ATTACHMENT

QUAD CITIES STATION

THIRD TEN-YEAR INTERVAL
IST PLAN REVISION

IST PLAN EXECUTIVE SUMMARY

PAGE	DESCRIPTION OF CHANGE
ii	Changed PUMPS page number in table from 2-12 to 2-17
1-14	Under Pump 2-2302, Vibration, Added "Addendum" after RP-00A
2-4	Added Summary for RP-00A ADDENDUM
2-5 to 2-6	RP-00A, deleted specific reference to HPCI.
2-7 to 2-11	RP-00A ADDENDUM, New Document
2-12 to 2-17	RP-11A, RP-52A, Page number changes only, no change in content

IST PLAN PAGE REPLACEMENT INSTRUCTIONS

REMOVE PAGE	INSERT PAGE
ii	ii
1-14	1-14
2-4 TO 2-1	22-4 to 2-17

REVISION SUMMARY SHEET

Effective Page(s)	Rev.
INFORMATION COMMON TO PUMPS AND VALVES	
i to v	4
1-1 to 1-2	4
2-1 to 2-10	4
PUMPS	
1-1 to 1-15	4
2-1 to 2-17	4
3-1 to 3-3	4
4-1 to 4-2	4
5-1 to 5-2	4
VALVES	
1-1 to 1-187	4
2-1 to 2-65	4
3-1 to 3-5	4
4-1 to 4-21	4
5-1 to 5-2	4
6-1 to 6-2	4

Table 1.0-2
UNIT 2 PUMP LISTING

PUMP NUMBER	P&ID NUMBER	DWG COORD	IST CLASS	TEST TYPE	TEST FREQ	RELIEF REQUEST	TECHNICAL POSITION
2A-1102	M-0082	D-7	2	INLET PRESSURE	QTLY	RP-11A	
				DIFFERNTL PRESSURE		RP-11A	
				FLOW RATE			
				VIBRATION		RP-00A	
				BEARING TEMPERATURE		RP-00B	
FUNCTION: STANDBY LIQUID CONTROL PUMP 2A							
2B-1102	M-0082	E-7	2	INLET PRESSURE	QTLY	RP-11A	
				DIFFERNTL PRESSURE		RP-11A	
				FLOW RATE			
				VIBRATION		RP-00A	
				BEARING TEMPERATURE		RP-00B	
FUNCTION: STANDBY LIQUID CONTROL PUMP 2B							
2-2302	M-0087	A-4	2	SPEED	QTLY		
				INLET PRESSURE			
				DIFFERNTL PRESSURE			
				FLOW RATE			
				VIBRATION		RP-00A Addendum	
				BEARING TEMPERATURE		RP-00B	
FUNCTION: HIGH PRESSURE COOLANT INJECTION							

Table 2.0-1

RELIEF REQUEST SUMMARIES

RELIEF REQUEST	SUMMARY
RP-00A	Tables IWP-3100-1 and -2, IWP-4510 Vibration velocity will be used to assess pump mechanical degradation in lieu of vibration displacement. Vibration velocity is more sensitive than vibration displacement to all modes of pump degradation.
RP-00A ADDENDUM	Tables IWP-3100-1 and -2, IWP-4510 Unit 2 HPCI has historically exhibited high vibrations not due to pump degradation. This Addendum is an interim relief to increase the upper Alert limit to allow normal frequency testing until the U2 HPCI is modified to reduce the vibrations to meet the ranges specified in RP-00A.
RP-00B	IWP 3100, Table IWP-3100-1 Bearing temperature is not a particularly useful test. Pump bearing vibration tests will detect mechanical problems well before bearing temperature begins to increase.
RP-11A	IWP-3100, Table IWP-3100-1, IWP-3110 Differential pressure and suction pressure cannot be measured for the Standby Liquid Control pumps. All evaluations of pump performance will be based on discharge pressure. Since these pumps are positive displacement pumps, discharge pressure is just as sensitive to change as differential pressure.
RP-52A	IWP-3100, Table IWP-3100-1, IWP-3110 Differntial pressure and suction pressure cannot be measured for the Diesel Fuel Oil Transfer pumps. All evaluations of pump performance will be based on discharge pressure. Since these pumps are positive displacement pumps, discharge pressure is just as sensitive to change as differential pressure.

RELIEF REQUEST NUMBER: RP-00A (Sheet 1 of 2)

COMPONENT IDENTIFICATION

PUMP NUMBER	CODE CLASS	DRAWING NUMBER	COORDINATE
<All pumps>	1, 2, & 3		

FUNCTION(S)

All pumps in the IST Plan are affected. These pumps are required to perform a specific function in shutting down the reactor or mitigating the consequences of an accident and are provided with an emergency power source.

CODE REQUIREMENT

Table IWP-3100-1,	"Inservice Test Quantities," Vibration amplitude (V)
Table IWP-3100-2,	"Allowable Ranges of Test Quantities," Acceptable, Alert Range, and Required Action Range for vibration amplitude
Article IWP-4510,	"Vibration Amplitude," The Code requires vibration measurements to be recorded and analyzed based on displacement in mils (thousandths of an inch).

BASIS FOR RELIEF

10CFR50.55a(a)(3)(i), "acceptable level of quality and safety"

Low amplitude, high frequency vibration due to misalignment, imbalance, or bearing wear is difficult to detect via vibration amplitude measurements when pump speed is greater than or equal to 600 RPM.

Vibration velocity measurements are much more sensitive to small changes that are indicative of developing mechanical problems. Vibration velocity is a far more informative reading because it accounts for both displacement and frequency range. A vibration monitoring program based on velocity is more comprehensive than that required by the Code.

RELIEF REQUEST NUMBER: RP-00A (Sheet 2 of 2)

PROPOSED ALTERNATE TESTING

Pump vibration measurements will be taken in vibration velocity (inches per second) if the pump speed is greater than or equal to 600 RPM. The allowable ranges of vibration velocity will be based on Table 1.

Table 1
ALLOWABLE RANGES OF VIBRATION VELOCITY

Pump Type	Acceptable Range	Alert Range	Required Action Range
Centrifugal with speed ≥ 600 RPM	≤ 2.5 V_r or ≤ 0.325 ips whichever is less	> 2.5 V_r and ≤ 6.0 V_r or > 0.325 ips and ≤ 0.700 ips whichever is less	> 6.0 V_r or > 0.700 ips whichever is less
Reciprocating	≤ 2.5 V_r	> 2.5 V_r and ≤ 6.0 V_r	> 6.0 V_r
Gear	≤ 2.5 V_r	> 2.5 V_r and ≤ 6.0 V_r	> 6.0 V_r

V_r: vibration reference value
ips: inches per second
mils: thousandths of an inch (applies to low speed pumps only)

NOTE: There are no safety related centrifugal pumps that operate at speeds < 600 RPM at Quad Cities. There are no safety related vertical line shaft pumps at Quad Cities.

APPLICABLE TIME PERIOD

Relief is requested for the 3rd ten (10) year interval.

RELIEF REQUEST NUMBER: RP-00A ADDENDUM (Sheet 1 of 5)

THIS IS A TEMPORARY RELIEF REQUEST

COMPONENT IDENTIFICATION

PUMP NUMBER	CODE CLASS	DRAWING NUMBER	COORDINATE
2-2302	2	M-87	A-4

FUNCTION(S)

The Unit 2 High Pressure Coolant Injection (HPCI) pump is required to inject water into the reactor vessel under Loss of Coolant Accident conditions which do not result in a rapid depressurization of the pressure vessel.

CODE REQUIREMENT

Table IWP-3100-1,	"Inservice Test Quantities," Vibration amplitude (V)
Table IWP-3100-2,	"Allowable Ranges of Test Quantities," Acceptable, Alert Range, and Required Action Range for vibration amplitude
Article IWP-4510,	"Vibration Amplitude," The Code requires vibration measurements to be recorded and analyzed based on displacement in mils (thousandths of an inch).

BASIS FOR RELIEF

10CFR50.55a(a)(3)(i), "acceptable level of quality and safety"

Interim relief is requested to assign an expanded Alert Range vibration limits to the Unit 2 HPCI pump. This interim relief is based on the consistently high vibration level history experienced with the inboard bearing (Bearing 3) of the main pump on Unit 2 HPCI.

Since 1988, the station has made gradual progress in reducing the vibration amplitudes on bearing 3.

From January 1988 until June 1988, the vibrations on Bearing 3 ranged from 0.500 inches per second (ips) to 0.750 ips in the horizontal direction and 0.344 ips to 0.489 ips in the vertical direction. The Acceptable Range at that time was 0 - 0.900 ips which was from the 2nd Ten Year Interval IST program Relief Request PR-1. This limit was based on ASME Technical Paper #78-WA/NE-5, Table 2.

RELIEF REQUEST NUMBER: RP-00A ADDENDUM(Sheet 2 of 5)

BASIS FOR RELIEF(CONT.)

Although the vibrations were considered at that time to be in the acceptable range, the station realized that there was a need to reduce the vibration levels.

In June 1988, the station installed a five vane split impeller into the HPCI booster pump. This vendor-recommended change was implemented to eliminate a vane passage frequency which was resonating the crossover piping from the booster pump to the main pump. The resonating crossover piping induced a high horizontal vibration on the inboard bearing bracket of the main pump (Bearing 3). The impeller change and an alignment of the turbine to the main pump resulted in a reduction in horizontal vibration to 0.494 ips and vertical vibration to 0.344 ips.

In May 1992, the station made another attempt to reduce vibrations by balancing the HPCI Turbine rotor and performing another alignment. This work resulted in a reduction in horizontal vibration in Bearing 3 to 0.189 ips. However the vertical vibration in Bearing 3 increased to 0.614 ips. During this time the station revised the IST Program to reflect the more conservative vibration limits specified in ANSI/ASME OM-6. This placed the Unit 2 HPCI in the ALERT range and 45-day increased frequency testing commenced. The station also decided to try specialized alignment equipment called Permalign to measure and track the thermal and dynamic movements of the HPCI train. The resulting Permalign information was intended to provide insight into how to align the HPCI train so that the thermal and dynamic movements would allow the train to grow into alignment while running. The station has previously used the Permalign equipment on such constant running pumps as the Reactor Feed and Condensate pumps. However, since this was first time the Permalign process was used on HPCI, the information gathered was considered to be for information only.

The Permalign equipment is designed to identify thermal and dynamic movement in rotating assemblies. It is normally used on constantly running equipment. Standard practice is to zero out the Permalign lasers when the equipment is in the "cold" condition. The test is then initiated in conjunction with starting up the rotating equipment. The rotating equipment is then allowed to reach its normal operating parameters and target values are obtained with the Permalign lasers. This data is then used at a later date when the rotating equipment is re-aligned in the "cold" condition. During this re-alignment process, the rotating equipment is purposely offset in accordance with the previously obtained target values so that the equipment thermally and dynamically "grows" into alignment.

In the case of the HPCI Permalign test, the HPCI was run for approximately twenty minutes. The data gathered by the Permalign equipment was in relation to the thermal and dynamic changes

RELIEF REQUEST NUMBER: RP-00A ADDENDUM(Sheet 3 of 5)

BASIS FOR RELIEF(CONT.)

identified for the first twenty minutes of run time. The station believes that the twenty minute run time was insufficient for the HPCI to reach its full thermal and dynamic growth.

In August 1992, the station took a Limiting Condition of Operation (LCO) to perform alignments using the Permalign data obtained in May 1992. Some limited moves were conducted using this data and the resulting vibrations on bearing 3 ranged from 0.305 to 0.369 ips in the horizontal and 0.325 to 0.529 ips in the vertical direction. Using all of the Permalign data to the fullest extent would have entailed performing modifications such as the shaving of the pump footings and the cutting and redesign of the pump's discharge piping supports. The station was reluctant to perform these tasks because of the cost involved in designing and performing these modifications and the level of uncertainty in the interpretation of the Permalign data. This uncertainty was based on the fact that the data was taken after only a twenty minute run time, which was insufficient for the HPCI to reach its full thermal and dynamic growth.

As part of an effort to improve the HPCI System performance, the station plans to perform some significant maintenance activities on the Unit 2 HPCI during the Fall 1993 maintenance outage. Five Exempt changes (minor modifications) are scheduled which will replace all of the oil pressure switches, upgrade the level switches, and upgrade the flow and pressure transmitters. Additionally, nine Corrective Maintenance work requests are scheduled which include valve repairs, local valve control stations and control switch repairs, replacement of temperature recorders, and the disassembly of the motor gear unit.

As part of this work, the station will make adjustments to the HPCI motor speed changer and motor gear unit to adjust the pump flow characteristics to better meet the pump curve. The station will also take alignment readings of the HPCI turbine/pump train in the cold condition using the station's regular alignment equipment to establish a baseline for future Permalign tests. The pump's vendor has also recently recommended a modification intended to reduce another vane passage frequency which was resonating the crossover piping from the booster pump to the main pump. It is believed that the resonating crossover piping is inducing a high vibration on the inboard bearing bracket of the main pump (Bearing 3). The recommendation is to disassemble the booster pump and cut the volute lips to increase the "Gap B" clearance. The station plans on performing the Gap "B" clearance Modification during the Q2R13 Refuel Outage in September 1994. Since an investigation into the Permalign process revealed that the actual Permalign data would be affected by the higher flow rates of the system and the gap "B" clearance,

RELIEF REQUEST NUMBER: RP-00A ADDENDUM(Sheet 4 of 5)

BASIS FOR RELIEF(CONT.)

the station plans on completing these modifications and maintenance actions prior to retaking the Permalign data.

Once the listed modifications and maintenance actions are complete, the station plans to enlist the assistance of the Permalign technical representative to incorporate a new improved set up process for this device. The assistance is intended to allow the station to gain the most effective use of the Permalign and eliminate the uncertainties in the previously collected Permalign data. Preliminary discussions indicate that an improved set up process may be required which will entail the fabrication of new brackets to support the Permalign device components. The station plans to be ready to retest using the Permalign device at the end of Q2R13(December 1994) and evaluating the results with technical experts thereafter. Actual alignment moves based on the new Permalign data would then be scheduled to be performed during the following refueling outage, Q2R14 (Spring 1996).

Spectral Analysis of the current vibration data indicates no evidence of bearing degradation on any of the Unit 2 HPCI pump bearings. The pump vendor considers the current vibration level of 0.374 ips on bearing 3 to be "relatively moderate" and only recommended to continue monitoring for any sudden increases in vibration amplitude until the Gap "B" clearance Modification is performed during the Q2R13. Spectral Analysis is routinely performed on all of the bearings on the Unit 2 HPCI during the quarterly IST surveillance. Based on the spectral analysis and the vibration improvements already achieved, the station is confident that the existing vibration levels are not indicative of a degraded condition. If the planned maintenance and modifications prove to be successful in reducing the vibration levels consistently below 0.300 ips, this interim relief request will be withdrawn and the provisions of RP-00A will be followed for the Unit 2 HPCI.

PROPOSED ALTERNATE TESTING

The allowable ranges of vibration velocity for Unit 2 HPCI will be based on Table 2. The purpose of the increased Alert Range limit of 0.425 ips is to relieve the station of having to test the Unit 2 HPCI on an increased frequency which would cause additional normal wear of the pump. Since the increased frequency test is to monitor a degraded condition and no degradation has been detected, then there is no benefit to running the HPCI pump on an increased frequency. However, 0.425 ips is also relatively close enough to the highest measured vibration data, so that if any additional pump degradation occurs, the pump would still be placed in the Alert Range and on an increased monitoring frequency.

RELIEF REQUEST NUMBER: RP-00A ADDENDUM (Sheet 5 of 5)

Table 2
ALLOWABLE RANGES OF VIBRATION VELOCITY

Pump Type	Acceptable Range	Alert Range	Required Action Range
Centrifugal with speed ≥ 600 RPM (U2 HPCI ONLY)	≤ 1.5 V_r or ≤ 0.425 ips whichever is less	> 1.5 V_r and ≤ 2.5 V_r or > 0.425 ips and ≤ 0.700 ips whichever is less	> 2.5 V_r or > 0.700 ips whichever is less

V_r: vibration reference value
ips: inches per second

APPLICABLE TIME PERIOD

Interim Relief is requested for until the end of Q2R14 (June 1996) or until the station is successful in reducing the vibration levels consistently below 0.300 ips. Whichever is sooner.

RELIEF REQUEST NUMBER: RP-00B (Sheet 1 of 2)

COMPONENT IDENTIFICATION

PUMP NUMBER	CODE CLASS	DRAWING NUMBER	COORDINATE
<All pumps>	1, 2, & 3		

FUNCTION(S)

All pumps in the IST Plan are affected. These pumps are required to perform a specific function in shutting down the reactor or mitigating the consequences of an accident and are provided with an emergency power source.

CODE REQUIREMENT

IWP-3100,	"Inservice Test Procedure," The test quantities shown in Table IWP-3100-1 shall be measured or observed and recorded.
Table IWP-3100-1,	"Inservice Test Quantities," Bearing Temperature (T_b) shall be measured.

BASIS FOR RELIEF

10CFR50.55a(a)(3)(i), "acceptable level of quality and safety"

Pump bearing vibration monitoring can be used to detect: worn bearings, misalignment of bearings, a change in the balance of rotating parts, a change in hydraulic forces, and general pump integrity. Quarterly pump bearing vibration measurements, combined with an observation of lubricant level/pressure, are more sensitive than bearing temperature measurements to the types of problems that may be exhibited by increased bearing temperature. Since bearing vibration monitoring is more sensitive and is performed more frequently, there is no need to measure bearing temperature.

RELIEF REQUEST NUMBER: RP-00B (Sheet 2 of 2)

BASIS FOR RELIEF (Continued)

Given controlled environmental conditions, bearing temperature measurements may be capable of detecting pump degradation, but the following problems exist in a power plant setting:

1. Many bearings are lubricated by the pumped fluid; and the temperature of the pumped fluid will change depending on the season.

2. Long run times to stabilize bearing temperature are not practical for the HPCI pump (during the summer, the Suppression Pool temperature may approach the 95 °F limit because the HPCI turbine exhaust is directed to the Suppression Pool).

These environmental condition variables make it extremely difficult, if not impossible, to evaluate bearing temperature test results.

Bearing temperature measurements could potentially be misinterpreted and they do not provide any additional information concerning the pump's condition. This inservice test quantity is impractical to measure and evaluate.

PROPOSED ALTERNATE TESTING

In comparison to the other tests used to detect mechanical and hydraulic change, a bearing temperature test does not provide additional, meaningful information. Vibration velocity measurements are much more sensitive to pump degradation. No alternate testing is appropriate.

APPLICABLE TIME PERIOD

Relief is requested for the 3rd ten (10) year interval.

RELIEF REQUEST NUMBER: RP-11A (Sheet 1 of 2)

COMPONENT IDENTIFICATION

PUMP NUMBER	CODE CLASS	DRAWING NUMBER	COORDINATE
Unit 1			
1102A	2	M-0040	D-7
1102B	2	M-0040	E-7
Unit 2			
1102A	2	M-0082	D-7
1102B	2	M-0082	E-7

FUNCTION(S)

The Standby Liquid Control (SBLC) pumps are used to inject poison (sodium pentaborate) into the reactor vessel, if the Control Rod Drive Hydraulic system fails. The poison injected by the SBLC system will absorb neutrons and control reactivity.

CODE REQUIREMENT

IWP-3100,	"Inservice Test Procedure," The test quantities shown in Table IWP-3100-1 shall be measured or observed and recorded.
Table IWP-3100-1,	"Inservice Test Quantities," Inlet Pressure (P_i) shall be measured before pump startup and during the test. Differential pressure (dP) shall be measured.
IWP-3110,	"Reference Values," Differential Pressure will be duplicated during subsequent inservice testing.

BASIS FOR RELIEF

10CFR50.55a(a)(3)(i), "acceptable level of quality and safety"

The SBLC inservice test is conducted using the SBLC Test Tank (1104 @ B-7), rather than the Standby Liquid Control Tank (1103 @ A-10). The Test Tank is filled at the start of the test (minimum water level 16"), and the Test Tank level remains virtually constant throughout the inservice test.

RELIEF REQUEST NUMBER: RP-11A (Sheet 2 of 2)

BASIS FOR RELIEF (cont'd)

Inlet pressure instrumentation was not installed for the SBLC pumps. Inlet pressure before the test (P_{ib}) could be calculated based on Test Tank level, but this calculated hydrostatic pressure is meaningless once the pump starts.

The SBLC pumps are positive displacement pumps. The performance of the SBLC pumps is not sensitive to changes in pump inlet pressure. SBLC discharge pressure can be substituted for differential pressure, and the ability to detect changes in hydraulic performance will not be affected.

OM-6 recognizes the validity of this approach and requires that outlet pressure be measured in lieu of ΔP.

PROPOSED ALTERNATE TESTING

Discharge pressure will be substituted for differential pressure in any test requirements or acceptance criteria for the SBLC pumps.

APPLICABLE TIME PERIOD

Relief is requested for the 3rd ten (10) year interval.

RELIEF REQUEST NUMBER: RP-52A (Sheet 1 of 2)

COMPONENT IDENTIFICATION

PUMP NUMBER	CODE CLASS	DRAWING NUMBER	COORDINATE
Unit 1			
5203	NC	M-0029	F-3
Unit 1/2			
5203-1/2	NC	M-0029	F-3
Unit 2			
5203	NC	M-0029	F-3

FUNCTION(S)

The Diesel Fuel Oil Transfer pumps are used to keep the Diesel Fuel Oil Day Tank (5202) full while the diesel generator is required to generate emergency power.

CODE REQUIREMENT

IWP-3100,	"Inservice Test Procedure," The test quantities shown in Table IWP-3100-1 shall be measured or observed and recorded.
Table IWP-3100-1,	"Inservice Test Quantities," Inlet Pressure (P_i) shall be measured before pump startup and during the test. Differential pressure (dP) shall be measured.
IWP-3110,	"Reference Values," Differential Pressure will be duplicated during subsequent inservice testing.

BASIS FOR RELIEF

10CFR50.55a(g)(6)(i), "impractical"
10CFR50.55a(a)(3)(i), "acceptable level of quality and safety"

Inlet pressure instrumentation was not installed for the Diesel Fuel Oil Transfer pumps. The Diesel Fuel Oil Storage Tanks (5201) are located below the Diesel Fuel Oil Transfer pumps. Therefore, the suction pressure will be negative, and the suction pressure before the test will vary from test-to-test depending on the tank level. Positive displacement, gear pumps are used in this application because they do not require positive suction head for proper operation. Diesel Fuel Oil Transfer pump

RELIEF REQUEST NUMBER: RP-52A (Sheet 2 of 2)

discharge pressure can be substituted for differential pressure, and the ability to detect changes in hydraulic performance will not be affected.

OM-6 recognizes the validity of this approach and requires that outlet pressure be measured in lieu of ΔP.

PROPOSED ALTERNATE TESTING

Discharge pressure will be substituted for differential pressure in any test requirements or acceptance criteria for the Diesel Fuel Oil Transfer pumps.

APPLICABLE TIME PERIOD

Relief is requested for the 3rd ten (10) year interval.