U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Nuclear Power Plants Operations: Outlook and Output and FLEX Implementation Status

NRC/FERC Joint Commission Meeting

February 23, 2017

Agenda

- William Dean, Director, Office of Nuclear Reactor Regulation
- Nuclear Power Plants Operations: Outlook and Outputs and
- FLEX Implementation Status

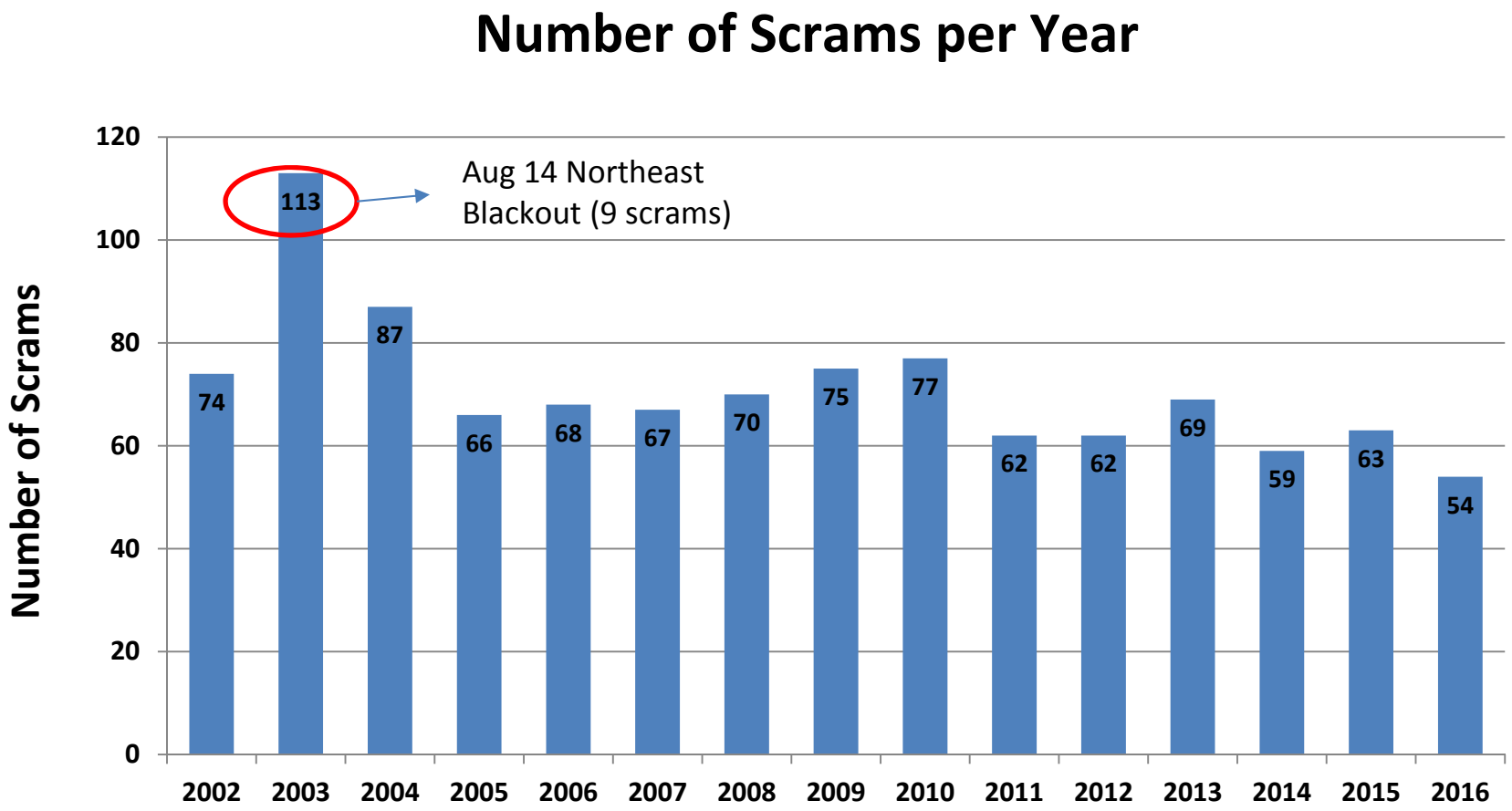
Nuclear Safety Enhanced by Interagency Agreements

- NRC staff share information with FERC and NERC related to ongoing issues and activities associated with
  - Grid Reliability, Cyber & Physical Security, Dam Safety
- Formal Agreement between the NRC, FERC and NERC to facilitate this goal.
  - Memorandum of Agreement (MOA)
  - Memorandum of Understanding (MOU)

Current Fleet of Operating Reactors

- 99 Commercial Power Reactors in Operation
- 309,207 MWt (~100,000 MWe)
- 87 Reactors with Renewed Licenses
- 4 Uprates Under Review/9 Expected

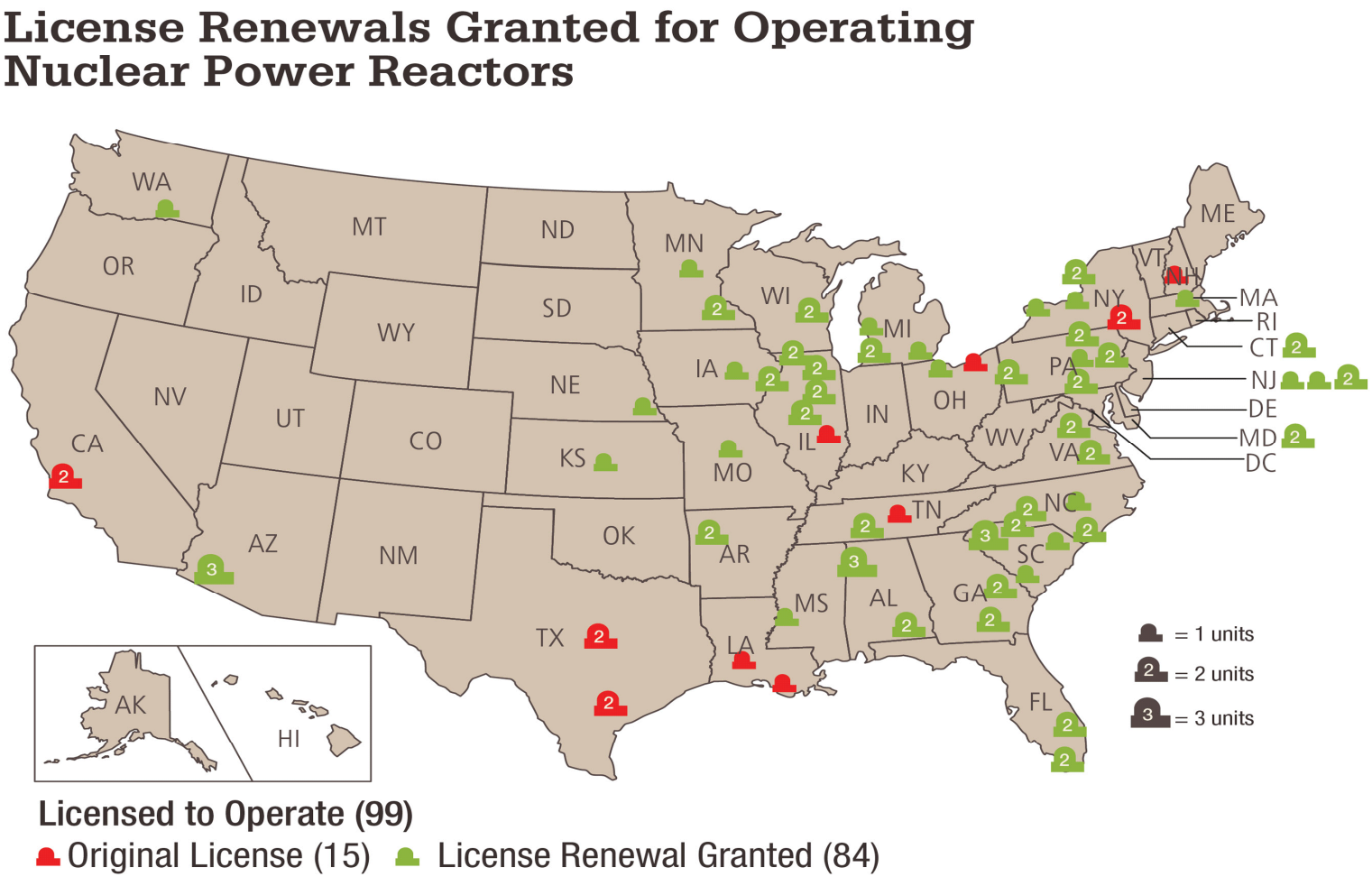
Nuclear Industry 15-Year Performance Trend



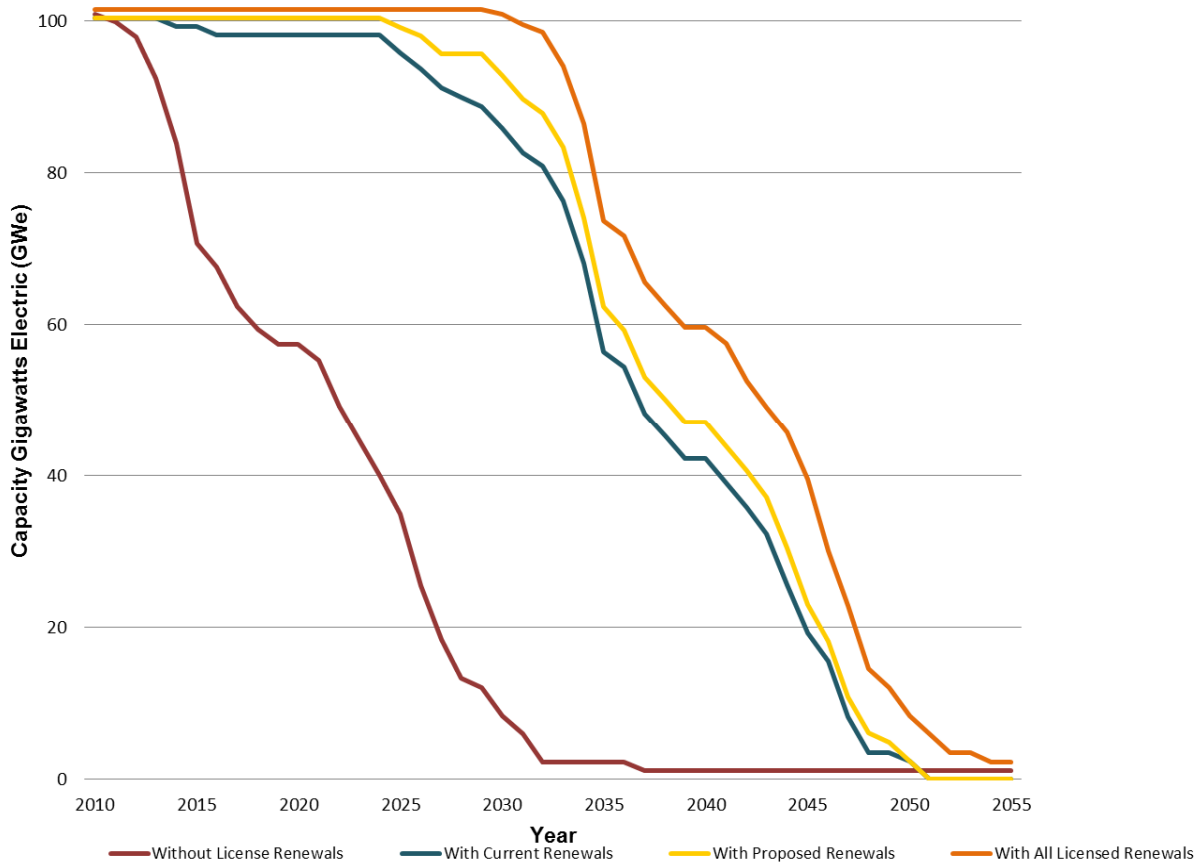
License Renewal Regulation and Review Process Ensure Plant Safety

- Regulations ensure that passive components perform intended functions.
- License renewal application review:
  - Safety and Environmental Reviews
  - Audit and Inspection Activities
- Reviews and the Reactor Oversight Process ensure plant safety of active and passive components.

Majority of Operating Nuclear Power Reactor Licenses Renewed



Projected Electric Capacity Dependent on License Renewals



As of January 2017

Existing Fleet Approaching 60 Years of Operation

- As of December 2016, 45 units in operation more than 40 years
- Plants will reach 60 years of operation as early as 2029
- If nuclear fleet retires at 60 years, all but two units offline by mid 2053

Significant Progress Preparing for Subsequent License Renewal (SLR)

- Final SLR guidance to be issued 2017
- 1st SLR application in mid-2018
- 2nd SLR application in early 2019
- Ongoing progress to resolve technical issues and implement resolutions.
  - Vessel neutron embrittlement
  - Degradation of vessel internals
  - Concrete degradation
  - Cable aging

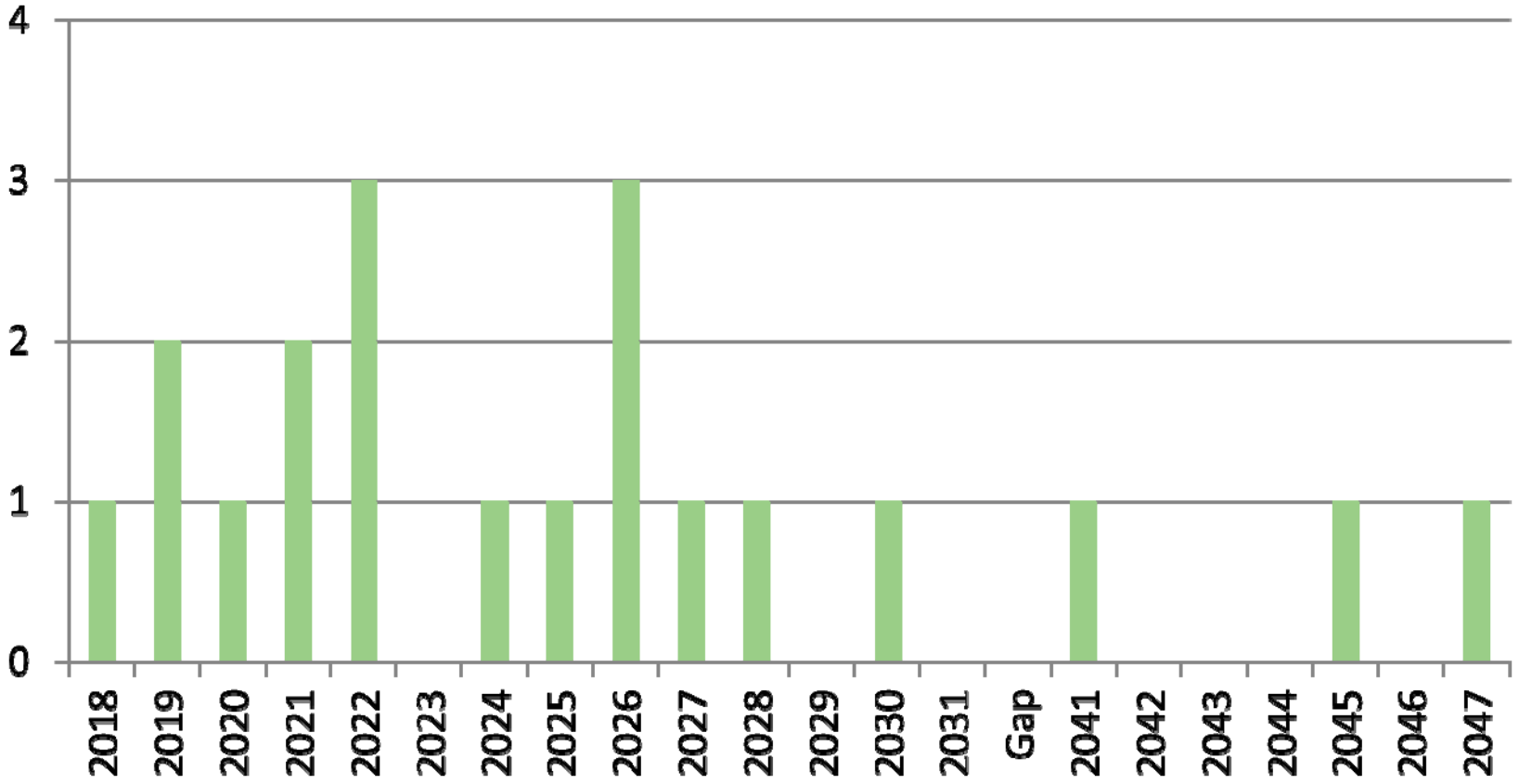
Some Factors Affecting the Potential for SLR Applications

- Low-cost of natural gas
- Subsidized wind and solar power
- Clean air subsidies
- Regulated versus deregulated markets
- Requirements imposed by the States

Some Factors Affecting the Potential for SLR Applications

- Location could impact transmission capability
- Number of units
  - Lower unit cost with more units
- Costs to repair/replace major equipment

SLR Applications Expected



Source: NEI 2016

Recent Power Reactors Decommissioning

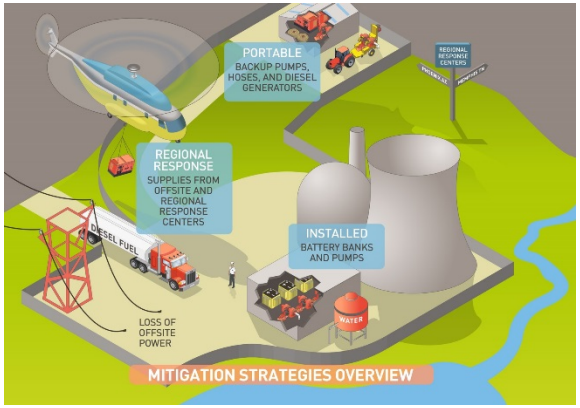
Reactor Name	Last year of Operation	Power Output (Mwe)
Crystal River 3 - S	2009	860
San Onofre 2 - D	2012	1070
San Onofre 3 - D	2012	1080
Kewaunee - S	2014	566
Vermont Yankee - S	2014	635
Fort Calhoun - S	2016	482
Palisades - P	2018	778
Pilgrim - P	2019	680
Oyster Creek - P	2019	636
Indian Point 2 & 3 - P	2020 and 2021	1020
Diablo Canyon 1 & 2 – P	2024 and 2025	1120
S = SAFSTOR	D = DECON	P = Planned

Safety Ensured Prior to and During Decommissioning Activities

- NRC continues to ensure safety during the entire decommissioning process
  - Timely reviews of license amendment requests and exemptions
  - Lessons-learned report was issued on October 28, 2016 (ML16085A029)
  - Development of decommissioning rulemaking

Post-Fukushima Safety Enhancements Nearly Complete

- U.S. reactor safety has been enhanced
- FLEX implementation complete at majority of sites
- Draft Final Mitigation of Beyond-Design-Basis Events Rule submitted to Commission

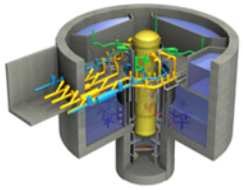


Impact of FLEX on the Regulatory Process

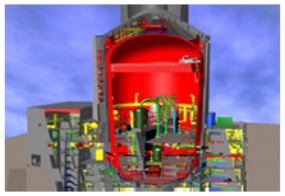
- MS/FLEX could provide added safety enhancement beyond the intended use
- NRC team evaluating credit for MS in RIDM
  - Evaluating areas of potential credit
  - Monitoring ongoing applications
- Updating Guidance (when needed)
- Communication

New Reactor Licensing in the U.S.

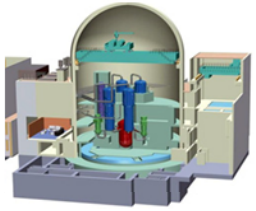
ABWR –
1,300 MWe



ESBWR –
1,500 MWe

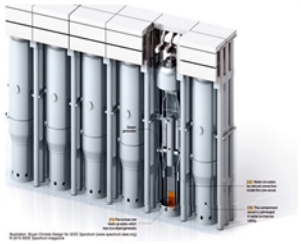


AP1000 –
1,110 Mwe



US APWR –
1,700 MWe

APR1400 –
1,450 MWe



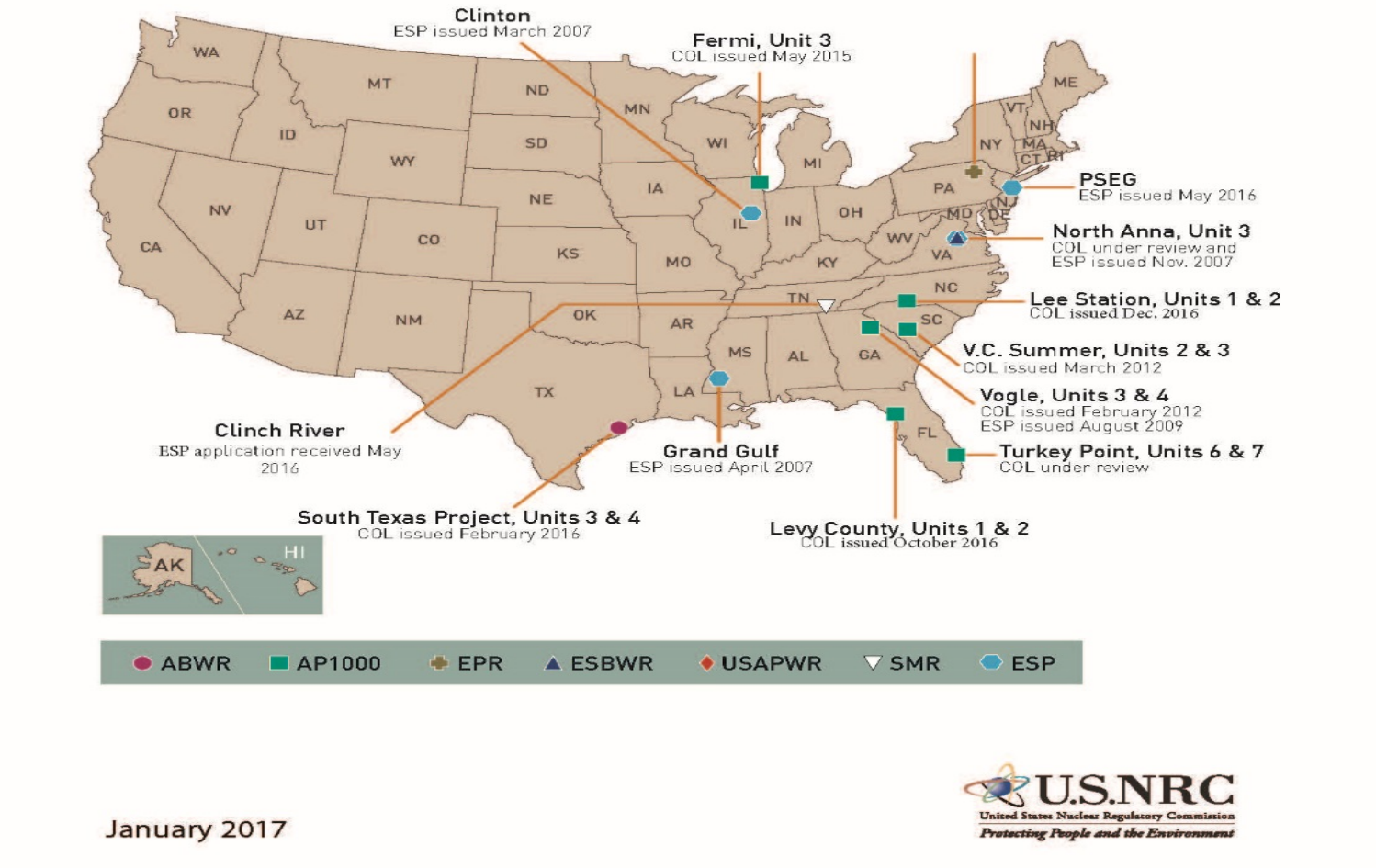
NuScale
50 MWe/module

Four New Reactors Under Construction

Unit	Power Generation Output (MWe)	Operation
Vogtle Unit 3	1,110	June 2019*
Vogtle Unit 4	1,110	June 2020*
VC Summer Unit 2	1,110	April 2020**
VC Summer Unit 3	1,110	December 2020**

***Based on Securities and Exchange Commission filing.**
****Based on SCANA press release dated 2/14/17**

Eleven Licenses for Light Water Reactors Issued



Staff Beginning to Review Small Modular Reactors

- NuScale submitted an application for design certification January 6, 2017.
- NRC docketed an application from TVA for an ESP for two or more SMR modules (up to 800 MWe) at the Clinch River site in December 2016.
- UAMPS plans to apply for a combined license referencing the NuScale design.

Extensive Interest in Advanced Reactor Designs

- Vision and Strategy for non-light water reactor readiness issued.
- Near term implementation action plans issued
- Anticipated applications
  - Pre-application interactions have started
  - Application(s) expected in the next 2 to 4 years

Acronyms

- CDBI – Component Design Basis Inspection
- ESP – Early Site Permit
- FERC – Federal Energy Regulatory Commission
- FLEX – Diverse and Flexible Coping Strategies
- IMC – NRC Inspection Manual Chapter
- MS – Mitigating Systems
- NERC - North American Electric Reliability Corporation
- PI&R - Problem Identification and Resolution

Acronyms

- RIDM – Risk-Informed Decision Making
- ROP – Reactor Oversight Process
- SLR - Subsequent License Renewal
- SMR – Small Modular Reactor
- TVA – Tennessee Valley Authority
- UAMPS - Utah Associated Municipal Power Systems