Andrew Whittaker, University at Buffalo

Reducing overnight capital cost of advanced reactors using equipment-based seismic protective technologies

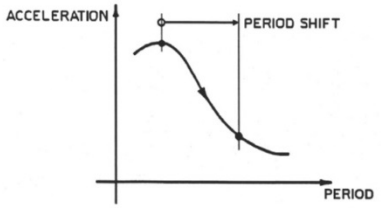
Team members

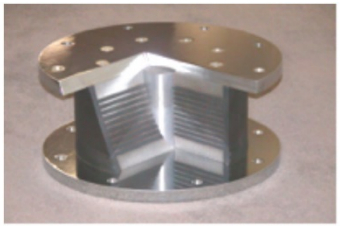
- Michael Constantinou, UB
- M. Sivaselvan, UB
- Kourosh Shirvan, MIT
- David Scott, EPRI
- Michael Cohen, TerraPower
- Harlan Bowers, X-energy
- Ben Kosbab, SC Solutions
- Troy Morgan, Exponent

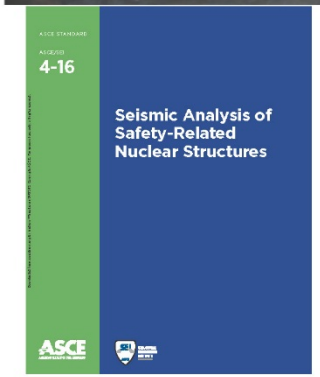
- Modular packages of seismic seismic protective systems to enable use of NOAK equipment in advanced reactors
- Cradle-to-grave project to deliver tools, hardware, assembly procedures and regulatory guidance
- Disruptive philosophy to fundamentally change a flawed deign paradigm
- Builds on prior developments by the team members (including NUREG/CRs) and DOE research in the late 1980s

Goal

- Fundamentally transform the design of structures, systems and components (SSCs) in advanced reactors, maintaining safety and driving down OCC







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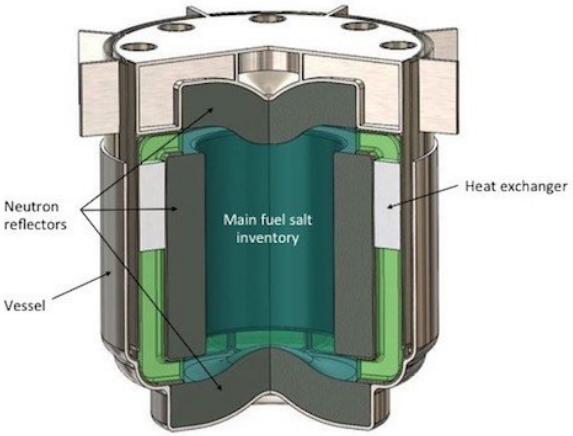
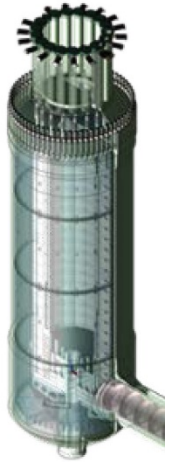
Multi-disciplinary project team

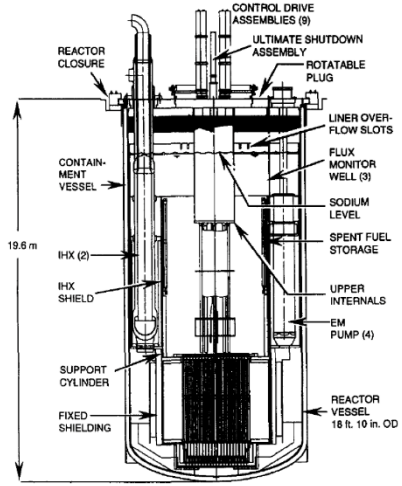
- Identify safety-class SSCs in two fundamentally different advanced reactors and describe generically
- Characterize cost as a function of intensity of earthquake shaking (i.e., the seismic penalty)
- Identify design spaces for SSCs
- Develop and prototype 2D and 3D seismic protective systems for SSCs
- Verify and validate numerical models of the 2D and 3D seismic protective systems
- Develop MIL simulation methods for equipment qualification, combing analysis and physical testing
- Develop mandatory language and commentary for ASCE 4-21 and ASCE 43-23
- Move products to the AE marketplace and socialize with NRC



TerraPower



X-energy



Gluekler et al. (1997)

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Project is transformational

- Products will be technology neutral but proven for SSCs in two advanced reactors
- Cradle to grave
  - Technology, tools, hardware, qualification, regulatory pathway
- Performance targets include
  - NOAK for all safety-class SSCs
  - Minimum OCC
  - Adequate plant safety
  - MIL seismic qualification
  - Regulatory pathway
- NOAK for safety-class SSCs
  - One time analysis, design, design-space identification, documentation, shop drawings, seismic qualification, tooling
  - SSCs optimized for operational performance

Challenges, opportunities and connections

- Biggest challenges: to build a cost data base for SSCs (i.e., quantify the seismic penalty) and adapt proven buildings technologies for nuclear applications
- Opportunities: develop and prototype 2D and 3D packages of protective systems, verify and validate numerical models, MIL (hybrid) simulation methods, be disruptive and drive change
- MEITNER workshop: build connections with advanced reactor vendors (nuclear technology companies), explain what can be achieved with seismic protective technologies, discuss supply chains, introduce design spaces for SSCs