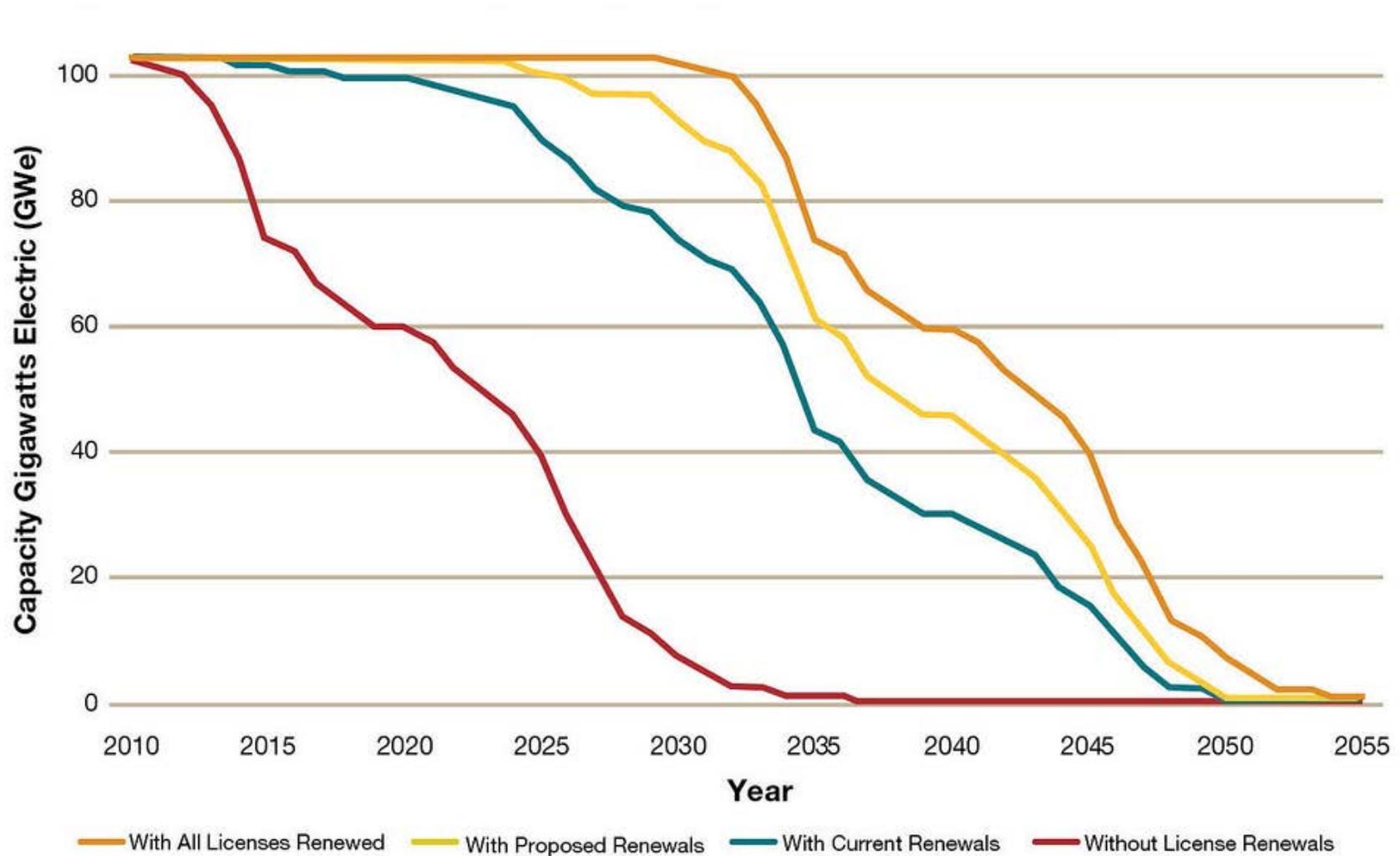




Nuclear Power Plants
Extended Loss of All AC Power
Analysis of Electromagnetic Pulse
Joint FERC/NRC Meeting

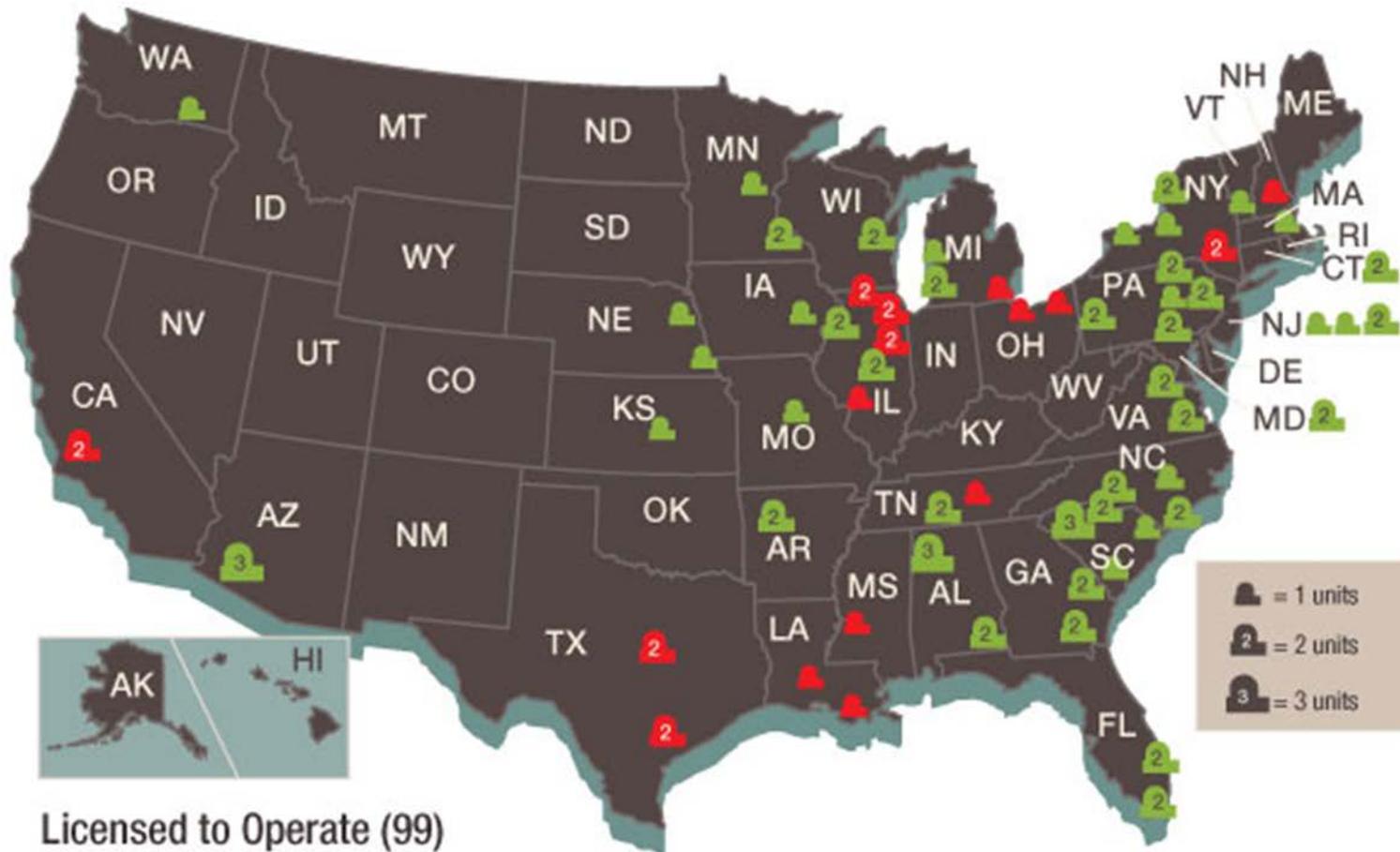
Jennifer Uhle, Deputy Director
Office of Nuclear Reactor Regulation
October 21, 2015

Projected Electric Capacity Dependent on License Renewals



As of July 2005

Majority of Operating Nuclear Power Reactor Licenses Renewed



Licensed to Operate (99)

▲ Original License (23) ▲ License Renewal Granted (76)

Updated 10/2015

License Renewal Regulation and Review Process Ensure Plant Safety

- Regulation ensures passive components perform intended functions.
- Application reviews include:
 - Safety and Environmental Review
 - Audit and Inspection Activities
- Reviews and the Reactor Oversight Process ensure plant safety of active and passive components.

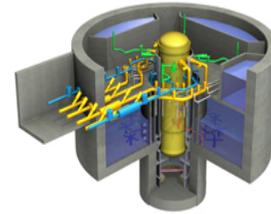
Significant Progress Preparing for Subsequent License Renewal

- Expect first application in late 2018 or 2019
- Ongoing progress to resolve technical issues and implement resolutions.
 - RPV Embrittlement
 - Cable Aging
 - Cracking of Vessel Internals
 - Concrete Degradation

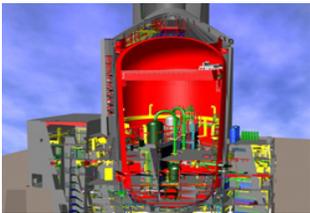
New Reactor Licensing in the U.S.



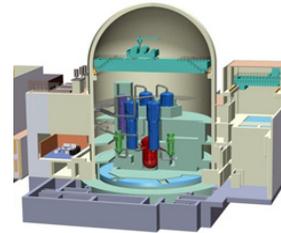
ABWR –
1,300 MWe



ESBWR –
1,500 MWe



AP1000 –
1,110 MWe



US APWR –
1,700 MWe



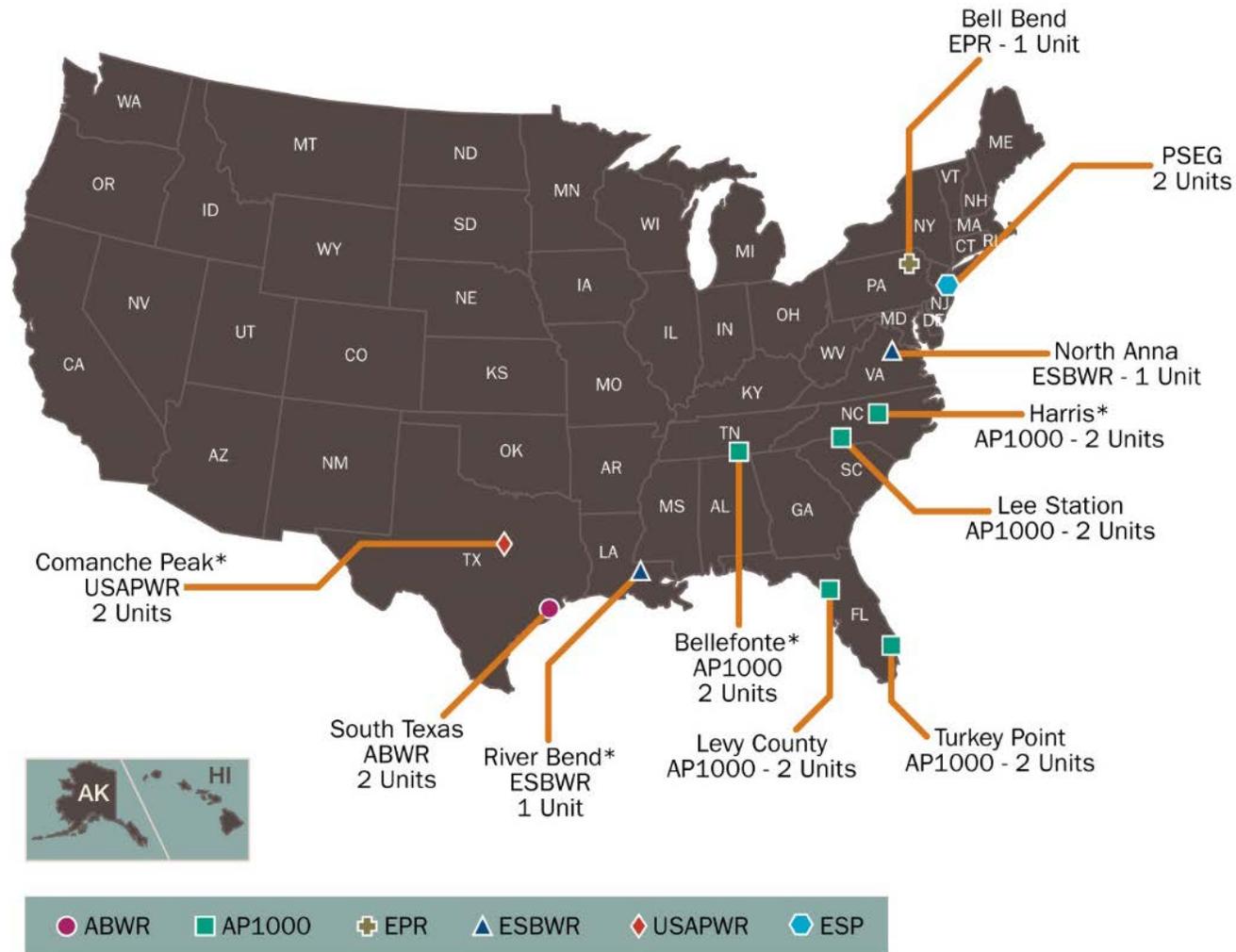
APR1400 –
1,450 MWe

Five New Reactors Under Construction

<u>Unit</u>	<u>Licensing Status</u>	<u>Power Generation Output (MWe)</u>	<u>Operation</u>
Watts Bar Unit 2	Construction Permit Issued	1,150	Dec. 2015
Vogtle Unit 3	License Issued	1,110	June 2019*
Vogtle Unit 4	License Issued	1,110	June 2020*
V.C. Summer Unit 2	License Issued	1,110	Aug. 2019
V.C. Summer Unit 3	License Issued	1,110	May 2020

* Based on Securities and Exchange Commission filing.

Eight Applications for Large Light-Water Reactors Under Review



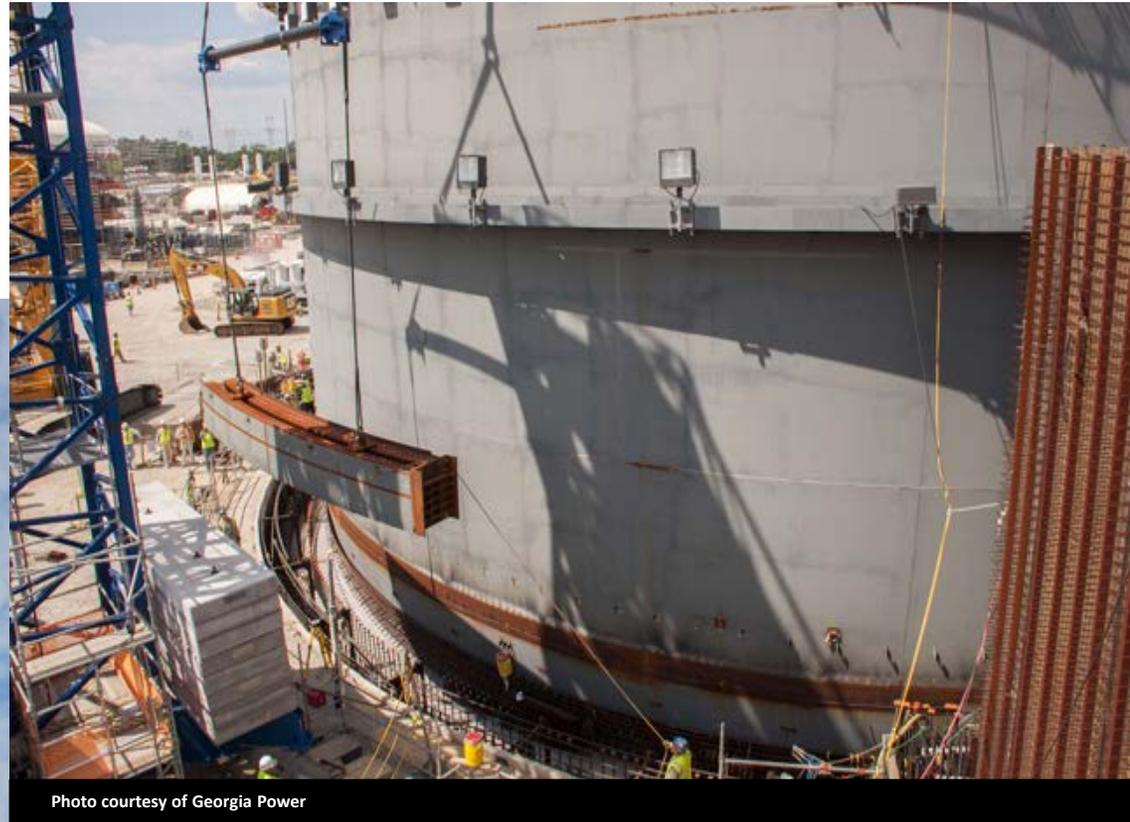
*Review Suspended by Applicant

-Large LWRs—Large Light-Water Reactors, generally on the order of 1000 MW(e) or more

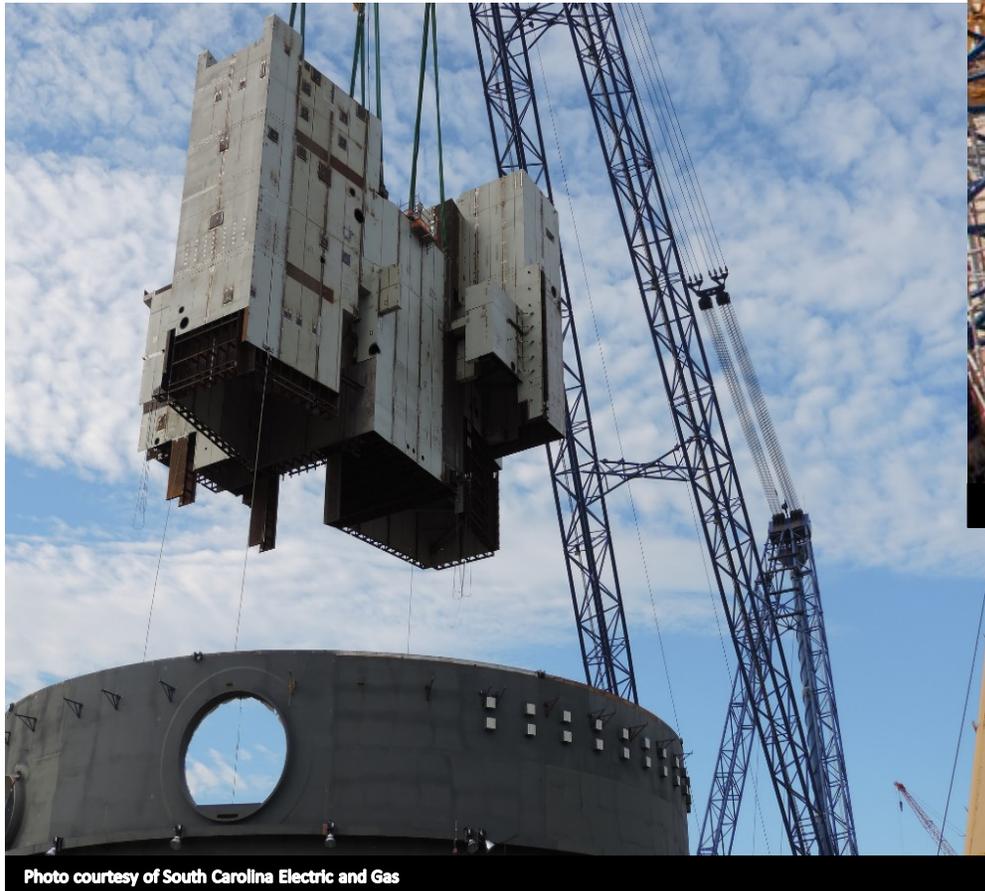
as of September 28, 2015

Vogtle and Summer Using Modular Construction

V.C. Summer Unit 2 Steam Generator & Refueling Canal Module Placement



Vogtle Unit 3 Shield Building Panel Installation (August 2015)



Extensive Interest in Small Modular and Advanced Reactor Designs

- NuScale application for design certification expected December 2016.
- Utah Associated Municipal Power Systems plans to apply for a COL in 2017.
- NRC is preparing for future non-LWR applications.

Power Reactors Decommissioning Status



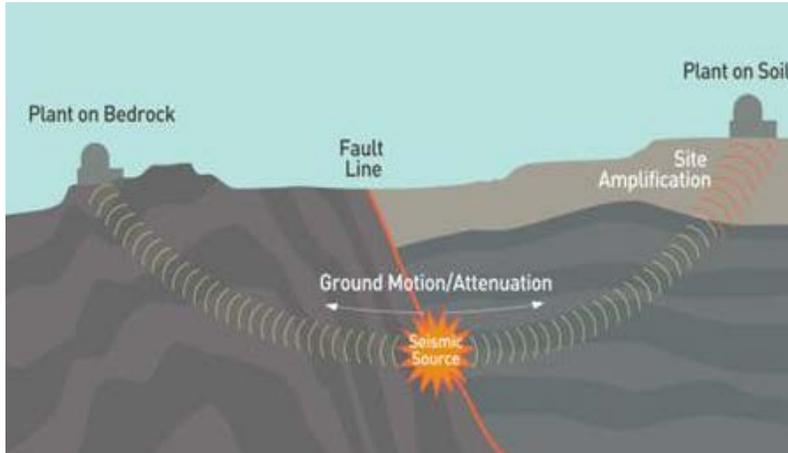
REACTOR NAMES	LAST YEAR OF OPERATION	POWER OUTPUT (MWe)
San Onofre 2 and 3	2012	1070 and 1080
Crystal River 3	2009	860
Oyster Creek	2019	836
Vermont Yankee	2014	635
Kewaunee	2013	566

NRC-abbreviated reactor names listed

Safety Ensured During Decommissioning Activities

- NRC continues to ensure safety during the entire decommissioning process
 - Timely reviews of license amendment requests and exemptions
 - Development of new guidance documents
 - Development of decommissioning rulemaking

Reactor Safety Has Been Enhanced Post-Fukushima



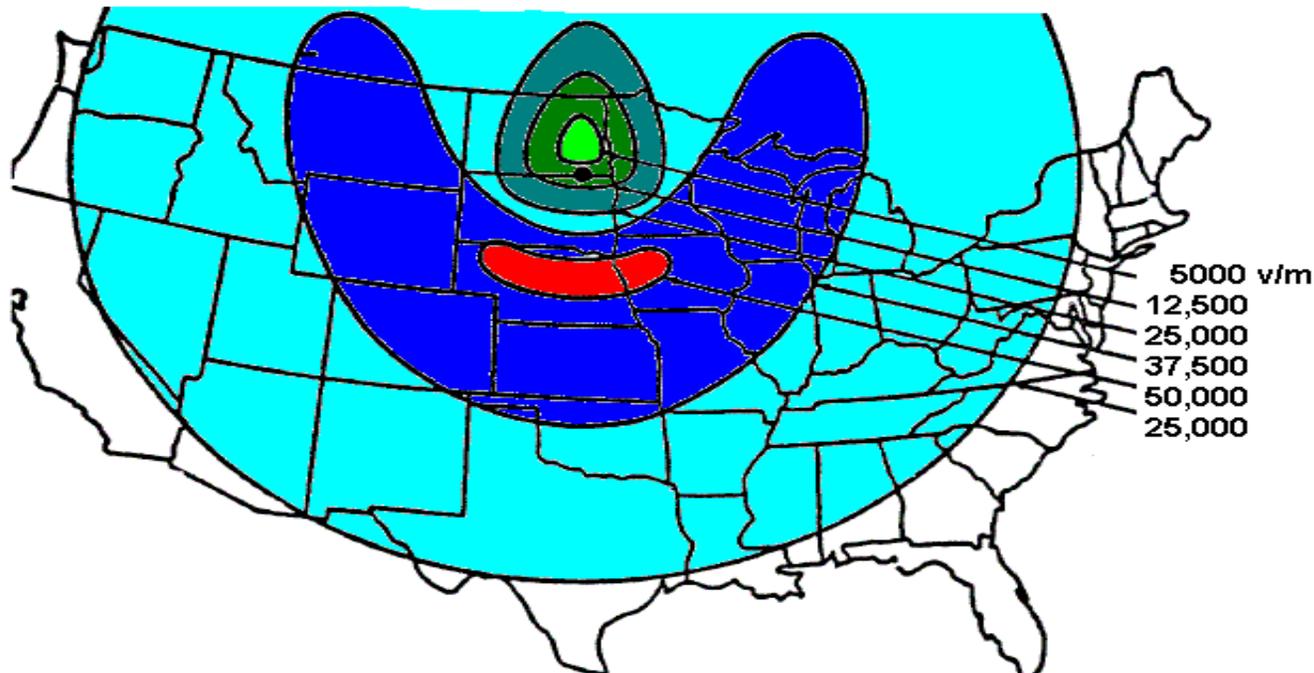
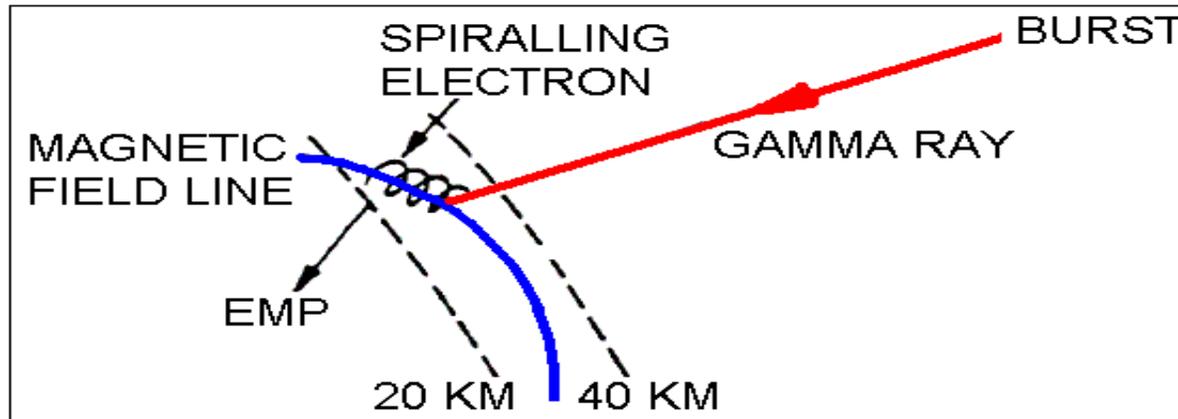
Rulemaking to Require Mitigation Strategies for Beyond Design Basis Events Underway

- Will make generically applicable mitigating strategies for beyond design basis external events imposed by orders
- Intended to put in place requirements for an integrated accident response capability
- 75 day public comment period starts in November 2015
- Proposed final rule to Commission in December 2016

Significant Progress on Addressing Fukushima Lessons Learned

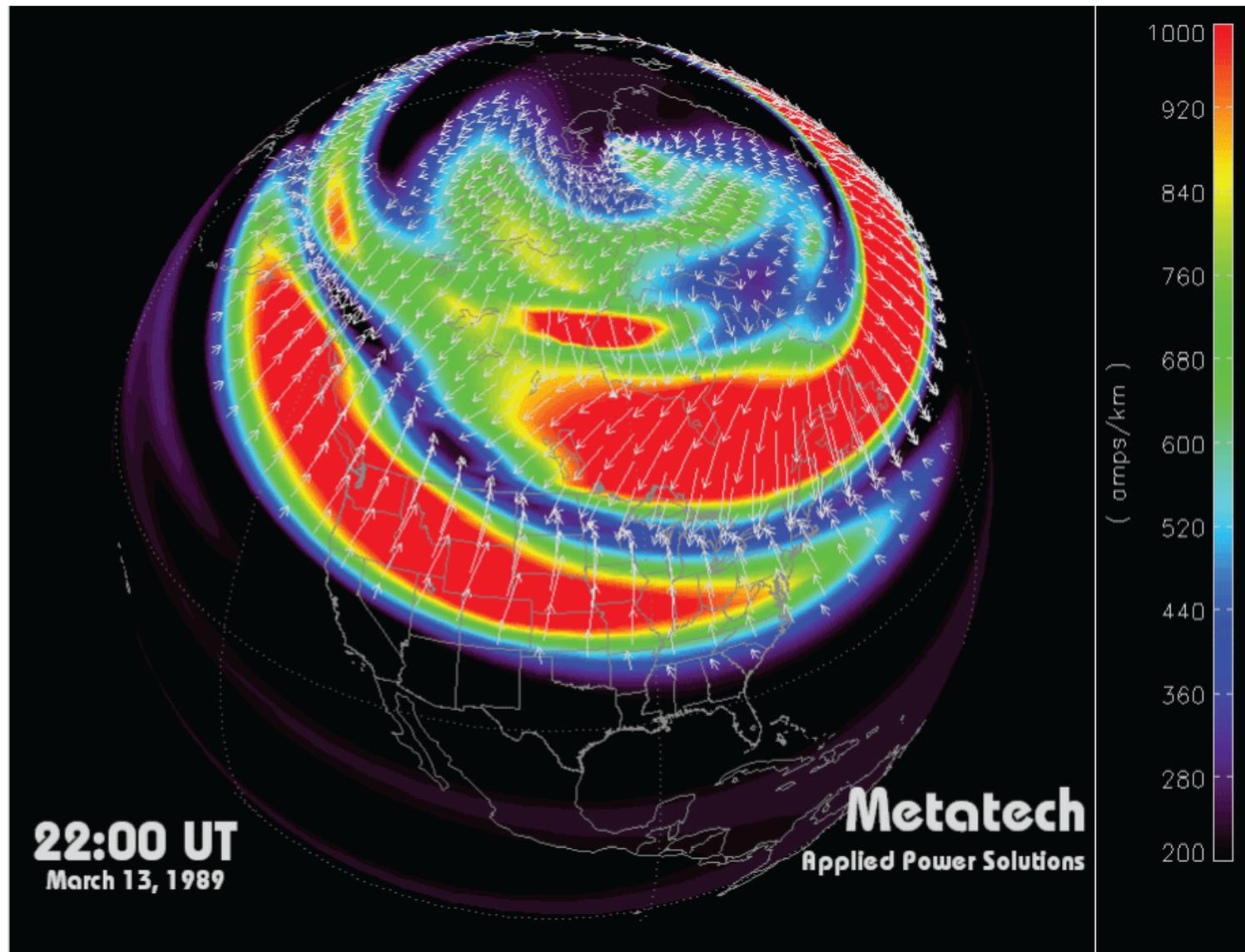
- Strong focus on the safety and security of operating plants
- Demonstrable improvement in safety as the lessons are implemented
- Substantial safety enhancements are ongoing and will be in place by 2016

Man-Made EMP Threatens Electrical Systems



Source: Nuclear Environment Survivability,
U. S. Army, report AD-A278230 (1994)

Geomagnetic Storms Pose Natural Threats



Nuclear Plants can Withstand EMP Impacts

- 1983 – NUREG/CR- 3069, “Interaction of Electromagnetic Pulse with Commercial Nuclear Power Plant Systems- Main Report”
- 2009 – Sandia study – EMP impact on NPPs
- 2010 – Sandia study – CME/GIC impact on NPPs
- Screened for Generic Issues Program
- Loss of offsite power can be mitigated.

NRC Oversight Ensures NPP Safety

- Regulations and guidance
- Recent Petition for Rulemaking
 - Fukushima ELAP mitigations
- Monitor threat potentials
- Participation in National strategic planning initiatives, e.g.
 - DHS Critical Infrastructure initiatives
 - NSTC – Space Weather Strategy and Action Plans
- NRC commends the FERC/NERC rulemaking

Acronyms

- RPV – Reactor Pressure Vessel
- ESBWR – Economic Simplified Boiling Water Reactor
- U.S. EPR – U.S. Evolutionary Power Reactor
- US-APWR – Advanced Pressurized Water Reactor
- ABWR – Advanced Boiling Water Reactor
- AP1000 – Advanced Passive 1000

Acronyms

- APR1400 – Advanced Power Reactor 1400
- COL – Combined License
- MWe – Mega-watts electric
- LWR – Light Water Reactor
- AC – Alternate Current
- ELAP – Extended Loss of AC Power
- NSTC – National Science and Technology Council