Accession No. ML12223A091

10 CFR 50.55a REQUEST NUMBER – PR 06
HPCI Pump Testing Utilizing Pump Curves

Proposed Alternative In Accordance with 10CFR50.55a(a)(3)(i)
On the basis that the proposed alternative provides an acceptable level of quality and safety.

1. ASME Code Component(s) Affected

P-209, High Pressure Coolant Injection (HPCI) Pump (Class 2) (Group B)

Component/System Function
The HPCI System is designed to pump water into the reactor vessel under loss-of-coolant conditions which do not result in rapid depressurization of the pressure vessel. The loss-of-coolant might be due to loss of reactor feedwater or to small line breaks which do not cause depressurization of the reactor vessel [Updated Safety Analysis Report 6.2.4].

2. Applicable Code Edition and Addenda

ASME OM Code-2004 Edition, with Addenda through OMb Code-2006.

3. Applicable Code Requirement(s)

ISTB-5122, "Group B Test Procedure" (Centrifugal Pumps)

ISTB-5122(a), states in part, the pump shall be operated at a speed adjusted to the reference point (± 1 percent).

ISTB-5122(c), specifies system resistance may be varied as necessary to achieve the reference point.

ISTB-5123, "Comprehensive Test Procedure" (Centrifugal Pumps)

ISTB-5123(a), states in part, The pump shall be operated at a speed adjusted to the reference point (± 1 percent).

ISTB-5123(b), states in part, the resistance of the system shall be varied until the flow rate equals the reference point. The differential pressure shall then be determined and compared to its reference value.

4. Reason for Request

In order to perform accurate trending and data analysis, the use of an accurate reference value is very important. The complexities of the flow control system used for HPCI makes it difficult to exactly duplicate the reference points. Additionally, iterative manipulation of the control system equipment to refine the hydraulic and speed parameters contributes

additional wear to system components. As alternative testing is allowed under the provisions of 10 CFR 50.55a, MNGP Northern States Power – Minnesota (NSPM) proposes an alternative test method for the Comprehensive and Group B HPCI pump test, as required by ASME OM Code, Subsection ISTB.

5. Proposed Alternative and Basis for Use

As stated in NUREG-1482, Rev 1, Section 5.2, some system designs do not allow for testing at a single reference point or a set of reference points. In such cases, it may be necessary to plot pump curves to use as the basis for variable reference points. Code Case OMN-16, "Use of Pump Curves for Testing," is included in the issuance of ASME Code OMb-2006. This Code Case has not been accepted by NRC staff for inclusion in NRC Regulatory Guide (RG) 1.192; "Operation and Maintenance Code Case Acceptability, ASME OM Code"; however, Code Case OMN-9 "Use of Pump Curves for Testing" has been conditionally accepted by NRC staff for inclusion in RG 1.192. The conditions imposed on OMN-9 as stated in RG 1.192 have been incorporated into OMN-16. In addition, Code applicability for the use of OMN-16 includes OM Code-2004 with Addenda through OMb-2006 which is the fifth interval Code of Record for the MNGP IST Program.

As an alternative to the testing requirements of ISTB-5122 and ISTB-5123, NSPM will assess pump performance and operational readiness through the use of reference pump curves per the guidelines provided in Code Case OMN-16. Flow rate and pump differential pressure will be measured during inservice testing in the as found condition of the system and compared to an established reference curve. The following elements will be used in the development of the reference pump curves. |

During Comprehensive and Quarterly HPCI Pump Testing, pump differential pressure and flow rate will be evaluated using a reference point derived from a pump curve. Figure 1 and Figure 2 provide the representative graph which NSPM proposes to use for Quarterly and Comprehensive Testing, respectively. The reference point test pump curve will be restricted to an operating range that is representative of accident conditions, or conservative conditions that are the most sensitive indicator of pump degradation. Appropriate upper and lower acceptance criteria limits for differential pressure will be established for the Required Action and Alert range limits, as applicable, for Group B (Quarterly) and Comprehensive testing.

These limits will be scalar multiples of the reference pump curve. For determination of whether the In-service Testing (IST) Acceptance Criteria is met, Table 1 and Table 2 are proposed to be used to analyze the data. These acceptance criteria satisfy the requirements specified in Code Case OMN-16, paragraph 16-6200(a) "Alert Range" and paragraph 16-6200(b) "Required Action Range".

NSPM will follow the stipulations established by Pump Relief Request PR-03, "HPCI Pump Vibration" for the Vibration Alert Levels and Code established limits for the Action Required Levels over the reference value curve range for Comprehensive testing.

The vibration data (see Figure 3 through Figure 6) from the test was reviewed and no adverse correlation was evident between flow rate and vibration at the nominal reference point speed. Therefore, NSPM will not establish new vibration reference values and related allowable limits over the reference value curve at this time.

If future requirements necessitate the need for re-generation of a new pump reference curve, NSPM will obtain vibration readings across the expected operating test range of the pump.

The alternative testing described above provides an acceptable level of quality and safety because the method will provide increased accuracy in trending and data analysis. Since the methodology utilized is consistent with the NRC staff guidance provided in NUREG-1482, Rev.1, Section 5.2 and Code Case OMN-16 it will provide reasonable assurance of pump operational readiness.

6. Duration of Proposed Alternative

The proposed alternative identified in this relief request shall be implemented during the Fifth Ten Year IST Interval beginning September 1, 2012.

7. Precedents

NRC Safety Evaluation for Monticello Nuclear Generating Plant, Evaluation of Relief Request PR-06 Relating to the Fourth 10-Year Interval Inservice Testing Program, Docket No. 50-263. (TAC No. MB9550), August 7, 2003.

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Attachments:

Table 1 – "HPCI Pump Group B Quarterly Test Acceptance Criteria"
Table 2 – "HPCI Pump Comprehensive Test Acceptance Criteria"
Figure 1 – "HPCI P-209 Group B Quarterly Testing Limits"
Figure 2 – "HPCI P-209 Comprehensive Testing Limits"
Figures 3 through Figure 6 – "HPCI Vibration Comparison over Reference Curve Flow Range"

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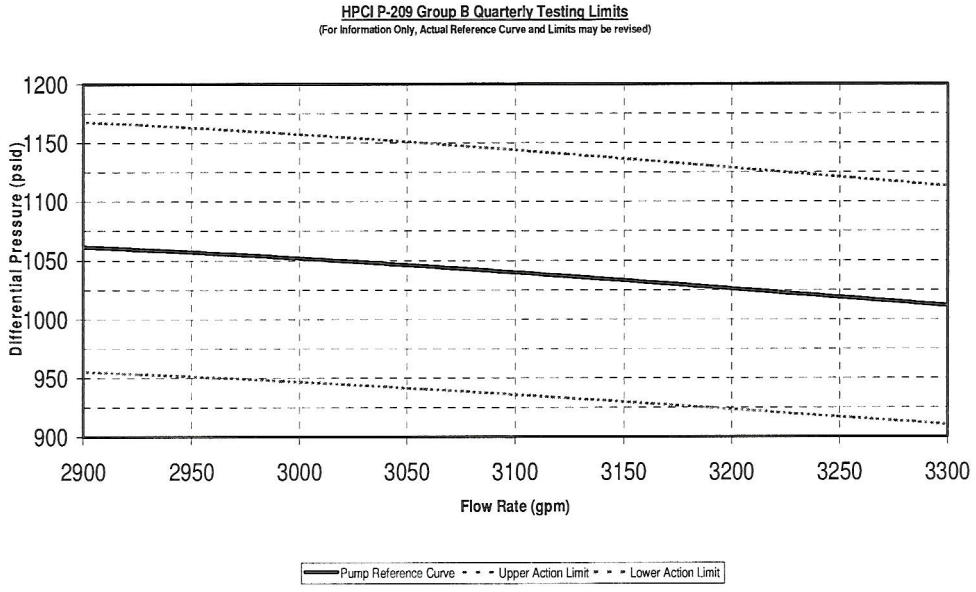
HPC Pump Group B Quarterly Test Acceptance Criteria

(Actual data may change during 5th IST Interval) |

Table 1

Pump Flow Reference Point (gpm)	Pump Diff Press Reference Value (psid)	Group B Quarterly Test	
		Upper Required Action Range (> psid)	Lower Required Action Range (< psid)
2900	1061.4	1167.5	955.3
2950	1057.0	1162.7	951.3
3000	1051.9	1157.0	946.8
3050	1046.0	1150.6	941.4
3100	1039.7	1143.6	935.8
3150	1032.9	1136.1	929.7
3200	1025.9	1128.4	923.4
3250	1018.8	1120.6	917.0
3300	1011.6	1112.7	910.5

Figure 1



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HPC Pump Comprehensive Test Acceptance Criteria

(Actual data may change during 5th IST Interval)

Table 2

Pump Flow Reference Point (gpm)	Pump Diff Press Reference Value (psid)	Comprehensive Test		
		Upper Required Action Range (> psid)	Alert Range (< psid)	Lower Required Action Range (< psid)
2900	1061.4	1093.2	987.2	955.3
2950	1057.0	1088.7	983.1	951.3
3000	1051.9	1083.4	978.3	946.8
3050	1046.0	1077.3	972.8	941.4
3100	1039.7	1070.8	967.0	935.8
3150	1032.9	1063.8	960.6	929.7
3200	1025.9	1056.6	954.1	923.4
3250	1018.8	1049.3	947.5	917.0
3300	1011.6	1041.9	940.8	910.5

Figure 2

HPCI P-209 Comprehensive Testing Limits
(For Information Only, Actual Reference Curve and Limits may be revised)

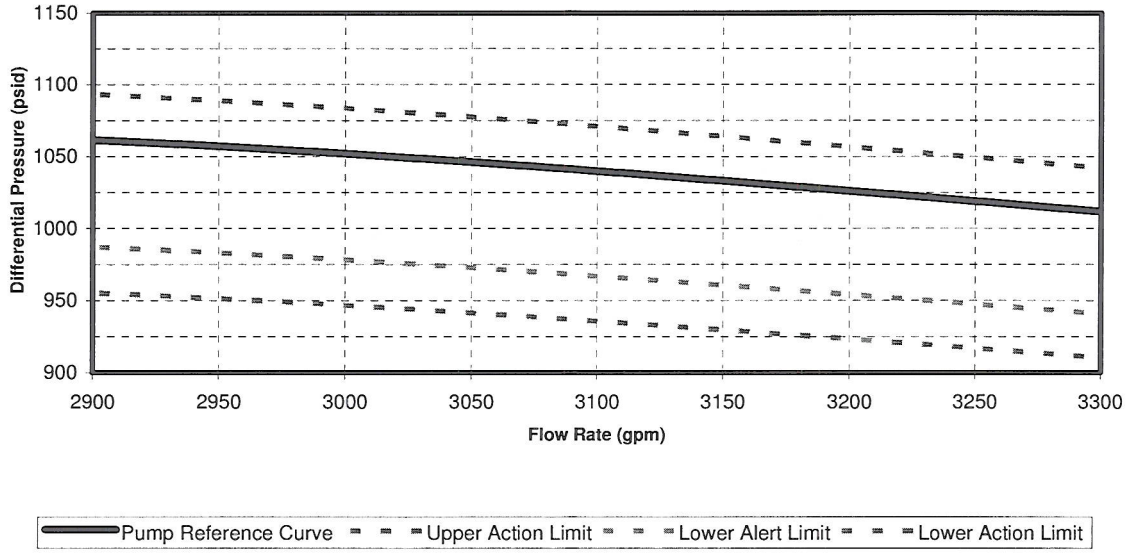

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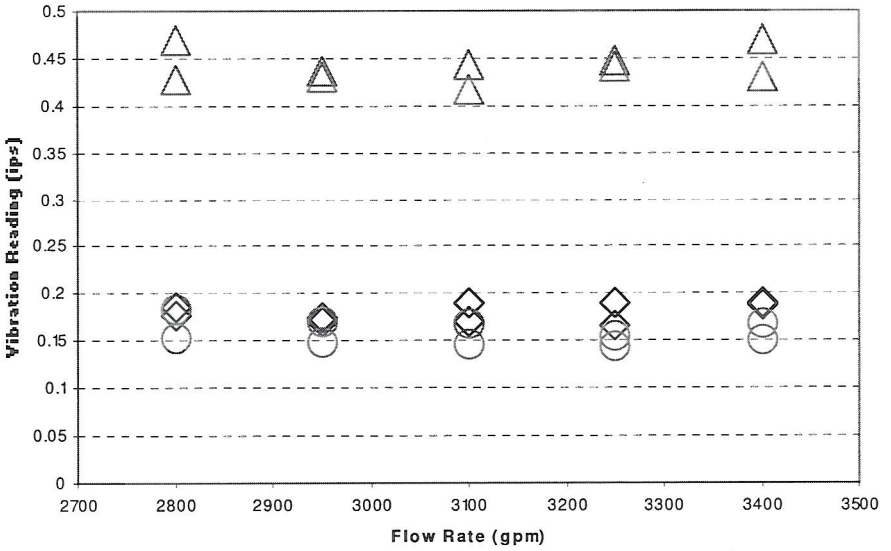
Figure 3

HPCI Vibration Comparision over Reference Curve Flow Range
(2.12.03 Test)



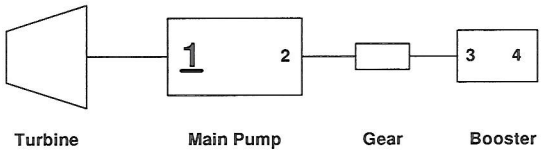


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Figure 4

HPCI Vibration Comparision over Reference Curve Flow Range (2.12.03 Test)

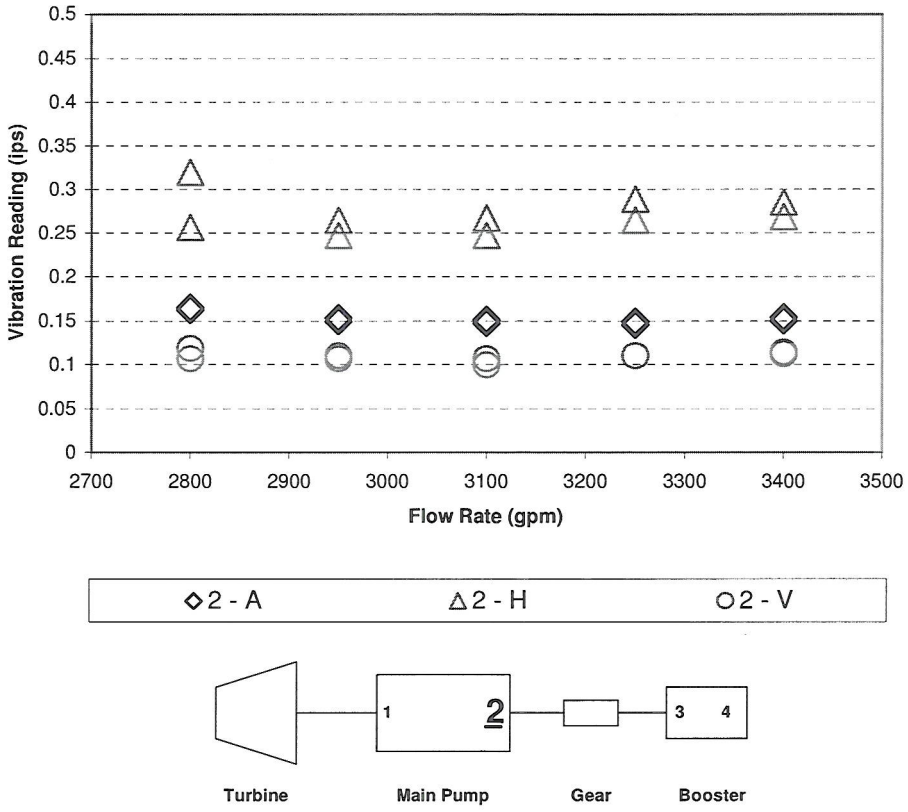

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Figure 5

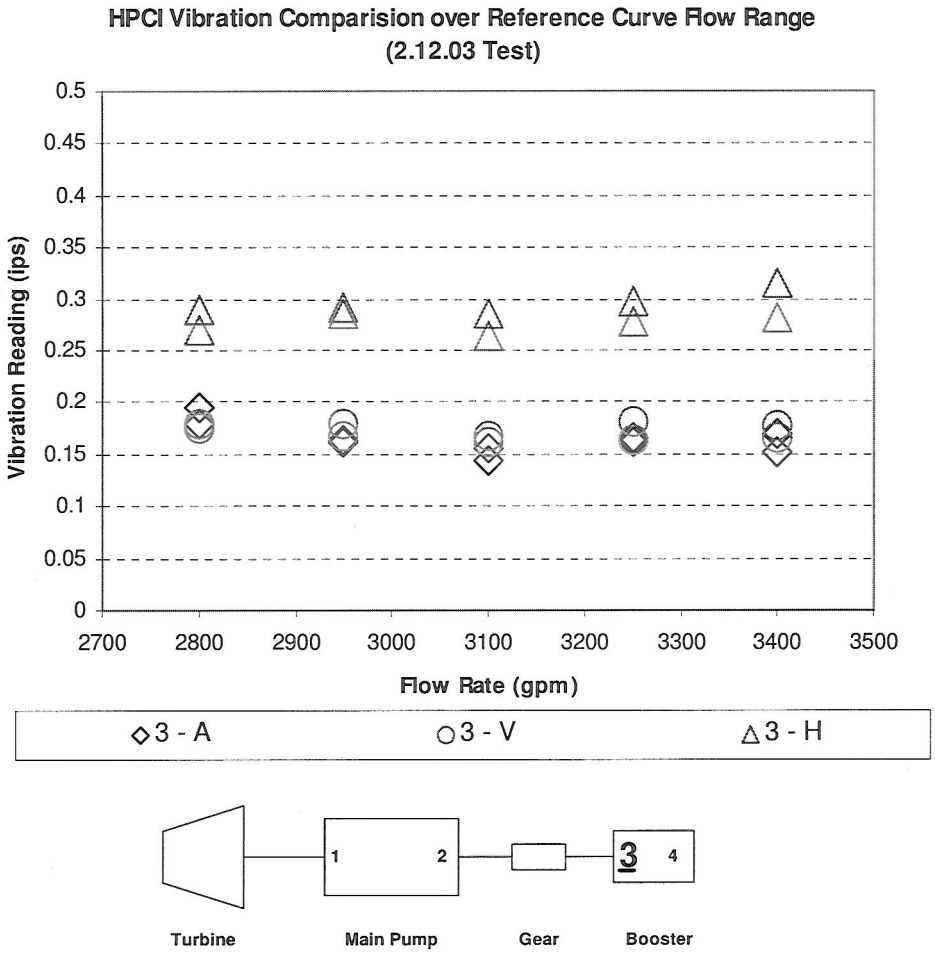

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Figure 6