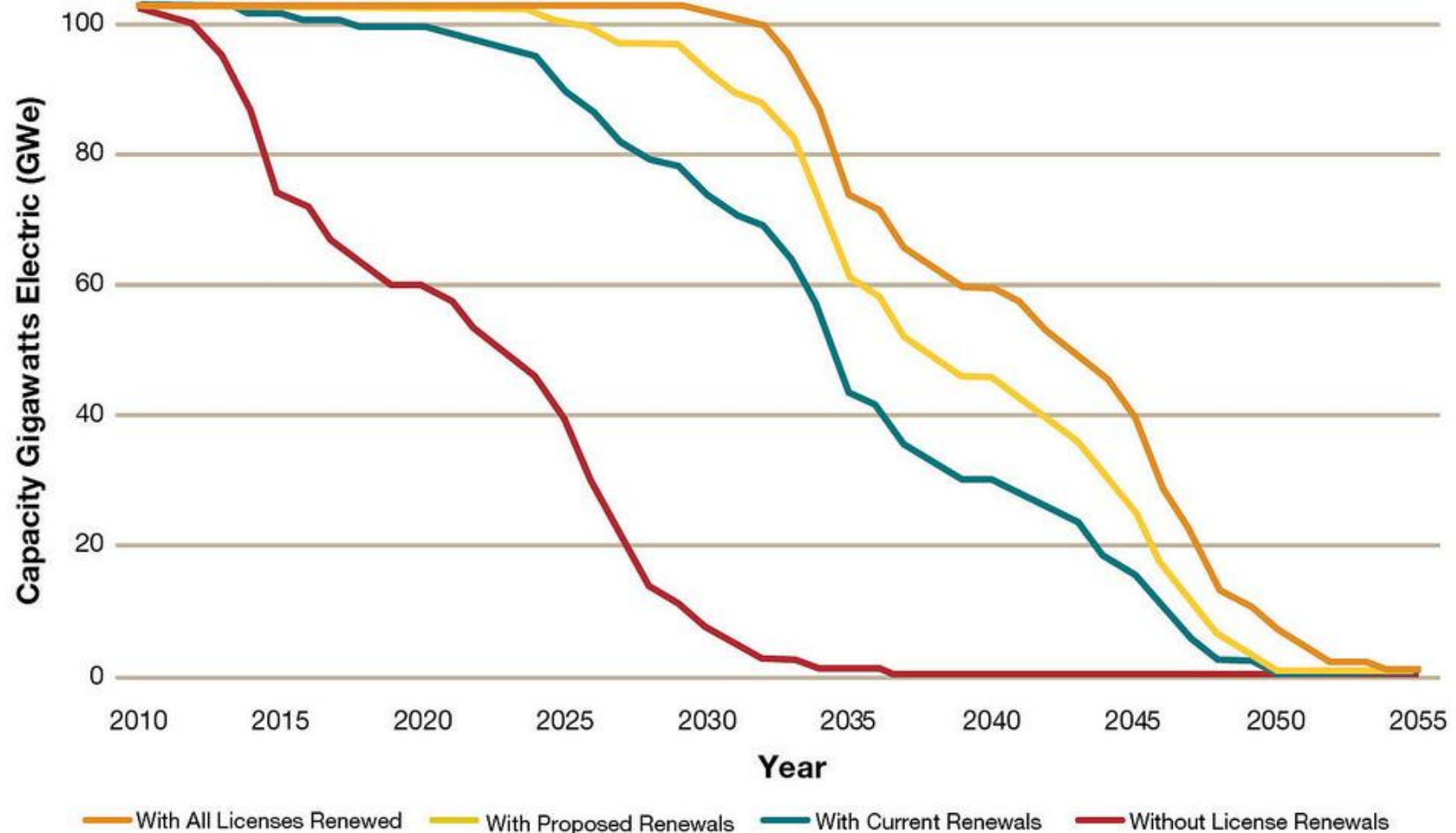




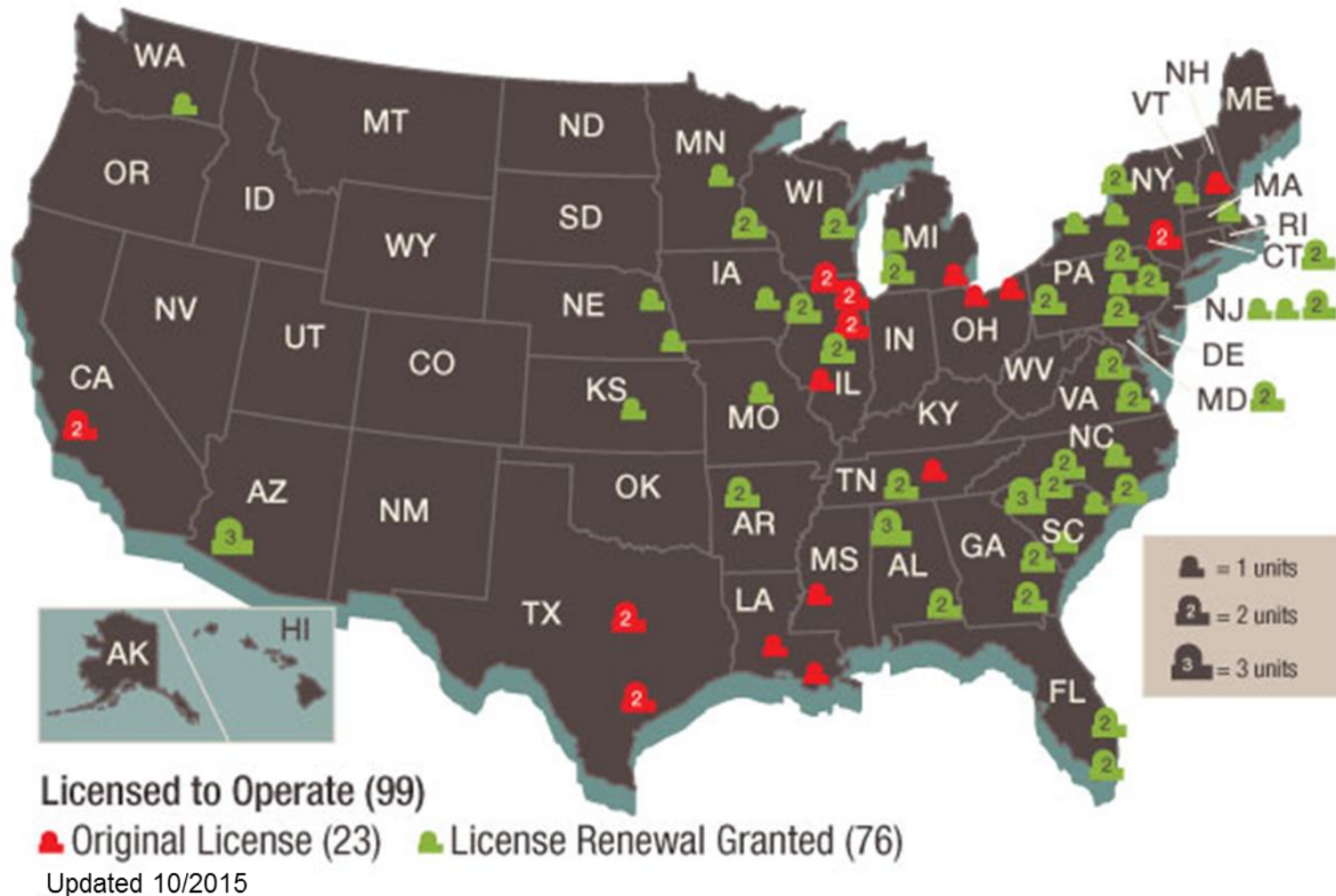
# **Nuclear Power Plants Extended Loss of All AC Power Analysis of Electromagnetic Pulse Joint FERC/NRC Meeting**

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

# Projected Electric Capacity Dependent on License Renewals



# Majority of Operating Nuclear Power Reactor Licenses Renewed



# **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.**

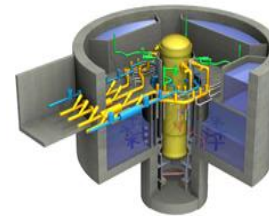
# **Significant Progress Preparing for Subsequent License Renewal**

- **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**

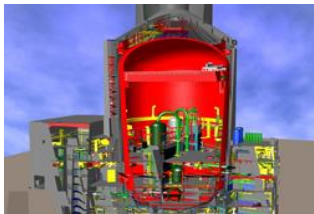
# New Reactor Licensing in the U.S.



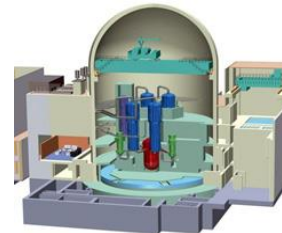
**ABWR –  
1,300 MWe**



**ESBWR –  
1,500 MWe**



**AP1000 –  
1,110 MWe**



**US APWR –  
1,700 MWe**



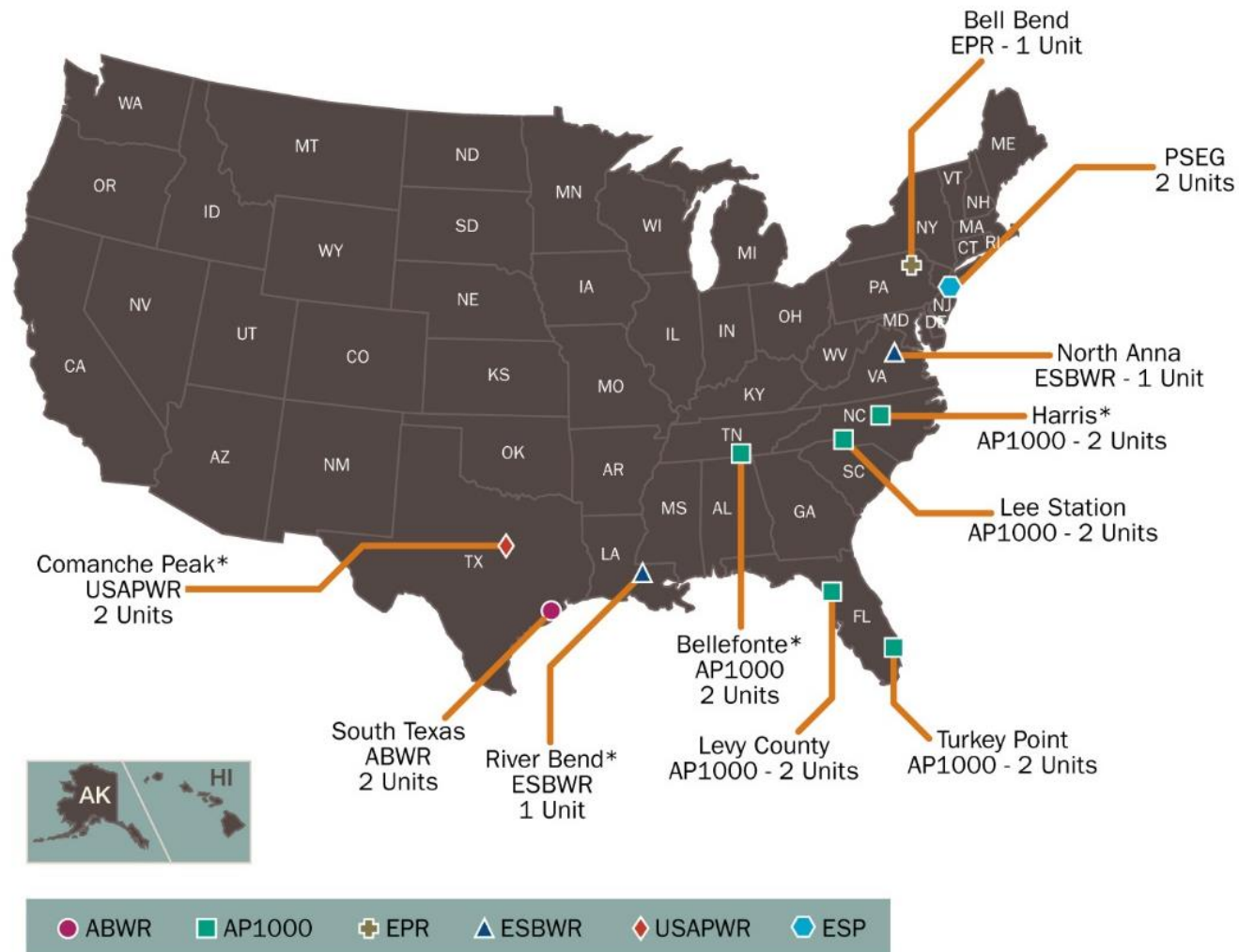
**APR1400 –  
1,450 MWe**

# Five New Reactors Under Construction

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

\* 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

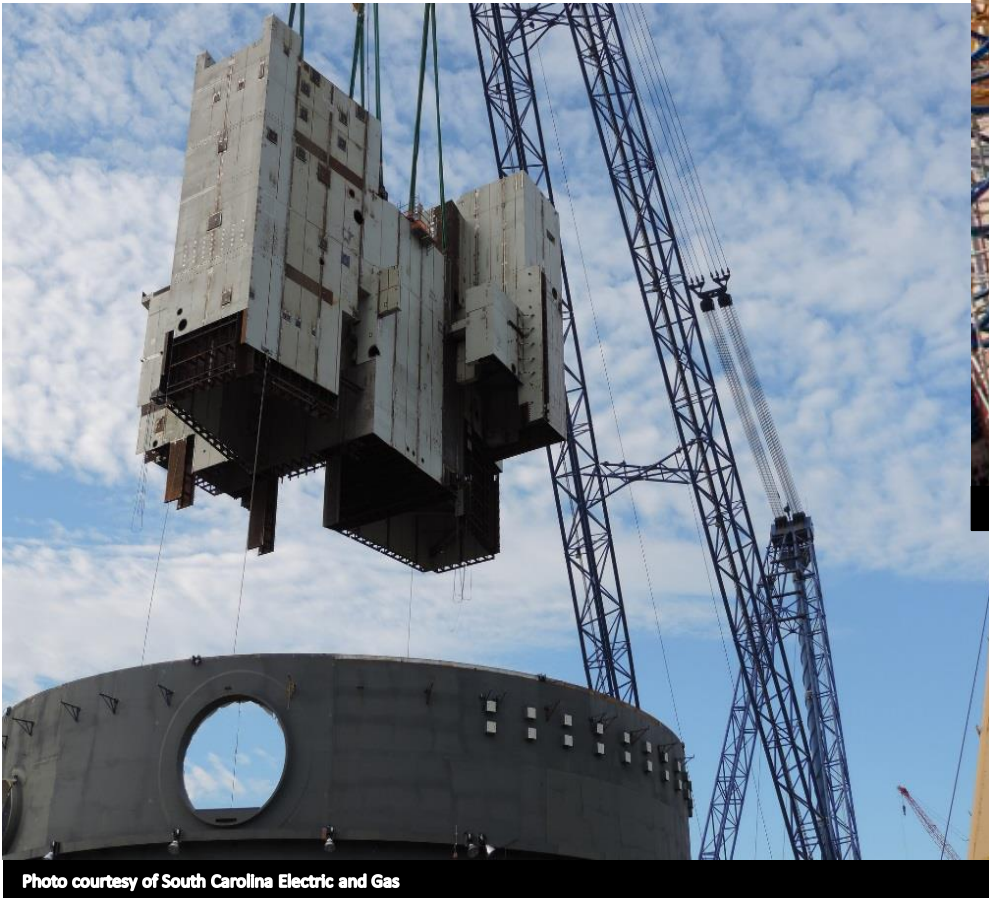


Photo courtesy of South Carolina Electric and Gas

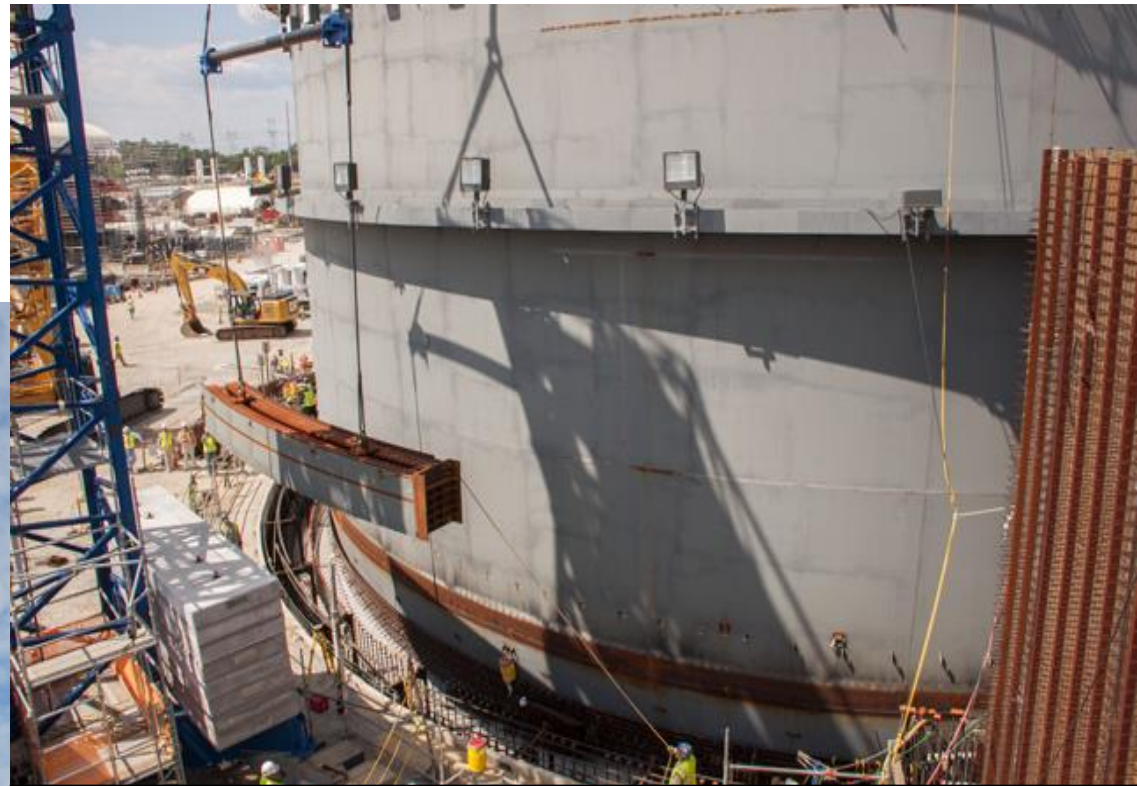


Photo courtesy of Georgia Power

## 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

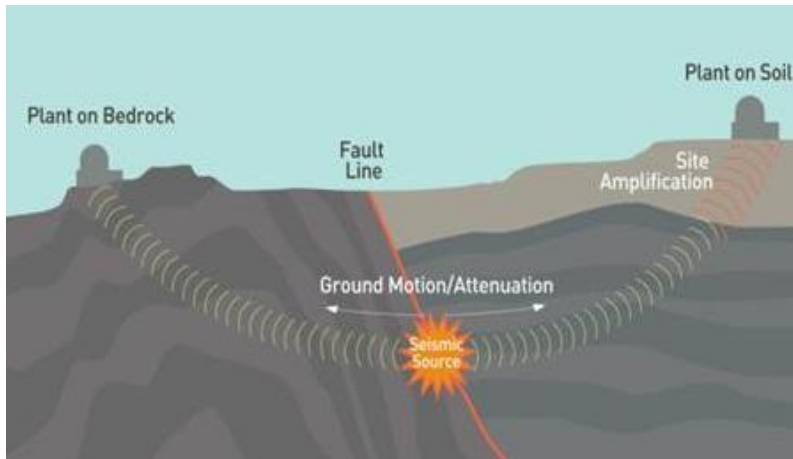
NRC-abbreviated reactor names listed

# **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



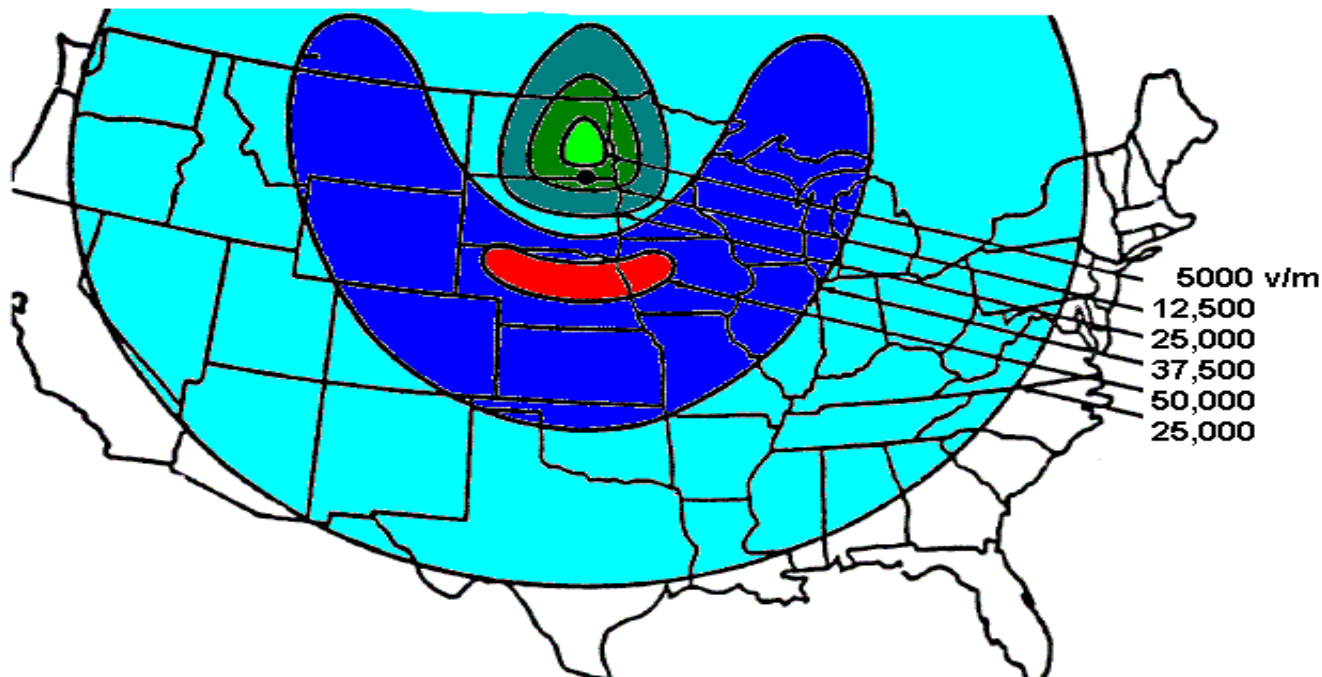
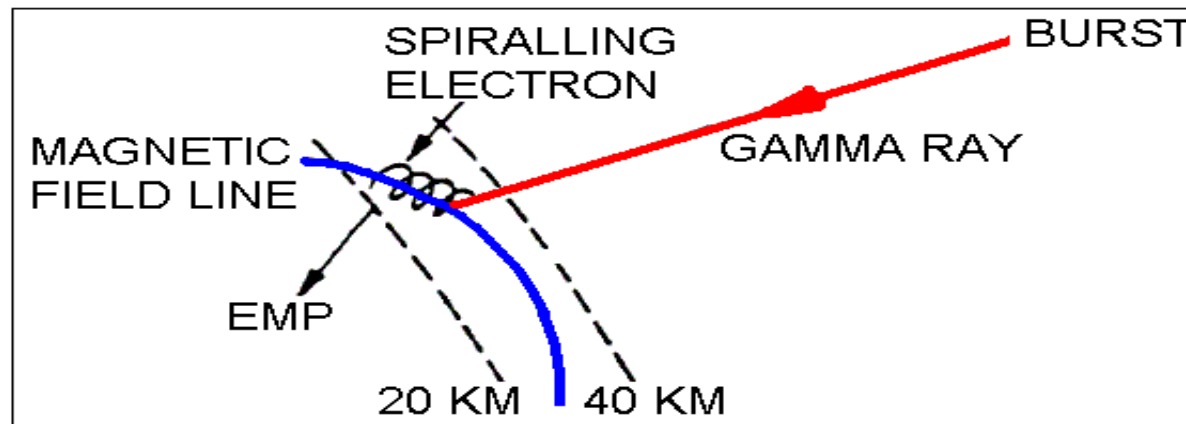
# **Rulemaking to Require Mitigation Strategies for Beyond Design Basis Events Underway**

- **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**

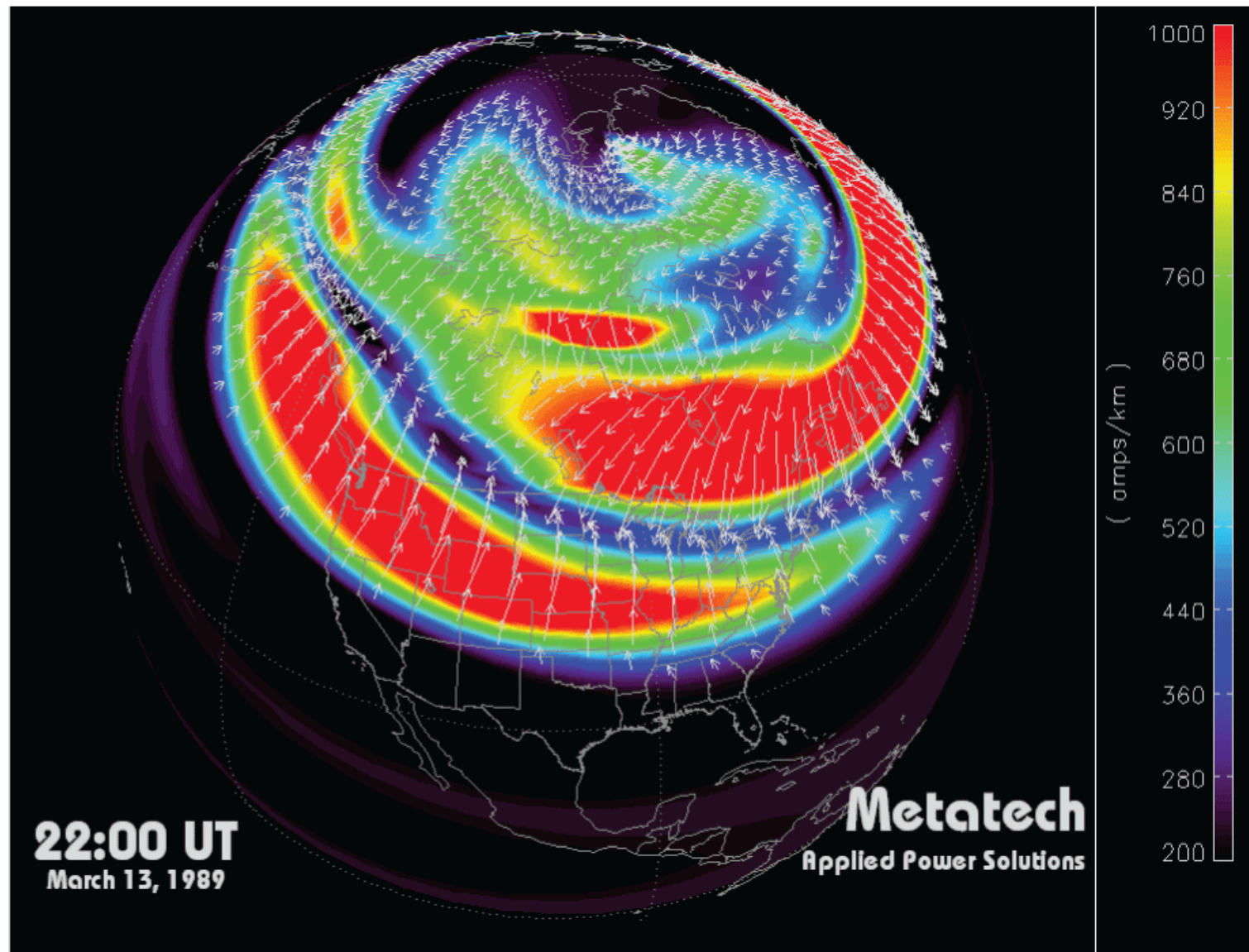
# Man-Made EMP Threatens Electrical Systems



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**