UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555

ENCLOSURE 2

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO THE INSERVICE TESTING PROGRAM AND REQUESTS FOR RELIEF

COMMONWEALTH EDISON COMPANY

BYRON STATION, UNITS 1 AND 2

DOCKET NOS. STN 50-454 AND STN 50-455

1.0 INTRODUCTION

The Code of Federal Regulations (Regulations), 10 CFR 50.55a, requires that inservice testing (IST) of the American Society of Mechanical Engineers (ASME) Code Class 1, 2, and 3 pumps and valves be performed in accordance with Section XI of the ASME Boiler and Pressure Vessel Code (Code) and applicable addenda, except where specific written relief has been requested by the licensee and granted by the Commission pursuant to 10 CFR 50.55a(a)(3)(i), (a)(3)(ii), or (g)(6)(i). In requesting relief, the licensee must demonstrate that: (1) the proposed alternatives provide an acceptable level of quality and safety; (2) compliance would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety; or (3) the conformance with certain requirements of the applicable Code edition and addenda is impractical for its facility. The Regulations, 10 CFR 50.55a(a)(3)(i), (a)(3)(ii), and (g)(6)(i), authorize the Commission to grant relief from these requirements upon making the necessary findings.

This Safety Evaluation (SE) relates to relief requests PR-1, PR-2, PR-7, VR-2, VR-18, VR-19, and VR-20 in Revisions 9, 9a, 10, 10a, and 10c of the Byron 1 and 2 IST program, submitted in letters dated May 23, 1991, September 13, 1991, and September 23, 1991. Other relief requests contained in these submittals are not addressed in this SE because they have either been evaluated in previously issued SEs dated September 15, 1988, September 14, 1990, and August 16, 1991, or granted in accordance with the guidelines of Generic Letter (GL) 89-04. The approval status is summarized at the end of each relief request.

This IST program, which is based on the requirements of Section XI of the ASME Code, 1983 Edition through the Summer of 1983 Addenda, covers the first ten-year inspection intervals from September 16, 1985, to September 16, 1995, for Byron 1 and from August 21, 1987, to August 21, 1997, for Byron 2.

2.0 DESCRIPTION AND EVALUATION OF RELIEF REQUESTS

2.1 Revision of Relief Request PR-1

The licensee requested relief from the requirements of ASME Code Section XI, Table IWP-3100-2, relating to the measurement of pump vibration. The licensee proposed to measure vibration in units of velocity rather than displacement, using a program patterned after ANSI/ASME OMb-1989, Part 6 (OM-6) as described in Section 2.1.1, below, for all pumps in the IST program.

2.1.1 Licensee's Basis for Requesting Relief

The measurement of pump vibration is required so that developing problems can be detected and repairs initiated prior to a pump becoming inoperable. Measurement of vibration only in displacement quantities, as required by the ASME Code, does not take into account frequency which is also an important factor in determining the severity of the vibration.

The ASME Code minimum standards require measurement of the vibration amplitude in mils (displacement). Byron Station proposes an alternate program of measuring vibration velocity (inches per second) which is more comprehensive than that required by ASME Code Section XI. This technique is an industry-accepted method which is much more meaningful and sensitive to small changes that are indicative of developing mechanical problems. These velocity measurements detect not only high amplitude vibration, that indicates a major mechanical problem such as misalignment or unbalance, but also the equally harmful low amplitude, high frequency vibration due to bearing wear that usually goes undetected by simple displacement measurements.

The allowable ranges of vibration and their associated action levels will be patterned after the guidelines established in OM-6 Table 3 and Table 3a. These ranges will be used in whole to assess equipment operational readiness for all components except the Essential Service Water Makeup Pumps 0SX02PA & B (see PR-7).

The acceptable performance range for all components (except the Essential Service Water Make Up Pumps 0SX02PA & B) will be as follows:

Acceptance Range (in/sec)	Alert Range (in/sec)	Required Action Range (in/sec)
V≤2.5Vr and V≤0.325	2.5Vr<V≤[illegible].0Vr or 0.325<V≤0.700	V>6.0Vr or V>0.700

where Vr is the reference velocity.

For all pumps, the evaluation of data to determine whether the pump belongs to the Alert or Required Action ranges will be done immediately per the requirements of NRC Generic Letter 89-04, Attachment 1, Position 8. This will be done using industry accepted vibration analysis equipment, such as a full spectrum analyzer.

Vibration measurements for all pumps will be obtained and recorded in velocity, inches per second, and will be broadband unfiltered peak measurements. The monitored locations for vibrations analysis will be marked so as to permit subsequent duplication in both location and plane.

The frequency response range of the vibration transducers and their readout system shall be capable of measuring frequency responses from one-third minimum pump shaft rotational speed to at least one thousand hertz.

The centrifugal pumps in the program will have vibration measurements taken in a plan approximately perpendicular to the rotating shaft in two orthogonal directions on each accessible pump bearing housing and in the axial direction on each accessible pump thrust bearing housing.

Measurements of vibration in mils displacement are not sensitive to small changes that are indicative of developing mechanical problems. Therefore, the proposed alternate method of measuring vibration velocity in inches/second (in conjunction with the use of the allowable vibration ranges and limits established in OM-6) provides added assurance of the continued operability of the pumps.

2.1.2 Evaluation

Using vibration velocity measurement rather than vibration displacement measurements has been demonstrated to provide an acceptable indication of pump degradation. The OM-6 guidelines for measuring vibration velocity are acceptable to the NRC as an alternative to the requirements of ASME Code Section XI provided the licensee complies with all of the Part 6 vibration measurement requirements except those for which specific relief has been requested and granted.

Based on the determination that the OM-6 pump velocity measurement will provide acceptable indication of pump mechanical condition, and will thus provide an acceptable level of quality and safety, relief may be granted from the Code vibration testing requirements pursuant to 10 CFR 50.55a(a)(3)(i) for pumps in this relief request provided the licensee complies with all of the OM-6 vibration measurement requirements.

2.2 Revision of Relief Request PR-2

The licensee requested relief from the IWP-3100 requirement of Section XI of ASME Code for measurement of bearing temperature for all pumps in the IST program.

2.2.1 Licensee's Basis for Requesting Relief

The AF, CC, CS, CV, DO, RH, SI, SX and WO pumps' (42 total) bearings are not provided with permanent temperature detectors or thermal wells. Therefore, gathering data on bearing temperature is impractical. The only temperature measurements possible are from the bearing housing. Measurement of housing temperature on the pumps does not provide positive information on bearing condition or degradation. For example, the bearings on the Essential Service Water Pumps (0SX02PA, and 0SX02PB) and Diesel Oil Transfer Pumps (1DO01PA through D and 2DO01PA through D) are cooled by the pumped fluid. Therefore, any heat generated by degraded bearings is carried away by the cooling fluid and would not be directly measured at the bearing housing.

Even those cases where bearing temperature monitoring equipment is available, bearing temperature measurements will not provide significant additional information regarding bearing condition other than that already obtained by measuring vibration. Measurement of vibration provides more concise and consistent information with respect to pump and bearing conditions. The usage of vibration measurements can provide information as to a change in the balance of rotating parts, misalignment of bearing, worn bearing, changes in internal hydraulic forces and general pump integrity prior to the condition degrading to the point where the component is jeopardized. Bearing temperature does not always predict such problems.

An increase in bearing temperature most often does not occur until the bearing has deteriorated to a point where additional pump damage may occur. Bearing temperatures are also affected by the temperature of the medium being pumped, thus, the hydraulic and vibration readings are more consistent.

Quarterly measurement of hydraulic parameters and vibration readings provides a more positive method of monitoring pump condition and bearing degradation.

By measuring pump hydraulic parameters and vibration velocity (as described in PR-1), the pump operability and the trending of mechanical degradation are assured. Also, since these parameters (i.e., hydraulic parameter and vibration) are measured quarterly, the pump mechanical condition will be more accurately determined than would be possible by measuring bearing temperature on a yearly basis.

2.2.2 Evaluation

The temperature at the bearing most often would not increase significantly until just before a bearing failure. Therefore, the likelihood of detecting an impending bearing failure with a single annual bearing temperature measurement is very small. The quarterly pump vibration measurements provide more information about the degradation of the bearing than the annual bearing temperature measurement.

Relief may be granted as requested pursuant to 10 CFR 50.55a(a)(3)(i), since the alternate testing provides an acceptable level of quality and safety.

2.3. Relief Request Number PR-7

The licensee requested relief from the requirements of OM-6 for the acceptable ranges of test parameters.

2.3.1 Licensee's Basis for Requesting Relief

The Essential Service Water Pumps OSX02PA & B are of a very unique design (See Figures 1 and 2). The pump is attached to a horizontal diesel driver via a right angle gear drive, and the gear drive is located approximately 39 feet above the pump. This configuration assures pump operability during the design basis flooding of the Rock River. As would be expected, this extreme configuration results in vibration characteristics which are different from pumps of a more conventional design. The vibration levels for these pumps are consistently higher than the commonly expected values. These pumps exhibited higher than usual vibration levels at the time of their installation (approximately 0.4 - 0.45 in/sec for the gear box and approximately 0.20 - 0.25 in/sec for the pump), at which time they were verified by the vendor to be operating properly, and to have continued to display high vibration levels throughout their service life.

Also characteristic of these pumps is the fact that the gear box vibration levels are consistently higher than the pump vibration levels. The licensee proposed that, in order to properly monitor this uniquely designed pump, separate acceptance ranges be used for the gear box and the pump. The vibration levels for the pump, though consistently higher than those for conventional pumps, display no significant upward trend over a period of approximately six years.

This is significant evidence that these vibration levels are characteristic of this unique design and do not indicate pump degradation. However, the licensee proposed that tighter acceptance criteria be used for the pump than for the gear box in order to detect any degradation that may occur in the future. Based on performance data, Byron Station proposes that the following ranges be utilized to monitor vibration levels for OSX02PA & B (where V = the vibration velocity [in inches per second] and Vr = the reference vibration velocity [in inches per second] established when the pump was known to be operating acceptably):

OSX02PA & B Location	Acceptance Range (in/sec)	Alert Range (in/sec)	Required Action Range (in/sec)
Pump Shaft	$V \leq 2.5Vr$ and $V \leq 0.325$	$2.5Vr < V \leq 6.0Vr$ or $0.325 < V \leq 0.700$	$V > 6.0Vr$ or $V > 0.700$
Gearbox	$V \leq 2.5Vr$ and $V \leq 0.600$	$2.5Vr < V \leq 6.0Vr$ or $0.600 < V \leq 0.900$	$V > 6.0Vr$ or $V > 0.900$

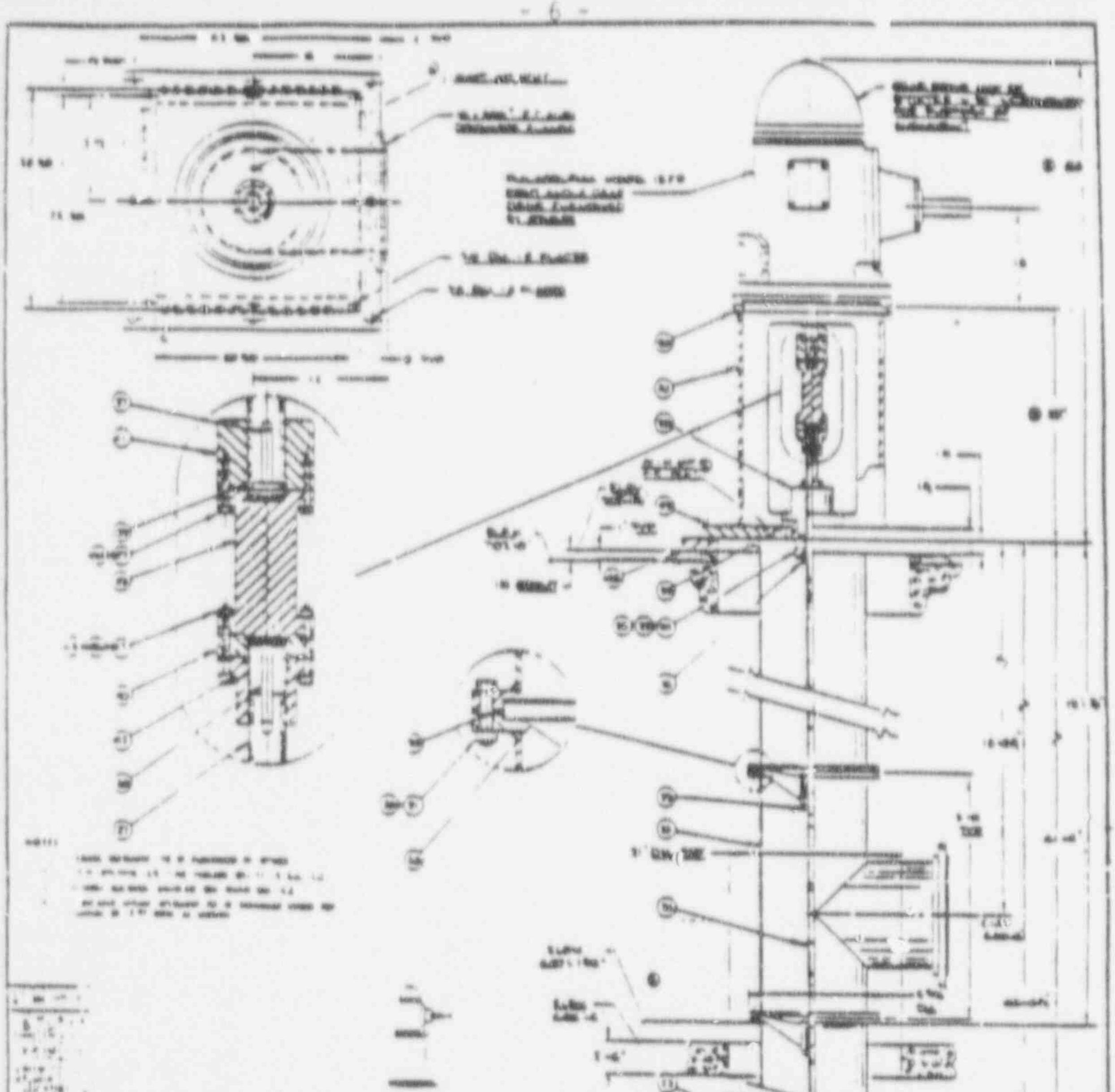

Figure 1 Byron Station Essential Service Water Pump

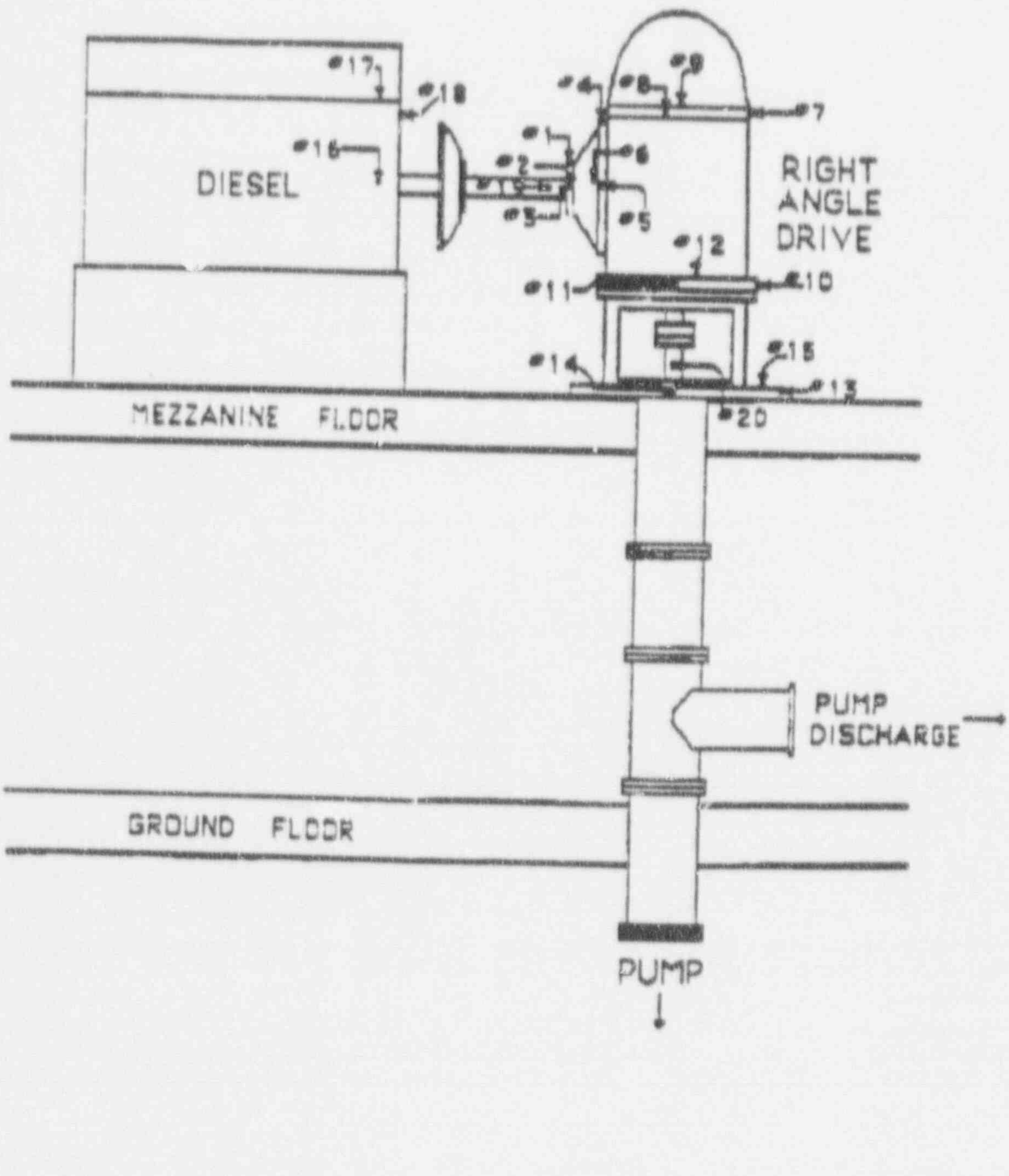

Figure 2 Configuration of Byron Station ESW pump, gear drive and diesel driver. Points of vibration level measurements.

Additionally, although it is obvious that this pump has unusual characteristics and understandably high vibration levels, the licensee plans to maintain conservatism in its maintenance practices and replace the gear assembly when parts are available to verify that the high vibration levels are characteristic of this pump design.

A review of past performance parameters for the SX make-up pumps has been completed. The licensee provided graphs of flowrate and vibration data over the last 2.5 years of operation. Prior to 1989, only the maximum peak vibration values were recorded without indication of orientation. Since 1989, all the individual peak vibration levels at each location were recorded with associated orientation, therefore, the prior data cannot be directly compared to recent data. From the licensee's plots and tables it can be seen that the vibration fluctuates dramatically but showed no overall upward trend over a 2.5 year period. Also, Commonwealth Edison System Material Analysis Department (SMAD) measured vibration levels at the points shown in Figure 2 and compared the results to available data on vibration amplitudes for similar gear drive arrangements in the diesel driven fire pump units at Braidwood, Zion, and Dresden Stations. Regardless of vendor, these three units all exhibited high vibration amplitudes on the gear drive consistent with the elevated vibration levels recorded on the SX Make-up pumps at Byron Station.

The OM-6 limit on the alert range for vibration is either 2.5 times the reference value or 0.325 (whichever is less) and limit on the required action range is 6.0 times the reference value or 0.700 (whichever is less). Based on engineering judgement, an alert range value of 0.600 and a required action value of 0.900 were selected as conservative limits in comparison to the OM-6 limits.

OM-6 limits allow an increase of 140% between the alert limit and the required action limit (for 2.5 times reference to 6.0 reference) or an increase of 115% (for the 0.325 to 0.700). The alert limit being proposed here is 0.600 (a limit recognized as a reasonable limit in the July 15, 1991, conference call between NRC and the licensee) and the required action range is 0.900. The proposed range here is a 50% increase from alert to required action. This is a much more conservative increase than the OM-6 requirement.

By using acceptance ranges which are reflective of the intrinsic characteristics of the pump, performance can be monitored more effectively and unnecessary and excessive testing of properly functioning equipment can be avoided.

2.3.2 Evaluation

Using vibration velocity rather than vibration displacement has been demonstrated to provide acceptable indication of pump degradation. Guidelines for vibration published in OM-6 are acceptable to the NRC as an alternative to the vibration requirements of Section XI of ASME Code.

The essential service water makeup pumps, OSX02PA and B, are vertical pumps coupled to horizontal diesel engine drivers through a right angle gear drive. At the time of installation, when the pumps were verified by the vendor to be operating properly, vibration velocity measurements ranged between approximately 0.4 to 0.45 inches/second for the gear box and approximately 0.2 to 0.25 inches/second for the pump shaft. The licensee proposed to use the OM-6 action limits for the pump shaft. However, for the gear box, the licensee proposed the following limits to account for the normally high vibration levels: "Alert" range of 2.5 to 6 times the reference value or greater than 0.60 inches/ second and "Required Action" range of greater than 6 times the reference value or greater than 0.90 inches/second. The licensee indicated that these values are based on six years of testing experience.

Based on the determination that using the OM-6 pump vibration measurement requirements will provide acceptable indication of pump mechanical condition, and will thus provide an acceptable level of quality and safety, relief may be granted from the Code vibration testing requirements pursuant to 10 CFR 50.55a(a)(3)(i) relative to the pump shafts in this relief request provided licensee complies with all of the OM-6 vibration measurement requirements.

Since the gear box normally exhibits relatively high vibration levels, the use of greater than 0.325 inches/second "Alert" range as in OM-6 would not be practical in that it would require doubling the test frequency when the vibration velocity is normal. Also, complying with greater than 0.7 inches/ second "Required Action" range as in OM-6 would not be consistent with several years of empirical data which show vibration velocities to be in this range on several occasions without apparent pump failure or damage. The proposed "Alert" and "Required Action" limits appear reasonable considering the six years of test data; however, because these pumps are of a unique design with unusually high vibration characteristics, obtaining the vendor's concurrence of these limits is appropriate. The empirical data combined with the vendor's concurrence should provide reasonable assurance that applying the proposed action limits will not compromise the operational readiness of these pumps.

Based on the determination that it is impractical to use the "Alert" and "Required Action" ranges of OM-6 for the OSX02PA and B gear box and considering the licensee's proposed alternative and the burden on the licensee if the OM-6 requirements were imposed, relief may be granted as requested for the gear box pursuant to 10 CFR 50.55a(g)(6)(i), provided the licensee obtains the vendor's concurrence of the proposed ranges and complies with all other OM-6 vibration measurement requirements.

2.4 Relief Request Number VR-2

The licensee requested relief from exercising valves, 1(2)CS020A and B, containment spray [illegible] NaOH additive system check valves, in accordance with the requirements of ASME Code Section XI, Paragraph IWV-3522, and proposed to disassemble and [illegible] these valves during refueling outage to demonstrate valve operability.

2.4.1 Licensee's Basis for Requesting Relief

The check valves in the spray additive system cannot be stroked without introducing NaOH into the CS system.

The A train and B train valves are of the same design (manufacturer, size, model number, and materials constru-tion) and have the same service conditions, including orientation, therefore, tney form a sample disassembly group.

Group 1	Group 2
1CS020A	2CS020A
1CS020B	2CS020B

One valve frum each group, on a per unit basis, will be tested each refueling outage. If the disassembled valve is not capable of being full-stroke exercised or if there is binding or failure of valve internals, the remaining valve on the affected unit will be inspected.

Full-flow testing of these valves cannot be accomplished without posing a serious threat to the safety of equipment and personnel. It is impractical to either full or part-stroke exercise these valves since flow through these valves would result in the introduction of NaOH into the CS system. Full-flow testing would require a special test hook-up and necessitate flushing the system.

The alternate test frequency is justifiable in that maintenance history and previous inspections of these valves at Byron and Braidwood Stations have shown no evidence of degradation or physical impairment (this is to be expected since the valves see very limited operation). Industry experience, as documented in Nuclear Plant Reliability Data System (NPRDS), showed no history of problems with these valves. A company wide check valve evaluation addressing the "EPRI Applications Guidelines for Check Valves in Nuclear Power Plants" revealed that the location, orientation, and application of these valves are not conducive to the type of wear or degration correlated with Significant Operating Experience Report (SOER) type problems, but, these valves still require some level of monitoring to detect hidden problems.

The wafer type design of the valve body for these valves make their removal a simple process, with little chance of damage to their internals. Also, there is no disassembly of internal parts required; all wear surfaces are accessible by visual examination. After inspection and stroke testing, the valve is reinstalled into the li-e and post-maintenance testing is performed. The valve inspection procedure requires post-inspection visual examination of the check valve to insure that the pin is oriented properly and that the flow direction is correct. The alternate test method is sufficient to insure operability of these valves and is consistent with Generic Letter (GL) 89-04.

2.4.3 Evaluation

Exercising these valves with CS system flow is impractical during normal plant operation because that would require either spraying the containment or injecting highly corrosive sodium hydroxide into the refueling water storage tank (RWST) via the pump minimum flow recirculation line. Spraying the containment with water would result in equipment and lagging damage while adding sodium hydroxide to the RWST could greatly increase corrosion and reduce the reliability of all systems in contact with the water.

Full-flow testing would require a special test hook-up and necessitate flushing the system; however, the licensee states that full-flow testing of these valves cannot be accomplished without posing a serious threat to the safety of equipment and personnel.

Disassembly and inspection of these valves is an acceptable method to assess valve condition if it is impractical to test the valves by other viable means. However, the NRC staff considers valve disassembly and inspection to be a maintenance procedure that is not equivalent to exercising with fluid flow. This procedure has risks and should not be used if testing is possible. The NRC staff positions regarding valve disassembly and inspection are explained in detail in GL 89-04, Attachment 1, Item 2. The minutes of the public meetings on GL 89-04 regarding Item 2 further stipulate that a part-stroke exercise test using flow is expected to be performed before the valve is returned to service after disassembly and inspection is completed. The licensee should investigate methods of part-stroke exercising these valves following disassembly and inspection if full-stroke exercising using flow is not possible. Sodium hydroxide is commonly used in industry, and draining and disposing (or recycling) the NaOH in the special test loop should not involve excessive hazard or hardship.

An alternative available to the licensee is to verify that these valves open sufficiently to pass the maximum required accident flow rate during flow testing by use of non-intrusive diagnostic techniques at least once each refueling outage.

Based on the impracticality of complying with the Code requirements, the burden on the licensee if the Code requirements were imposed, and considering the licensee's proposed alternative, relief may be granted from the Code requirements pursuant to 10 CFR 50.55a(g)(6)(i) provided the licensee complies with the GL 89-04, Position 2 guidelines on disassembly and the valves are verified to be at least part-stroke exercised with flow following reassembly prior to returning them to service. The licensee should actively investigate the use of non-intrusive diagnostic techniques to demonstrate that these valves exercise open during flow testing. This relief request should be revised or deleted if a method is developed to verify the full-flow stroke capability of these valves.

2.5. Relief Request Number VR-18

The licensee requested relief from exercising 98 valves in accordance with the requirements of ASME Code Section XI, Paragraph IWV-3521. The licensee proposed to verify valve operability by testing the valves during refueling outages following the guidelines in GL 89-04, Attachment 1, Positions 1, 2, and 3.

2.5.1 Licensee's Basis for Requesting Relief

The valves listed in the Table below can not be safely full-stroke exercised (Ct) open and/or back-flow tested (Bt) closed during plant operation or cold shutdowns, as required by the ASME Code. NRC GL 89-04, Attachment 1, Positions 1, 2, and 3 provide guidelines for method and frequency of testing check valves.

Refer to the Table below for a list of valves, direction, and alternate testing frequency requested:

VALVES	DIRECTION	ALTERNATE TESTING FREQUENCY
1/2CC9486	Close	Note 1
1/2CC9518	Close/Open	Note 1/Note 1
1/2CC9534	Close/Open	Note 1/Note 1
1/2CV8113	Close/Open	Note 1/Note 1
1/2IA091	Close	Note 1
1/2PR002G,H	Close	Note 1
1/2PR032	Close	Note 1
1/2PS231A,B	Close	Note 1
1/2RH8705A,B	Close/Open	Note 2/Note 3
1/2RY8046	Close	Note 1
1/2RY8047	Close	Note 1
1/2SI8815	Close	Note 2
1/2SI8818A-D	Close	Note 2
1/2SI8819A-D	Close	Note 2
1/2SI8841A,B	Close	Note 2
1/2SI8900A-D	Close	Note 2
1/2SI8905A-D	Close	Note 2
1/2SI8948A-D	Close	Note 2
1/2SI8949A-D	Close	Note 2
1/2SI8956A-D	Close	Note 2
1/2SI8958	Close	Note 1
1/2WM191	Close	Note 1
1/2WO007A,B	Close	Note 1

Table Notes:

1. Perform test during refueling outages in conjunction with Appendix J, Local Leak Rate Test. See IST Program Relief Request VR-1.

2. Perform test during refueling outage in conjunction with Byron Station Technical Specification 4.4.6.2.2 seat leakage testing. As follows:

   a. At least once per 18 months.

b. Prior to entering MODE 2 whenever the plant has been in COLD SHUTDOWN for 72 hours or more and if leakage testing has not been performed in the previous 9 months.

c. Prior to returning the valve to service following maintenance, repair, or replacement work on the valve.

d. Within 24 hours following valve actuation due to automatic or manual action or flow through the valve.

3. These valves are verified to be operable by observation of depressurization in the applicable line. This is a test method which was approved by the NRC in an SE dated September 14, 1990.

Testing these check valves on the same schedule as their required seat leakage tests will allow for coordination of testing activities without imposing additional check valve leak rate testing requirements. Such activity coordination will optimize testing efforts and resources while adequately maintaining the system in a state of operational readiness. The frequency will also minimize personnel exposure to radiation by minimizing the amount of work performed inside containment during power operations.

2.5.2 Evaluation

The staff finds that the basis provided by the licensee is not in sufficient detail to justify this request. The relief, therefore, can not be granted based on the information presented.

The basis should be described in such a way that it is evident that (1) testing the affected components as required by the Code is impractical, (2) compliance would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety, or (3) the proposed alternatives provide an acceptable level of quality and safety. Analysis may be based on historical data from the manufacturer, onsite, or other plants. In demonstrating that compliance with Code requirements is impractical, the reasons must be presented for each valve clearly and thoroughly and specifically address technical concerns such as damage to equipment, hazards to personnel, or the possibility of a plant trip. The licensee needs to explain for each valve how the alternative verifies full-stroke exercising. Personnel radiation exposure concerns should contain information about the general area radiation field, local hot spots, plant radiation limits and stay times, and the amount of exposure personnel performing the testing would receive.

2.6 Relief Request Number VR-19

The licensee requested relief from verifying the closure capability of check valves 1(2)AF001A/B in accordance with the requirements of ASME Code Section XI, Paragraph IWV-3522, and proposed to verify the closure capability by disassembly and inspection during refueling outages following the guidelines in GL 89-04, Attachment 1, Positions 1, 2, and 3.

2.6.1 Licensee's Basis for Requesting Relief

Adequate closure capabilities of these valves cannot be verified by performing a back pressure test or other non-intrusive methods due to the multiple boundary isolation points. This configuration makes it impossible to assign any observed leakage to any individual component.

The A train and B train valves are of the same design (manufacturer, size, model number, and materials construction) and have the same service conditions, including orientation, therefore, they form a sample disassembly group.

Group 1	Group 2
1AF001A	2AF001A
1AF001B	2AF001B

One valve from each group, on a per-unit basis, will be tested each refueling outage. If the disassembled valve is not capable of being full-stroke exercised or if there is binding or failure of valve internals, the remaining valve on the affected unit will be inspected.

Performing a pressure test to verify closure is impractical due to the system configuration. To perform this test, it would be necessary to attach a pump to a test connection and pressurize the line containing the valve. However, this line also contains many potential leakage paths (valves, pump seals, and instrument lines). It is impossible to assign a leakage value to any specific path.

The alternate test frequency is justifiable in that removal of these valves requires that the system be taken out of service for an extended period of time. Due to Safety System Performance, Probabilistic Risk Assessment (PRA), and availability concerns involving the auxiliary feedwater system, these valves cannot be removed on a quarterly frequency without impacting plant safety. Maintenance history and previous inspections of these valves at Byron and Braidwood Stations have shown no evidence of degradation or impairment. Industry experience, as documented in NPRDS, showed no history of problems with these valves. A company wide check valve evaluation addressing the "EPRI Applications Guidelines for Check Valves in Nuclear Power Plants" revealed that the location, orientation and application of these valves are not conducive to the type of wear or degradation correlated with SOER 86-03 type problems but still require some level of monitoring to detect hidden problems.

The alternate test method is sufficient to insure operability of these valves and is consistent with GL 89-04.

Although these valves will be full-stroke tested per the ASME Section XI Code requirements for cold shutdown valves, they also have an additional Technical Specification requirement. Per note 12 in Section 4.4 of the licensee's submittal dated May 23, 1991, these valves are full-stroke tested during cold shutdown in accordance with Technical Specification 4.7.1.2.2 which insures the operability of the Auxiliary Feedwater flowpath to each steam generator by verifying flow to each steam generator following each cold shutdown of 30 days prior to entering Mode 2. Testing at this frequency is sufficient to insure operability of this system and forms the basis of this Technical Specification.

2.6.2 EVALUATION

System configuration and many potential leakage paths preclude pressure or leak testing to verify valve closure capability. The licensee proposed disassembly and inspection during refueling outages to verify the closure capability.

The NRC staff positions regarding check valve disassembly and inspection are explained in detail in GL 89-04. The minutes of the public meetings on GL 89-04 regarding Position 2, "Alternatives to Full-Flow Testing of Check Valves," further stipulate that a partial-stroke exercise test using flow is expected to be performed before the valve is returned to service after disassembly and inspection. A full-stroke exercise using flow should be performed if possible. The NRC staff considers valve disassembly and inspection to be a maintenance procedure with inherent risks. The routine use of disassembly and inspection as a substitute for testing is undesirable when other testing methods are possible. Non-intrusive diagnostic techniques such as acoustics or radiography can be used to demonstrate that these valves close when subjected to reverse-flow conditions.

Based on the impracticality of complying with the Code requirements, the burden on the licensee if the Code requirements were imposed and considering the licensee's proposed alternative, relief may be granted as requested from the Code requirements pursuant to 10 CFR 50.55a(g)(6)(i) provided the licensee complies with the GL 89-04, Position 2 guidelines on disassembly and the valves are verified to be at least part-stroke exercised with flow prior to returning them to service following reassembly. The licensee should actively investigate the use of non-intrusive diagnostic techniques to demonstrate that these valves will close upon cessation or reversal of flow. This relief request should be revised or deleted if a non-intrusive method is developed to verify the closure capability of these valves.

2.7 Relief Request Number VR-20

The licensee requested relief from the corrective action requirements of ASME Code Section XI, Paragraph IWV-3417(a) for 340 valves in the IST program. The licensee proposed that corrective action limits be based on an increase in stroke time from a reference value instead of the stroke time of the previous test.

2.7.1 Licensee's Basis for Requesting Relief

Trending stroke times, based on the percent change from the previous test, as ASME Code Section XI requires, allows gradual degradation to occur over a long period of time without triggering the additional trending attention that increased testing frequency requires. An improved method of component performance monitoring is proposed, which will require a valve to be placed on increased test frequency based on the percent change from the fixed reference value established via GL 89-04, Attachment 1, Position 5.

For all power-operated valves which normally stroke in greater than two seconds, an "Alert" range will be established based on reaching a given percent change from the reference value established via GL 89-04. The following table will be used as a starting point in evaluation of this fixed "Alert" range:

VALVE TYPE	REFERENCE STROKE TIME (Tref)	ALERT RANGE	REQUIRED ACTION
SOV's HOV's AOV's	>10 sec.	(1.25)(Tref)-(1.75)(Tref) or (Tref+10 sec)-(Tref+20 sec)	>(1.75)(Tref) or >(Tref + 20 sec)
MOV's	>10 sec.	(1.15)(Tref)-(1.25)(Tref) or (Tref+10 sec)-(Tref+20 sec)	>(1.25)(Tref) or >(Tref + 20 sec)

The following criteria will be used as general guidance to establish "Alert" and "Required Action" ranges for power-operated valves:

SOV's/HOV's/AOV's-Less than or equal to 10 seconds:

"Alert" range: $(1.50)(T_{ref})$-[illegible]
"Required Action" value: [illegible](2.0)[illegible]

MOV's-Less than or equal to 10 seconds:

"Alert" range: $(1.25)(T_{ref})-(1.50)(T_{ref})$
"Required Action" value: $>(1.50)(T_{ref})$

Notes:

A. Fast acting valves (valves which normally stroke in less than 2 seconds consistently) are included in Relief Request VR-12. These valves are not assigned "Alert" ranges and are not trended.

B. In all cases, the "Required Action" value cannot exceed Technical Specification or Updated Final Safety Analysis Report (UFSAR) values, regardless of calculated values.

C. The above Table is a guideline and cannot cover all valves. The "Alert" ranges and "Required Action" values are selected based on the comparison between the "Reference" value, limiting value given in Technical Specifications/UFSAR, and calculated values using the table above:

   1. All values are rounded to the nearest whole second.

   2. Valves which serve the same function on dual trains (i.e., 1CC9473A and 1CC9473B) and dual units (i.e., 1CC9473A and 2CC9473A) are assigned the same Required/Alert range values based on human factors considerations, unless valve or system design differences exist between the trains/units.

Using fixed "Alert" ranges based on the valve "Reference" value established when the valve was known to be operating acceptably will ensure that gradual valve performance degradation is monitored and evaluated, by placing the valve on increased testing frequency when the stroke time exceeds a fixed multiple of the "Reference" value. This method is superior to that required by the ASME Code in that the point of reference used to evaluate the performance trend on a valve remains fixed. This alternative utilizes the same stroke time percentage change value as required by the ASME Code to place a valve on increased frequency testing.

2.7.2 <u>Evaluation</u>

Using empirically derived reference values of valve-stroke time for comparison with subsequent test data provides a reasonable alternative to Code requirements. The Code requirements allow a continual increase in valve-stroke time over a long period which could result in significant valve degradation without requiring an increased test frequency or corrective action. Because test data is compared only to the previous stroke time, a valve could degrade significantly even though each incremental increase in stroke time meets the limit specified in Paragraph [illegible]17(a). Comparing test results to a reference value based on stroke times [illegible]lished when the valve is known to be in good operating condition helps to ensure that such an oversight could not occur.

Based on the determination that the proposed alternative would provide an acceptable level of quality and safety, relief may be granted as requested pursuant to 10 CFR 50.55a(a)(3)(i) with respect to the reference value instead of the previous value in determining change in stroke times.

3.0 CONCLUSION

During the rev ew of the licensee's IST program relief requests, the staff identified areas where the licensee did not provide the requisite bases to justify the requests. These areas are addressed in the evaluation sections of this SE. The IST program relief request VR-18 can not be granted based on the information provided. The licensee should submit the necessary bases to justify this request as soon as possible. The relief requests PR-1, PR-7, VR-2, and VR-19 are acceptable for implementation provided that the changes and actions described in the evaluation sections are made within one year of receipt of this SE.

The staff has determined that granting relief, pursuant to 10 CFR 50.55a(a)(3)(i), (a)(3)(ii) or (g)(6)(i), is authorized by law and will not endanger life or property, or the common defense and security and is otherwise in the public interest. In making this determination the staff has considered the alternate testing being implemented, compliance resulting in a hardship without a compensating increase in safety, and the impracticality of performing the required testing considering the burden if the requirements were imposed. The evaluation section for each relief request identifies the regulation under which the requested relief is granted. The granting of relief is based upon the fulfillment of any committments made by the licensee in its basis for each relief request and the proposed alternative testing.

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