



**UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS  
WASHINGTON, DC 20555 - 0001**

July 31, 2023

Mr. Daniel H. Dorman  
Executive Director for Operations  
U.S. Nuclear Regulatory Commission  
Washington, DC 20555-0001

**SUBJECT:** EPRI TOPICAL REPORT 3002018337, "USE OF DATA VALIDATION AND RECONCILIATION METHODS FOR MEASUREMENT UNCERTAINTY RECAPTURE"

Dear Mr. Dorman:

During the 707<sup>th</sup> meeting of the Advisory Committee on Reactor Safeguards (ACRS), July 12-14, 2023, we completed our review of the Electric Power Research Institute (EPRI) topical report 3002018337, "Use of Data Validation and Reconciliation Methods for Measurement Uncertainty Recapture," and the associated staff draft safety evaluation (SE). Our Accident Analyses - Thermal Hydraulic Subcommittee reviewed this topic on June 7, 2023. During these meetings, we had the benefit of discussions with the staff and representatives from EPRI. We also had the benefit of the referenced documents.

**CONCLUSIONS AND RECOMMENDATION**

1. The methodology documented in the EPRI-3002018337 topical report presents a viable roadmap for future use of data validation and reconciliation (DVR) methods for measurement uncertainty recapture (MUR).
2. The limitations and conditions in the draft staff SE report provide a well-documented set of expectations for future submittals applying this methodology.
3. The SE report should be issued.

**BACKGROUND**

DVR is a methodology to obtain more accurate estimates of process variables by using multiple measurements and engineering relationships that provide analytic redundancy. DVR is typically used to accurately estimate the core thermal power (CTP). Nuclear reactor licenses specify the maximum CTP that can be achieved while maintaining margins to acceptance criteria that provide reasonable assurance that public health and safety are not compromised. If the CTP cannot be estimated accurately during operation, the actual operating power must be reduced by the amount of the measurement uncertainty. These CTP measurement uncertainties are typically dominated by inaccuracies in the calorimetric algorithm, especially feedwater flow rate

and temperature. Reducing uncertainty allows licensees to operate at thermal powers closer to the licensed limit, which increases their electrical power output. EPRI estimates that electric power may be increased by as much as 15 MWe in some facilities.

DVR methodologies have been used by the nuclear power industry in the U.S., Brazil, and Germany since 1999; the EPRI proposed methodology follows a German Standard, VDI-2048. At a high level, DVR utilizes known analytic relationships or 'constraints' between multiple measurements (e.g., feedwater flow and pressure drop across components) to estimate the most likely value of a parameter that is consistent with all those measurements; thus, DVR methodologies estimate a more accurate CTP.

## **DISCUSSION**

The EPRI topical report provides a roadmap to implement DVR at a facility for the purpose of MUR. A licensee can use the methodologies described in the report to develop a specific license amendment request (LAR) for staff review. The limitations and conditions in the staff SE report provide a well-defined set of expectations for future submittals applying this methodology. For example, the conditions and limitations require that the licensee verify that all measurement uncertainties be appropriately quantified, normally distributed, and statistically independent. In addition, they require that measurement data are obtained at steady state and that constraint equations are correct, appropriate, and behave linearly in the region of interest. The application of DVR methodology to MUR is sound, and the SE report should facilitate the review of future applications.

The staff review was thorough and was supplemented by a structured approach based on risk-informed principles. In their review, the staff addressed the 'risk triplet' questions: what can go wrong? how likely is it? and what are the consequences? In addition, they added a fourth consideration - what is the risk of answering these three questions incorrectly? The staff concluded that the main safety concern (what can go wrong) was due to various failures that would result in a reconciled power estimate that was too low (i.e., non-conservative). Because it was not possible to quantitatively determine the likelihood for various failure modes and scenarios, the staff focused on evaluating reasonable worst-case scenarios and concluded the associated consequences would be negligible.


While we agree that EPRI's DVR approach is sound, additional items should be considered during DVR LAR reviews. These include more frequent calibration of key sensors and potential burden on control room operators. Because implementation at a new site requires "tuning" of all the DVR constraint equations, the process may introduce subjective biases and should be verified carefully by the staff. Finally, the integrity of data for plant calibration needs to be protected.

## SUMMARY

The methodology documented in EPRI-3002018337 topical report presents a viable roadmap for future use of DVR methods for MUR. The limitations and conditions in the draft staff SE report provide a well-documented set of expectations for future submittals applying this methodology. The SE report should be issued.

We are not requesting a formal response from the staff to this letter report.

Sincerely,



Signed by Rempe, Joy  
on 07/31/23

Joy L. Rempe  
Chairman

## REFERENCES

1. Electric Power Research Institute, Report 3002018337, "Use of Data Validation and Reconciliation Methods for Measurement Uncertainty Recapture," November 2020, (ML21053A031) (Proprietary Version, Non-Publicly Available) and (ML21053A030) (Nonproprietary Version, Publicly Available).
2. United States Nuclear Regulatory Commission, "Draft Safety Evaluation Report for EPRI Technical Report 3002018337, 'Use of Data Validation and Reconciliation Methods for Measurement Uncertainty Recapture', (EPID No. L-2021-TOP-0006)," March 28, 2023, (ML23079A038) (Proprietary, Non-Publicly Available).
3. Verein Deutscher Ingenieure (VDI), VDI-2048, Part I-Control and quality improvement of process data and their uncertainties by means of correction calculation for operation and acceptance tests, ICS 17.020;27.010, September 2017.
4. Verein Deutscher Ingenieure (VDI), VDI-2048, Part 2-Uncertainties of measurement during acceptance tests on energy conversion and power plants Examples; August 2003.

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