UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, D.C. 20555-0001

May 19, 1995

NRC GENERIC LETTER 92-01, REVISION 1, SUPPLEMENT 1: REACTOR VESSEL STRUCTURAL INTEGRITY

Addressees

All holders of operating licenses (except those licenses that have been amended to possession-only status) or construction permits for nuclear power reactors.

Purpose

The U.S. Nuclear Regulatory Commission (NRC) is issuing this supplement to Generic Letter (GL) 92-01, Revision 1, to require that all addressees identify, collect and report any new data pertinent to analysis of structural integrity of their reactor pressure vessels (RPVs) and to assess the impact of that data on their RPV integrity analyses relative to the requirements of Section 50.60 of Title 10 of the *Code of Federal Regulations* (10 CFR 50.60), 10 CFR 50.61, Appendices G and H to 10 CFR Part 50, (which encompass pressurized thermal shock (PTS) and upper shelf energy (USE) evaluations) and any potential impact on low temperature overpressure (LTOP) limits or pressure-temperature (P-T) limits.

Background

The staff issued GL 92-01, Revision 1, "Reactor Vessel Structural Integrity," on March 6, 1992, to obtain information necessary to assess compliance with requirements regarding RPV integrity in view of certain concerns raised in its review of RPV integrity for the Yankee Nuclear Power Station. All licensees submitted the information requested by July 2, 1992. Following receipt and review of licensee supplements responding to requests for additional information, the staff completed its review of licensee responses to GL 92-01, Revision 1, in the fall of 1994. The staff issued NUREG 1511, "Reactor Vessel Status Report," summarizing key aspects of the work in December 1994 [Ref. 1].

The staff has recently reviewed data relevant to the PTS evaluations of several plants. These reviews showed that licensees may not have considered all pertinent data in their responses to GL 92-01, Revision 1, or in their RPV integrity evaluations. It has now become apparent to the staff that no single organization has all the data relevant to RPV integrity evaluations. A major complicating element in this regard is that proprietary considerations have inhibited effective sharing of information.

It has been demonstrated that some RPV integrity evaluations are very sensitive to consideration of new data. For example, under certain conditions, changing the mean copper content for the limiting vessel beltline

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material by a few hundredths weight percent can change the predicted date for reaching the PTS screening criteria of 10 CFR 50.61 by several years. In addition, changes in estimates of mean copper content can affect the validity of PTS evaluations based on surveillance data. The staff will be considering the impact of these findings in plant-specific evaluations and in its longer-term reassessment of 10 CFR 50.61. PTS is a concern only for pressurized water reactors (PWRs) because boiling water reactors (BWRs) operate with a large inventory of water at saturated steam conditions and, therefore, are not subject to PTS.

However, in addition to concerns regarding PTS evaluations, consideration of additional, unreviewed RPV data can also affect evaluations for USE, P-T limits, and LTOP limits. These evaluations pertain to both PWRs and BWRs, except for LTOP limits, which apply only to PWRs. The staff recognizes that addressees have previously submitted data pertinent to these evaluations as required by the regulations and in responses to GL 92-01, Revision 1, and GL 88-11.

Based on currently available information, the staff believes that the near-term focus for RPV integrity will be the Palisades RPV which is predicted to reach the PTS screening criteria by late 1999, before any other plant. However, because of the importance of RPV integrity and the potential impact of additional, unreviewed data on existing RPV evaluations, the staff believes that this issue needs to be resolved on an expedited basis. Although the issues raised in this GL supplement were highlighted by concerns pertaining to PTS analyses, licensees should consider the effect of the reexamination of RPV data on all aspects of RPV structural integrity.

Regulatory Requirements

As required by 10 CFR 50.60(a), licensees for all light water nuclear power reactors must meet fracture toughness requirements and maintain a material surveillance program for the reactor coolant pressure boundary. These requirements are set forth in Appendices G and H to 10 CFR Part 50. 10 CFR 50.60(b) provides that proposed alternatives to the requirements of Appendices G and H to 10 CFR Part 50 may be used when an exemption is granted under 10 CFR 50.12. 10 CFR 50.61 provides fracture toughness requirements for protecting PWRs against PTS events. Licensees and permit holders have also made commitments in response to GL 88-11, "NRC Position on Radiation Embrittlement of Reactor Vessel Materials and Its Impact on Plant Operations," to use the methodology in Regulatory Guide 1.99, Revision 2, "Radiation Embrittlement of Reactor Vessel Materials," to predict the effects of irradiation as required by Paragraph V.A of Appendix G to 10 CFR Part 50.

Discussion

The staff focused its examination of the GL 92-01, Revision 1, data and other docketed information on the two key aspects of RPV structural integrity of primary concern to the NRC: PTS and USE. With respect to USE, licensees of

all plants were able to demonstrate compliance with the Appendix G requirements either through consideration of applicable data or through equivalent margins analyses. With regard to PTS, only two plants (Beaver Valley 1 and Palisades) were projected to exceed the PTS screening criteria of 10 CFR 50.61 before the end of operating life (EOL). As stated previously, based on data and analyses submitted for GL 92-01, Revision 1, and other recent reviews (e.g, Ref. 2), the staff has determined that not all licensees were aware of all the information pertinent to the analysis of the structural integrity of their RPVs. In addition, recent reviews have indicated larger-than-expected variabilities in weld chemical composition, which have, in turn, highlighted the extreme sensitivity of RPV embrittlement estimates to small changes in the chemical composition of beltline materials.

Recent NRC Staff Evaluations of RPV Structural Integrity Data for PTS Events

The staff issued a safety evaluation report to the licensee for Palisades on the variability of reactor vessel weld properties for the Palisades reactor vessel on April 12, 1995 [Ref. 2]. The staff agreed with the licensee's best-estimate analysis of the chemical composition of the reactor vessel welds and concluded that continued operation through Cycle 14 (late 1999) was acceptable. As discussed previously, while performing the evaluation, the staff noted larger variability in the chemical composition of the welds compared to that assumed for the development of the PTS rule. The staff evaluated the implications of this larger variability on the PTS rule generic margins for the Palisades vessel using the same analytic methods as those used in formulating the rule. The staff has reviewed the other PWR vessels and, based upon currently available information, believes that the Palisades vessel will reach the PTS screening criteria by late 1999, before any other PWR.

On March 27 and 28, 1995, the staff reviewed the Asea Brown Boveri-Combustion Engineering proprietary RPV data-base. The most significant information reviewed concerned the Kewaunee RPV. The particular concern was the impact of data generated subsequent to the response to GL 92-01, Revision 1, on the plant's PTS evaluation. The staff met with the licensee for Kewaunee (April 13, 1995) to discuss issues related to consideration of all appropriate chemical composition data in addition to the applicable surveillance program data. In that meeting, the licensee presented its plant-specific surveillance program results and some new information related to the chemical composition variability in the RPV welds. Based upon this information, the licensee believes that the Kewaunee vessel will not exceed the PTS screening criteria before EOL. The staff has not completed its review of the new information on the Kewaunee vessel. However, based on the new vessel specific surveillance data, chemical composition data and the greater margin to the PTS screening criteria (300°F for the limiting Kewaunee circumferential weld compared to 270°F for the limiting Palisades axial weld), the staff believes that the Kewaunee vessel will not exceed the PTS screening criteria before the Palisades vessel. A key aspect of the Kewaunee review is the determination of the need for use of the ratio procedure in accordance with the established Position 2.1 of Regulatory Guide 1.99, Revision 2, by licensees using surveillance data.

NRC Staff Generic Evaluation of RPV Structural Integrity Data for PTS Events

The staff is assessing the generic implications of chemical composition variability with regard to the current methodology for ensuring protection against PTS events for PWRs. The staff considers that the larger variability observed in recent reviews could be applicable to other reactor vessels and may, therefore, reduce the margins of safety provided by the PTS screening criteria. The staff will evaluate this concern as part of its review of plant-specific evaluations and longer-term reassessment of the PTS rule.

To provide assurance that all PWRs will maintain adequate protection against PTS events while the PTS rule is being reassessed, the staff has assessed all of the PWR RPVs using generic values of chemistry and increased margin terms to account for potentially larger chemical composition variability. It should be noted that such analyses are considered conservative evaluations, that were performed to determine whether an immediate safety concern exists for this issue and whether there is adequate time to perform a more rigorous assessment of the issue. As stated in the previous section, based upon currently available information, the staff believes that the Palisades vessel will exceed the PTS screening criteria before any other PWR. However, because of the importance of RPV integrity and the potential impact of additional, unreviewed data on RPV evaluations, the staff believes that this issue needs to be resolved on an expedited basis.

Consideration of All Data Relevant to Reactor Pressure Vessel Integrity

As described previously, another result of recent reviews was that the staff became concerned that licensees might not necessarily have all of the data pertinent to the evaluation of the structural integrity of their RPVs. This is particularly true where the RPV fabricator holds, or has held, the applicable data to be proprietary in nature. Such data include, but are not limited to: chemical composition, heat treatment, plate and forging manufacturing process records, RPV fabrication records, all mechanical property data (tensile, impact, fracture toughness), and surveillance data. Sources of data that licensees should reexamine include material test reports from the steel producer, weld wire manufacturer, RPV fabricator, independent testing laboratories, and nuclear steam supply system (NSSS) vendor. Licensees are encouraged to work closely with their respective vessel owners groups and NSSS vendor groups to ensure that all sources of information pertinent to the analysis of the structural integrity of their RPVs have been considered. The information submitted in response to this generic letter should be considered to be public information.

Required Information

Addressees are required to provide the following information:

(1) a description of those actions taken or planned to locate all data relevant to the determination of RPV integrity, or an explanation of why the existing data base is considered complete as previously submitted;

(2) an assessment of any change in best-estimate chemistry based on consideration of all relevant data;

(3) a determination of the need for use of the ratio procedure in accordance with the established Position 2.1 of Regulatory Guide 1.99, Revision 2, for those licensees that use surveillance data to provide a basis for the RPV integrity evaluation; and

(4) a written report providing any newly acquired data as specified above and (1) the results of any necessary revisions to the evaluation of RPV integrity in accordance with the requirements of 10 CFR 50.60, 10 CFR 50.61, Appendices G and H to 10 CFR Part 50, and any potential impact on the LTOP or P-T limits in the technical specifications or (2) a certification that previously submitted evaluations remain valid. Revised evaluations and certifications should include consideration of Position 2.1 of Regulatory Guide 1.99, Revision 2, as applicable, and any new data.

Required Response

All addressees are required to submit the following written responses providing the information described above:

(1) within 90 days from the date of this generic letter, a written response to part (1) of the information requirement specified above; and

(2) within 6 months from the date of this generic letter, a written response to parts (2), (3), and (4) of the information requirement above.

Address the required written reports to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, D.C. 20555-0001, under oath or affirmation under the provisions of Section 182a, Atomic Energy Act of 1954, as amended, and 10 CFR 50.54(f). In addition, submit a copy to the appropriate regional administrator.

The NRC recognizes the potential difficulties (number and types of sources, age of records, proprietary data, etc.) that licensees may encounter while ascertaining whether they have all of the data pertinent to the evaluation of their RPVs. For this reason, 90 days is allowed for the initial response.

The information obtained from the licensees as a result of Revision 1 to GL 92-01 has been entered into a computerized reactor vessel integrity database (RVID), which will be made publicly available in the third quarter of 1995. The NRC intends to hold a public meeting on this GL supplement within 30 days of its issuance and a public workshop on RPV integrity, addressing the RVID and other RPV integrity issues, in the third quarter of 1995.

Related Generic Communications

(1) NRC Generic Letter 92-01, Revision 1, "Reactor Vessel Structural Integrity," March 6, 1992.

(2) NRC Generic Letter 88-11, "NRC Position on Radiation Embrittlement of Reactor Vessel Materials and Its Impact on Plant Operations," July 12, 1988.

Backfit Discussion

This generic letter supplement only requires information from the addressees under the provisions of Section 182a of the Atomic Energy Act of 1954, as amended, and 10 CFR 50.54(f). Therefore, the staff has not performed a backfit analysis. The information required will enable the NRC staff to determine whether licensees are complying with the requirements of 10 CFR 50.60, 10 CFR 50.61, Appendices G and H to 10 CFR Part 50 and any associated license conditions, and licensee commitments related to GL 88-11 and GL 92-01, Revision 1. The staff is not establishing a new position for such compliance in this generic letter supplement. Therefore, this generic letter supplement does not constitute a backfit and no documented evaluation or backfit analysis need be prepared.

Federal Register Notification

A notice of opportunity for public comment was not published in the *Federal Register* because the NRC needs to receive the responses to the generic letter in an expeditious manner. However, comments on the technical issue(s) addressed by this generic letter may be sent to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, D.C. 20555.

Paperwork Reduction Act Statement

The information collections contained in this request are covered by the Office of Management and Budget clearance number 3150-0011, which expires July 31, 1997. The public reporting burden for this collection of information is estimated to average 600 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needs, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to the Information and Records Management Branch (T-6 F33), U.S. Nuclear Regulatory Commission, Washington, D.C., 20555-0001, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0011), Office of Management and Budget, Washington, D.C. 20503.

Compliance with the following request for information is voluntary. The information would assist the NRC in evaluating the cost of complying with this GL supplement.

(1) the licensee staff time and costs to perform requested record reviews and developing plans for inspections;

(2) the licensee staff time and costs to prepare the requested reports and documentation;

(3) the additional short-term costs incurred as a result of the inspection findings such as the cost of the corrective actions or the costs of down time; and

(4) an estimate of the additional long-term costs that will be incurred as a result of implementing commitments such as the estimated costs of conducting future inspections and repairs.

If you have any questions about this matter, please contact the technical contacts listed below or the appropriate NRR project manager.

Roy P. Zimmerman
Associate Director for Projects
Office of Nuclear Reactor Regulation

Technical contacts: Edwin M. Hackett
(301) 415-2751

Keith R. Wichman
(301) 415-2757

Lead project manager: Daniel G. McDonald
(301) 415-1408

Attachments:
1. References
2. List of Recently Issued NRC Generic Letters

References

[1] NUREG-1511, "Reactor Pressure Vessel Status Report," U.S. Nuclear Regulatory Commission, Washington, DC, December, 1994.

[2] Letter from Elinor Adensam, USNRC, to Kurt Haas, Consumers Power Company forwarding, "Safety Evaluation by the Office of Nuclear Reactor Regulation Related to the Evaluation of the Pressurized Thermal Shock Screening Criteria, Consumers Power Company, Palisades Plant, Docket No. 50-255", April 12, 1995.

LIST OF RECENTLY ISSUED GENERIC LETTERS

Generic Letter	Subject	Date of Issuance	Issued To
95-04	FINAL DISPOSITION OF THE SYSTEMATIC EVALUATION PROGRAM LESSONS-LEARNED ISSUES	04/28/95	ALL HOLDERS OF OLs OR CPs FOR NUCLEAR POWER REACTORS.
95-03	CIRCUMFERENTIAL CRACKING OF STEAM GENERATOR TUBES	04/28/95	ALL HOLDERS OF OLs OR CPs FOR PRESSURIZED WATER REACTORS (PWRs).
95-02	USE OF NUMARC/EPRI REPORT TR-102348, "GUIDELINE ON LICENSING DIGITAL UPGRADES," IN DETERMINING THE ACCEPTABILITY OF PERFORMING ANALOG-TO-DIGITAL REPLACEMENTS UNDER 10 CFR 50.59	04/26/95	ALL HOLDERS OF OLs OR CPs FOR NUCLEAR POWER REACTORS.
89-04, SUPP. 1	GUIDANCE ON DEVELOPING ACCEPTABLE INSERVICE TESTING PROGRAMS	04/04/95	ALL HOLDERS OF OLs OR CPs FOR NUCLEAR POWER REACTORS.
95-01	NRC STAFF TECHNICAL POSITION ON FIRE PROTECTION FOR FUEL CYCLE FACILITIES	01/26/95	ALL CURRENT LICENSEES & APPLICANTS FOR URANIUM CONVERSION & FUEL FABRICATION FACILITIES.
94-04	VOLUNTARY REPORTING OF ADDITIONAL OCCUPATIONAL RADIATION EXPOSURE DATA	09/02/94	ALL HOLDERS OF OLs OR CPs FOR NPRs, RADIOGRAPHY LICENSEES, FUEL PROCESSING LICENSEES, FABRICATING & REPROCESSING LICENSEES, MANUFACTURERS & DISTRIBUTORS OF BY-PRODUCT MAT'L, INDEPENDDENT SPENT FUEL STORAGE INSTALLATIONS, FACILITIES FOR LAND DISPOSAL OF LOW-LEVEL WASTE, & GEOLOGIC REPOSITORIES FOR HIGH-LEVEL WASTE.

OL = OPERATING LICENSE
CP = CONSTRUCTION PERMIT
NPR = NUCLEAR POWER REACTORS