



PWROG

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Westinghouse – PA-SEE-2067 DVR Applications

Nuclear Industry Power Uprating Workshop – May 29, 2024

Issue Summary

- **Data Validation and Reconciliation (DVR) is a modeling tool that uses existing plant instrumentation, fundamental equations, and statistical methods to derive fundamental relationships between plant parameters.**
- **With a large suite of instrumentation available to a nuclear plant, including the LEFM, the output of these sensors and their respective information could be used to reduce instrument uncertainty when used in concert.**
- **DVR is being considered as a tool to support power uprates as another means to perform or enhance a Measurement Uncertainty Recapture (MUR) uprate**

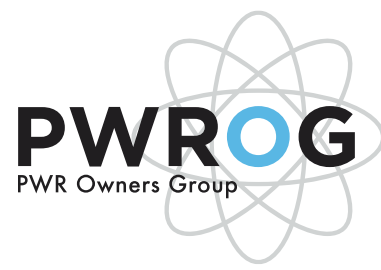
Issue Applicability

- **This proposed Project Authorization (PA) has cafeteria (plant specific) and generic aspects and is applicable to all PWR plants.**
 - This could be extended to BWRs
- **This PA supports initiatives associated with PA-SEE-1985, Uprating Task Force**
 - This PA specifically supports the focus on closing gaps to allow for expanded savings and benefits from upratings
- **Westinghouse developed this PA-SEE-2067 to help utilities save money implementing MUR uprates coming up with common tasks to perform work and cost share.**

PA-SEE-2067: Data Validation and Reconciliation (DVR) Applications

Regulatory Nexus & Status

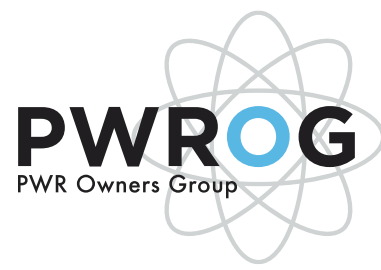
- **DVR Topical Report (TR) documented in EPRI report 3002018337, “Use of Data Validation and Reconciliation Methods for Measurement Uncertainty Recapture.”**
- **SER – issued in draft August 2023, formally approved in January 2024**
- **Opportunity to consider various applications of DVR across the PWR fleet**



Cafeteria Scope
Pilot Plant #1 (assumed to be Salem)

PA Scope Summary

- **Task 1 – Develop DVR example model to determine the MUR uprate uncertainty**
 - Implement more detailed assessments to better understand the capabilities of the DVR when applied to a MUR uprate
 - Determine if higher power increases could be safely obtained
 - Better assess which parameters have the most profound impact on the DVR methodology – it may be possible to improve on the overall uncertainty of the MUR uprate
 - Step 1: Develop plant-specific model, determine what the measurement uncertainty inputs are required to be for key instrumentation, investigate potential improvements in instrumentation
 - Step 2: Fine tune example DVR model for online implementation
- **Initial MUR expected to be in the 1.2%-1.4%, without a UFM like LEFM**



Cafeteria Scope

Pilot Plant #2 (TBD)

PA Scope Summary

- **Task 2 – Develop DVR example model for a plant with installed LEFM**
 - Generate a pilot plant DVR model for a plant with LEFM installed (similar to Task 1)
 - Example plant has already implemented a MUR uprate utilizing LEFM
 - Assumes a DVR model already exists for pilot plant
 - Using existing DVR model, determine appropriate measurement uncertainties for all plant instruments included in DVR model
 - Determine what improvements can be made to the existing DVR model to improve measurement redundancies and reduce uncertainty
 - Tune the unit-specific DVR model to allow for continuous reliable online reconciliation of plant data
 - This model will be used to support Tasks 4 & 5

Generic Scope

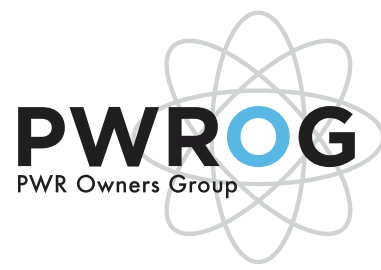
PA Scope Summary

- **Task 3 – Licensing Support to Implement the DVR Topical Report**
 - Preparation of a LAR for Task 1 example plant to replace the MUR uprate uncertainty associated with the UFM with the MUR uprate uncertainty based on the DVR TR
 - Investigate the potential for a generic example LAR, including areas of synergies that could be identified which would allow for consistent industry approaches for utilities planning to implement DVR
 - Provide engineering analysis and justification to determine responses to the Conditions and Limitations (11 total) included in the NRC Safety Evaluation (SE) for the DVR Topical Report
 - The results of this task will be integrated into an example LAR template that can be used as a starting point for plants

Generic Scope

PA Scope Summary

- **Task 4 – Guidebook to use DVR for MUR uprates (based on example model)**
 - Development of a guidebook that addresses potential troubleshooting, identifies key instrumentation whose loss would have a large impact on the uncertainty, and operational experience (OE) that has been accumulated across industry
 - Collect relevant data and information to support the guidance of the application and use of DVR at nuclear power plants
 - Develop report for general methodology of applying DVR for MUR uprates, including requirements and operational guidelines
 - The feasibility of using the DVR method in place of the LEFM will be studied to determine what power level can still be achieved without a significant power reduction (use of Task 2 DVR model)



Cafeteria Scope

Applies to various plants with LEFM's pursuing additional MWt via DVR

PA Scope Summary

- **Task 5 – Use of DVR to correct for conservative LEFM bias (power recovery)**
 - Study the use of DVR to decrease the uncertainty associated with a utility that has already performed an MUR via a LEFM (pilot example in Task 2).
 - Objective is to identify potential incremental increases in power through the decrease in the uncertainty associated with the implementation of the LEFM
 - LEFM included in DVR model
 - Has the potential to allow for a small uprate (i.e., 1.4% MUR, this may allow the utility to extend the uprate to ~1.7%)

PA-SEE-2067: Data Validation and Reconciliation (DVR) Applications



PA Scope Summary

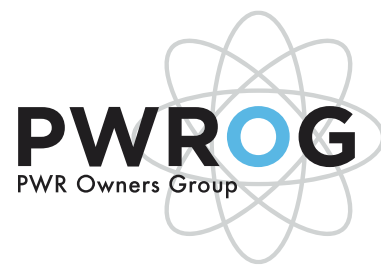
Cafeteria Scope
Pilot Plant #1 (assumed to be Salem)

• Task 6 – DVR Engineering Reconciliation Study with the CROSSFLOW UFM

- Examine the data link requirements to collect and gather information from the plant computer / historian and to understand the process for data gathering. Determine the scope and price.
 - The data link engineering change is considered plant-specific scope and is not included in this task.
- Assess and determine how the reduced uncertainty will be applied to the plant calorimetric program algorithm (i.e., swapping the input from CROSSFLOW Cf to the input from the DVR model Cf).
- Determine the scope and price for reconciliation between current power level data and SPU/EPU power levels and review all potential impacts.
- Develop the DOR and scope for the engineering change packages to accomplish the implementation of the DVR method.
- Determine the scope and price to revise the previous MUR documentation from the NSSS and BOP from CROSSFLOW to reflect the use of the DVR method.
- Assess any deviations in the site's cyber-security due to the change in methods and determine the scope and price.
- The results and conclusions will be documented in a summary report. This work will need to be implemented after the completion of this summary report.

There are other design aspects related to the implementation of an MUR power uprate that are not covered by this PA. The scope of this PA is only to evaluate the DVR method for the MUR power uprate. Other aspects of an MUR that are required for implementation (e.g. Chapter 15 analyses, design changes, ECP, and other scope) will be plant specific.

PA-SEE-2067: Data Validation and Reconciliation (DVR) Applications



Benefits

- **Example added value of (0.1%-0.3%) power increase on 1000 MWe plant provides 1-3 MWe of available output**
 - Additional output equal to (~\$250k-825K at \$35/MWeh per year)
- **Using DVR to maintain plant power in the event of lost LEFM avoids lost power production capability (assuming a 72 hour LCO)**
- **Common guidebook and LAR reduces expenses to utilities and provides consistency across industry**
- **This PA should streamline the NRC review time for MUR uprates using DVR with the common approach**
- **The PWROG has been successful in licensing other generic programs which have saved utilities schedule time and money**