NUCLEAR POWER ~~BUSINESS UNIT~~
CALCULATION REVIEW AND APPROVAL

FILE 7144

Calculation # 96-0277

Number of Pages

Title of Calculation: Instrument Uncertainty Associated with Flow Instrumentation used for IT-15 Chill Water Pumps Inservice Test

☑ Original Calculation ☑ QA-Scope

☐ Revised Calculation. Revision # _____

☐ Superseding Calculation. Supersedes Calculation # _____

Modification #	Description:
N/A	

Other References:

Prepared By:	Date: 12/16/96

This Calculation has been reviewed in accordance with NP 7.2.4. The review was accomplished by one or a combination of the following (as checked):

____ A review of a representative sample of repetitive calculations.

X A detailed review of the original calculation.

____ A review of the calculation against a similar calculation previously performed.

____ A review by an alternate, simplified, or approximate method of calculation.

Comments:

- Assumption 1 is justified further by noting that the flow measuring device is temperature compensated.
- Recent calibrations 'as-found' data to support Assumption 3 were ~~NOT~~ BK 12/17/96 made available to this reviewer. Calibrations performed on Aug 22, '96 per ICP 06.062 show as found values well within the setting limits.

Reviewed By:	Date: Dec 17, '96	Approved B	Date: 12/18/96

A. Purpose: The purpose of this calculation is to determine the instrument uncertainties associated with the flow instrumentation used for the performance of the chill water pumps inservice test (IT-15).

B. References

1. PBNP Inservice Test, IT-15, "Chill Water Pumps and Valves", Revision 4, March 20, 1995.
2. MR 91-166*A, "Provide Test Instruments for Control Room and Cable Spreading Room Chilled Water Systems", Closed 5/28/93.
3. Barton Product Bulletin 227A-3 "Model 227A Indicator", 1991.
4. PBNP Instrumentation and Control Procedures ICP 6.062 "Control Room and Cable Spreading Room Chilled Water System Instrumentation Calibration", Revision 3, September 5, 1995.
5. "Process/Industrial Instruments and Controls Handbook", Fourth Edition, Douglas M. Considine, McGRAW-HILL, INC.
6. DG-I01 "Instrument Setpoint Methodology", Revision 1, September 12, 1995.
7. NPBU Instrumentation and Control Information Sheets ICI-12, "Selection of M&TE for Field Calibrations, Revision 3, August 20, 1996.

C. Assumptions

1. The temperature effect on the instrumentation will be assumed to be negligible as the performance specification for the indicators list a temperature limit range of -40°F to +180°F. [Reference 3]

2. The measuring and test equipment (M&TE) uncertainties for the flow instruments are assumed to be equal to the calibration setting tolerance of the instruments. This assumption is based on uncertainties associated with the measuring and test equipment used for calibration being less than uncertainty associated with the instrument itself per review of the most recent calibration. Reference 7 also provides the following guidance "If possible, M&TE used for field calibrations will have a tolerance four times better than field equipment, but always better than field equipment."

3. Uncertainties associated with drift of an instrument have been assumed to be equal to the calibration setting tolerance of the instrument. This assumption is based on as-found values typically within the tolerance allowed by the calibration procedure per review of most recent calibrations.

4. It is assumed that dial indicators can be read accurately to one-half of their smallest division/increment.

D. Inputs

The inservice test (IST) for the chill water pumps is performed per IT-15. The IST currently records flow from FI-4667 for P-111A,B and FI-4666 for P-112A,B. [Reference 1]

For this calculation, the total uncertainty associated with the flow instrumentation (FI-4666/FE-4666 & FI-4667/FE-4667) used to perform the IST must be taken into account. Error contributors to this total uncertainty include:

- Instrument Accuracy
- Calibration Setting Tolerance
- Drift
- Indicator Readability
- M&TE Uncertainty

1. Instrument Uncertainties for FI-4666 (discharge differential pressure flow indicator, Barton Model 227). The flow indicator has a range of 0-140 gpm which corresponds to a full scale differential pressure input range of 0-58.53" H_2O. [Reference 4]

   a. Instrument accuracy; Performance specifications for the Barton Model 227 meter show an accuracy ±0.5% of full scale differential pressure (0-58.53" H_2O) [Reference 2 & 3]. FI-4666 measures differential pressure, therefore the uncertainties given in Reference 3 are associated with the differential pressure reading. The following method was used to convert the uncertainty seen in the differential pressure reading to an uncertainty in flow.

   $Q = \text{Constant}\,(dP)^{1/2}$ (Equation 1, See Reference 6 - Appendix C)

   Where, Q is the Volumetric flow rate

   and dP is the Differential Pressure measured across the orifice

   Using Equation 1 recognizing that a dP of 58.53" is expected with a flowrate of 140 gpm, solve for the constant:

   $140\ \text{gpm} = \text{Constant}(58.53")^{1/2}$

   Therefore the Constant =18.3

   The Uncertainty is equal to 0.5%of full scale dP (58.53") or ± 0.3"

   The dP @ 140 gpm (58.53") plus uncertainty (0.3") = 58.83"

   Using Equation 1 this dP corresponds to a flowrate of:

   $Q = 18.3(58.83")^{1/2} = 140.4\ \text{gpm}$

   The corresponding uncertainty in gpm =140.4 gpm - 140 gpm = ± 0.4 gpm

b. Calibration Setting Tolerance; The as-left tolerance for the instrument is ±2 gpm. [Reference 4]
c. Drift; ±2 gpm (See Assumption C.3)
d. Indicator Readability; The minor division of FI-4666 is 2 gpm in the range of concern, therefore it will conservatively be assumed that the instrument can be read accurately to within ±1 gpm. (See Assumption C.4)
e. M&TE; ±2 gpm. (See Assumption C.2)

2. Uncertainties for FE-4666 (flow orifice associated with FI-4666)
The nominal accuracy for a flow orifice is ±0.6% [Reference 5] of maximum flow (140 gpm) or ± 0.84 gpm.

3. Instrument Uncertainties for FI-4667 (discharge differential pressure flow indicator, Barton Model 227). The flow indicator has a range of 0-110 gpm which corresponds to a full scale differential pressure input range of 0-35.49" H_2O. [Reference 4]

a. Instrument accuracy; Performance specifications for the Barton Model 227 meter show an accuracy ±0.5% of full scale differential pressure (0-35.49" H_2O) [Reference 2 & 3]. FI-4667 measures differential pressure, therefore the uncertainties given in Reference 3 are associated with the differential pressure reading. The following method was used to convert the uncertainty seen in the differential pressure reading to an uncertainty in flow.

$Q = \text{Constant}\,(dP)^{1/2}$ (Equation 1, See Reference 6 - Appendix C)

Where Q is the Volumetric flow rate

and dP is the Differential Pressure measured across the orifice

Using Equation 1 recognizing that a dP of 35.49" is expected with a flow rate of 110 gpm, solve for the constant:

$110 \text{ gpm} = \text{Constant}\,(35.49")^{1/2}$

Therefore the Constant =18.5

The Uncertainty is equal to 0.5% of full scale dP (35.49") = ±0.18"

The dP @ 110 gpm (35.49") plus uncertainty (0.18") = 35.67"

Using Equation 1 this dP corresponds to a flowrate of:

$Q = 18.5(35.67")^{1/2} = 110.5 \text{ gpm}$

The corresponding uncertainty in gpm =110.5 gpm - 110 gpm =±0.5 gpm

b. Calibration Setting Tolerance; The as-left tolerance for the instrument is ±1.5 gpm. [Reference 4]
c. Drift; ± 1.5 gpm (See Assumption C.3)
d. Indicator Readability; The minor division of FI-4667 is 1 gpm in the range of concern, therefore it will conservatively be assumed that the instrument can be read accurately to within ±0.5 gpm. (See Assumption C.4)
e. M&TE; ±1.5 gpm. (See Assumption C.2)

4. Uncertainties for FE-4667 (flow orifice associated with FI-4667)
The nominal accuracy for a flow orifice is ±0.6% [Reference 5] of maximum flow (110 gpm) or ± 0.7 gpm.

E. Calculation

1. The uncertainties of the instrumentation described in the input section will be combined using a systematic method established in Reference 6. Reference 6 also provides the basis for identifying, quantifying, and characterizing the error effects which must be considered in the development of an instrument uncertainty calculation. This methodology does not determine the maximum uncertainty possible, but rather determines the best estimate uncertainty. The best estimate or realistic approach combines independent and random uncertainties using the statistical square root sum of squares (SRSS) method. Non-random or directional uncertainties would be combined algebraically (straight sum) according to their sign with the results of the SRSS computation. However, this calculation does not contain any directional uncertainties.

Total Uncertainty associated with FI-4666 & FE-4666 (see Sect. D.1 & D.2)

$$U_{4666} = \pm\sqrt{(0.4)^2 + (2)^2 + (2)^2 + (1)^2 + (2)^2 + (0.84)^2}$$

$$U_{4666} = \pm 3.8 \text{ gpm}$$

Total Uncertainty associated with FI-4667 & FE-4667 (see Sect. D.3 & D.4)

$$U_{4667} = \pm\sqrt{(0.5)^2 + (1.5)^2 + (1.5)^2 + (0.5)^2 + (1.5)^2 + (0.7)^2}$$

$$U_{4667} = \pm 2.8 \text{ gpm}$$

F. Results

A best estimate total uncertainty associated with the flow instrumentation (FI-4666 & FE-4666) used for the performance of the control room chiller water pump inservice test (IT-15) was determined to be ± 3.8 gpm.

A best estimate total uncertainty associated with the flow instrumentation (FI-4667 & FE-4667) used for the performance of the cable spreading room chiller water pump inservice test (IT-15) was determined to be ± 2.8 gpm.

CR 96 - 416

OPERABILITY DETERMINATION

1. Degraded or potentially nonconforming equipment:

   Cable Spreading Room Ventilation Chil' ' Pumps P-111A & P-111B

2. Safety function(s) performed:

   None, pump is non-safety related. The CSR-HVAC system provides chilled water to the cable spreading room to ensure that electrical equipment vital to post accident recovery activities is properly cooled.

3. Circumstances of potential nonconformance, including possible failure mechanisms:

   Condition Report 96-416 identified a potential concern for adequacy of the IST program to ensure that pumps in the program meet design basis as well as ASME Section XI requirements. This evaluation supports determination of operability pending completion of detailed analysis.

4. Requirement or commitment established for the equipment, and why it may not be met:

   P-111A and P-111B are integral parts of the CSR-HVAC system. Each chilled water pump shall circulate chilled water through the cable spreading room chilled water cooling coils (HX-101A and HX-101B) a sufficient flowrate to support heat exchanger heat removal requirements.

   at 96 10/1/96

5. How and when the potentially nonconforming equipment was first discovered:

   This generic concern was first identified in June 1996 as a specific concern for safety injection pump acceptance criteria from ASME Section XI versus design requirements.

6. Basis for declaring affected equipment operable:

   Pump Nameplate Data - 96 gpm @ 53'

   Latest IST Data - P-111A - 101 gpm @ 51.47', IST Acceptance Range - 47.87' to 52.51'

   P-111B- 100.5 gpm @ 50.78' , IST Acceptance Range - 47.31' to 51.7'

   Design Basis for pump performance - 96 gpm @ 53' per 6118-M-48. P-111 A and P-111B circulates chill water between HX- 38A and HX-101 A&B therefore the design flowrates in these coolers must be considered.

   HX-101A&B - Design chilled water flowrate through the coils is 48 gpm per coil @ design heat removal rate of 240,000 btu\hr (96 gpm required for 480,000 btu\hr) per specification 6118-M-37 Rev. 1.

   HX-38A - Westinghouse CIM #130 page 17, Performance of model PB045W - Capacity when supplied with 92 gpm is 40.2 tons. The total required flow is 92 gpm per design. (6118-M-37 Rev. 1)

   The maximum cooling load per Calculation WEP008.0601, Cable Spreading , HVAC Evaluation, dated 4/10/92 table 4.1-1, is 239,000 btu/hr or 19.92 tons.

   The pump performance as measured by the latest IT-15 exceeds the required design flow conditions of the pump and heat exchangers therefore the pump is operable.

Prepared By: _____ Date: 9/30/96

Approved By: _____ Date: 10/1/96

RES Manager

viewed By: _____ Date: 10/1/96

PRESSURE TEST

Pump Reference Values

Pump#: P111A IT-015

Date Established: 5/25/95
Entered By: DEK

Reference Values

Reference Pressure: 22.30 psig Flow: 101.00 gpm

Reference Vibration	Pump End		Motor End	
Point A:	.024 ips	Point E:	.019 ips
Point B:	.014 ips	Point F:	.022 ips
Point C:	.014 ips		
Point D:	.012 ips		

Acceptable Range

Pressure: 20.74 psig to 22.75 psig

Vibration	Pump End		Motor End	
Point A: ≤	.060 ips	Point E: ≤	.048 ips
Point B: ≤	.035 ips	Point F: ≤	.055 ips
Point C: ≤	.035 ips		
Point D: ≤	.030 ips		

Alert Range

Low Pressure: 20.07 psig to 20.74 psig
High Pressure: 22.75 psig to 22.97 psig

Vibration	Pump End	Motor End
Point A:	.060 ips to .144 ips	Point E: .048 ips to .114 ips
Point B:	.035 ips to .084 ips	Point F: .055 ips to .132 ips
Point C:	.035 ips to .084 ips	
Point D:	.030 ips to .072 ips	

Required Action Range

Low Pressure: 20.07 psig
High Pressure: 22.97 psig

Vibration	Pump End		Motor End	
Point A: >	.144 ips	Point E: >	.114 ips
Point B: >	.084 ips	Point F: >	.132 ips
Point C: >	.084 ips		
Point D: >	.072 ips		

Comment: CHANGED REFERENCE VALUES DUE TO GUAGE CHANGE.

TEST DATA FOR ONE PUMP 8/26/96 Page 1

Pump: P111A

Test: 015

Pressure Test

		Vibrations (ips)						
Test Date	Diff P	Vert Inbd	Horz Inbd	Axial	Vert Outbd	Horz Outbd	Int	Remarks
5/26/92	0	.020	.020	0.000	.010	.010	LEH	ROUTINE SURVEILLANCE
8/25/92		.020	.010		.020	.020	JH	ROUTINE SURVEILLANCE
11/25/92		.025	.018		.016	.015		
11/25/92		.030	.020	.020	.030	.020	LEH	ROUTINE SURVEILLANCE
12/26/92		.028	.015		.019	.014		
12/26/92		.020	.010		.020	.020	JH	IWP 91-166 *A-02 *A-
2/25/93		.031	.024		.024	.019		
5/26/93		.024	.018		.013	.014		
7/07/93	20	.018	.013		.022	.016		
8/25/93	20	.016	.013		.019	.013		
11/22/93	20	.025	.016		.035	.016		
2/24/94	19	.017	.015		.019	.014		
5/25/94	20	.019	.015		.024	.013	BAT	ROUTINE SURVEILLANCE
8/27/94	20	.017	.011		.022	.014	LEH	ROUTINE SURVEILLANCE
11/22/94	21	.020	.018		.021	.013	BAT	ROUTINE SURVEILLANCE
5/25/95	22	.014	.012		.024	.014	LRD	ROUTINE SURVEILLANCE
8/25/95	21	.016	.012		.020	.013	LRD	ROUTINE SURV, 950896
11/25/95	22	.014	.012		.016	.014	LEH	ROUTINE SURVEILLANCE
2/25/96	22	.014	.011		.019	.012	LEH	ROUTINE SURVEILLANCE
5/25/96	22	.015	.019		.020	.016	LRD	ROUTINE SURVEILLANCE
8/25/96	22	.017	.010		.023	.014	LRD	ROUTINE SURVEILLANCE

PRESSURE TEST

Pump Reference Values

Date Established: 8/25/96

Pump#: P111B IT-015 Entered By: LEH

Reference Values

Reference Pressure: 22.00 psig Flow: 100.50 gpm

Reference Vibration	Pump End		Motor End	
Point A:	.014 ips	Point E:	.026 ips
Point B:	.015 ips	Point F:	.019 ips
Point C:	.017 ips		
Point D:	.012 ips		

Acceptable Range

Pressure: 20.50 psig to 22.40 psig

Vibration	Pump End		Motor End	
Point A: ≤	.035 ips	Point E: ≤	.065 ips
Point B: ≤	.038 ips	Point F: ≤	.048 ips
Point C: ≤	.042 ips		
Point D: ≤	.030 ips		

Alert Range

Low Pressure: 19.80 psig to 20.50 psig

High Pressure: 22.40 psig to 22.70 psig

Vibration	Pump End	Motor End
Point A:	.035 ips to .084 ips	Point E: .065 ips to .156 ips
Point B:	.038 ips to .090 ips	Point F: .048 ips to .114 ips
Point C:	.042 ips to .102 ips	
Point D:	.030 ips to .072 ips	

Required Action Range

Low Pressure: 19.80 psig

High Pressure: 22.70 psig

Vibration	Pump End		Motor End	
Point A: >	.084 ips	Point E: >	.156 ips
Point B: >	.090 ips	Point F: >	.114 ips
Point C: >	.102 ips		
Point D: >	.072 ips		

Comment: Changed DP reference due to evaluation for 08/25/96 test record. maintained previous vibration references.

TEST DATA FOR ONE PUMP 8/26/96 Page 1

Pump: V111B

Test: 015

Pressure Test

		Vibrations (ips)						
Test Date	Diff P	Vert Inbd	Horz Inbd	Axial	Vert Outbd	Horz Outbd	Int	Remarks
5/26/92	0	.020	.020	0.000	.040	.030	LEH	ROUTINE SURVEILLANCE
8/25/92		.020	.020		.040	.060	JH	ROUTINE SURVEILLANCE
8/25/92		.020	.020		.040	.060	JH	ROUTINE SURVEILLANCE
11/25/92		.025	.018		.019	.016		
11/25/92		.020	.020	.020	.030	.020	LEH	ROUTINE SURVEILLANCE
12/26/92		.027	.027		.023	.021		
12/26/92		.020	.020		.030	.020	JH	IWP 91-166 *A-02 *A-
2/25/93		.025	.029		.022	.016		
5/26/93		.017	.018		.017	.015		
8/25/93	19	.015	.014		.016	.018		
11/22/93	18	.021	.016		.024	.020		
2/24/94	19	.017	.013		.015	.012		
5/25/94	21	.018	.013		.016	.014	BAT	ROUTINE SURVEILLANCE
8/27/94	21	.016	.011		.015	.015	LEH	ROUTINE SURVEILLANCE
11/22/94	22	.017	.011	.016	.011	.028	BAT	ROUTINE SURVEILLANCE
5/25/95	21	.017	.012		.014	.015	LRD	ROUTINE SURVEILLANCE
8/25/95	21	.017	.012		.013	.013	LRD	ROUTINE SURV. 950896
11/25/95	21	.016	.013		.013	.011	LEH	ROUTINE SURVEILLANCE
2/25/96	21	.015	.012		.013	.011	LEH	OUTINE SURVEILLANCE
5/25/96	21	.017	.011		.012	.014	LRD	ROUTINE SURVEILLANCE
8/25/96	22	.017	.013		.013	.015	LRD	ROUTINE SURVEILLANCE

____ CR _____ _____ - _____

OPERABILITY DETERMINATION

1. Degraded or potentially nonconforming equipment:

   Control Room Ventilation Chiller Pumps P-112A & P-112B

2. Safety function(s) performed:

   None, pump is non-safety related. Although continuous control room occupancy is related to nuclear safety, equipment temperature limits and habitability during plant accidents can be maintained without continuous reliance on the CR-HVAC system

3. Circumstances of potential nonconformance, including possible failure mechanisms:

   Condition Report 96-416 identified a potential concern for adequacy of the IST program to ensure that pumps in the program meet design basis as well as ASME Section XI requirements. This evaluation supports determination of operability pending completion of detailed analysis.

4. Requirement or commitment established for the equipment, and why it may not be met:

   The CR-HVAC system provides heating, ventilation, air conditioning and radiological habitability for the control and computer rooms, which are both within the control room envelope.

   P-112A and P-112B are integral parts of the CR-HVAC system. Each chilled water pump shall circulate chilled water through the control room duct cooling coils (HX-100A and HX-100B) a sufficient flowrate to support heat exchanger heat removal requirements.

   The CR-HVAC system equipment is designed to maintain a room temperature of 75 *F. Temperature limits for equipment are based on the most limiting component temperature range. The PBNP FSAR Section 7.2 states that "... protective equipment inside the room ...will provide its protective function in an ambient of 100*F. Instrumentation and associated circuitry in the control room is generally rated for an ambient temperature range of 40 *F to 120 *F.

5. How and when the potentially nonconforming equipment was first discovered:

   This generic concern was first identified in June 1996 as a specific concern for safety injection pump acceptance criteria from ASME Section XI versus design requirements.

6. Basis for declaring affected equipment operable:

   Pump Nameplate Data - 116 gpm @ 65'

   Latest IST Data - P-112A - 117 gpm @ 64.62'

   P-112B- 118 gpm @ 63.93'

   Design Basis for pump performance - 116 gpm @ 55' from DBD-31 reference 10.6.8, Johnson Component Instruction #440. P-112 A and P-112B circulates chill water between HX-38B and HX-100 A&B therefore the design flowrates in these coolers must be considered.

   HX-38B - Westinghouse CIM #130 page 17, Performance of model PB055W - (HX-38B) requires 120 gpm of condenser water to provide 48.8 Tons. Per Calculation WEP008.0601, Main Control Room, HVAC Evaluation, dated 4/10/92 table 4.1-1 determined a maximum cooling load of 440,000 BTU/HR or 36.67 tons. Using a linear approximation for the current capacity based on P-112A&B performance the heat removal capacity of HX-38B is 47.58 tons for the flow associated with P-112A and 47.99 tons for P-112B.

   HX-100A&B - Design chilled water flowrate through the coils is 116 gpm @ design heat removal rate of 580,000 btu/hr (48.3 tons, DBD-31)

   The pump performance as measured by the latest IT-15 exceeds the required design flow conditions of the pump however based on a linear approximation of the heat removal capabilities of HX-38B the required chill water flow is 90.17 gpm. This is based on HX-38B's ability to remove 48.8 tons @ 120 gpm. The worst case heat load is 36.67 tons which equates (via a linear approximation) to 90.17 gpm required chill water flow. Because the current pump capacity exceeds the

maximum required flow P-112A & P-112B are operable.

Prepared By: _ Date: 9/30/96

Approved By: _ Date: 10/1/96

Reviewed By: _ Date: 10/1/96

~~DCS~~

PRESSURE TEST

Pump Reference Values

Pump#: P112A IT-015

Date Established: 8/25/96
Entered By: LEH

Reference Values

Reference Pressure: 27.50 psig

Flow: 117.00 gpm

Reference Vibration

	Pump End	Motor End
Point A:	.016 ips	
Point B:	.008 ips	
Point C:	.014 ips	
Point D:	.011 ips	
Point E:		.017 ips
Point F:		.019 ips

Acceptable Range

Pressure: 25.60 psig to 28.00 psig

Vibration

	Pump End	Motor End
Point A:	≤ .040 ips	
Point B:	≤ .020 ips	
Point C:	≤ .035 ips	
Point D:	≤ .028 ips	
Point E:		≤ .042 ips
Point F:		≤ .048 ips

Alert Range

Low Pressure: 24.80 psig to 25.60 psig
High Pressure: 28.00 psig to 28.30 psig

Vibration

	Pump End	Motor End
Point A:	.040 ips to .096 ips	
Point B:	.020 ips to .048 ips	
Point C:	.035 ips to .084 ips	
Point D:	.028 ips to .066 ips	
Point E:		.042 ips to .102 ips
Point F:		.048 ips to .114 ips

Required Action Range

Low Pressure: 24.80 psig
High Pressure: 28.30 psig

Vibration

	Pump End	Motor End
Point A:	> .096 ips	
Point B:	> .048 ips	
Point C:	> .084 ips	
Point D:	> .066 ips	
Point E:		> .102 ips
Point F:		> .114 ips

Comment: Changed DP reference values due to evaluation for test record dated 08/25/96. Vibration reference retained from previous data.

Pump: P112A
Test: 015
Pressure Test

		Vibrations (ips)						
Test Date	Diff P	Vert Inbd	Horz Inbd	Axial	Vert Outbd	Horz Outbd	Int	Remarks
5/26/92	0	.020	.010	0.000	.020	.020	LEH	ROUTINE SURVEILLANCE
8/25/92		.010	.010		.020	.020	JH	ROUTINE SURVEILLANCE
11/25/92		.018	.010		.015	.015		
11/25/92		.020	.010	.020	.020	.020	LEH	ROUTINE SURVEILLANCE
12/26/92		.013	.010		.016	.011		
12/26/92		.020	.010		.020	.020	JH	IWP 91-166 *A-02 *A-
2/25/93		.016	.012		.018	.013		
5/26/93		.019	.013		.016	.014		
8/25/93	23	.016	.011		.018	.013		
11/22/93	25	.018	.012		.011	.018		
2/24/94	25	.014	.015		.013	.010		
5/25/94	26	.015	.009		.010	.008	BAT	ROUTINE SURVEILLANCE
8/27/94	25	.013	.013		.016	.008	LEH	ROUTINE SURVEILLANCE
11/22/94	25	.018	.012		.011	.018	BAT	ROUTINE SURVEILLNACE
5/25/95	27	.014	.011		.016	.008	LRD	ROUTINE SURVEILLANCE
8/25/95	27	.013	.010		.015	.010	LRD	ROUTINE SURV. 950896
11/25/95	26	.013	.011		.016	.011	LEH	ROUTINE SURVEILLANCE
2/25/96	27	.012	.010		.012	.009	LEH	ROUTINE SURVEILLANCE
5/25/96	27	.014	.010		.016	.008	LRD	ROUTINE SURVEILLANCE
8/25/96	28	.013	.012		.014	.010	LRD	ROUTINE SURVEILLANCE

PRESSURE TEST

Pump Reference Values

Date Established: 8/25/96

Pump#: P112B IT-015 Entered By: LEH

Reference Values

Reference Pressure: 27.70 psig Flow: 118.00 gpm

Reference Vibration	Pump End		Motor End	
Point A:	.013 ips	Point E:	.020 ips
Point B:	.012 ips	Point F:	.016 ips
Point C:	.020 ips		
Point D:	.010 ips		

Acceptable Range

Pressure: 25.80 psig to 28.30 psig

Vibration	Pump End		Motor End	
Point A:	≤ .032 ips	Point E:	≤ .050 ips
Point B:	≤ .030 ips	Point F:	≤ .040 ips
Point C:	≤ .050 ips		
Point D:	≤ .025 ips		

Alert Range

Low Pressure: 24.90 psig to 25.80 psig

High Pressure: 28.30 psig to 28.50 psig

Vibration	Pump End	Motor End
Point A:	.032 ips to .078 ips	Point E: .050 ips to .120 ips
Point B:	.030 ips to .072 ips	Point F: .040 ips to .096 ips
Point C:	.050 ips to .120 ips	
Point D:	.025 ips to .060 ips	

Required Action Range

Low Pressure: 24.90 psig

High Pressure: 28.50 psig

Vibration	Pump End		Motor End	
Point A:	> .078 ips	Point E:	> .120 ips
Point B:	> .072 ips	Point F:	> .096 ips
Point C:	> .120 ips		
Point D:	> .060 ips		

Comment: Changed DP reference values due to evaluation of 08/25/96 test record. Previous vibration reference values retained.

TEST DATA FOR ONE PUMP 8/26/96 Page 1

Pump: P112B

Test: 015

Pressure Test

		Vibrations (ips)						
Test Date	Diff P	Vert Inbd	Horz Inbd	Axial	Vert Outbd	Horz Outbd	Int	Remarks
5/26/92	0	.020	.010	0.000	.030	.020	LEH	ROUTINE SURVEILLANCE
8/25/92		.010	.010		.020	.020	JH	ROUTINE SURVEILLANCE
11/25/92		.016	.015		.016	.014		
11/25/92		.020	.010	.020	.030	.020	LEH	ROUTINE SURVEILLANCE
12/26/92		.015	.016		.023	.012		
12/26/92		.020	.010		.020	.020	JH	IWP 91-166 *A-02 *A-
2/25/93		.017	.015		.021	.010		
5/26/93		.014	.013		.018	.011		
8/25/93	23	.022	.011		.023	.020		
11/22/9	25	.022	.014		.018	.017		
2/24/94	26	.021	.011		.017	.013		
5/25/94	26	.017	.011		.017	.014	BAT	ROUTINE SURVEILLANCE
8/27/94	23	.019	.011		.014	.013	LEH	ROUTINE SURVEILLANCE
9/23/94	23	.019	.012		.018	.020	LEH	Increased frequency
10/28/94	20	.015	.010		.012	.017	LEH	ROUTINE SURVEILLANCE
11/22/94	26	.018	.013		.012	.013	BAT	ROUTINE SURVEILLANCE
5/25/95	26	.020	.010		.013	.012	LRD	ROUTINE SURVEILLANCE
8/25/95	25	.017	.014		.014	.019	LRD	ROUTINE SURV, 950896
11/25/95	25	.020	.014		.016	.019	LEH	ROUTINE SURVEILLANCE
2/25/96	25	.017	.011		.010	.013	LEH	ROUTINE SURVEILLANCE
5/25/96	26	.020	.011		.012	.013	LRD	ROUTINE SURVEILLANCE
8/25/96	28	.017	.010		.012	.011	LRD	ROUTINE SURVEILLANCE