

POLICY ISSUE
NOTATION VOTE

RESPONSE SHEET

TO: Carrie M. Safford, Secretary

FROM: Commissioner Crowell

SUBJECT: SECY-22-0019: Rulemaking Plan for Revision of
Embrittlement and Surveillance Requirements for
High-Fluence Plants in Long-Term Operation

Approved X Disapproved Abstain Not Participating

COMMENTS: Below Attached X None

Entered in STARS

Yes X
No

BRADLEY
CROWELL

Signature

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BRADLEY CROWELL
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**Commissioner Crowell's Comments on SECY-22-0019,
"Rulemaking Plan for Revision of Embrittlement and Surveillance Requirements for High-
Fluence Plants in Long-Term Operation"**

Extended operation of nuclear power plants is an option that many licensees will continue to pursue in order to make use of vital assets in continuing to provide clean power. In doing so, part of the duty of the NRC is to ensure the operational envelope of these plants remain within well-understood regimes. These plants were generally designed and constructed with a 40-year lifetime in mind, with a potential 20-year license renewal. Today, a number of licensees are planning to seek approval or are approved to operate beyond 60 years, which takes some plants into extended operational conditions that were not originally contemplated during the initial licensing phase given the lack of available data at the time with respect to certain phenomena, such as embrittlement, due to accumulated neutron irradiation. Put simply, when reactors operate, neutrons from the core hit the reactor pressure vessel (RPV) steel, and over time this can reduce the RPV's ability to withstand the various stresses of operating over extended timeframes.

The NRC staff is concerned that the requirements of the current regulations governing RPV material surveillance will not be sufficiently protective for a subset of light-water reactors that continue to operate beyond 40 years and experience higher neutron fluence levels. This paper requests Commission consideration of options related to RPV embrittlement and surveillance requirements for light-water reactors, including options for rulemaking. The embrittlement trend curve referred to in current NRC regulations¹ was based on surveillance test data available in 1988. Subsequently, in the more than 30 years since, additional data has become available which suggests that the initial forecast or predictions of embrittlement was under-estimated relative to the accumulated neutron fluence experienced during the extended lifetime of many reactors. The impact of embrittlement and options to mitigate the phenomena is complicated by plant-specific considerations that need to be accounted for. But this trend is described well by the staff in its review of RG 1.99² which highlights that in the coming years dozens of plants are likely to operate in a condition where RPV strength is non-conservatively predicted by continuing to rely on the older data.

Gathering data as a reactor ages is also important to ensure there is reasonable assurance that the facility continues to operate within its established safety margins. However, under the current regulations, impacted licensees can delay withdrawal and testing of surveillance capsules in a fashion that may not support practical operational timelines. The data from these capsules is intended to confirm embrittlement predictions to reduce uncertainty and better assess the real, current condition of the RPV. The staff recognizes the current deferral practice could impact "long-term confidence in the integrity of the RPV for certain plants – that is, about 10 years from now."³ This rulemaking would provide an evidence-based alignment of the potential burden of capsule withdrawal to the operational timelines and impacts of embrittlement on the facility.

The scope of these concerns does not extend to every operating nuclear power reactor but does appear to reflect a real reduction in potential vessel performance. Accordingly, I agree with

¹ 10 CFR 50.61 and the related Regulatory Guide (RG) 1.99

² Assessment of the Continued Adequacy of Revision 2 of Regulatory Guide 1.99 (ML19203A089)

³ SECY-22-0019 at 2.

the staff recommendation that a generic, long-term solution should be established and tailored to impacted facilities. I therefore approve the staff's recommended Alternative 2, a focused solution where the impact is limited to potentially affected reactor vessels. The Advisory Committee on Reactor Safeguards supports this approach as well, finding that it "will increase assurance of adequate protection against RPV failure at higher fluences" while focusing the use of a new or revised embrittlement model on plants of concern.⁴ To the extent practicable, the staff should ensure the proposed rule is performance based and includes appropriate provisions to ensure surveillance data is available to cover a plant's projected period of operation.

Finally, I share Commissioner Hanson's view that the staff should assess and consider, as appropriate, stakeholder interest in a regulatory framework that also permits voluntary adoption of alternative vessel embrittlement calculations for operating and new reactors as part of this rulemaking effort. Other correlations to set safety margins may be more appropriate for new designs, and to the extent applicants elect to use more refined correlations where appropriate justification and data gathering support them, the regulatory framework should facilitate that.

⁴ Letter from Joy L. Rempe, Chairman, Advisory Committee on Reactor Safeguards, to Chairman Hanson (April 28, 2022) at 3.