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NRC's audit results for the PWROG's FLEX OpE data collection and analysis

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NEI FLEX Summit
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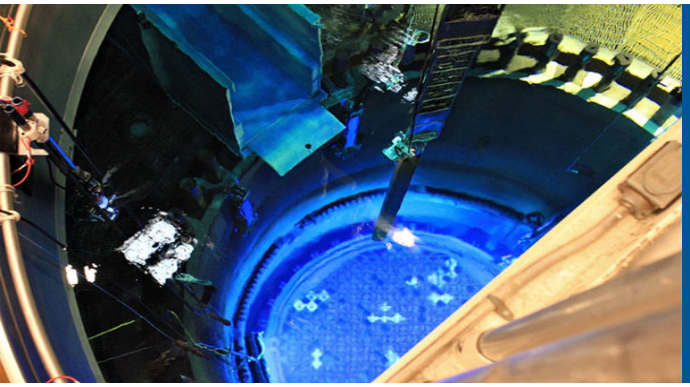



Objective

- Brief History
- Audit Team
- PWROG approach
- Audit Results
- Path Forward
- Questions

Project History

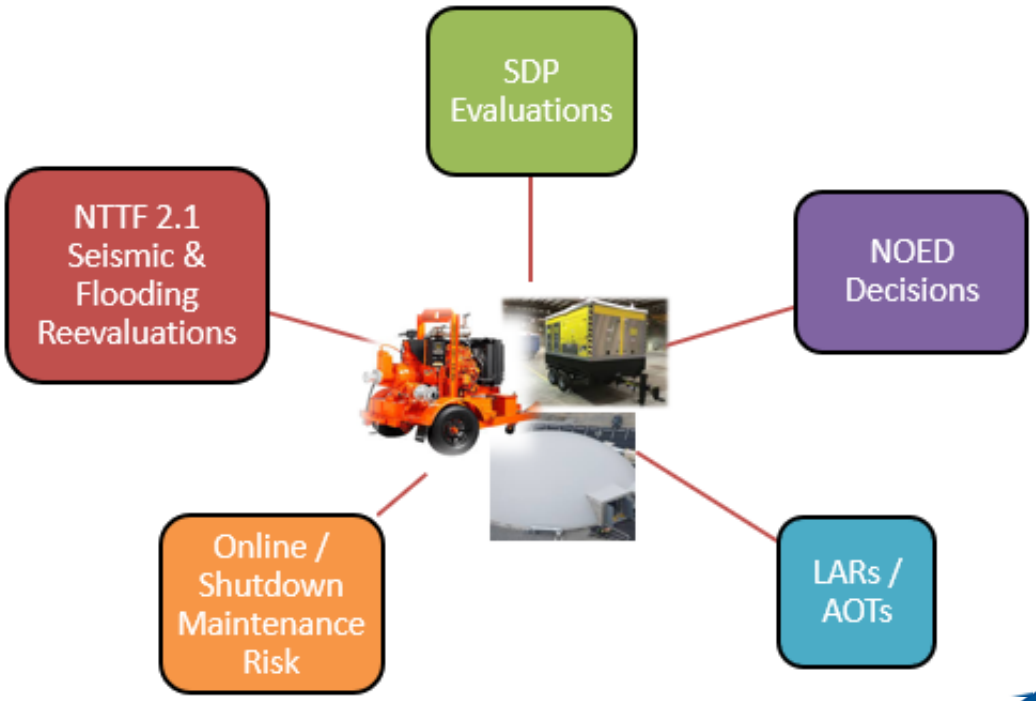
- One of the two remaining challenges to crediting FLEX
  - Highlighted from the beginning of crediting FLEX project
- Credit for FLEX has been provided
  - Data is needed to support efficient decisions
- EPRI initially had the lead
- PWROG took over the effort (2017)
  - Access to the PWROG report (March 2020)
  - Audit – March 24-25 extended to May 4th

Commission's PRA policy statement:

"PRA evaluations in support of regulatory decisions should be as realistic as practicable and appropriate supporting data should be publicly available for review."

Audit Team

- Team
  - Matt Humberstone (NRR/DRA)
  - John Lane (RES/DRA)
  - Mike Montecalvo (NRR/DRA)
  - Frank Arner (RI SRA)
  - Zhegang Ma (INL)
- Idaho National Lab Support
  - Shawn St. Germain
  - John Schroeder
  - Andrea Mack (Statistics)
  - Cynthia Gentillon (Statistics) retired
  - Cory Atwood (Statistics) retired
  - Tom Wierman



PWROG Approach

PWROG-18043-P rev.0, "FLEX Equipment Data Collection and Analysis"

- GOAL: Consistent with NUREG/CR-6928, "Industry-Average Performance for Components and Initiating Events at U.S. Commercial Nuclear Power Plants"
- Did not address CCF or unavailability
- Data Compilation
  - Data from all nuclear sites
  - Condition reports (CRs), preventative maintenance (PMs), and EPRI PM database
- Component Boundaries
- Common FLEX equipment (589 pieces of equipment, 16 categories)
- 32 total parameters (16 categories with FTS and FTR)

PWROG Approach Continued

PWROG-18043-P rev.0, "FLEX Equipment Data Collection and Analysis"

- Used INL's Nuclear Reliability and Operating Experience Database (NROD) and the RADS calculator to support their calculations
- **Data Analysis Approach (3 methods)**
  - **Empirical Bayes (EB)** (8 parameters)
  - **Jeffreys Noninformative Prior (JNI)** (13 parameters)
  - **Weakly Informed Prior (WIP)** (11 parameters)
    - Parameters with weak operating experience
    - < 50 demands or <100 hrs operating
    - Represents 54 out of 582 pieces of FLEX equip (~ 9%)
    - Uses permanently installed equip as priors
    - Engineering judgement

PWROG Results

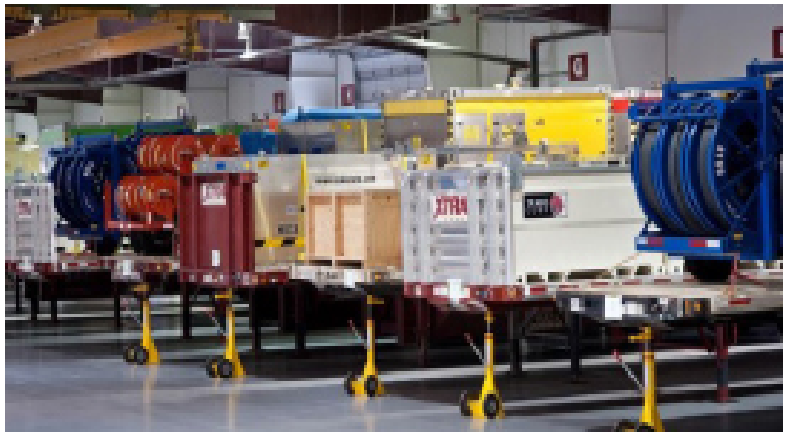
PWROG-18043-P rev.0, "FLEX Equipment Data Collection and Analysis"

- Table 6-1, "Generic Failure Rates for FLEX Equipment"
  - Failure Mode
  - Distribution
  - Mean
  - Method (EB, JNI, or WIP)

- Most failure probabilities are greater than similar permanently installed equipment
  - FLEX DGs (5x FTR, 3x FTS)
  - Combustion Turbine Generator (1.5x FTS, 0.2x FTS)
  - Motor-Driven PD pump (80x FTR, 8.7x FTS)

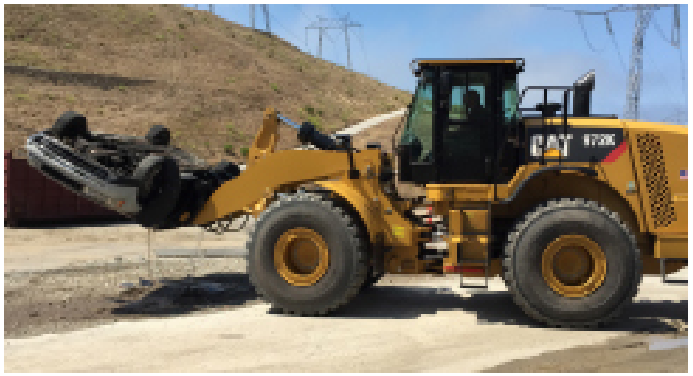
Audit Result/Observations

- **PROCESS**
  - Need for explicit failure definition
  - Formal update process needed
  - Component Boundary definitions
- **DATA COLLECTION**
  - Overall data pedigree (PM frequencies aligned with actual starts)
  - Data collected from before FLEX was officially established
  - Does run data reflect loaded conditions
- **DATA ANALYSIS**
  - WIP method relies heavily on engineering judgement
  - Potential errors in WIP results
  - CCF and unavailability



Path Forward

- PWROG to review the NRC's audit summary
  - Potential adjustments to process
  - Finalize FLEX OpE data analysis report
    - Publicly available



- NRC audit team plans to review PWROGs final report
  - NRC will establish a position on final report
  - The process/results could have significant changes

Conclusions

- NRC Audit Summary (ADAMS Accession No. ML20155K827)
- INL/EXT-20-58327, “Evaluation of Weakly Informed Priors for FLEX data,” (ADAMS Accession No. ML20155K834)

- **Audit Conclusion**

  If these observations and concerns are addressed in the PWROG’s updated approach, this will provide a robust basis for FLEX equipment failure probabilities.

Questions?