

Power Transformer seismic resilience

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U.S. DEPARTMENT OF
ENERGY

OFFICE OF
ELECTRICITY

Acronyms

FEM (finite element modeling)

INL (Idaho National Laboratory)

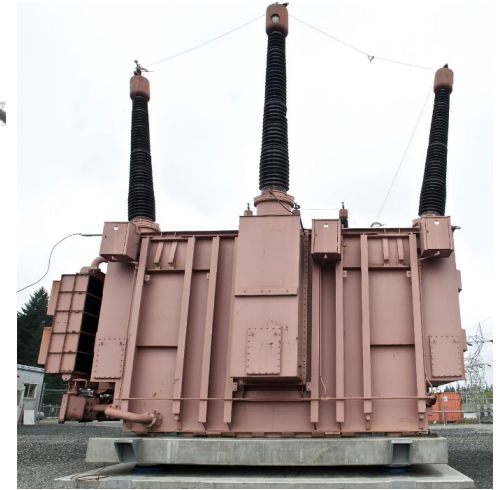
WEGAI (W.E. Gundy and Associates, Inc.)

CITRC (Critical Infrastructure Test Range Complex)

Project Summary

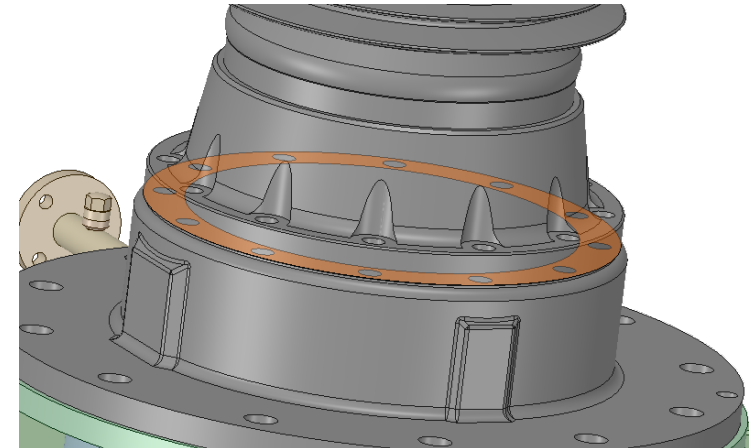
Problem

- Dynamic Coupling – “whipping” during an earthquake can cause insulator bending failure
 - Insufficient requirements
- Current base isolation solutions are costly and may be inadequate



Proposed solution

- Bushing mount decoupler
 - Cost effective
 - Retrofit flexibility
 - Fits wide range of transformer designs

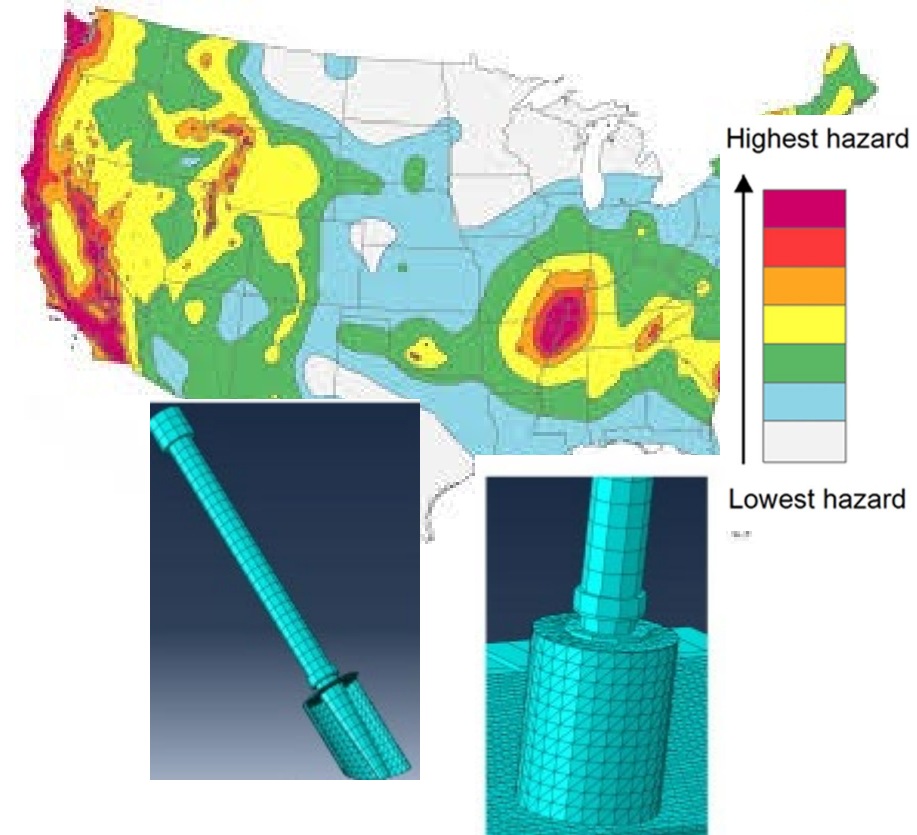


The Numbers

- DOE PROGRAM OFFICE:
OE – Transformer Resilience and Advanced Components (TRAC)
Cybersecurity, Energy Security, and Emergency Response (CESER)
- FUNDING OPPORTUNITY:
XXX
- LOCATION:
Idaho Falls, ID
- PROJECT TERM:
06/01/2023 to 09/30/2026
- PROJECT STATUS:
Beginning
- AWARD AMOUNT (DOE CONTRIBUTION):
\$750k [OE] \$1,200k [CESER]
- AWARDEE CONTRIBUTION (COST SHARE):
\$0
- PARTNERS:
University at Buffalo, Utility partner TBD

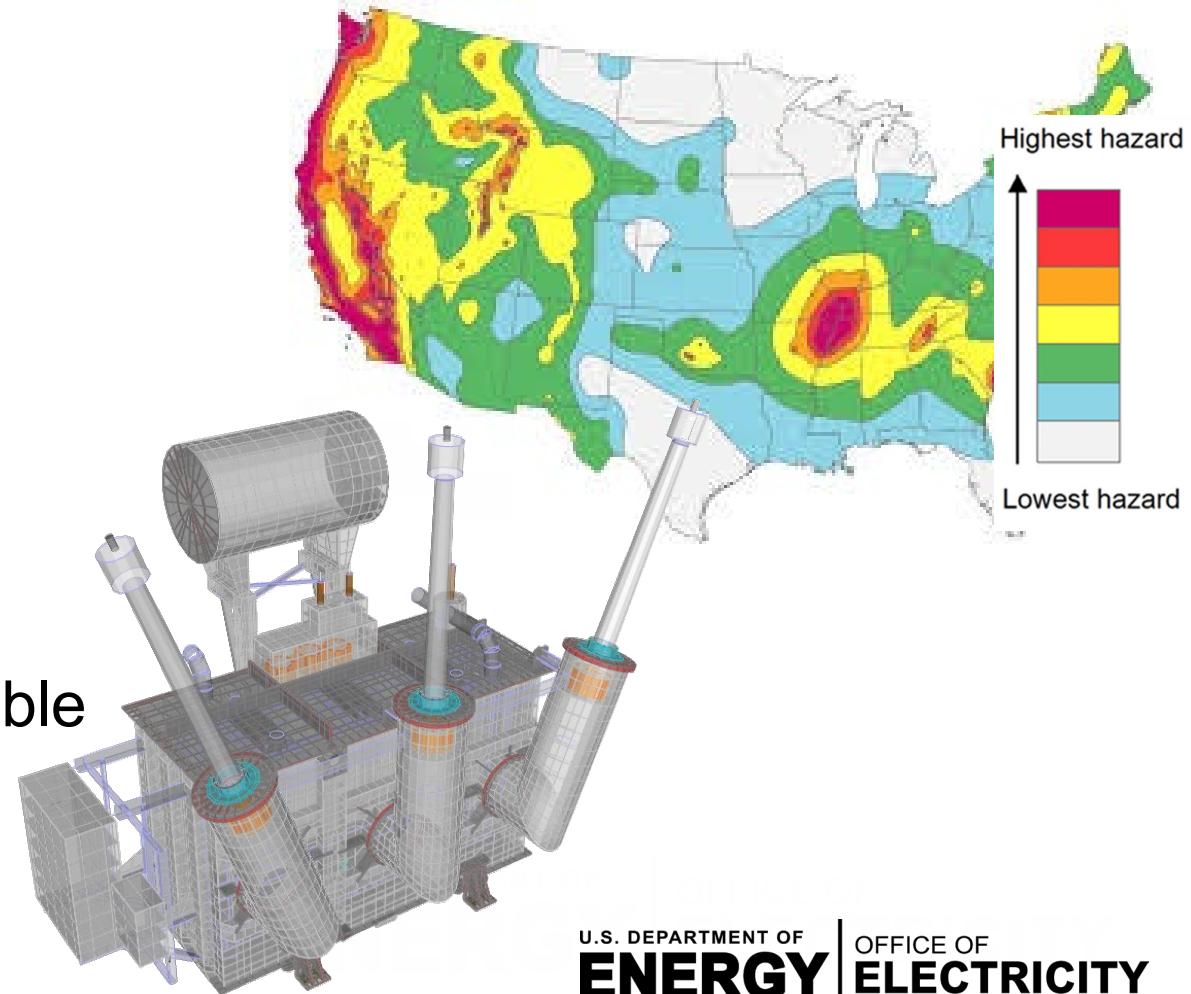
Technical Approach – Year 1

- Develop design requirements for bushing isolator
 - Parametric studies
 - Current industry standards
 - Functional/Environmental/structural requirements
- Identify materials for construction
- Begin experimental studies on design concepts



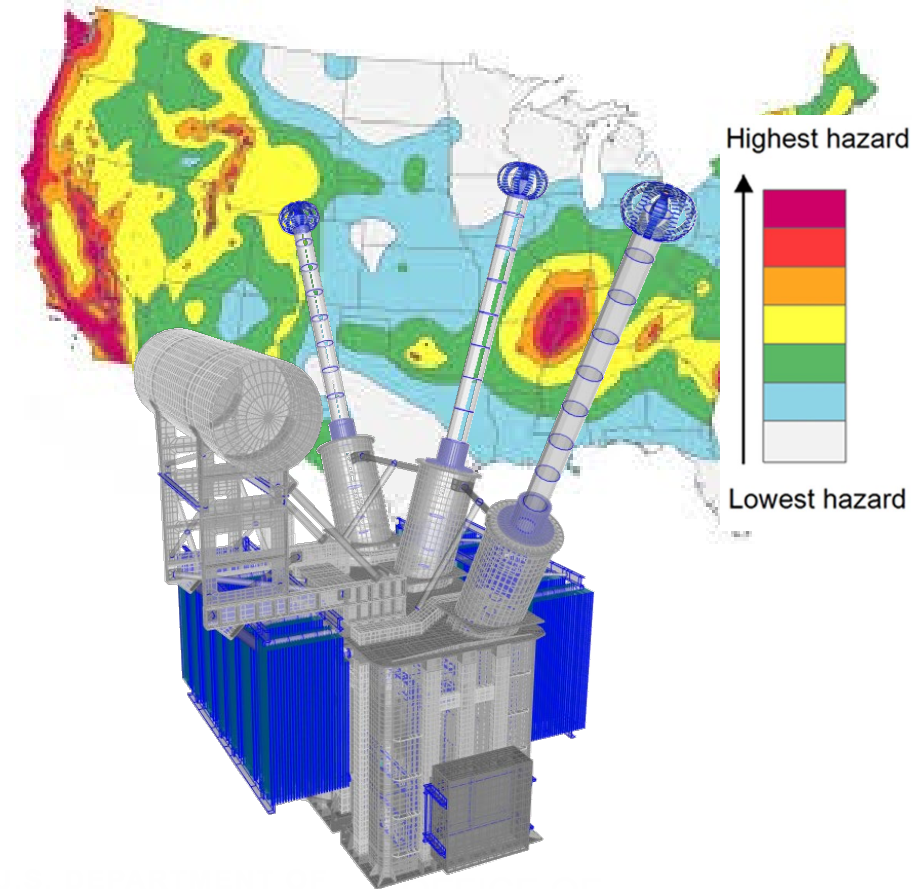
Technical Approach – Year 2

- Identify a design concept for detailed characterization
- Perform detailed mechanical characterization with small-medium scale experiments
- Validate and update numerical models based on testing results
- Begin coordinating time on large shake table test



Technical Approach – Year 3

- Finalize design concept based on experimental data
- Perform snap back tests and shake table test on a fully dressed (decommissioned) power transformer with and without design concept implemented
- Validate and update models based on testing results
- Finalize guidelines for bushing isolator design

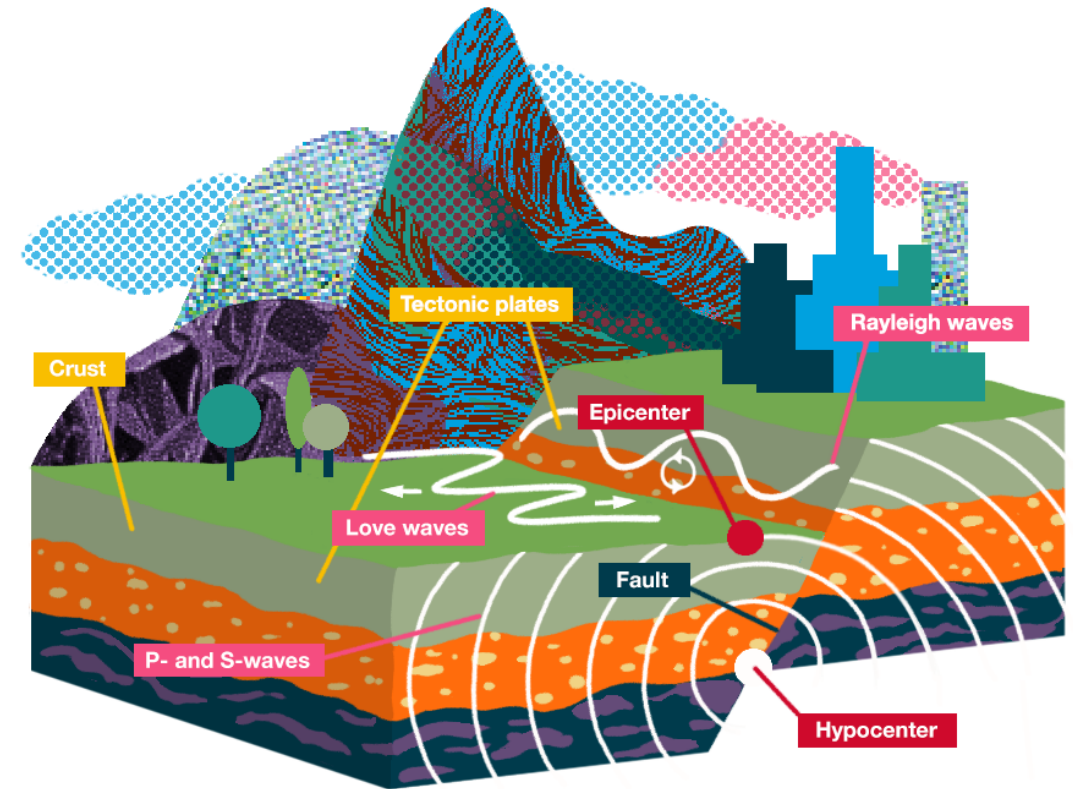


Timeline – Year 1

Milestone Name/Description	Criteria	End Date	Type	Completion
1.1 FY23 Q4: INL will Develop design requirements for the bushing isolator solution	Annual Report	09/30/2023	Annual Milestone (Regular)	0%
1.2 FY24 Q1: Identify potential materials for the bushing isolator and develop a set of conceptual designs that meet the requirements in Task 1.	Quarterly report	12/30/2023	Quarterly Progress Measure (Regular)	0%
1.3 FY24 Q2: Construct a pre-prototype 1.4 FY24 Q3: Experimentally characterize the pre-prototype and update models based on results	Quarterly report	6/30/2024 planned	Quarterly Progress Measure (Regular)	0%
1.5 FY24 Q4: Publish and disseminate results.	Annual report Submitted Journal Article	9/30/2024 planned	Annual Milestone (Regular)	0%

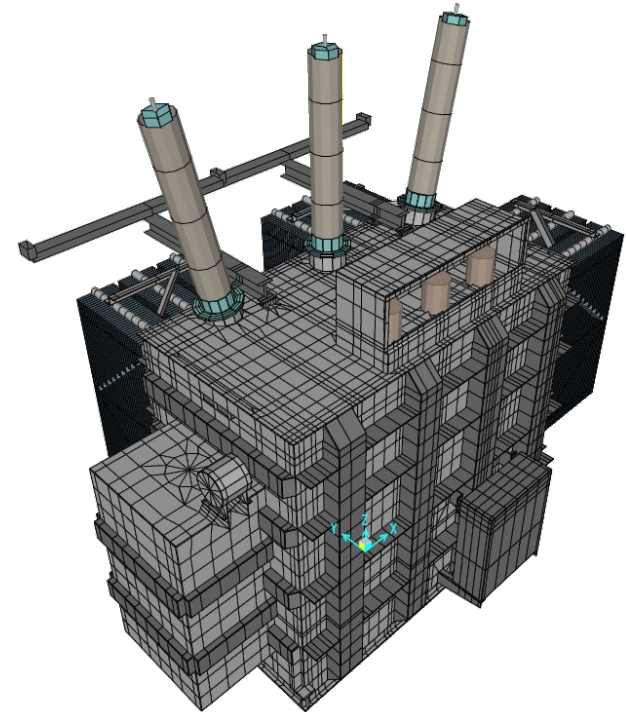
Impact/Commercialization

- Journal publications, conference presentations and IEEE working group presentations
 - Inform design standards for power transformers
- Patentable bushing isolator devices



Future Work

- Kick off project
- Begin developing simulations and researching design parameters



THANK YOU

This project is supported by the U.S. Department of Energy (DOE) Office of Electricity's Transformer Resilience and Advanced Components (TRAC) program. It is led by Andre Pereira, TRAC program manager. This project is also supported by DOE Office of Cybersecurity, Energy Security, and Emergency Response (CESER) lead by Dave Howard.



Backup Slides

