

# Seismic isolation of nuclear power plants



Andrew Whittaker, Ph.D., S.E.

Professor

Director, MCEER

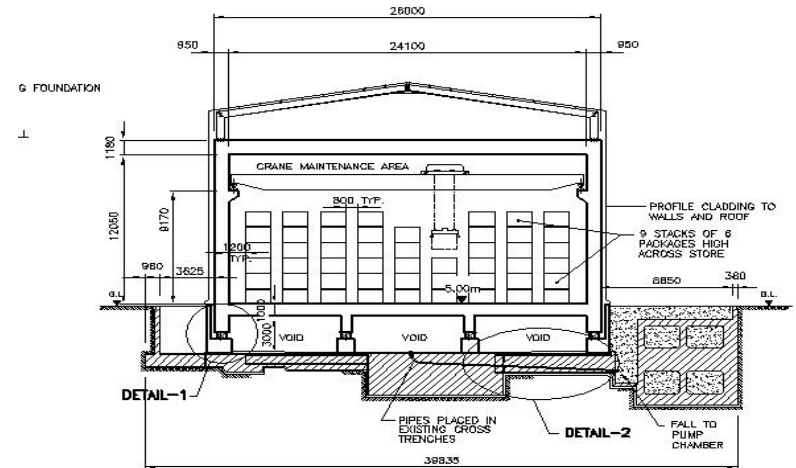
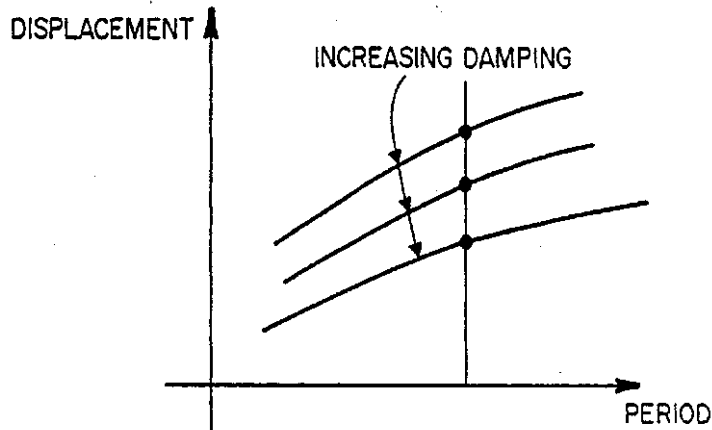
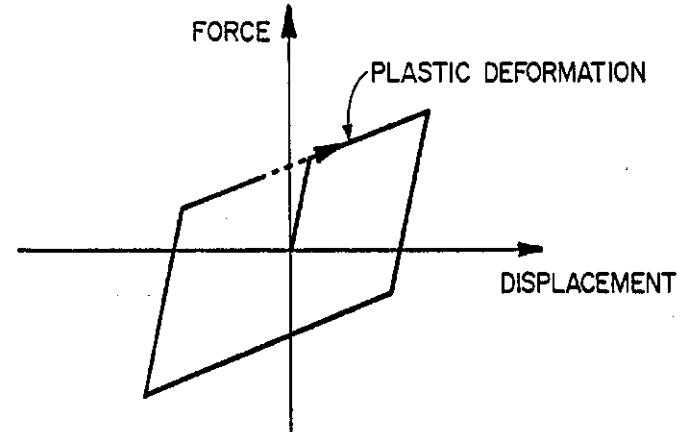
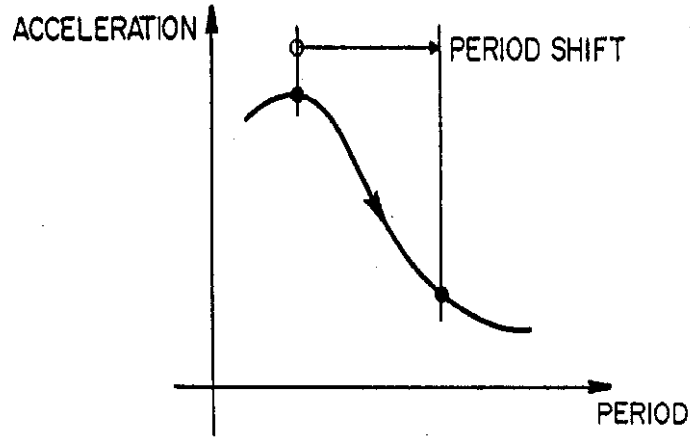
Chair, ASCE Nuclear Standards Committee

Department of Civil, Structural and Environmental  
Engineering

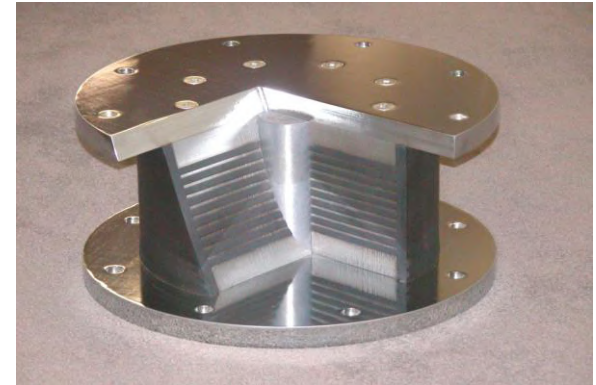
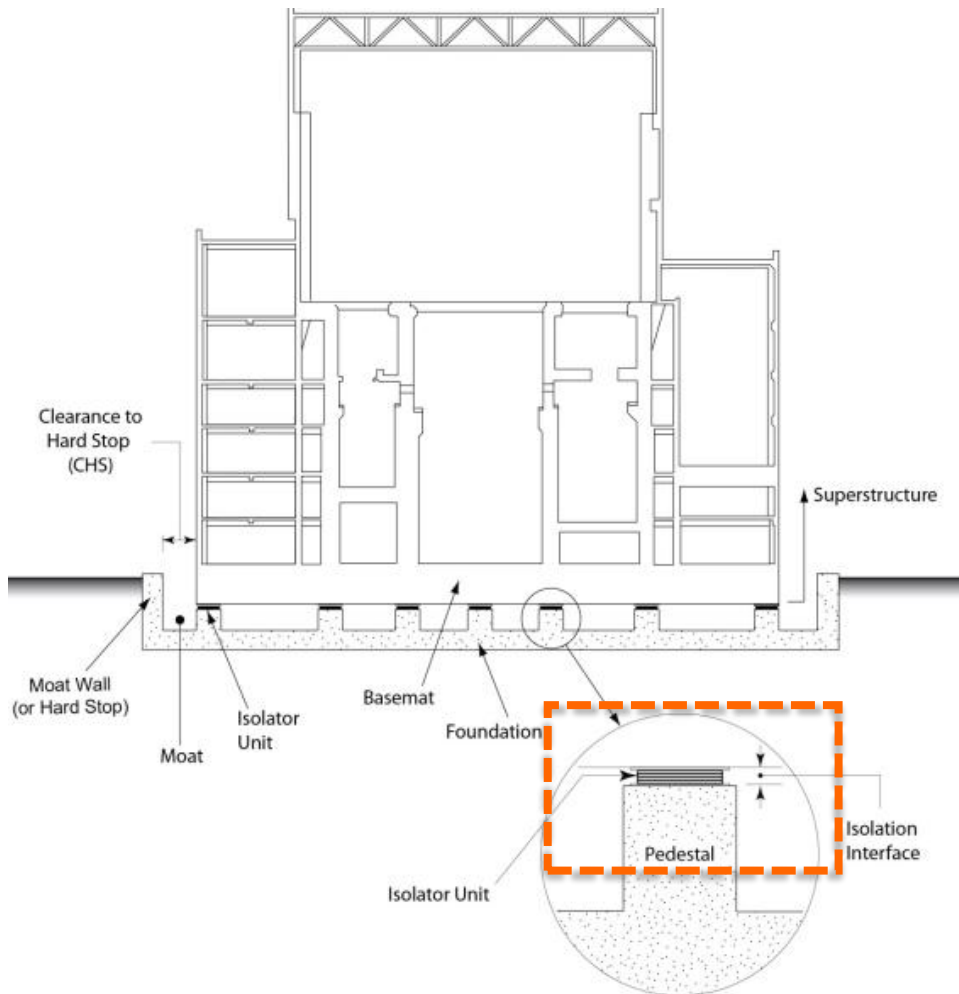
University at Buffalo



# Seismic isolation: basis

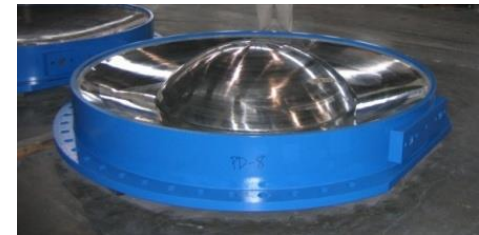
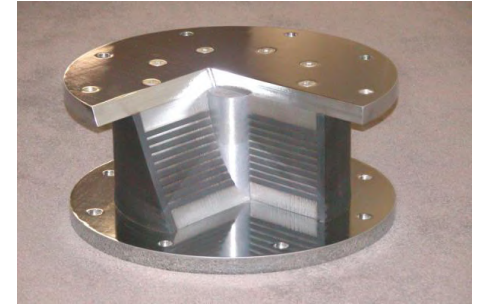


# Seismic isolation: isolators

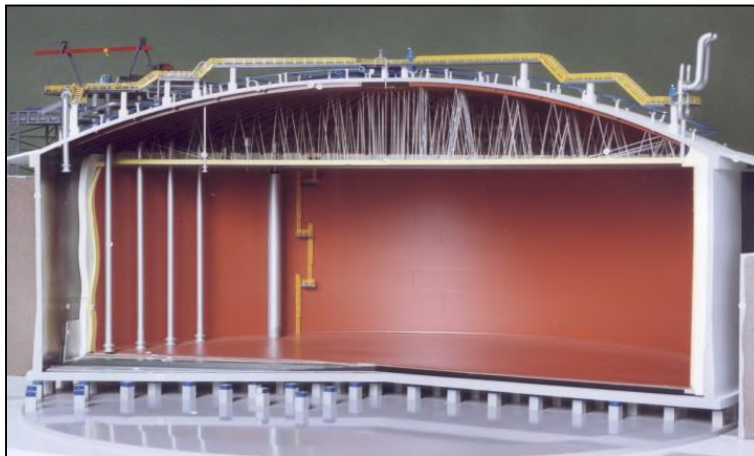


# Seismic isolation: impediments

- Lack of new build nuclear construction
- Technology unfamiliar to *nuclear* A/E firms
  - 30 year US history for buildings and infrastructure
- No prior use in US nuclear facilities
  - DOE complex or commercial nuclear fleet
- Benefits not quantified
  - Now addressed: safety and ROM cost
- Lack of regulatory guidance
  - Now addressed: ASCE/SEI Standard 4-16, 3 NUREG/CRs
- Lack of analysis tools
  - Now addressed: LS-DYNA, ABAQUS, OpenSees, all V+V'd
- Lack of appropriate SPRA tools
  - Now addressed: published techniques, ASCE/SEI 4-16



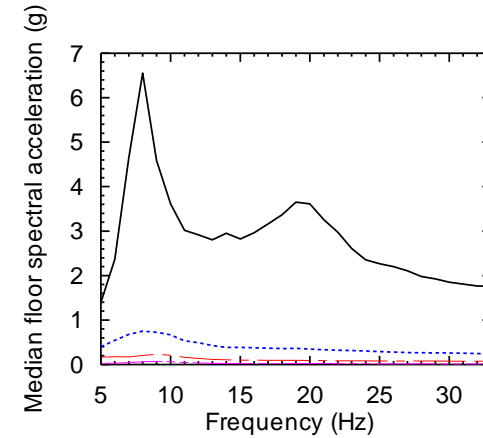
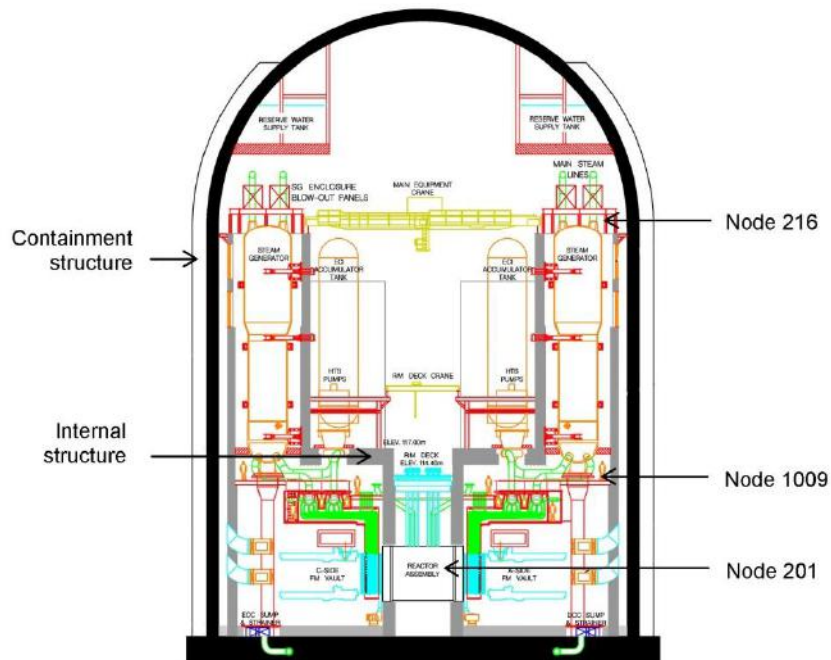
# Seismic isolation: applications



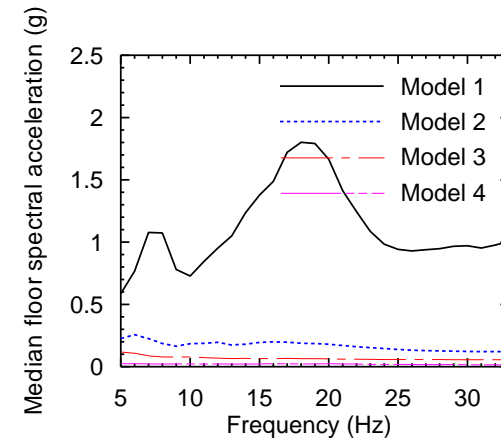


# Seismic isolation: benefits

- A game changer
  - Risk reduction



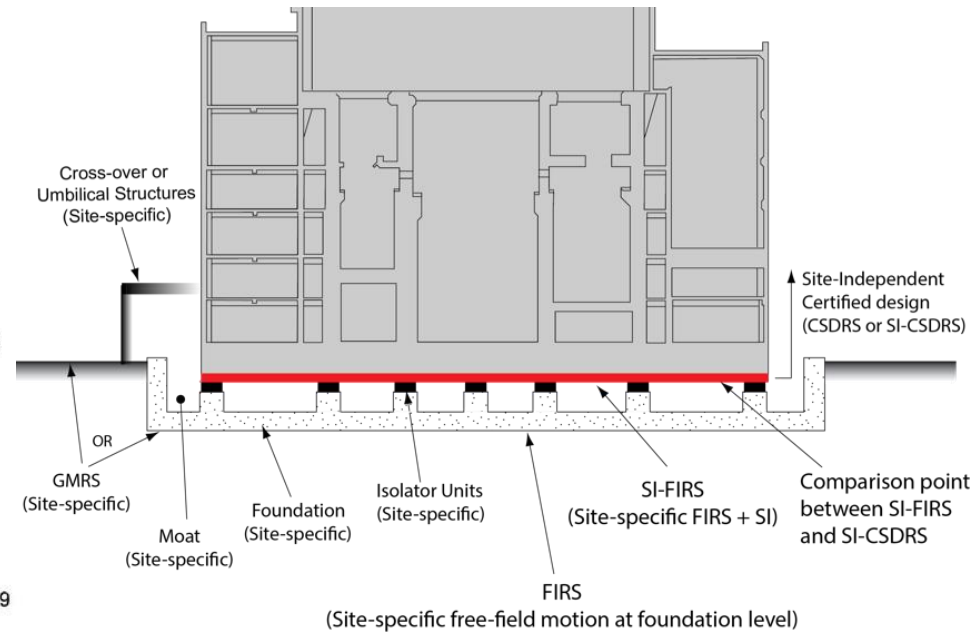
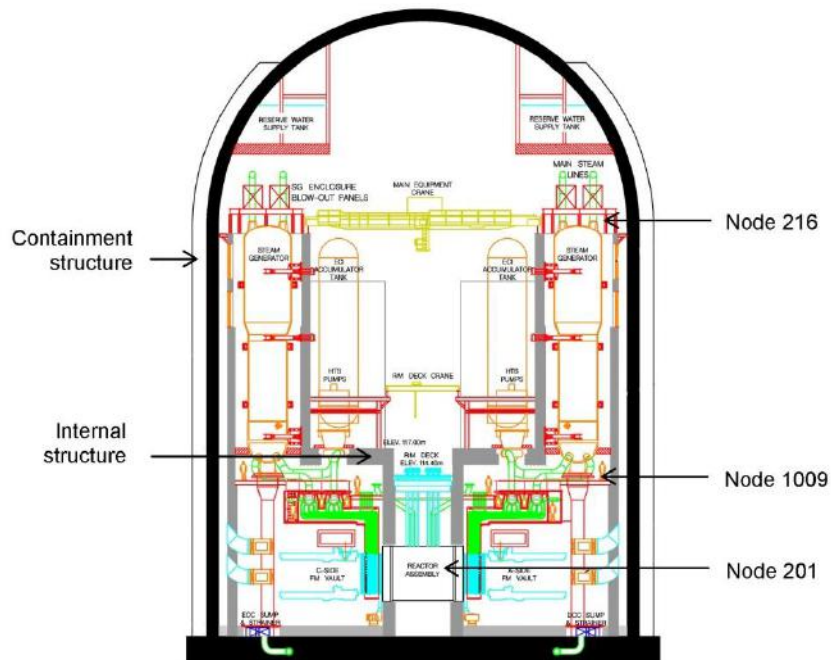
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# Seismic isolation: benefits

- A game changer
  - Certified designs

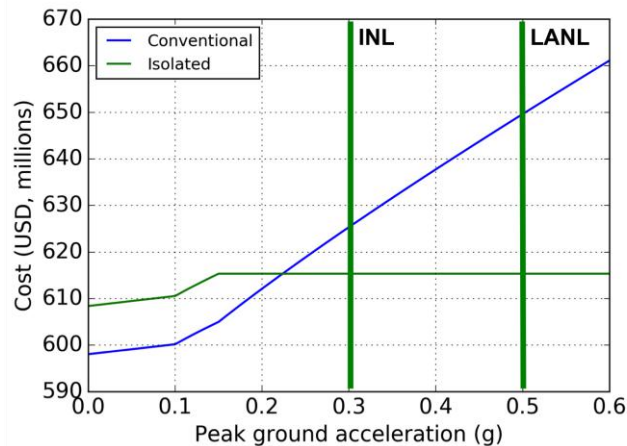
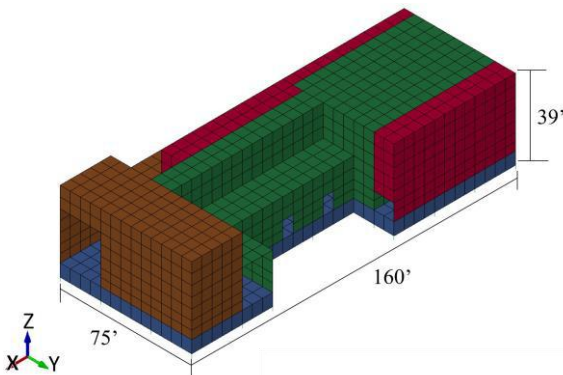






# Seismic isolation: benefits

- A game changer
  - Construction cost



INL/EXT-16-40122

## Characterizing the Benefits of Seismic Isolation for Nuclear Structures: A Framework for Risk-Based Decision Making

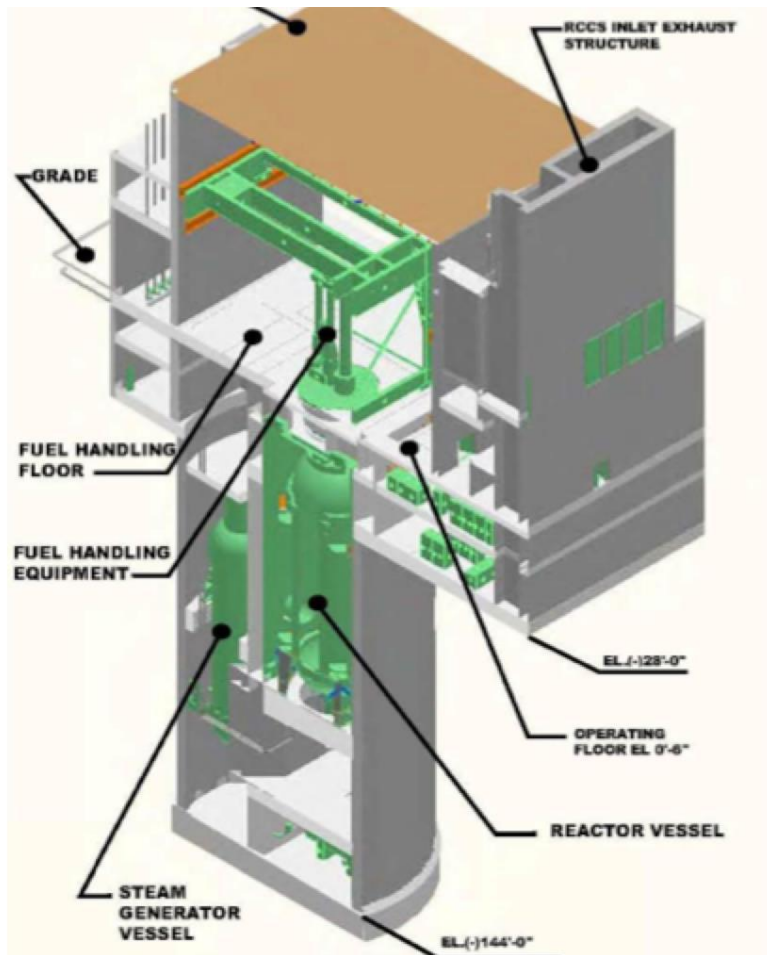
INL Seismic Research Group

November 2016



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# Seismic isolation: SMRs and ARs



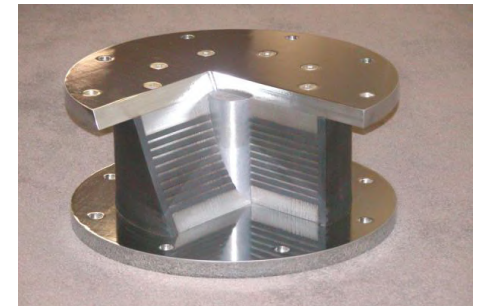
NuScale, 2016



www.generationmpower.com

# Frequently asked questions

- Is seismic isolation a mature technology?
  - Yes, 30 years of history in the United States
- Can seismic isolation increase safety?
  - Yes, with risk reductions by orders of magnitude
- Can seismic isolation reduce construction cost
  - Yes, less rugged SSCs, capacity reduction by 5+
  - Yes, speedier review, isolation system only
  - Tipping point: PGA of 0.15g to 0.20g
- Can seismic isolation accommodate increases in site-specific hazard?
  - Yes, only the isolation system affected, not the SSCs
- Is seismic isolation broadly applicable to NPPs?
  - Yes, all sites of nuclear facilities in the United States
  - Buildings to reactor vessels to diesel generator sets



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[awhittak@buffalo.edu](mailto:awhittak@buffalo.edu)

716-645-4364