

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
TECHNICAL SPECIFICATION CHANGES ON PRESSURE-TEMPERATURE LIMITS

NINE MILE POINT UNIT 1

NIAGARA MOHAWK POWER CORPORATION

DOCKET NO. 50-220

1.0 INTRODUCTION

By letter dated June 19, 1998, the licensee submitted changes related to the pressure-temperature (P-T) limits in the Nine Mile Point Unit 1 (NMP-1) Technical Specifications (TS). The licensee revised the P-T limits to provide new limits that are valid to 28 effective full power years (EFPY).

The staff evaluated the P-T limits based on the following NRC regulations and guidance: Appendix G to 10 CFR Part 50; Generic Letters (GL) 88-11 and 92-01; Regulatory Guide (RG) 1.99, Rev. 2; and Standard Review Plan (SRP) Section 5.3.2. Appendix G to 10 CFR Part 50 requires that P-T limits for the reactor vessel must be at least as conservative as those obtained by Appendix G to Section XI of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code. GL 88-11 requires that licensees use the methods in RG 1.99, Rev. 2, to predict the effect of neutron irradiation on the adjusted reference temperature (ART) of reactor vessel materials. The ART is defined as the sum of initial nil-ductility transition reference temperature (RT_{NDT}) of the material, the increase in RT_{NDT} caused by neutron irradiation, and a margin to account for uncertainties in the prediction method. The increase in RT_{NDT} is calculated from the product of a chemistry factor and a fluence factor.

The chemistry factor may be calculated using credible surveillance data, obtained by the licensee's surveillance program, as directed by Position 2 of Regulatory Guide (RG) 1.99, Rev. 2. If credible surveillance data are not available, the chemistry factor is calculated dependent upon the amount of copper and nickel in the vessel material as specified in Table 1 of RG 1.99, Rev. 2. GL 92-01 requires licensees to submit reactor vessel materials data, which the staff uses in the review of the P-T limits submittals.

SRP 5.3.2 provides guidance on calculation of the P-T limits using the linear elastic fracture mechanics methodology specified in Appendix G to Section III of the ASME Code. The linear elastic fracture mechanics methodology postulates sharp surface defects that are normal to the direction of maximum stress and have a depth of one-fourth of the reactor vessel beltline thickness ($1/4T$) and a length of 1-1/2 times the beltline thickness. The critical locations in the vessel for this methodology are the $1/4T$ and $3/4T$ locations, which correspond to the maximum depth of the postulated inside surface and outside surface defects, respectively.

ATTACHMENT 1

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2.0 EVALUATION

For the NMP-1 reactor vessel, the licensee determined that the most limiting material at the 1/4T and 3/4T locations is plate G-307-4. This plate was fabricated using plate heat P2076. The licensee calculated an ART of 167.7°F at the 1/4T location and 136.9°F at the 3/4T location at 28 EFPY. The neutron fluence used in the ART calculation was 1.76×10^{18} n/cm² at the 1/4T location and 7.48×10^{17} n/cm² at the 3/4T location. The initial RT_{NDT} for the limiting plate was 40°F. The margin term used in calculating the ART for the limiting plate was 34°F.

The staff performed an independent calculation of the ART values for the limiting material using the methodology in RG 1.99, Revision 2. Based on these calculations, the staff verified that the licensee's limiting material for the NMP-1 reactor vessel is plate G-307-4. The staff's calculated ART value for the limiting material agreed with the licensee's calculated ART value.

Substituting the ART values for the NMP-1 vessel into equations in SRP 5.3.2, the staff verified that the proposed P-T limits satisfy the requirements in paragraph IV.A.2 of Appendix G of 10 CFR Part 50.

In addition to beltline materials, Appendix G of 10 CFR Part 50 also imposes a minimum temperature at the closure head flange based on the reference temperature for the flange material. Section IV.A.2 of Appendix G states that when the pressure exceeds 20% of the preservice system hydrostatic test pressure, the temperature of the closure flange regions highly stressed by the bolt preload must exceed the reference temperature of the material in those regions by at least 120°F for normal operation and by 90°F for hydrostatic pressure tests and leak tests. Based on the flange RT_{NDT} of 40°F for NMP-1, the staff has determined that the proposed P-T limits have satisfied the requirement for the closure flange region during normal operation and inservice leak and hydrostatic testing.

3.0 CONCLUSION

The staff has performed an independent analysis to verify the licensee's proposed P-T limits. The staff concludes that the proposed P-T limits for heatup and cooldown for non-critical operations; heatup and cooldown for critical operations; and non-critical leakage/hydrotest are acceptable to 28 EFPY since the limits conform to the requirements of Appendix G of 10 CFR Part 50 and GL 88-11. Hence, the proposed P-T limits may be incorporated in the NMP-1 Technical Specifications.

4.0 REFERENCES

1. Regulatory Guide 1.99, Radiation Embrittlement of Reactor Vessel Materials, Revision 2, May 1988
2. NUREG-0800, Standard Review Plan, Section 5.3.2: Pressure-Temperature Limits
3. Code of Federal Regulations, Title 10, Part 50, Appendix G, Fracture Toughness Requirements
4. Generic Letter 88-11, NRC Position on Radiation Embrittlement of Reactor

Vessel Materials and its Impact on Plant Operations, July 12, 1988

5. ASME Boiler and Pressure Vessel Code, Section III, Appendix G for Nuclear Power Plant Components, Division 1, "Protection Against Nonductile Failure"
6. March 31, 1998, Letter from R. B. Abbott, to USNRC Document Control Desk, Subject: 10 CFR 50, Appendix H, Reactor Vessel Material Surveillance Program Requirements, Report of Test Results.
7. June 19, 1998, Letter from J. H. Mueller to USNRC Document Control Desk which forwards Attachment D, Subject: Report No. MPM-59838 Pressure-Temperature Operating Curves for Nine Mile Point Unit 1, MPM Technologies, Inc.

SALP INPUT

FACILITY NAME: Nine Mile Point Unit 1

SUMMARY OF REVIEW ACTIVITIES

The staff reviewed the licensee's proposed changes to pressure-temperature (P-T) limits in the Nine Mile Point Unit 1 Technical Specifications. Generic Letter (GL) 88-11 recommends that licensees use Regulatory Guide 1.99, Rev. 2, to calculate the adjusted nil-ductility reference temperature, ART, which is a parameter used in establishing the P-T limits. The staff verified the licensee's calculated ART of the limiting beltline material. The staff also verified the P-T limits using Standard Review Plan 5.3.2. and the limiting ART.

NARRATIVE DISCUSSION OF LICENSEE PERFORMANCE-FUNCTIONAL AREA SAFETY ASSESSMENT/QUALITY VERIFICATION

The licensee's submittal adequately described the Technical Specification (TS) changes, and provided the appropriate information to technically support the P-T limits evaluation. The submittal was well prepared and concise.

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