ENCLOSURE 3

SECTION 3.0
INSERVICE TESTING
PROGRAM PLAN FOR PUMPS

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SECTION 3.1
PROGRAM DESCRIPTION

PROGRAM DESCRIPTION

The Pump Inservice Testing (IST) Program Plan for Byron Nuclear Power Station Units 1 and 2, is implemented in accordance with the requirements of Subsection IWP of Section XI of the ASME Boiler and Pressure Vessel Code, 1983 Edition, through the Summer of 1983 Addenda. Where these requirements are determined to be impractical, specific relief is requested. Additional pump relief requests may be necessary and these will be identified during subsequent inservice tests. Byron Station received a Safety Evaluation Report (SER) on September 15, 1988 and is listed in Table 2 of NRC Generic Letter 89-04 as a plant with a reviewed IST Program and SER issued. Per NRC Generic Letter 89-04, the status of relief requests as stated in the SER is unchanged. Any modifications to Byron Station relief requests approved in the SER (PR-1 through PR-5), which are covered by one of the eleven positions discussed in NRC Generic Letter 89-04 Attachment 1, must be performed in accordance with the guidelines given in the Generic Letter. Pre-approval is granted for all relief requests submitted which are consistent with the eleven positions given. New relief requests dealing with a position not covered by NRC Generic Letter 89-04, Attachment 1, must receive NRC approval prior to implementation. The pumps subject to ISI testing are those pumps which are identified in accordance with the scope of ASME Section XI, subsection IWP-1100: "IWP-1100 SCOPE... This Subsection provides the rules and requirements for inservice testing of Class 1, 2, and 3 centrifugal and displacement type pumps that are installed in light-water cooled nuclear power plants, that are required to perform a specific function in shutting down a reactor or in mitigating the consequences of an accident, and that are provided with an emergency power source. The results of these tests are to be used in assessing operational readiness of the pumps during their service life."

The only exceptions are the diesel driven auxiliary feedwater pumps (1AF01PB and 2AF01PB), and essential service water makeup pumps (0SX02PA and 0SX02PB), which are not supplied by an emergency power source. The diesel oil transfer pumps (1/2 DO01PA, 1/2DO01PB, 1/2DO01PC and 1/2DO01PD) are classified none-ASME Class G.

Pump reference values shall be determined from the results of a preservice test, which may be run during preoperational testing, or from the results of the first inservice test run during power operation. Reference values shall be at points of operation readily duplicated during subsequent inservice testing. Additional reference values may be necessary and these will be taken in accordance with IWP-3111 and 3112:

1. After a pump has been replaced,

2. When a reference value or set of values may have been affected by repair or routine servicing of a pump, or

3. If it is necessary or desirable for some other reason than 1 or 2 above.

Per NRC Generic Letter 89-04, Attachment 1, Position #8, whenever pump data is determined to be within the Required Action Range, the pump is inoperable, and the Technical Specification LCO Action statement time starts.

In the event a pump must be declared inoperable as a result of inservice testing, limitations on plant operation will be as stated in the Technical Specifications.

Section XI of the ASME Boiler and Pressure Vessel Code shall not be construed to supersede the requirements of any Technical Specification.

SECTION 3.2
PROGRAM REFERENCES

PROGRAM REFERENCES

1. Title 10, Code of Federal Regulations, Part 50, Domestic Licensing of Production and Utilization Facilities, particularly Section 50.55a, Codes and Standards.

2. ASME Boiler and Pressure Vessel Code, Section XI, Rules for Inservice Inspection of Nuclear Power Plant Components, 1983 Edition, Summer 1983 Addenda.

3. ASME/ANSI OM-1987, Operation and Maintenance of Nuclear Power Plants, including 1989 Addenda, Part 6, Inservice Testing of Pumps in Light Water Reactor Power Plants.

4. U.S. Nuclear Regulatory Commission, Generic Letter 89-04, Guidance on Developing Acceptable Inservice Testing Programs.

5. Byron Station UFSAR, Section 3.9.6.1, Inservice Testing of Pumps.

6. Byron Station Technical Specification, 3/4.0.5, Generic ASME Program Requirement.

7. Byron Station Technial Staff Procedure, BVP 200-1, ISI Requirements for Pumps.

8. NRC Safety Evaluation Reports (SER's):
   a. 09/15/88 (Initial Program Plan Review)
   b. 09/14/90 (Supplemental Program Plan Review)

9. Byron Staion IST Pump Program Plan Review Responses (file: 3.11.0240):
   a. Byron Letter 88-1321 (Initial Program Plan Review Response)
   b. Byron Letter 90-0724 (Supplemental Program Plan Review Response)

SECTION 3.3
PROGRAM TABLES

TABLE DESCRIPTION

The following information is ipcluded in the summary tables:

The first four columns include the unique Byron Station Equipment Piece Number, the Pump Name, the Code Class, and the system P & ID for the pump listed.

Speed: Speed will be measured by a tachometer for variable speed drives.

Inlet pressure: Inlet pressure will be measured via permanently installed gauges or other means, provided the equipment accuracy meets the requirements of IWP-4150. This is to be measured both before pump startup and during the test.

Differential pressure: Differential pressures will be measured using calibrated differential pressure gauges or by recording the difference between calibrated inlet and outlet pressure gauges.

Flow rate: Flow rates will be measured using permanently installed instrumentation or other means, provided that equipment accuracy meets the requirements of IWP 4150.

Vibration: Vibration measurement shall be made using portable or hand held instruments at locations as marked on the pumps.

Bearing Temperature: Bearing temperature will be measured by permanently installed devices where such devices are present. Portable measurement devices will be used where temperature wells are provided.

Per IWP-3300, bearing temperatures are required only once per year. Byron Station takes the data for bearing temperatures once per year during summer testing and following maintenance on a pump if bearing temperatures may have been affected.

Test Interval: An inservice test shall be run on each pump nominally every 3 months during normal plant operation, in accordance with IWP-3400, except during periods when the pump is not required to be operable.

Lubrication Level: Lubrication level will be observed through sight glasses for the pumps listed in the program.

Revision: The current revision of the program is listed.

Table Page: The table pages are numbered sequentially and show the total number of pages.

CLASS 1, 2, & 3 PUMPS
BYRON NUCLEAR POWER STATION
UNITS 0, 1, 2

PUMP NUMBER	PUMP NAME	CLASS	SYSTEM P & ID	TEST PARAMETERS						TEST INTERVAL	LUBRICATION LEVEL	REMARKS
				SPEED	INLET PRES	DIFF PRES	FLOW RATE	VIBRATION	BEARING TEMP			
1AF01PA	Auxiliary feedwater pump (Motor)	3	M-37	No	Yes	Yes	Yes	PR-1	Yes	Quarterly	Yes	
1AF01PB	Auxiliary feedwater pump (Diesel)	3	M-37	Yes	Yes	Yes	Yes	PR-1	Yes	Quarterly	Yes	
2AF01PA	Auxiliary feedwater pump (Motor)	3	M-122	No	Yes	Yes	Yes	PR-1	Yes	Quarterly	Yes	
2AF01PB	Auxiliary feedwater pump (Diesel)	3	M-122	Yes	Yes	Yes	Yes	PR-1	Yes	Quarterly	Yes	
0CC01P	Component cooling pump	3	M-66	No	Yes	Yes	PR-5	PR-1	PR-2	Quarterly	Yes	Note 3
1CC01PA	Component cooling pump	3	M-66	No	Yes	Yes	PR-5	PR-1	PR-2	Quarterly	Yes	Note 3
1CC01PB	Component cooling pump	3	M-66	No	Yes	Yes	PR-5	PR-1	PR-2	Quarterly	Yes	Note 3
2CC01PA	Component cooling pump	3	M-66	No	Yes	Yes	PR-5	PR-1	PR-2	Quarterly	Yes	Note 3
2CC01PB	Component cooling pump	3	M-66	No	Yes	Yes	PR-5	PR-1	PR-2	Quarterly	Yes	Note 3
1CS01PA	Containment spray pump	2	M-46	No	Yes	Yes	Yes	PR-1	PR-2	Quarterly	No	Note 2
1CS01PB	Containment spray pump	2	M-46	No	Yes	Yes	Yes	PR-1	PR-2	Quarterly	No	Note 2

CLASS 1, 2, & 3 PUMPS
BYRON NUCLEAR POWER STATION
UNITS 0, 1, 2

PUMP NUMBER	PUMP NAME	CLASS	SYSTEM P & ID	TEST PARAMETERS						TEST INTERVAL	LUBRICATION LEVEL	REMARKS
				SPEED	INLET PRES	DIFF PRES	FLOW RATE	VIBRATION	BEARING TEMP			
2CS01PA	Containment spray pump	2	M-129	No	Yes	Yes	Yes	PR-1	PR-2	Quarterly	No	Note 2
2CS01PB	Containment spray pump	2	M-129	No	Yes	Yes	Yes	PR-1	PR-2	Quarterly	No	Note 2
1CV01PA	Centrifugal charging pump	2	M-64	No	Yes	Yes	PR-5	PR-1	Yes	Quarterly	Yes	
1CV01PB	Centrifugal charging pump	2	M-64	No	Yes	Yes	PR-5	PR-1	Yes	Quarterly	Yes	
2CV01PA	Centrifugal charging pump	2	M-138	No	Yes	Yes	PR-5	PR-1	Yes	Quarterly	Yes	
2CV01PB	Centrifugal charging pump	2	M-138	No	Yes	Yes	PR-5	PR-1	Yes	Quarterly	Yes	
1DO01PA	Diesel oil transfer pump	3	M-50	No	Yes	PR-6	PR-5	PR-1	PR-2	Quarterly	No	Note 2
1DO01PB	Diesel oil transfer pump	3	M-50	No	Yes	PR-6	PR-5	PR-1	PR-2	Quarterly	No	Note 2
1DO01PC	Diesel oil transfer pump	3	M-50	No	Yes	PR-6	PR-5	PR-1	PR-2	Quarterly	No	Note 2
1DO01PD	Diesel oil transfer pump	3	M-50	No	Yes	PR-6	PR-5	PR-1	PR-2	Quarterly	No	Note 2

INSERVICE TESTING PROGRAM PLAN

CLASS 1, 2, & 3 PUMPS
BYRON NUCLEAR POWER STATION
UNITS 0, 1, 2

PUMP NUMBER	PUMP NAME	CLASS	SYSTEM P & ID	TEST PARAMETERS						TEST INTERVAL	LUBRICATION LEVEL	REMARKS
				SPEED	INLET PRES	DIFF PRES	FLOW RATE	VIBRATION	BEARING TEMP			
2D001 A	Diesel oil transfer pump	3	M-130	No	Yes	PR-6	PR-5	PR-1	PR-2	Quarterly	No	Note 2
2D001PB	Diesel oil transfer pump	3	M-130	No	Yes	PR-6	PR-5	PR-1	PR-2	Quarterly	No	Note 2
2DO01PC	Diesel oil transfer pump	3	M-130	No	Yes	PR-6	PR-5	PR-1	PR-2	Quarterly	No	Note 2
2DO01PD	Diesel oil transfer pump	3	M-130	No	Yes	PR-6	PR-5	PR-1	PR-2	Quarterly	No	Note 2
1RH01PA	Residual heat removal pump	2	M-62	No	Yes	Yes	Yes	PR-1	PR-2	Quarterly	No	Note 2
1RH01PB	Residual heat removal pump	2	M-62	No	Yes	Yes	Yes	PR-1	PR-2	Quarterly	No	Note 2
2RH01PA	Residual heat removal pump	2	M-137	No	Yes	Yes	Yes	PR-1	PR-2	Quarterly	No	Note 2
2RH01PB	Residual heat removal pump	2	M-137	No	Yes	Yes	Yes	PR-1	PR-2	Quarterly	No	Note 2
1SI01PA	Safety injection pump	2	M-61	No	Yes	Yes	Yes	PR-1	Yes	Quarterly	Yes	
1SI01PB	Safety injection pump	2	M-61	No	Yes	Yes	Yes	PR-1	Yes	Quarterly	Yes	
2SI01PA	Safety injection pump	2	M-136	No	Yes	Yes	Yes	PR-1	Yes	Quarterly	Yes	

(0090D/0034D)

CLASS 1, 2, & 3 PUMPS
BYRON NUCLEAR POWER STATION
UNITS 0, 1, 2

PUMP NUMBER	PUMP NAME	CLASS	SYSTEM P & ID	TEST PARAMETERS						TEST INTERVAL	LUBRICATION LEVEL	REMARKS
				SPEED	INLET PRES	DIFF PRES	FLOW RATE	VIBRATION	BEARING TEMP			
2SI01PB	Safety injection pump	2	M-136	No	Yes	Yes	Yes	PR-1	Yes	Quarterly	Yes	
0SX02PA	Essential service water makeup pump (Diesel)	3	M-42	Yes	Yes	Yes	PR-5	PR-1	PR-2	Quarterly	Yes	Note 5
0SX02PB	Essential service water makeup pump (Diesel)	3	M-42	Yes	Yes	Yes	PR-5	PR-1	PR-2	Quarterly	Yes	Note 5
1SX01PA	Essential service water pump	3	M-42	No	Yes	Yes	PR-5	PR-1	Yes	Quarterly	Yes	Note 3
1SX01PB	Essential service water pump	3	M-42	No	Yes	Yes	PR-5	PR-1	Yes	Quarterly	Yes	Note 3
2SX01PA	Essential service water pump	3	M-42	No	Yes	Yes	PR-5	PR-1	Yes	Quarterly	Yes	Note 3
2SX01PB	Essential service water pump	3	M-42	No	Yes	Yes	PR-5	PR-1	Yes	Quarterly	Yes	Note 3
0W001PA	Control room chilled water pump	3	M-118	No	Yes	Yes	Yes	PR-1	PR-2	Quarterly	Yes	Note 3
0W001PB	Control room chilled water pump	3	M-118	No	Yes	Yes	Yes	PR-1	PR-2	Quarterly	Yes	Note 3

SECTION 3.4

NOTES

NOTE 1

"Deleted"

NOTE 2

The Diesel Oil Transfer (1DO01PA-D and 2DO01PA-D), Residual Heat Removal (1RH01PA,B and 2RH01PA,B) and Containment Spray (1CS01PA,B and 2CS01PA,B), pumps cannot be measured for lubrication level. These pumps are lubricated by the fluid pumped and hence have no indication for lubrication level.

NOTE 3

The Component Cooling Water pumps (0CC01P, 1CC01PA,B and 2CC01PA,B), Essential Service Water Pumps (1SX01PA,B and 2SX01PA,B), and the Control Room Chilled Water Pumps (0WO01PA, B) are in systems which are in continuous operation. The idle inlet pressure for these pumps cannot be obtained without interrupting normal system operation and causing system transients. The idle inlet pressure will be recorded only if the pump to be tested is not in operation at the start of the test. Proper pump operation is assured by continuous pump operation as well as quarterly monitoring of the remaining ISI pump parameters.

NOTE 4

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NOTE 5

The essential Service Water Make Up pumps (0SX02PA and 0SX02PB) are submerged, vertical well type pumps. They take their suction from a River Screen House (RSH) forebay. The inlet suction pressures for the pumps can not be measured in as much as they are well type pumps. Furthermore, inlet pressure shall be calculated from a difference of river and pump level. The allowable range for the inlet pressure shall be determined from high and low river levels specified in the Technical Specifications and pump vendor information.

SECTION 3.5
RELIEF REQUESTS

RELIEF REQUEST NO. PR-1

1. PUMP NUMBER: All pumps in the program plan.

2. NUMBER OF ITEMS: 41 pumps.

3. ASME CODE CLASS: 2 & 3

4. ASME CODE, SECTION XI REQUIREMENTS: In reference to Table IWP-3100-2, "Allowable Ranges of Test Quantities", pump vibration is to be measured in and compared to values given in mils displacement.

5. BASIS FOR 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 does not take into account frequency which is also an important factor in determining the severity of the vibration.

6. ALTERNATE TESTING: 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 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 indicate 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 ANSI/ASME OM-6 Draft 8, Table 6100-1 and Figure 6100-1. These ranges will be used in whole to assess equipment operational readiness for all components except the Essential Service Water Make-up Pumps OSX02PA & B.

The acceptable performance range for all components except the Essential Service Water Make Up Pumps OSX02PA & B will be $\leq$ 2.5 times the reference value, not to exceed .325 inches per second. The alert range, at which time the testing frequency would be doubled, will be $>$ 2.5 to 6 times the reference value, not to exceed .70 inches per second. Any vibrating velocity greater than 6 times the reference value or greater than .70 inches per second will require corrective actions to be performed on the affected component.

The OSX02PA & B Pumps, however, are submerged vertical well type pumps utilizing diesel engine prime movers rated at 228 continuous break horse power and are coupled directly to these engines through right angle gear drives. These prime movers and gear drives are elevated to protect them against the technical specification postulated flood scenario and the pumps hang vertically down 41' 4" from the bottom of the right angle gear drive to their respective pump suction inlet basket strainers. These pumps are of a water lubricated, hollow line shaft drive, seven stage type and utilize rubber line shaft bearings along their length.

Therefore, these OSX02PA & B pumps, due to their design, will experience vibration velocity readings that will normally exceed 0.4 inches per second. A vibration of this magnitude would fall into the "Alert" range of the ANSI/ASME OM-6, Table 6100-1 and would require "Doubling the Test Frequency". For these reasons, given the inherent operating characteristics of the OSX02PA & B pumps and the testing constraints of the ANSI/ASME OM-6, Draft 8 Document, the guidance set forth in Table 6100-1 and Figure 6100-1 will be slightly modified so as to more accurately assess equipment operational readiness.

The acceptable performance range of the OSX02PA & B pumps will be $\leq$ 2.5 times the reference value, not to exceed .60 inches per second. The alert range, at which point in time the testing frequency would be doubled, will be $>$ 2.5 to 6 times the reference value, not to exceed .90 inches per second. Any vibration velocity greater than 6 times the reference value or greater than .90 inches per second will require corrective actions to be performed on the affected component. This reference value is established based on the guidance set forth in ANSI/ASME OM-6, Draft 8 and prior operating history of these pumps. The operating history consists of approximately 3 years of operation and testing, and provides sufficient data base from which to establish the aforementioned criteria. This criteria is based upon a sufficient amount of baseline data to provide for the monitoring of pump degradation to the greatest extent possible given this prime mover/pump configuration.

For all pumps, evaluation of data, to assign equipment to the alert or action ranges, will be done within 96 hours (per IWP-3220 of Section XI). 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 vibration 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 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 plane approximately perpendicular to the rotating shaft in two orthogonal directions or each accessible pump bearing housing and in the axial direction on each accessible pump thrust bearing housing.

The Vertical Line Shaft Pumps in the program will have vibration measurements taken on the upper motor bearing housing in three orthogonal directions, one of which is the axial direction.

7. JUSTIFICATION: 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 amplitude in inches/second provides added assurance of the continued operability of the pumps.

8. APPLICABLE TIME PERIOD: This relief is requested once per quarter during the first inspection interval.

9. APPROVAL STATUS:

a. Relief granted except from Required Action for the OSX02A/B pumps per SER 9/15/88. The SER evaluation concerns regarding measurement of the essential service water makeup pump inlet pressures were resolved and verbal approval to use this relief request was obtained based on the December 12, 1988 conference call with Byron/Braidwood ISI members, R. Chrzanowski (Byron NLA), H. Rockhold and S. Hartley (EG & G Idaho/NRC).

b. Relief granted per NRC Generic Letter 89-04.

c. Relief pending per SER 9/14/90. This relief request will be revised and resubmitted in March 1991.

RELIEF REQUEST NO. PR-2

1. PUMP NUMBER: 0CC01P, 1CC01PA, 1CC01PB, 2CC01PA, 2CC01PB, 1CS01PA, 1CS01PB, 2CS01PA, 2CS01PB, 1DO01PA, 1DO01PB, 1DO01PC, 1DO01PD, 2DO01PA, 2DO01PB, 2DO01PC, 2DO01PD, 1RH01PA, 1RH01PB, 2RH01PA, 2RH01PB, 0SX02PA, 0SX02PB, 0WO01PA, 0WO01PB

2. NUMBER OF ITEMS: 25 pumps

3. ASME CODE CLASS: 2 & 3

4. ASME CODE, SECTION XI REQUIREMENTS: Per IWP-3100, Inservice Test Procedure pump bearing temperatures are required to be measured to detect any change in the mechanical characteristics of a bearing. IWP-3500(b) requires three successive readings taken at ten minute intervals that do not vary more than 3%.

5. BASIS FOR RELIEF:

   a. These pumps' bearings are not provided with permanent temperature detectors or thermal wells. Therefore, gathering data on bearing temperature is impractical.

   b. The only temperature measurements possible are from the bearing housing. To detect high bearing temperature at the bearing housing would require that the bearings in question be seriously degraded.

   c. Measurement of housing temperature on these pumps does not provide positive information on bearing condition or degradation. For example, the bearings on the Essential Service Water pumps (0SX02PA, 0SX02PB) and Diesel Oil Transfer Pumps (1DO01PA thru D and 2DO01PA thru 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.

6. ALTERNATE TESTING: No direct alternate test is proposed for bearing temperatures. However, measurement of hydraulic parameters and vibration readings do provide a more positive method of monitoring pump condition and bearing degradation.

7. JUSTIFICATION: By measuring pump hydraulic parameters and vibration velocity, (as described in PR-1), pump operability and the trending of mechanical degradation is assured. Also, since these parameters (i.e., hydraulic parameters 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.

8. APPLICABLE TIME PERIOD: This relief is requested once per year, during the first inspection interval.

9. APPROVAL STATUS:

a. Relief granted per SER 9/15/88.

b. Relief granted per NRC Generic Letter 89-04.

c. Relief granted per SER 9/14/90.

RELIEF REQUEST NO. PR-3

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RELIEF REQUEST NO. PR-4

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RELIEF REQUEST NO. PR-5

1. PUMP NUMBER: 0CC01P, 1CC01PA, 1CC01PB, 2CC01PA, 2CC01PB, 1CV01PA, 1CV01PB, 2CV01PA, 2CV01PB, 1DO01PA, 1DO01PB, 1DO01PC, 1DO01PD, 2DO01PA, 2DO01PB, 2DO01PC, 2DO01PD, 0SX02PA, 0SX02PB, 1SX01PA, 1SX01PB, 2SX01PA, 2SX01PB

2. NUMBER OF ITEMS: 23 pumps

3. ASME CODE CLASS: 2 & 3

4. ASME CODE, SECTION XI REQUIREMENTS: Per IWP-4120, the full scale range of each instrument shall be three times the reference value or less.

5. BASIS FOR RELIEF: The full scale range of ultrasonic flowmeters, used to collect Section XI flow data, exceed three times the reference value.

6. ALTERNATE TESTING: Ultrasonic flowmeters, with digital readouts and totalizer features will be utilized to obtain Section XI flow data.

7. JUSTIFICATION: Ultrasonic flowmeters provide an accurate means of measuring flowrate. They utilize a digital display whose accuracy is independent of the full scale range. The ultrasonic flowmeter is well within the requirements of IWP-4110 and IWP-4120, which refer to an instrument accuracy of ± 2 % of full scale for an instrument with a range of three times the reference value or less. The following examples will illustrate this point. The component cooling pumps (0CC01P, 1/2CC01PA, and 1/2CC01PB) have a reference value of approximately 4500 gpm. Using the Code requirements, an instrument with a full scale range of 13,500 gpm (3 x 4500 gpm), the acceptable instrument accuracy is ± 270 gpm (.02 x 13500 gpm). Using the ultrasonic flowmeter, with an accuracy of ± 4% of the indicated reading, provides an instrument accuracy of ± 180 gpm.(.04 x 4500 gpm).

The diesel oil transfer pumps (1DO01PA-PD and 2DO01PA-PD) have a reference value of approximately 25 gpm. Using the Code requirements, an instrument with a full scale of 75 gpm (3 x 25 gpm) the acceptable instrument accuracy is ± 1.5 gpm (.02 x 75 gpm). Using the ultrasonic flowmeter with an accuracy of ± 4% of indicated reading will provide an instrument accuracy of ± 1.0 gpm (.04 x 25 gpm).

Use of an ultrasonic flowmeter, with totalizer and integrator feature, instead of other instruments allowed by IWP-4110 and IWP-4120, will provide more precise and accurate flow measurements.

8. APPLICABLE TIME PERIOD: This relief is requested once per quarter, during the first inspection interval.

9. APPROVAL STATUS:

a. Relief granted per SER 9/15/88.

b. Relief granted per NRC Generic Letter 89-04.

c. Relief granted per SER 9/14/90.

RELIEF REQUEST NO. PR-6

1. PUMP NUMBER: 1DO01PA, 1DO01PB, 1DO01PC, 1DO01PD,
   2DO01PA, 2DO01PB, 2DO01PC, 2DO01PD,

2. NUMBER OF ITEMS: 8 pumps

3. ASME CODE CLASS: 3

4. ASME CODE, SECTION XI REQUIREMENTS: Per IWP-3100, differential pressure shall be measured on all pumps that are tested.

5. BASIS FOR RELIEF: These pumps are positive displacement Diesel Oil Transfer Pumps. The pump differential pressure is not a factor affecting pump performance, but rather dependent only on the inlet pressure to the pump. As the pump discharge pressure is constant, and the inlet pressure varies with tank level, the differential pressure is not a valid operational parameter.

6. ALTERNATE TESTING: Pump discharge pressure for positive displacement pumps is a valid operational parameter. This will be used to evaluate the Diesel Oil Transfer Pumps performance.

7. JUSTIFICATION: Using pump discharge pressure in lieu of pump differential pressure will provide meaningful pump performance data for evaluation of operational readiness of the Diesel Oil Transfer Pumps.

8. APPLICABLE TIME PERIOD: This relief is requested once per quarter during the first inspection interval.

9. APPROVAL STATUS:

   a. Relief granted per SER 9/15/88.

   b. Relief granted per NRC Generic Letter 89-04.

   c. Relief granted per SER 9/14/90.

DRAFT REVISION OF
RELIEF REQUEST NO. PR-1

1. PUMP NUMBER: All pumps in the program plan.

2. NUMBER OF ITEMS: 41 pumps.

3. ASME CODE CLASS: 2 & 3

4. ASME CODE, SECTION XI REQUIREMENTS

(a) In reference to Table IWP-3100-2, "Allowable Ranges of Test Quantities", pump vibration is to be measured in and compared to values given in mils displacement.

(b) In reference to ANSI/ASME OMb-1989, Part 6 measurement of vertical pump bearing vibration is required at the upper motor bearing in three orthogonal directions. This portion of the code also requires measurement of lower pump bearing vibration.

5. BASIS FOR RELIEF

(a) 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.

DRAFT REVISION OF
RELIEF REQUEST NO. PR-1

(b) Measurement of vertical pump bearing vibration is required at the upper motor bearing in three orthogonal directions, one of which is axial, by OM-Part 6. The thrust bearing on the vertical Containment Spray Pumps (CS) and Residual Heat Removal Pumps (RH) is located at the lower motor bearing, therefore, the most effective axial bearing vibration monitoring point for Byron Station's vertical CS & RH pumps is at the lower motor bearing.

OM-Part 6 also requires measurement of lower pump bearing vibration. The RH and CS pumps and motors have an integral shaft and no pump bearings. The lower motor bearing serves as the pump bearing.

6. ALTERNATE TESTING

(a) 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 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.

DRAFT REVISION OF
RELIEF REQUEST NO. PR-1

The allowable ranges of vibration and their associated action levels will be patterned after the guidelines established in ANSI/ASME OMb-1989, Part 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 Make-up Pumps 0SX02PA & B (see PR-7).

The acceptable performance range for all components (except the Essential Service Water Make Up Pumps OSX02PA & B) will be $\leq$ 2.5 times the reference value, not to exceed .325 inches per second. The alert range, at which time the testing frequency would be doubled, will be $>$ 2.5 to 6 times the reference value, not to exceed .70 inches per second. Any vibrating velocity greater than 6 times the reference value or greater than .70 inches per second will require corrective actions to be performed on the affected component.

For all pumps, evaluation of data, to assign equipment 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.

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RELIEF REQUEST NO. PR-1

Vibration measurements for all pumps will be obtained and recorded in velocity, inches per second, and will be broadband unfiltered [filtered-out (IRD) or total (TEC Smart meter)] peak measurements. The monitored locations for vibration 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 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 plane 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.

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(b) The Vertical Line Shaft Pumps in the program (1/2RH01PA, 1/2RH01PB, 1/2CS01PA, and 1/2CS01PB) will have vibration measurements taken on the upper motor frame in two orthogonal directions, in a plane approximately perpendicular to the rotating shaft. Vibration measurements will also be taken in three orthogonal directions on the lower motor/pump frame, one of which is the axial direction. This is contrary to OMb-1989, Part 6, Section 4.6.4, which requires the axial direction at the upper motor bearing housing. This is because the thrust bearing is located in the lower frame of the motor for the RH and CS pumps at Byron Station. The radial bearing is located at the upper motor frame and is inaccessible due to the presence of a motor dust cover.

The RH and CS pumps and motors have an integral shaft (and no pump bearings), therefore no pump bearing measurements will be taken.

7. JUSTIFICATION

(a) 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 amplitude in inches/second (in conjunction with the use of the allowable vibration ranges and limits as established in ANSI/ASME OMb-1989, Part 6) provides added assurance of the continued operability of the pumps.

(b) The thrust bearings on the Vertical Line Shaft Containment Spray Pumps (CS) and Residual Heat Removal Pumps (RH) are located at the lower motor bearings therefore, measurement of axial vibration at the lower motor bearings will provide more effective trending of axial vibration on these pumps.

(c) Vibration measurements can not be taken on the pump bearings of the RH and CS pumps. Pump bearings do not exist in these pumps.

8. APPLICABLE TIME PERIOD: This relief is requested once per quarter during the first inspection interval.

9. APPROVAL STATUS: This relief request is a proposed change to the approved PR-1 and is NOT approved for use. Formal written approval from the NRC is required prior to changing the vibration monitoring points on the vertical line shaft pumps in the program. (1/2RH01PA, 1/2RH01PB, 1/2CS01PA, 1/2CS01PB). Expedited review and approval is requested.

DRAFT REVISION OF
RELIEF REQUEST NO. PR-2

1. PUMP NUMBER: All pumps in the program plan.

2. NUMBER OF ITEMS: 41 pumps

3. ASME CODE CLASS: 2 & 3

4. ASME CODE, SECTION XI REQUIREMENTS: Per IWP-3100, Inservice Test Procedure pump bearing temperatures are required to be measured to detect any change in the mechanical characteristics of a bearing. IWP-3500(b) requires three successive readings taken at ten minute intervals that do not vary more than 3%.

5. BASIS FOR RELIEF:

a. The CC, CS, DO, RH, SX and WO pumps' (25 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 these pumps does not provide positive information on bearing condition or degradation. For example, the bearings on the Essential Service Water pumps (0SX02PA, 0SX02PB) and Diesel Oil Transfer Pumps (1DO01PA thru D and 2DO01PA thru D) are cooled by the pumped fluid.

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RELIEF REQUEST NO. PR-2

Therefore, any heat generated by degraded bearings is carried away by the cooling fluid and would not be directly measured at the bearing housing.

b. 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 condition. The usage of vibration measurements can provide information as to a change in the balance of rotating parts, misalignment of bearings, worn bearings, 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.

c. 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.

6. ALTERNATE TESTING: Quarterly measurement of hydraulic parameters and vibration readings provide a more positive method of monitoring pump condition and bearing degradation.

DRAFT REVISION OF
RELIEF REQUEST NO. PR-2

7. JUSTIFICATION: By measuring pump hydraulic parameters and vibration velocity, (as described in PR-1), pump operability and the trending of mechanical degradation is assured. Also, since these parameters (i.e., hydraulic parameters 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.

8. APPLICABLE TIME PERIOD: This relief is requested once per year, during the first inspection interval.

9. APPROVAL STATUS: This relief is a proposed change to the approved PR-2 and is NOT approved for use. Formal written approval from the NRC is required prior to use. Expedited review and approval is requested.

DRAFT RELIEF

REQUEST NO. PR-7

1. PUMP NUMBER: 0SX02PA, B pumps

2. NUMBER OF ITEMS: 2 pumps.

3. ASME CODE CLASS: 2 & 3

4. ASME CODE, SECTION XI REQUIREMENTS: ANSI/ASME OMb-1989, Part 6, Table 3 and Table 3a states that the acceptable performance range for all components will be ≤2.5 times the Reference Valve, not to exceed .325 inches per second. The alert range, at which time the testing frequency would be doubled, will be >2.5 to 6 times the Reference Valve, not to exceed .70 inches per second. Any vibrating velocity greater than 6 times the Reference Valve or greater than .70 inches per second will require corrective actions.

5. BASIS FOR RELIEF: Per NRC SER dated 9/15/90 more information is needed on this issue. Therefore this Relief Request will be revised and resubmitted prior to 3/15/91.