

Section 19

FINAL SUPPORTING STATEMENT FOR FRACTURE TOUGHNESS REQUIREMENTS FOR PROTECTION AGAINST PRESSURIZED THERMAL SHOCK EVENTS

10 CFR 50.61, 10 CFR 50.61(b)(1), 10 CFR 50.61(b)(3), 10 CFR 50.61(b)(4),
10 CFR 50.61(b)(6) and 10 CFR 50.61(c)(3)

DESCRIPTION OF THE INFORMATION COLLECTION

Pressurized thermal shock (PTS) events are system transients in pressurized water reactors (PWRs) that can cause severe overcooling (thermal shock) concurrent with or followed by immediate repressurization to a high pressure. The thermal stresses caused by rapid cooling of the reactor vessel's inside surface combine with the pressure stresses to increase the potential for fracture if an initiating flaw is present in low-toughness material. Such material may exist in the reactor vessel beltline, adjacent to the core, where neutron radiation gradually embrittles the material during the plant lifetime. The toughness of reactor vessel materials is characterized by a "reference temperature for nil ductility transition" (RT_{NDT}). The value of RT_{NDT} at a given time in a vessel's life is used in fracture mechanics calculations to determine whether assumed pre-existing flaws would propagate as cracks when the vessel is stressed.

10 CFR 50.61 establishes a screening criterion, a limiting level of embrittlement beyond which operation cannot continue without further plant-specific evaluation. The screening criterion is given in terms of RT_{NDT} , calculated as a function of the copper and nickel contents of the material and the neutron fluence according to the procedure given in 10 CFR 50.61, and called RT_{PTS} to distinguish it from other procedures for calculating RT_{NDT} .

Effective January 1996, 10 CFR 50.61 was amended to change the procedure for calculating the amount of radiation embrittlement when surveillance data meet the credibility criteria of Regulatory Guide 1.99, Revision 2, "Radiation Embrittlement of Reactor Vessel Materials." The amended rule requires resubmittal of the RT_{PTS} analysis if there is a significant change in projected values of RT_{PTS} , or upon a request for a change in the expiration date for operation of the facility.

10 CFR 50.61(b)(1) requires each PWR licensee, other than a licensee for a PWR for which 10 CFR 50.82(a)(1) certifications have been submitted, to have projected values of RT_{PTS} , accepted by the NRC, for each reactor vessel beltline material for the expiration date of the operating license (EOL) fluence of the material. The assessment must use the calculation procedures given in 10 CFR 50.61 and must specify the bases for the projected value, including the assumptions regarding core loading patterns, and must specify the copper and nickel contents and the fluence value used in the calculation for each beltline material. This assessment must be updated whenever there is a significant change in projected values of RT_{PTS} , or upon a request for a change in the expiration date for operation of the facility.

10 CFR 50.61(b)(3) provides for submittal and anticipated approval by the NRC of detailed plant-specific analyses, submitted to demonstrate acceptable risk with RT_{PTS} above the screening limit due to plant modifications, new information, or new analysis techniques. 10 CFR 50.61(b)(4) requires licensees for PWRs for which the analysis required by 10 CFR

50.61(b)(3) indicates that no reasonably practical flux reduction program will prevent RT_{PTS} from exceeding the PTS screening criterion to submit a safety analysis to determine what, if any, modifications to equipment, systems, and operation are necessary to prevent potential failure of the reactor vessel as a result of postulated PTS events if continued operation beyond the screening criterion is allowed. This analysis must be submitted at least three years before RT_{PTS} is projected to exceed the PTS screening criterion.

10 CFR 50.61(b)(6) states that if NRC concludes that operation of the facility with PT_{PTS} in excess of the PTS screening criterion cannot be approved on the basis of the licensee's analyses submitted in accordance with 10 CFR 50.61(b)(3) and (4), the licensee shall request and receive approval by NRC prior to any operation beyond the criterion.

10 CFR 50.61(c)(3) requires licensees to report to NRC any information believed to significantly improve the accuracy of the RT_{PTS} values. The burden is included in the estimates for RT_{PTS} assessment under Item 12 of this Supporting Statement.

In response to 10 CFR 50.61, the licensees of operating PWRs have submitted the fluence predictions and chemical composition data and these have now been accepted. A number of licensees have undertaken flux reduction programs for those plants having high values of RT_{PTS} . Some of these are still under review. Submittal of requests to operate beyond the screening criterion [per 10 CFR 50.61(b)(4)], is expected to be made during the years 2013-2016. The number of licensees affected by 50.61(b)(4) is estimated at 3 during this clearance period because some plants have instituted sufficient flux reduction to prevent them from reaching the screening criteria before end of life.

JUSTIFICATION

1. Need for the Collection of Information

Maintaining the structural integrity of the reactor pressure vessel of light-water-cooled reactors is a critical concern related to the safe operation of nuclear power plants. To assure the structural integrity of reactor vessels, the NRC has developed regulations, including 10 CFR 50.61, and regulatory guides, including Regulatory Guide 1.99, Revision 2, to provide analysis and measurement methods and procedures to establish that the reactor vessel has adequate safety margin for continued operation. The fracture toughness of the vessel materials varies with time. As the plant operates, neutrons escaping from the reactor core impact the vessel beltline materials causing embrittlement of those materials. The information collections in 10 CFR 50.61, as well as those in 10 CFR 50.60 and 10 CFR 50 Appendix G and 10 CFR 50 Appendix H, provide estimates of the extent of the embrittlement, and evaluations of the consequences of the embrittlement in terms of the structural integrity of the vessel.

2. Agency Use of the Information

The information and analyses required by 10 CFR 50.61 will be reported on the plant's docket pursuant to the provisions of 10 CFR 50.4 and reviewed by NRC to ensure the requirements of the regulation are met. There is a safety issue involved in the information collection requirement described above. By reviewing the submittals from the PWR licensees, the NRC can make certain that (a) all of them are aware of the potential threat to the integrity of their reactor vessel from pressurized thermal shock events, and (b) those that need to consider additional flux reduction in order to stay

below the screening criterion will become aware of the need as early as possible, when flux reduction is most effective.

3. Reduction of Burden Through Information Technology

There are no legal obstacles to reducing the burden associated with this information collection. The NRC encourages respondents to use information technology when it would be beneficial to them. NRC issued a regulation on October 10, 2003 (68 FR 58791), consistent with the Government Paperwork Elimination Act, which allows its licensees, vendors, applicants, and members of the public the option to make submissions electronically via CD-ROM, e-mail, special Web-based interface or other means. It is estimated that approximately 50% of the potential responses are filed electronically.

4. Effort to Identify Duplication and Use Similar Information

No sources of similar information are available. There is no duplication of requirements. NRC has in place an ongoing program to examine all information collections with the goal of eliminating all duplication and/or unnecessary information collections.

There are no other NRC or Federal government requirements regarding analyses for flux reduction or plant PTS safety analyses. Materials information leading to calculation of an RT_{NDT} value for the reactor vessel is submitted in response to the requirements of 10 CFR 50 Appendix G and 10 CFR 50 Appendix H, (See Supporting Statement included in this submittal as Section 18). For new plants, it appears in the final safety analysis report. During the operating life, the information is updated by the individual plant submittals that support requests for changes in the pressure-temperature limits.

5. Effort to Reduce Small Business Burden

This information does not affect small business.

6. Consequences to Federal Program or Policy Activities if the Collection is Not Conducted or is Conducted Less Frequently

If this information were not collected, the NRC would be unable to establish that each reactor pressure vessel has an adequate safety margin for continued safe operation.

7. Circumstances Which Justify Variations from OMB Guidelines

There are no variations from OMB guidelines in this collection of information.

8. Consultations Outside the NRC

Opportunity for public comment on the information collection requirements for this clearance package was published in the Federal Register on May 14, 2013 (78 FR 28244). No comments were received.

9. Payment or Gift to Respondents

Not applicable.

10. Confidentiality of Information

Confidential and proprietary information is protected in accordance with NRC regulations at 10 CFR 9.17(a) and 10 CFR 2.390(b). However, no information normally considered confidential or proprietary is requested.

11. Justification for Sensitive Questions

No sensitive information is requested under these regulations.

12. Estimated Industry Burden and Burden Hour Cost

The licensees of all 72 operating PWR plants are subject to the regulation. It is estimated that 30 plants would be affected by the RT_{PTS} assessment; approximately 6 plants would also be affected by the flux reduction analyses, and approximately 3 plants would be affected by the provisions of 10 CFR 50.61(b)(3) and (4).

Section	Number of Licensees	Reports per Licensee	Burden per Report	Total Annual Burden	Cost @ \$274hr
RT _{PTS} assessment	10	1	120	1,200	\$328,800
RT _{PTS} assessment	1	0.3333	1089	363	\$99,462
Flux reduction analyses	2	1	600	1,200	\$328,800
Provisions of 10 CFR 50.61(b)(3) and (4)	1	1	120	120	\$32,880
Total Reporting	14			2,883	\$789,942

Although each information collection contained in section 50.61 requires that a report or notification be submitted to NRC, the primary burden for each requirement is the preparation of the analysis or assessment that forms the basis for the report. Therefore, staff estimates that 90 percent of the burden for the requirements in 10 CFR 50.61 are attributable to recordkeeping (2,595 hours), and 10 percent of the burden (288 hours) is associated with submitting the required reports or notifications.

The provisions of this regulation affect 30 recordkeepers. An annualized total of 14 responses are expected each year during this clearance period.

13. Estimate of Other Additional Costs

The NRC has determined that the quantity of records to be maintained is roughly proportional to the recordkeeping burden and, therefore, can be used to calculate approximate records storage costs. Based on the number of pages maintained for a typical clearance, the records storage cost has been determined to be equal to 0.0004 times the recordkeeping burden cost. Because the recordkeeping burden is estimated to be 2,595 hours, the storage cost for this clearance is \$284.41 (2,595 hours x 0.0004 x \$274/hour).

14. Estimated Annualized Cost to the Federal Government

Licensee submittals will be evaluated by the staff at the estimated cost given below:

- 1) **RT_{PTS} Assessment:** The staff estimates that reevaluations of RT_{PTS} values will be submitted by 15 PWR licensees within the 3-year clearance period. (Of the 30 licensees affected by the RT_{PTS} assessment, as stated above, only 15 licensees will find significant changes that require NRC review.) On the average, 40 hours are estimated for the review of each submittal. Total review time is estimated at 600 staff hours at an estimated cost of \$164,400 (15 x 40 hours x \$274) over the 3-year clearance period. Thus, the estimated annualized burden is 200 hours at a cost of \$54,800.
- 2) It is estimated that an analysis and schedule for implementation of a flux reduction program will be submitted by 6 licensees over 3 years. Further, it is estimated that 25 hours will be required to review each submittal. Total review time is estimated to be 150 staff hours at a cost of \$41,100 (6 x 25 hours x \$274) over 3 years, or annualized for the 3-year clearance period, a burden of 50 hours per year at a cost of \$13,700.

It is estimated that evaluations of the requests under 10 CFR 50.61(b)(6) will be submitted by 3 licensees over 3 years. Further, it is estimated that 40 hours will be required to review each submittal. Total review time is estimated to be 120 staff hours at a cost of \$32,880 (3 x 40 x \$274) over 3 years, or annualized for the 3-year clearance period, a burden of 40 hours per year at a cost of \$10,960.

Total annual Federal cost = \$79,460 (\$54,800+ \$13,700+ \$10,960).

15. Reasons for Changes in Burden or Cost

There is no change in the overall burden; however, there has been an increase in the fee rate from \$257 to \$274 per hour.

16. Publication for Statistical Use

The collected information is not published for statistical purposes.

17. Reason for Not Displaying the Expiration Date

The requirement is contained in a regulation. Amending the Code of Federal Regulations to display information that, in an annual publication, could become obsolete would be unduly burdensome and too difficult to keep current.

18. Exceptions to the Certification Statement

None.

B. COLLECTIONS OF INFORMATION EMPLOYING STATISTICAL METHODS

Not applicable.