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July 22, 2010
L-10-194

10 CFR 50.55a

Attention: Document Control Desk
U. S. Nuclear Regulatory Commission
Washington, DC 20555-0001

SUBJECT:
Beaver Valley Power Station, Unit No. 2
Docket No. 50-412, License No. NPF- 73
10 CFR 50.55a Requests Associated with Service Water Pump Testing

Pursuant to 10 CFR 50.55a, the FirstEnergy Nuclear Operating Company hereby requests Nuclear Regulatory Commission approval of proposed alternatives to certain requirements associated with the inservice testing program (ISTP) for the Beaver Valley Power Station, Unit No. 2. The proposed alternatives are associated with service water pump testing. Pump Relief Request 4 (PRR4), which was approved for use during the third 10-year ISTP interval (ADAMS Accession No. ML080140299), is to be superseded by PRR4, Revision 1. PRR4, Revision 1 makes a correction to the applicable American Society for Mechanical Engineers (ASME) Operations and Maintenance (OM) Code section cited by the request, and eliminates the need for summer pump curves. Pump Relief Request 10 (PRR10) proposes the use of expanded pump test acceptance criteria in lieu of the acceptance criteria described in ASME OM Code Table ISTB-5200-1 to account for changes in pump performance caused by the differential expansion of pump internals due to changes in water temperature. The details of the requests are contained in Enclosures A and B.

The proposed alternatives are proposed for use during the remainder of the third ten-year ISTP interval, which began on November 18, 2007. FENOC requests the NRC staff authorize the proposed alternatives by July 30, 2011.

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There are no regulatory commitments contained in this submittal. If there are any questions or if additional information is required, please contact Thomas A. Lentz, Manager - Fleet Licensing, at 330-761-6071.

Sincerely,

Paul A. Harden

Enclosure:

A. Pump Relief Request 4, Revision 1, Relief Request in Accordance with 10 CFR 50.55a(f)(5)(iii), Inservice Testing Impracticality
B. Pump Relief Request 10, Proposed Alternative in Accordance with 10 CFR 50.55a(a)(3)(i), Alternative Provides Acceptable Level of Quality and Safety

cc: NRC Region I Office
NRC Senior Resident Inspector
NRC Project Manager
Director BRP/DEP
Site BRP/DEP Representative

ENCLOSURE A
L-10-194

Pump Relief Request 4, Revision 1

Relief Request
in Accordance with 10 CFR 50.55a(f)(5)(iii)
--Inservice Testing Impracticality--
(Three pages follow)

1. ASME Code Components Affected

2SWS*P21A, Service Water Pump (Class 3)
2SWS*P21B, Service Water Pump (Class 3)
2SWS*P21C, Service Water Pump (Class 3)

2. Applicable Code Edition and Addenda

American Society for Mechanical Engineers (ASME) Code for Operations and Maintenance (OM) Code-2001, with Addenda through OMb-2003.

3. Applicable Code Requirements

ISTB-5221, "Group A Test Procedure," states:

> Group A tests shall be conducted with the pump operating at a specified reference point.

ISTB-5221(b) states:

> 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. Alternatively, the flow rate can be varied until the differential pressure equals the reference point and the flow rate shall be determined and compared to the reference flow rate value.

ISTB-5223, "Comprehensive Test Procedure," states:

> Comprehensive tests shall be conducted with the pump operating at a specified reference point.

ISTB-5223(b) states:

> 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. Alternatively, the flow rate can be varied until the differential pressure equals the reference point and the flow rate shall be determined and compared to the reference flow rate value.

4. Impracticality of Compliance

Operating experience has shown that plant conditions due to heat loads requiring cooling by the service water system may preclude returning the service water pumps to the exact flow rate or differential pressure during pump surveillance testing. The service water system is dependent on seasonal Ohio River water temperatures and flow may vary from approximately 6,000 gallons per minute (gpm) in the cool winter months to approximately 14,000 gpm in the warm summer months.

In order to increase flow to a reference value during cold winter months, idle heat exchangers would need to be placed into service or additional flow would be needed through heat exchangers already in service. Increased cooling flow through primary and secondary component cooling and chiller unit heat exchangers already in service could result in a thermal transient and a potential plant trip. Clean heat exchangers may require placement into service prematurely if additional flow is required to return to a reference value. Idle heat exchangers are normally held in reserve following cleaning to improve plant reliability and safety until one of the inservice heat exchangers becomes fouled.

In order to throttle flow to a reference value during warm summer months, any inservice primary and secondary component cooling and chiller unit heat exchangers would need flow reduced or isolated, which could interrupt flow of cooling water to Train A or Train B cooling loads resulting in a thermal transient and potential plant trip. In addition, the added thermal cycling due to placement or removal of heat exchangers from service for pump testing could prematurely degrade the heat exchangers.

5. Burden Caused by Compliance

The thermal transients created by increasing or throttling service water system flow to the turbine plant cooling loads could result in stability problems. Changes in oil temperature from the turbine generator lube oil system could create vibration problems. Changes in the hydrogen gas cooler temperatures could imply problems or mask real problems with the generator. Chiller unit heat exchanger flow disturbances could result in a trip of the chiller unit that may cause reactor containment temperature to exceed the technical specification limit.

6. Proposed Alternative and Basis for Use

A pump curve developed in accordance with the guidelines provided in NUREG-1482, "Guidelines for Inservice Testing at Nuclear Power Plants," Revision 1, Section 5.2.2, "Reference Curves," will be used to compare flow rate with developed pump head at the flow conditions dictated by plant seasonal heat load requirements in accordance with the service water pump testing procedures during each quarterly Group A test and biennial Comprehensive test. Since normal flow varies, the most limiting vibration acceptance criteria will be used over this range of flows based on baseline vibration data obtained at various flow points on the pump curve.

ISTB-3320, "Establishment of Additional Set of Reference Values," provides for multiple sets of reference values. A pump curve is consistent with this Code section, since it merely is a graphical representation of the fixed response of the pump to an infinite number of flow conditions that are based on a finite number of reference values verified by measurement. Flow will be permitted to vary as system conditions require. Differential pressure will be calculated and converted to a developed head for the ranges included in Table ISTB-5200-1.

The paragraphs above describe an alternative to ISTB-5221(b) and ISTB-5223(b) requirements that flow rate and differential pressure be evaluated against reference values to monitor pump condition and allow detection of degradation. Establishing a reference curve for the pump when the pump is known to be operating acceptably, and basing the acceptance criteria on this curve, permits evaluation of the pump condition and detection of degradation. Thus, a pump curve developed in accordance with the proposed alternative will provide an acceptable alternative to the ASME OM Code requirements and reasonable assurance that the pumps are operationally ready.

7. Duration of Proposed Alternative

The duration of the proposed alternative is for the remainder of the third 10-year inservice test interval.

8. Precedent

The proposed relief request is similar to Pump Relief Request 4 that the NRC staff approved for the BVPS-2 second 10-year ISTP interval by letter dated November 18, 1997 (TAC NO. M98909). The approved pump relief request permitted the use of a pump curve, developed in accordance with the guidelines provided in NUREG-1482, "Guidelines for Inservice Testing at Nuclear Power Plants," Revision 0, Section 5.2, "Use of Variable Reference Values for Flow Rate and Differential Pressure During Pump Testing," for monitoring pump condition and detection of degradation.

ENCLOSURE B
L-10-194

Pump Relief Request 10

Proposed Alternative
in Accordance with 10 CFR 50.55a(a)(3)(i)
--Alternative Provides Acceptable Level of Quality and Safety--
(Seven pages follow)

1. ASME Code Components Affected

2SWS*P21A, Service Water Pump (Class 3)
2SWS*P21B, Service Water Pump (Class 3)
2SWS*P21C, Service Water Pump (Class 3)

2. Applicable Code Edition and Addenda

American Society for Mechanical Engineers (ASME) Code for Operations and Maintenance (OM) Code-2001, with Addenda through OMb-2003.

3. Applicable Code Requirements

ISTB-5221(e), "Group A Test Procedure," states:

> All deviations from the reference values shall be compared with the ranges of Table ISTB-5200-1

ISTB-5223(e), "Comprehensive Test Procedure," states:

> All deviations from the reference values shall be compared with the ranges of Table ISTB-5200-1

4. Reason for Request

The service water system operation is dependent on seasonal Ohio River water temperatures with pump flow rates varying between approximately 6,000 gallons per minute (gpm) in the cool winter months to approximately 14,000 gpm in the warm summer months. Due to variations in pump flow rate and differential pressure (pump head), and as requested in Pump Relief Request 4, a pump curve will be used to compare flow rate with developed pump head (H) at the flow conditions dictated by plant seasonal heat load requirements. The Group A and Comprehensive pump test acceptance criteria for differential pressure is provided in Table ISTB-5200-1 for vertical line shaft pumps. The developed head of a pump is calculated by multiplying the differential pressure by 2.31 feet/pounds per square inch.

The Table ISTB-5200-1 differential pressure (ΔP) acceptance criteria is as follows:

Group A Tests	Acceptable	Alert	Required Action
	0.95 to 1.10ΔP	0.93 to <0.95ΔP	<0.93 and >1.10ΔP

Comprehensive Tests	Acceptable	Alert	Required Action
	0.95 to 1.03ΔP	0.93 to <0.95ΔP	<0.93 and >1.03ΔP

The service water pumps are typically overhauled in the colder winter months when the demand on the service water system for cooling is less. The reference pump curve is developed during this time period. The service water pump shaft is made from stainless steel and the pump columns are made from carbon steel. As river water temperature increases, the stainless steel shaft expands at a different rate than the carbon steel columns resulting in a net change in the clearance at the impeller. Because the carbon steel columns grow slightly more than the stainless steel shaft, a wider gap between the impeller and bowl is created, which causes an increase in pump lift. This results in lower hydraulic performance from the reference pump curve. As river water temperature rises above 60 degrees Fahrenheit (°F), pump hydraulic performance decreases, sometimes into the alert range of 0.93 to <0.95ΔP. As river water temperature begins to cool again, pump hydraulic performance tends to return to the original cold weather reference value. This can be seen on the attached trend plots for the three service water pumps. The trend plots use head ratio which is calculated by dividing the developed head of the pump obtained during testing by the head from the pump curve at the tested flow value. This results in a ratio that would be above or below the pump curve at the tested value.

Therefore, the ASME OM Code limits of Table ISTB-5200-1 can be too restrictive for the service water pumps when river water temperature is above 60°F. Historical variations in pump head have caused the pumps to enter the alert range and require double frequency testing of the pumps when real degradation has not occurred. An allowable variation larger than these ranges is needed for both the Group A and Comprehensive pump tests, as applicable, in order to trend pump performance. NUREG-1482, "Guidelines for Inservice Testing at Nuclear Power Plants," Revision 1, Section 5.6, "Operability Limits of Pumps," states that if expanded ranges are needed, relief must be obtained. Furthermore, the request for relief must include the licensee's basis for the expanded ranges and the basis for finding that the pump performance does not demonstrate degrading conditions. The basis for acceptable pump performance pertains to the pump and not the system, though pump performance must meet system requirements to remain in an analyzed condition.

5. Proposed Alternative and Basis for Use

Expanded ranges, as defined below, will be used for the service water pumps during the Group A and Comprehensive pump tests when the river water temperature is above 60°F in lieu of the acceptance criteria specified in Table ISTB-5200-1.

The proposed expanded ranges to be used during both the Group A and Comprehensive pump tests, as modified for H, are as follows:

	Acceptable	Alert	Required Action
Group A Tests	0.93 to 1.10H	0.90 to <0.93H	<0.90 and >1.10H
Comprehensive Tests	0.93 to 1.03H	0.90 to <0.93H	<0.90 and >1.03H

Group A and Comprehensive pump testing will be performed in accordance with service water pump test procedures using the expanded ranges when river water temperature is above 60°F. These expanded ranges will still allow degrading conditions to be identified without needlessly placing the pump on double frequency testing and will provide assurance that the service water pumps will be capable of fulfilling their safety function.

Decreasing the lower limit of the Acceptable Range to 0.93 and of the Alert Range to 0.90 is consistent with lower range limits required by the ASME Boiler and Pressure Vessel Code, Section XI, Table IWP-3100-2. Currently, there are several feet of margin below the lower Required Action Range limit of 0.90 to the minimum operating point (MOP) curve for each pump. Service Water Pump, 2SWS*P21A, has 16.1 feet (6.74%) of margin to the MOP curve. Service Water Pump, 2SWS*P21B, has 21.5 feet (8.78%) of margin to the MOP curve. Service Water Pump, 2SWS*P21C, has 11.3 feet (4.85%) of margin to the MOP curve. If pump performance were to degrade in the summer months while river water temperature is above 60°F, enough margin exists above the respective pump's MOP curve to take action before challenging the design basis limits. In addition, once river water temperature decreases below 60°F, the more restrictive ASME OM Code limits from Table ISTB-5200-1 would resume, providing additional margin above the MOP curves.

Other activities are in place that enhance the ability to detect pump degradation. In addition to measuring vibrations on the upper motor bearing housing as required by the ASME OM Code, vibrations are also measured on the lower motor bearing housing each quarter. Spectral analysis of the vibrations is a good practice that can be used to determine the mechanical condition of a pump. Spectral data can provide information to determine if misalignment, unbalance, resonance, looseness, or a bearing problem is present. The trending of the spectral data could also determine a change in condition of the pump. Included in the BVPS-2 preventive maintenance program is a motor lube oil analysis that is performed every 24 weeks, and a complete overhaul of pump and motor that is performed every 516 weeks. The overhaul frequency is based on the expected condition of the pumps as a result of historical overhauls and was established to allow overhaul prior to the point of degradation resulting in questionable operational readiness.

Using the provisions of this relief request as an alternative to the requirements of Table ISTB-5200-1, the relief request provides an acceptable level of quality and safety since the alternative provides reasonable assurance of pump operational readiness.

6. Duration of Proposed Alternative

The duration of the proposed alternative is for the remainder of the third 10-year inservice test interval.

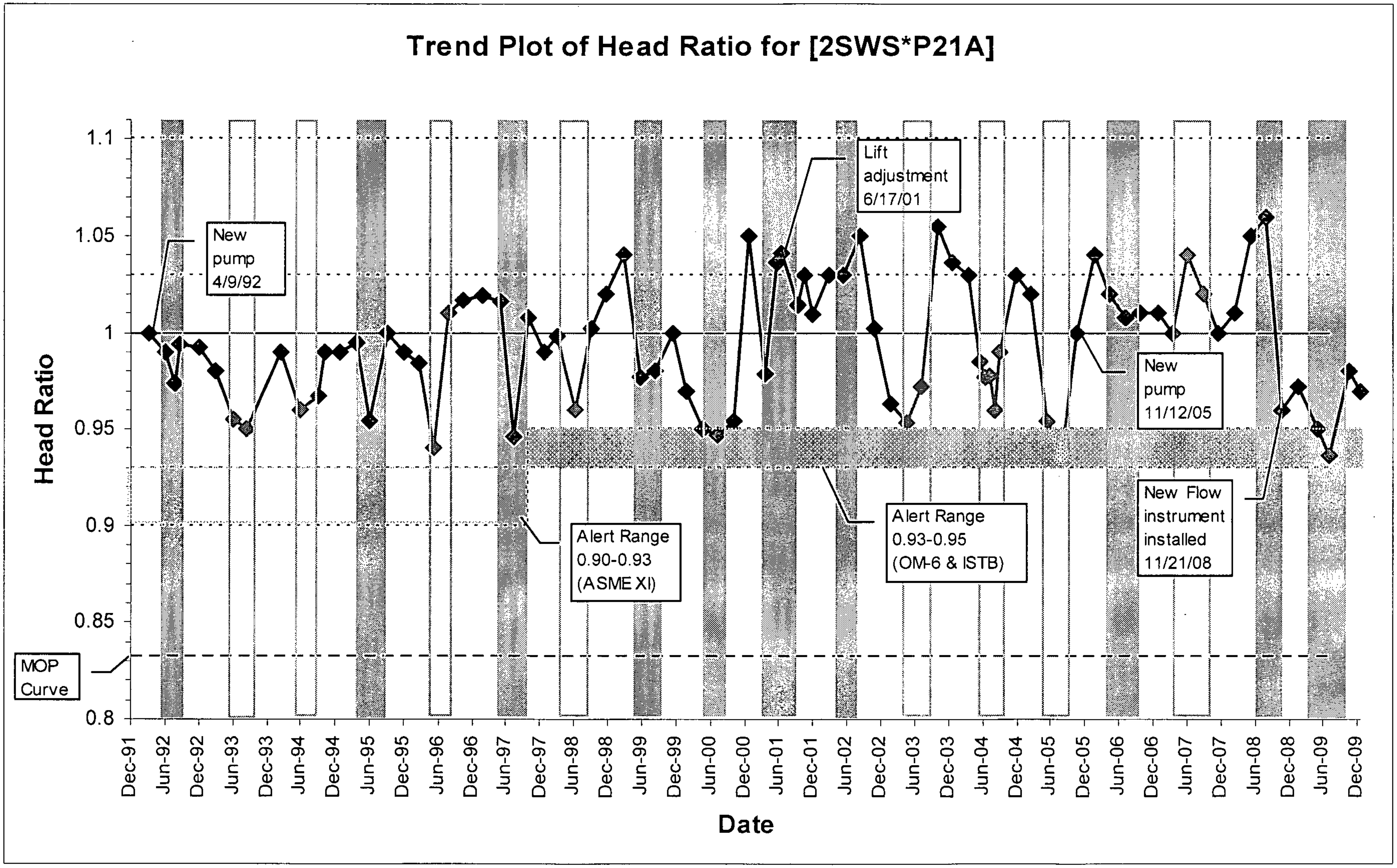
7. References

American Society for Mechanical Engineers (ASME) Code for Operations and Maintenance (OM) Section ISTB-5221(e), "Group A Test Procedure"

American Society for Mechanical Engineers (ASME) Code for Operations and Maintenance (OM) Section ISTB-5223(e), "Comprehensive Test Procedure"

American Society for Mechanical Engineers (ASME) Code for Operations and Maintenance (OM) Table ISTB-5200-1, "Vertical Line Shaft and Centrifugal Pumps Test Acceptance Criteria"

NUREG-1482, "Guidelines for Inservice Testing at Nuclear Power Plants," Revision 1, Section 5.6, "Operability Limits of Pumps


Trend Plot of Head Ratio for [2SWS*P21A]
Head Ratio
1.1
1.05
1
0.95
0.9
0.85
0.8
New pump 4/9/92
Lift adjustment 6/17/01
New pump 11/12/05
New Flow instrument installed 11/21/08
Alert Range 0.90-0.93 (ASME XI)
Alert Range 0.93-0.95 (OM-6 & ISTB)
MOP Curve
Dec-91
Jun-92
Dec-92
Jun-93
Dec-93
Jun-94
Dec-94
Jun-95
Dec-95
Jun-96
Dec-96
Jun-97
Dec-97
Jun-98
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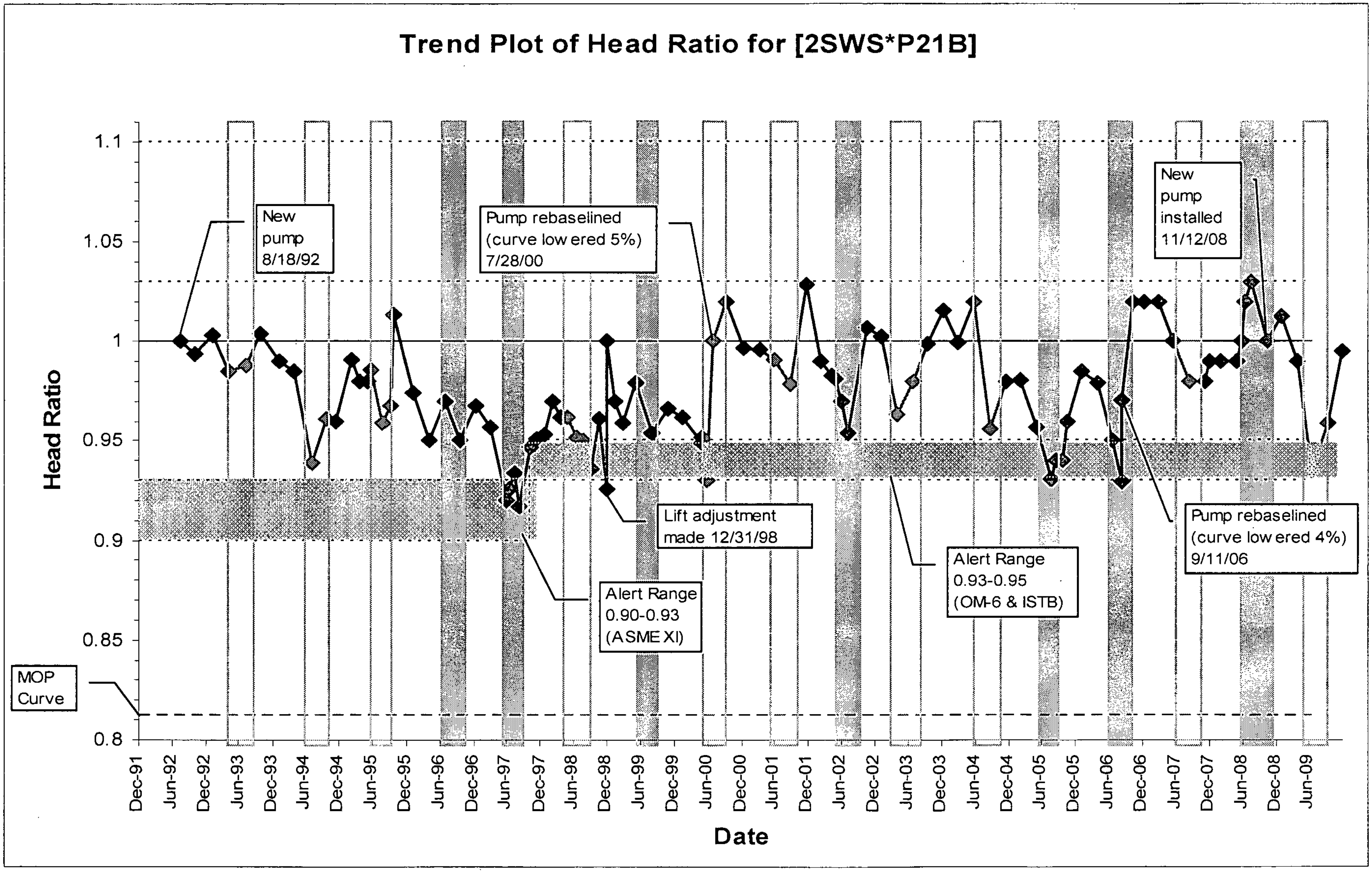
Trend Plot of Head Ratio for [2SWS*P21B]
Head Ratio
1.1
1.05
1
0.95
0.9
0.85
0.8
New pump 8/18/92
Pump rebaselined (curve low ered 5%) 7/28/00
New pump installed 11/12/08
Lift adjustment made 12/31/98
Alert Range 0.90-0.93 (ASME XI)
Alert Range 0.93-0.95 (OM-6 & ISTB)
Pump rebaselined (curve low ered 4%) 9/11/06
MOP Curve
Dec-91
Jun-92
Dec-92
Jun-93
Dec-93
Jun-94
Dec-94
Jun-95
Dec-95
Jun-96
Dec-96
Jun-97
Dec-97
Jun-98
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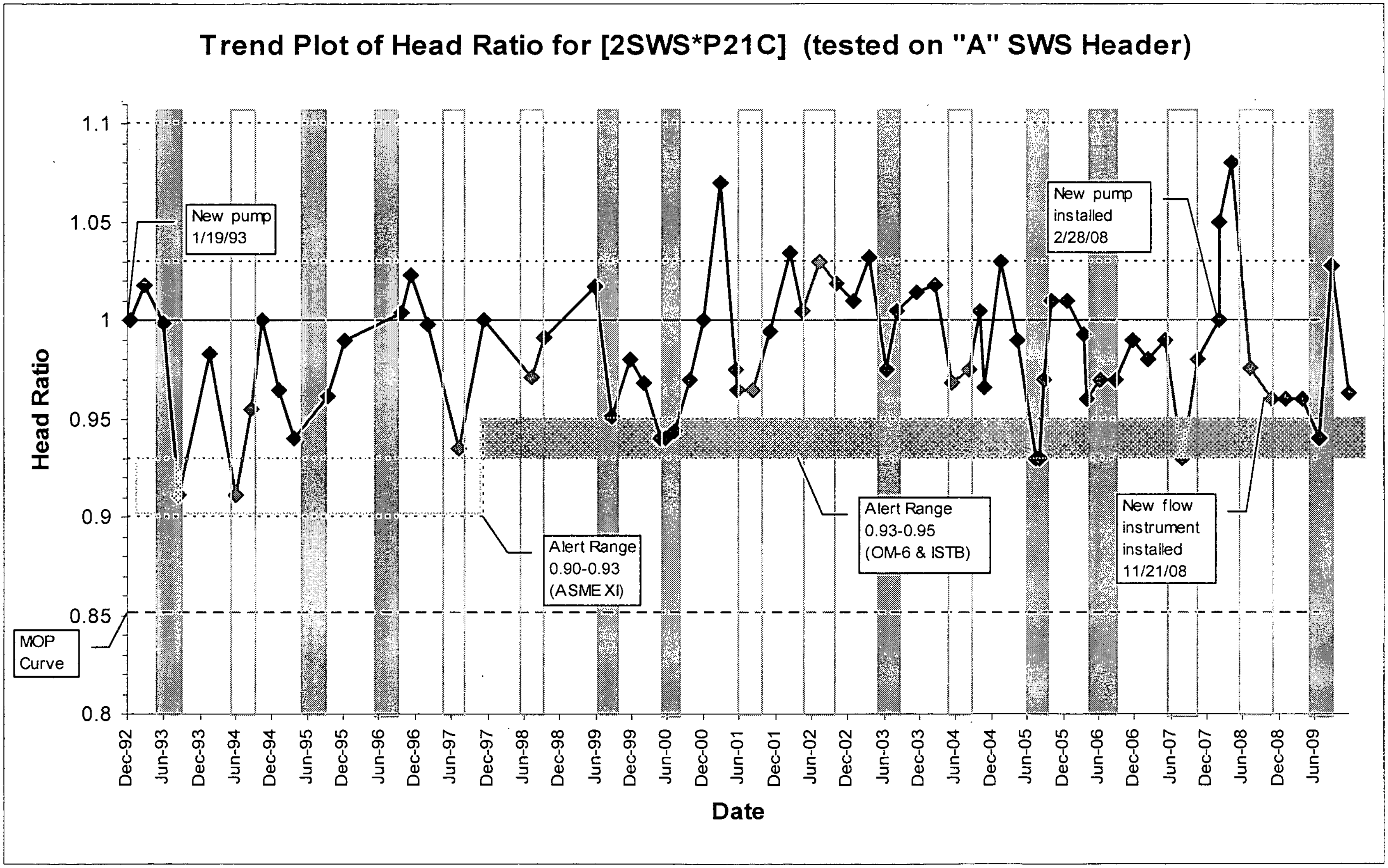

Trend Plot of Head Ratio for [2SWS*P21C] (tested on "A" SWS Header)
Head Ratio
1.1
1.05
1
0.95
0.9
0.85
0.8
New pump 1/19/93
New pump installed 2/28/08
Alert Range 0.90-0.93 (ASME XI)
Alert Range 0.93-0.95 (OM-6 & ISTB)
New flow instrument installed 11/21/08
MOP Curve
Dec-92
Jun-93
Dec-93
Jun-94
Dec-94
Jun-95
Dec-95
Jun-96
Dec-96
Jun-97
Dec-97
Jun-98
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