## Senior Design Project Description for SPRING 2017
## Project Title: Finite Element Analysis on Exhaust Stacks (EPRI_STACK)

Supporter: EPRI

Supporter Technical Representative: ASSIGNED

Faculty Mentor: _____ ASSIGNED __X__ TBD (check one)

Single Team __X__ Dual Team _____ (check one)

Personnel (EN/ET): _____ E, _____ Cp, _____ Cv, __5__ M, _____ SE

(Complete if the number of students required is known)

Expected person-hours:  (250 per student)

### Description of Project:

EPRI and NEI are working with the electric industry and NRC to develop a simplified method (TMRE) to calculate target hit probabilities for Exhaust stacks from electric generators (diesel, combustion turbine, steam boiler, etc.) are exposed to the elements.  The purpose of this project is to perform finite element analysis on a diesel generator exhaust or steam exhaust stacks getting hit by a tornado generated missile. The impact could potentially perforate, partial crimp and total crush the exhaust which may cause a challenge to the performance of the diesel generator and other safety related equipment.  The number of damaging missiles and vulnerable equipment are essential piece for this method.

The outcome of the analysis will be used to identify "robust targets" and/or reduce the number of "damaging missiles". Currently the industry is faced with a challenge to address tornado borne missiles hazard.

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### Initial Project Requirements (e.g. weight, size, etc.):

Build a finite element model of the steam exhaust stack (target) using ANSYS, LS-DYNA or any available commercial FEA. The model is a simple pipe with an elbow built parametrically to provide flexibility for the user to change the geometry (pipe ID, thickness, pipe length, elbow angle and radius). Boundary conditions are simple, basically the exhaust could be modeled as a cantilever that is fixed at the bottom of the pipe or modeled as a horizontal pipe (or tank) with different boundary conditions.

Requirements for the analysis included:

- Nonlinear material properties for the missile and the target, to capture yielding (energy dissipation) in both components and to allow stress distribution.
- Different tornado generated missiles (7/8 plywood, 3" pipe, 6" pipe)
- Post process the results to show the amount of deformation in the target and whether or not the perforation occurred.
- Missile(s) will be given an initial velocity pertinent to its type

**Expected Deliverables/Results:**

A report summarizing the results of the analysis will be provided.

**List here any specific skills or knowledge needed or suggested (If none please state none):**

Willingness to learn FEA software