reactor Project**
- **IAP: Implementation Action Plan**
- **ISG: Interim Staff Guidance**
- **LTA: Lead Test Assembly**
- **LWRS: Light Water Reactor Sustainability**
- **Non-LWR: Non-Light Water Reactor**
- **NRC: Nuclear Regulatory Commission**
- **NRO: Office of New Reactors**

Acronyms

- **NRR: Office of Nuclear Reactor Regulation**
- **PEO: Period of Extended Operation**
- **RES: Office of Nuclear Regulatory Research**
- **SAREF: Senior Expert Group on Safety Research Opportunities Post-Fukushima**
- **SLR: Subsequent License Renewal**
- **SRP: Standard Review Plan**
- **TVA: Tennessee Valley Authority**
- **UAMPS: Utah Associated Municipal Power Systems**