ENCLOSURES 1 AND 5 CONTAIN PROPRIETARY INFORMATION – WITHHOLD FROM PUBLIC DISCLOSURE IN ACCORDANCE WITH 10 CFR 2.390

Xcel Energy®

Monticello Nuclear Generating Plant
2807 W County Rd 75
Monticello, MN 55362

August 2, 2013

L-MT-13-076
10 CFR 50.90

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

Monticello Nuclear Generating Plant
Docket 50-263
Renewed License No. DPR-22

Monticello Extended Power Uprate: Replacement Steam Dryer – Responses to Requests for Additional Information (TAC MD9990)

References:

1) Letter from T J O'Connor (NSPM) to Document Control Desk (NRC), "License Amendment Request: Extended Power Uprate (TAC MD9990)," L-MT-08-052, dated November 5, 2008. (ADAMS Accession No. ML083230111)
2) Letter from T J O'Connor (NSPM) to Document Control Desk (NRC), "Monticello Extended Power Uprate: Replacement Steam Dryer Supplement (TAC MD9990)," L-MT-10-046, dated June 30, 2010. (ADAMS Accession No. ML102010462)
3) Letter from T J O'Connor (NSPM) to Document Control Desk (NRC), "Monticello Extended Power Uprate: Updates to Docketed Information (TAC MD9990)," L-MT-10-072, dated December 21, 2010. (ADAMS Accession No. ML103570026)
4) Letter from M A Schimmel (NSPM) to Document Control Desk (NRC), "Monticello Extended Power Uprate: Replacement Steam Dryer – Responses to Requests for Additional Information and Analysis Documentation (TAC MD9990)," L-MT-13-029, dated March 29, 2013. (ADAMS Accession No. ML13092A348)
5) Email from T Beltz (NRC) to J Fields (NSPM), "Monticello Nuclear Generating Plant - Draft Requests for Additional Information (MNGP EPU-EMCB-RSD-RAI-85 through 93) for the EPU Steam Dryer Review (TAC MD9990)," dated April 25, 2013.

A001
NRR

6) Email from T Beltz (NRC) to J Fields (NSPM), "Monticello Nuclear Generating Plant - Draft Requests for Additional Information (EPU-EMCB-RSD-RAI-94 - 119) re: Extended Power Uprate Steam Dryer Review (TAC No. MD9990)," dated May 19, 2013.
7) Email from T Beltz (NRC) to J Fields (NSPM), "Monticello Nuclear Generating Plant – Information Requested to Support Review of the Monticello Replacement Steam Dryer (TAC No. MD9990)," dated July 30, 2013.
8) Letter from M A Schimmel (NSPM) to Document Control Desk (NRC), "Monticello Extended Power Uprate: Supplement to Revise Technical Specification Setpoint for the Automatic Depressurization System Bypass Timer (TAC MD9990)," L-MT-12-091, dated October 30, 2012. (ADAMS Accession No. ML12307A036)

Pursuant to 10 CFR 50.90, the Northern States Power Company, a Minnesota corporation (NSPM), doing business as Xcel Energy, requested in Reference 1 an amendment to the Monticello Nuclear Generating Plant (MNGP) Renewed Operating License (OL) and Technical Specifications (TS) to increase the maximum authorized power level from 1775 megawatts thermal (MWt) to 2004 MWt.

In Reference 2, NSPM provided a supplement to Reference 1 to provide detailed design and analysis results for a replacement steam dryer (RSD) for MNGP. Reference 3 was provided to correct reactor internal pressure differential information provided in Reference 2. Reference 4 provided a revised set of analyses for the steam dryer based on a new analysis methodology called ACE 2.0.

In References 5 and 6 the Nuclear Regulatory Commission (NRC) provided NSPM draft requests for additional information (RAIs) related to the MNGP RSD. In Reference 7 the NRC requested clarifying information relative to previous RAI responses.

The purpose of this letter is to provide the NRC with responses to steam dryer related RAIs. This is the second in a series of letters that will provide responses to all the NRC RAIs included in References 5 and 6, and the clarifications requested in Reference 7.

Enclosure 1 contains Westinghouse Electric Company, LLC (WEC) letter LTR-A&SA-13-10, P-Attachment, "Responses to the U.S. NRC Request for Additional Information Relative to the Monticello Replacement Steam Dryer Acoustic/Structural Analyses Set #6," dated July 30, 2013. Enclosure 1 provides responses to the 10 RAIs identified on the Enclosure 1 cover page. Enclosure 1 contains proprietary information.

Enclosure 2 contains WEC letter LTR-A&SA-13-10, NP-Attachment, "Responses to the U.S. NRC Request for Additional Information Relative to the Monticello Replacement Steam Dryer Acoustic/Structural Analyses Set #6," dated July 30, 2013. This is a non-proprietary version of the responses provided in Enclosure 1.

Enclosure 3 contains NSPM responses to RAIs 93, 97 and 109.

Enclosure 4 contains Structural Integrity Associates report 1200978.404, Revision 0, "Interpretation of Static Strain Results during Hydro Pressurization Testing (In Response to RAI-93)." This report provides the basis for the statements made in response to RAI-93 provided in Enclosure 3.

Enclosure 5 contains WEC letter LTR-A&SA-13-15, P-Attachment, "Monticello Replacement Steam Dryer- Response to U.S. NRC Clarification Questions 2 and 3," dated August 1, 2013. This enclosure provides responses to two NRC clarifications requested in Reference 7. Clarifications 2 and 3 are included and contain proprietary information.

Enclosure 6 contains WEC letter LTR-A&SA-13-15, NP-Attachment, "Monticello Replacement Steam Dryer- Response to U.S. NRC Clarification Questions 2 and 3," dated August 1, 2013. This is a non-proprietary version of the RAI responses provided in Enclosure 5.

Enclosure 7 contains WEC affidavits executed to support withholding Enclosures 1 and 5 from public disclosure. The affidavits set forth the basis on which the information may be withheld from public disclosure by the NRC and addresses with specificity the considerations listed in 10 CFR 2.390(b)(4). NSPM requests that the proprietary information in Enclosures 1 and 5 be withheld from public disclosure in accordance with 10 CFR 2.390(a)4, as authorized by 10 CFR 9.17(a)4. Accordingly, it is respectfully requested that the information which is proprietary to WEC be withheld from public disclosure in accordance with 10 CFR 2.390.

Correspondence with respect to the copyright or proprietary aspects of WEC information or the supporting WEC affidavits in Enclosure 7 should be addressed to J. A. Gresham, Manager, Regulatory Compliance, Westinghouse Electric Company LLC, Suite 428, 1000 Westinghouse Drive, Cranberry Township, Pennsylvania 16066.

The RAI responses provided herein do not change the conclusions of the No Significant Hazards Consideration and the Environmental Consideration evaluations provided in Reference 1 as revised by References 3 and 8.

In accordance with 10 CFR 50.91(b), a copy of this application supplement, without enclosures is being provided to the designated Minnesota Official.

Summary of Commitments

This letter makes no new commitments and no revisions to existing commitments.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on: August 2, 2013

Mark A. Schimmel
Site Vice-President
Monticello Nuclear Generating Plant
Northern States Power Company-Minnesota

Enclosures (7)

cc: Administrator, Region III, USNRC (w/o enclosures)
Project Manager, Monticello Nuclear Generating Plant, USNRC
Resident Inspector, Monticello Nuclear Generating Plant, USNRC (w/o enclosures)
Minnesota Department of Commerce (w/o enclosures)

L-MT-13-076

ENCLOSURE 2

WESTINGHOUSE LETTER, LTR-A&SA-13-10, NP-ATTACHMENT (NON-PROPRIETARY)

RESPONSES TO THE U.S. NRC REQUEST FOR ADDITIONAL INFORMATION

RELATIVE TO THE MONTICELLO REPLACEMENT STEAM DRYER

ACOUSTIC/STRUCTURAL ANALYSES SET #6

This Enclosure covers the following NRC Requests for Additional Information.

1) MNGP EPU-EMCB-RSD-RAI-91
2) MNGP EPU-EMCB-RSD-RAI-92
3) MNGP EPU-EMCB-RSD-RAI-96
4) MNGP EPU-EMCB-RSD-RAI-98
5) MNGP EPU-EMCB-RSD-RAI-102
6) MNGP EPU-EMCB-RSD-RAI-103
7) MNGP EPU-EMCB-RSD-RAI-104
8) MNGP EPU-EMCB-RSD-RAI-110
9) MNGP EPU-EMCB-RSD-RAI-115
10) MNGP EPU-EMCB-RSD-RAI-117
11) MNGP EPU-EMCB-RSD-RAI-119

39 pages follow

LTR-A&SA-13-10 NP-Attachment

Responses to the U.S. NRC Request for Additional Information Relative to the Monticello Replacement Steam Dryer Acoustic/Structural Analyses Set #6

July 30, 2013

Westinghouse Electric Company LLC
1000 Westinghouse Drive
Cranberry Township, PA 16066 USA

Monticello Replacement Steam Dryer
RAI Responses for Acoustic/Structural Analyses Set #6

MNGP EPU-EMCB-RSD-RAI-91

The licensee is requested to revise Report WCAP-17251, Rev. 1, to address the following items.

(1) Figures 5-4 through 5-12 do not appear to be consistent and correctly reflect the effect of the Target Rock resonance on the pressure spectra. For example, (a) the waterfall plots in Figures 5-4 to 5-7 are [

]^{a,c}

(2) In addition, the frequency range for integrating the RMS pressure should be reduced from [ ]^{b} to better represent the behavior of the valve resonance in Figures 5-9 to 5-12.

Response

(1) [

]^{a,c} in Figures 5-4 to 5-7 of WCAP-17251-P, Revision 1, "Monticello Replacement Steam Dryer Four-Line Acoustic Subscale Testing Report."

[

]^{a,c}

[

]^{a,c}

[

]^{a,c}

(2) *Figure RAI-91-1 shows the RMS pressures for each main steam line (not normalized), calculated from [ ]^b*

[ ]b

Figure RAI-91-1 Target Rock RMS Pressures, [ ]^b

Figure RAI-91-2 shows the RMS pressures for each main steam line (not normalized), calculated from [ ]^{b}

[ ]^{b}

Figure RAI-91-2 Target Rock RMS Pressures, [ ]^{b}

Figure RAI-91-1 and Figure RAI-91-2 show the [ ]^{b}

[ ]^{a,c}

MNGP EPU-EMCB-RSD-RAI-92

The licensee utilizes subscale testing to assess potential dryer loads at EPU conditions. The subscale model testing included Mach numbers corresponding to power levels between 60% and 140% of CLTP conditions. One of the MSL valves, the Target Rock SRV, experiences the onset of flow-induced fundamental acoustic resonance slightly above CLTP conditions. Figures 5.4 through 5.8 clearly show that loads at the Target Rock resonance frequency, 160 Hz, increase at a rate much stronger than that of the square of flow velocity. However, the licensee discounts this increase, citing overall RMS trending in Figures 5.9 to 5.12 which appears to show negligible loading increases between CLTP and EPU conditions. Figures 5.9 to 5.12, however, are scaled so that the trending cannot be easily observed. The NRC staff notes that the load increases observed in Figures 5.4 to 5.8 at 160 Hz represent more relevant data.

The licensee is requested to address the following:

(1) Derive conservative scaling factors for EPU loads at the Target Rock SRV resonance frequency, considering not only subscale test results, but any nonconservatisms in the test due to incorrect matching of fluid density (air vs. steam), pressure, Reynolds Number (includes the effects of temperature differences), and uncertainty in actual vs. assumed Mach Number in the subscale testing.

(2) Confirm the conservatism of the scaling factors at the resonance frequency (i.e. the bump-up factors) by means of plant measurements of SRV resonance response, e.g. from QC2 plant data.

(3) Expand the ACE 2.0 bias errors and uncertainties to include bias errors and uncertainties (B&Us) specific to SRV resonances. The QC2-based ACM B&Us accepted previously may be acceptable. Apply the updated loads and B&Us for the frequencies corresponding to Target Rock valves to the dryer model and update the EPU stress calculations.

(4) Clearly define all scaling performed to estimate EPU dryer loads, including scaling factors for each monopole and dipole source. Compare CLTP and EPU dryer surface pressure spectra in plots, distinguishing between monopole and dipole contributions to the spectra.

Explain why the plant power ratio EPU to CLTP (2004 MWt/1775 MWt) was used to compute Mach number increase instead of the steam mass flow rate ratio at EPU & CLTP (8.34 Mlbm/hr /7.26 Mlbm/hr), as defined in Table 3-1 of WCAP-17252 Rev. 3).

Response

(1) Scaling spectra based on the ratio of the CLTP and EPU subscale test runs are presented in Figures RAI-92-1 through RAI-92-4.

a,c

Figure RAI-92-1: Monticello Scaling Spectra, MSL A

a,c

Figure RAI-92-2: Monticello Scaling Spectra, MSL B

a,c

Figure RAI-92-3: Monticello Scaling Spectra, MSL C

a,c

Figure RAI-92-4: Monticello Scaling Spectra, MSL D

[

]^{a,b,c}

The final stress ratios for the Monticello Replacement Steam Dryer at EPU conditions can be found in LTR-A&SA-13-15.

Table RAI-92: [ ]^a,c^

[ ]a,b,c

(2) *The conservatism of the scale factors are plant specific and can only be determined by Monticello plant data.* [

]^{a,c}

(3) *The calculation of the biases and uncertainties [*

]^{a,c} See response to MNGP EPU-EMCB-RSD-RAI-87.

(4) *The scaling performed to determine the acoustic loads at EPU is discussed in response to MNGP EPU-EMCB-RSD-RAI-88 1b. A comparison of the monopole and dipole contributions is provided in the response to MNGP EPU-EMCB-RSD-RAI-86.*

The multiplication factor used to scale the acoustic loads from CLTP to EPU is based on dynamic pressure scaling which is a function of the velocity squared. [

]^{a,c}

MNGP EPU-EMCB-RSD-RAI-96

(Follow-up to MNGP EPU-EMCB-RSD-RAI-67)

The licensee is requested to:

(a) Provide a summary of the operating history of Boiling Water Reactor (BWR) steam dryer regions that experienced cold-work-induced and crevice-induced inter-granular stress corrosion cracking (IGSCC).

(b) Explain how the plastic strain introduced by cold work during fabrication is measured or estimated.

(c) Explain whether the Replacement Steam Dryer (RSD) is susceptible to crevice-induced IGSCC.

Response

(a) During more than 200 accumulated reactor-years of operation of the Nordic dryers, with the vane banks arranged in polygon shape, no damage related to flow-induced vibrations has been found.

There have been a few instances of minor IGSCC cracking:
(1) Cracked vane plate which had been exposed to road salt during transportation.
(2) Crack in one bracket which was a special feature of that particular dryer. It has since been redesigned and the bracket does not exist in current designs, including the Monticello replacement steam dryer.
(3) Crack in cover plate due to excessive cold work of plate material during fabrication. With respect to dryer panels some parts have "built-in" crevices. Westinghouse has not experienced crevice-induced IGSCC in these components. See further discussion in part (c) below.

(b) Plastic strain induced by cold work during fabrication is addressed in the following manner:

(1) Bending/forming: Most cold work on the steam dryer is cold deformation from bending of plates. Forming and bending work must be done according to approved forming and bending procedures.

Solution heat treatment after cold forming must be performed if the degree of cold deformation is ≥2.5%. Solution heat treatment must be done according to approved solution heat treatment procedures.

The degree of cold deformation is calculated by t/2Rm, where:

t = thickness (of plate), and Rm = Mid bend radius = (inner bend radius + half plate thickness). Hardness is measured according to approved hardness procedure.

(2) Grinding:

Grinding of base metal surfaces in general is prohibited. If grinding is needed, grinding must be followed by polishing. Grinding and polishing must be performed according to approved grinding and polishing procedure. The procedures are proven and well established to minimize cold work.

(c) In the Westinghouse steam dryer design, crevices are avoided to a maximum extent.

With respect to welding, Westinghouse has specified the use full-penetration welds without crevices. Fillet welds and partial penetration welds shall be all-around to prevent open crevices.

With respect to dryer panels, some parts have "built-in" crevices, for example the dryer panels. Vane plates consist of spot welded plates with crevices in between. Vane plates and spacers are packed on tie rods with crevices in between. Westinghouse has not experienced crevice-induced IGSCC in these components.

The steam dryer is designed and manufactured according to all existing knowledge to prevent crevice induced IGSCC from occurring in the component.

MNGP EPU-EMCB-RSD-RAI-98

(Follow-up to MNGP EPU-EMCB-RSD-RAI-43)

In the response to RAI-43, the licensee states that [

]b,c

Please explain whether or not the Helmholtz analysis of the steam dome [

]b,c

Response

[

]a,b,c

Moreover, ACE Revision 2.0 [

]a,b,c

Table RAI-98-1 – Monticello RSD [ ]c

[ ] b,c

Contour plots of the [ ]a,c are shown in Figures RAI-98-1 and RAI-98-2. These figures clearly show that [

]a,c

[ ] a,b,c

Figure RAI-98-1 [ ]a,b,c

[ ] a,b,c

Figure RAI-98-2 [ ]^{a,b,c}

MNGP EPU-EMCB-RSD-RAI-102

(Follow-up to MNGP EPU-EMCB-RSD-RAI-56)

(a) The response to RAI-56(b) does not provide enough justification for showing that the use of stress concentration factors (SCFs) for fillet welds is conservative compared to the use of the fatigue evaluation approach described in the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code Section III, Subsection NG, Table NG-3352-1. The results for Examples 2 and 3, as discussed in the RAI response, show that the use of SCFs for fillet welds at the vane bank trough ledges is conservative by less than 10%.

Please evaluate additional high-stressed fillet welds in other parts of the dryer, including the outer hood and the skirt and provide a comparison of the results similar to the one presented in RAI-56(b).

Also, provide a detailed calculation for any one of the fillet welds.

(b) Table NG-3352-1 provides Quality Factors, q, in addition to the fatigue strength reduction factors, f. Please explain how the quality factors are employed in the analysis of the steam dryer welds.

Response

(a) [

]^{a,c}

Sample Stress Calculation for Vane Bank Partial-Penetration Weld – Weld A

[

]a,c

a,c

Figure RAI-102-1 – Schematic Diagram of Vane Bank Partial-Penetration Weld A and Weld B

a,c

Figure RAI-102-2 – Plane (x-z) where the Loads are Extracted

[

]a,c

a,c

[ ]a,c

(b) [

]a,c

MNGP EPU-EMCB-RSD-RAI-103

(Follow-up to MNGP EPU-EMCB-RSD-RAI-57)

(a) Please provide an example illustrating the use of the Multi point Constraint (MPC) approach for connecting shell elements to solid elements (shell-to-solid transitions).

(b) Based on the analysis results for a small model of a representative section of a hood, support ring and skirt, in WCAP-17549-P, Revision (Rev.) 1, Section 3.2.1, it is stated that, *"In dynamic analyses, the stresses in the solid model were generally slightly higher than either the overlaid shells or the MPCs. However, in most locations these stress differences were less than 10%. In a few locations, the stress differences were between 10 - 18%."*

Please explain how this underestimation of stresses is accounted for in the dynamic analysis of dryer stresses at EPU conditions.

(c) Please provide a sketch showing how the lifting rod-support ring connection is modeled.

Also, provide the results of the comparison of stresses obtained using the stiff beam-solid elements model and 3D modeling.

<u>Response</u>

(a) Example Shell-to-Solid Transition ANSYS Model:

A simple ANSYS finite element model (FEM) shown in Figure RAI-103-1 is used to illustrate the [

]a,c can be seen in the enlarged view inset on Figure RAI-103-1.

Figure RAI103-2 is a stress intensity plot for an applied positive Z-direction acceleration loading on the model.

a,c

Figure RAI-103-1 Shell-Solid MPC Connection

a,c

Figure RAI-103-2 Stress Intensity Plot for Acceleration Loading in Z-direction

(b) The few stress differences between 10 – 18% mentioned in the WCAP only occurred in static analyses. The stress differences from harmonic analyses are small and the only difference noted between the solid FEM and MPC FEM results is in a small frequency shift that is well within the +/-10% that we shift the loads in our harmonic analysis. The sentence in the WCAP is misleading because it was put at the end of the section and

should have been stated directly after the discussion of the static stresses. This section will be re-written in the next revision of the WCAP.

(c) Lifting Rod-Support Ring Model:

Figure RAI-103-3 shows how the [

]a,c

Comparison of Stress Results:

Harmonic analyses were performed on the [

]a,c

Table RAI-103-1 Peak Stress Intensities (S_{int}) of the
[ ]a,c

a,c

a,c

Figure RAI-103-3 [ ]^{a,c}

a,c

Figure RAI-103-4 [ ]^{a,c}

a,c

Figure RAI-103-5 Stress Intensity Plot on [ ]a,c

a,c

Figure RAI-103-6 Stress Intensity Plot on [ ]^{a,c}

a,c

Figure RAI-103-7 Stress Intensity Plot on [ ]^{a,c}

[ ]^{a,c}

Figure RAI-103-8 Stress Intensity Plot on [ ]^{a,c}

MNGP EPU-EMCB-RSD-RAI-103 (cont.)

Additional Information relative to teleconference comments received:

1. "Provide more justification as to why only occurring in the static analysis is acceptable."

   Response:

   The evaluation was performed in static, modal and harmonic analyses.

2. "Can we define small?"

   Response:

   This is somewhat subjective as it depends on which node or dryer component and which time. There are many ways to review the data. However, the main point is that no matter how you view the data, at all locations the difference is captured in the +/-10% frequency shifting.

3. "Response does not address NRC question of 'how this underestimation of stresses is accounted for...'"

   Response:

   This is already considered in the bias and uncertainties included describing the load definition based on strain gauge measurements.

<u>MNGP EPU-EMCB-RSD-RAI-104</u>

(Follow-up to MNGP EPU-EMCB-RSD-RAI-61)
The response to RAI-61 notes that, "The lug that was 180-degrees from the pivot lug would then close its gap at the seismic block a minimum of 1.5 times faster than at either of the remaining lugs." This response is unclear since the total diametric gap between seismic lugs and steam dryer is the same and the total diametric change in dimension would be the same during operating conditions. Additionally, the closure of the gaps at all four lugs may take place at the same time. The dryer analysis presented by the licensee was based on boundary conditions with two lugs at 180-degrees apart being active.
Please determine whether the gaps remain open or closed based on the thermal expansion of the dryer at CLTP/EPU operating conditions and utilize the corresponding boundary conditions in the dynamic analysis of the steam dryer to provide any changes to the dryer stress analysis results.

<u>Response</u>

The carbon steel vessel expands less than the stainless steel dryer, which effectively reduces the radial gap by about 0.1 inch. The existing radial gap between the dryer and the vessel wall is about 2.0 inches. Therefore, this radial gap will not be closed due to temperature. The harmonic analysis of the dryer is based on all four lugs restrained in the vertical and circumferential directions. Previous analyses were performed with two lugs at 180-degrees apart being active. However, the stress result differences between those cases and the case with all four lugs restrained are considered not significant.

<u>MNGP EPU-EMCB-RSD-RAI-110</u>

(Follow-up to MNGP EPU-EMCB-RSD-RAI-84)

Please provide the revised MSL limit curves which are based only on CLTP MSL spectra and CLTP minimum alternating stress ratios.

<u>Response:</u>

[

]a,c

The limit curves presented in L-MT-12-056 are based on [

]a,c

[

]a,b,c

[

]a,b,c *The limit curves are presented in Figures RAI-110-1 through RAI-110-4.*

]b

Figure RAI-110-1: Monticello Limit Curves, MSL A

[ ] b

Figure RAI-110-2: Monticello Limit Curves, MSL B b

Figure RAI-110-3: Monticello Limit Curves, MSL C

b

Figure RAI-110-4: Monticello Limit Curves, MSL D

MNGP EPU-EMCB-RSD-RAI-115

In Section 2.2 of WCAP-17549-P, Rev. 1, the licensee presented a step-by-step description of estimating the vane passing frequency (VPF) stress field at the EPU power level. Please provide the following clarifying information:

(a) In Step 5, provide data and plots showing how well the predicted strain magnitudes match the measurement at each gage location.

(b) Explain Step 6 in more detail. Provide information on the frequency load step. Also, provide a table listing the highest VPF stresses and the corresponding steam dryer component.

(c) In Step 7, explain how the VPF stress and acoustic stress are combined.

(d) Evaluate the measurements of the accelerometers at CLTP and other power levels and confirm whether any rocking motion of the steam dryer is present. If significant rocking is observed in the measurements (accelerometers on one side of the dryer out of phase with those on the other side), explain how this type of excitation and response is accounted for in estimating VPF stresses.

During a telecom on 7/10/13 the NRC requested that the licensee confirm that the

(e) RCP VPF tonal amplitudes are not expected to increase at EPU conditions.
(f) whether the previous power ascension calculations span the expected operating conditions of the RCP at EPU conditions?
(g) Does the RCP pump operating condition (flow rate/rpm) change at EPU? If so, how might this affect the VPF tonal amplitude?
(h) The staff is waiting for actual RSD stresses at VPF tones to compare to those from acoustic loads.

Response

(a) Table 2-1 in WCAP-17549-P provides the comparison of [

]^{a,c}

[ ]a,c

Figure RAI-115-1 Maximum Measured Strain vs. Predicted Strain

(b) The acceleration was applied [

]a,c

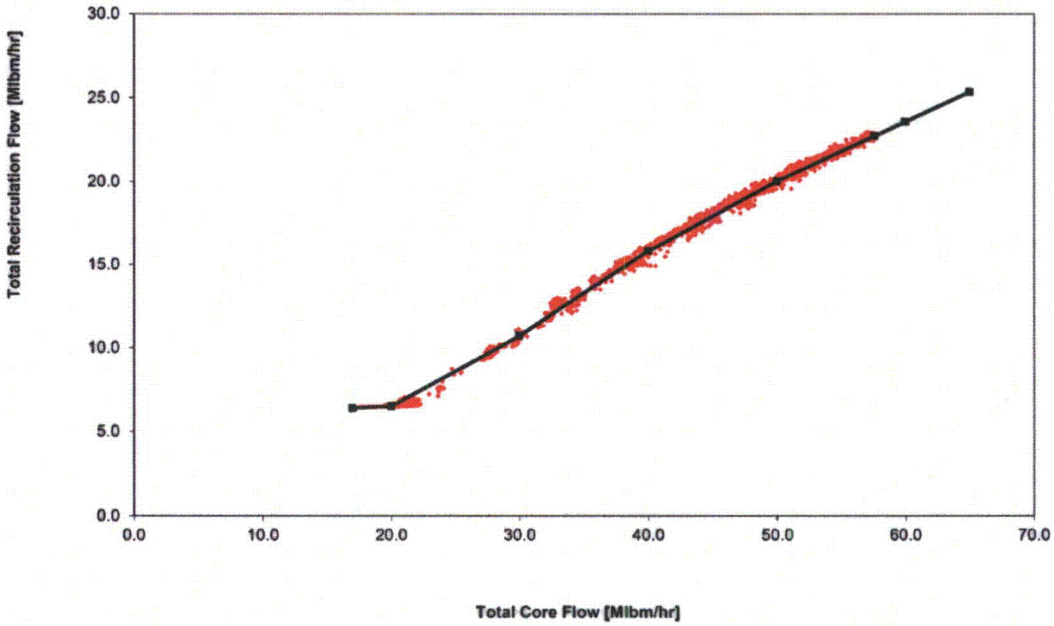
(c) At each node in the FEM, the [
]a,c

(d) The accelerometers [

]a,c

(e) The RCP VPF are a function of pump speed and the amount of work being performed by the pump. The RCPs take suction from the annulus area of the reactor and return flow to the jet pump nozzles in the annulus. Reactor pressure remains constant between CLTP and EPU. Therefore, pump suction and *discharge pressures do not change. At 100% core flow, CLTP annulus temperatures are 530.2 °F. At 100% core flow EPU annulus temperatures are 529.7 °F. Therefore, there is a negligible change in fluid conditions for the RCPs between CLTP and EPU. Since there is no change in pump operating procedures or use, there is no change in pump performance.*

The RCPs provide the drive flow for the jet pumps. The total jet pump flow defines core flow for the reactor. Figure RAI-115-2 following shows the historical comparison between RCP flow and core flow. MNGP is licensed for 105% core flow (60.5 Mlbm/hr) but the jet pumps do not have the capacity to provide this flow rate. The RCPs have a rated speed of 56 Hz as provided by the existing MG sets. The red dots on Figure RAI-115-2 show the range of pump operating speeds with associated flow rates for the pumps up to their maximum speed capability. This range of capabilities for RCP performance will not change with EPU. As shown, maximum core flow capability for MNGP is limited to about 56 Mlbm/hr due to jet pump performance and the maximum speed capability of the MG sets. These factors will not change with EPU. Therefore, RCP speed and flow for required ranges of operation will not change significantly for EPU from the conditions seen at CLTP. Tonal amplitudes will not change significantly since pump speed and flow will not change.



Core Flow (Mlbm/hr)	Recirculation Flow (Mlbm/hr)	Core Flow (Mlbm/hr)	Recirculation Flow (Mlbm/hr)
17	6.4	50	20.0
20	6.5	57.6	22.7
30	10.7	60	23.6
40	15.8	65	25.3

Figure RAI-115-2 RCP Flow Vs. Core Flow

(f) *Figure RAI-115-3 following shows the Power/Flow Map for EPU. This shows the core flow rates that are required in order to achieve higher power levels for the reactor. Use of Figures RAI-115-2 and RAI-115-3 allow a prediction of pump speed ranges required to achieve a specific power level. For a power level of interest all core flows to the right of the MELLLA boundary are acceptable. Power ascension testing at CLTP did include a broad range of pump speeds; see Table RAI-95b-1 in LTR-A&SA-13-14, Revision 0, "Responses to the US NRC Request for Additional Information Relative to the Monticello Replacement Steam Dryer Acoustic/Structural Analyses Set #5" for more information. Pump speeds ranged from 15.0 Hz at 5% power up to 54.1 Hz at full CLTP power.*

Section 2.2 of WCAP-17549-P notes that 14 data sets were used between 15% and 100% power to define VPF. This provides a good representation of possible pump speeds. Conservatism is provided by considering that all strain measured in *a VPF frequency is provided by the pump and that the highest measured strain from the 14 data sets that represented the available pump speeds was used to define the VPF load. Since data were available from 15 Hz to 54.1 Hz for pump speed and since the VPF loads were considered conservatively as shown here, the span of expected operation has been considered to define reasonable VPF loads.*

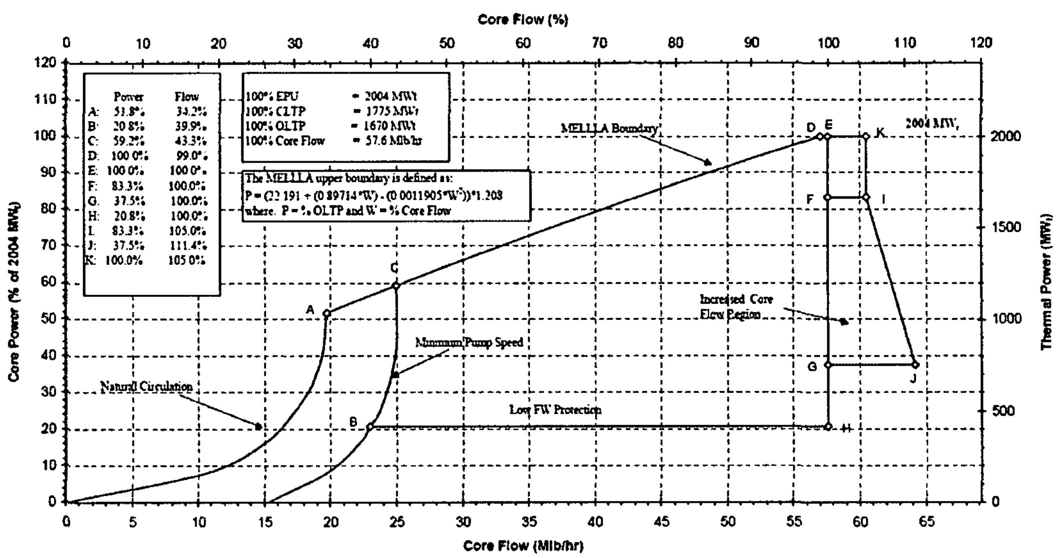


Figure RAI-115-3 Power/Flow Map

(f) *Flow rate/rpm will not change significantly and VPF tonal amplitude is not changed, see (e) above.*

(g) *Noted.*

MNGP EPU-EMCB-RSD-RAI-117

Section 7.4 of WCAP-17549-P, Rev. 1 discusses the use of sub-modeling. Please provide the following clarifying information:

(a) Explain how the size of the sub-model was determined.

(b) To ensure that the displacement boundary conditions and the loads are correctly applied, analyze the sub-model without any mesh refinement and compare the resulting stresses with the corresponding global stress results.

Response

(a) The size of the submodel was determined by [

]a,c

Table RAI-117-1 Submodel Cut Boundary Stress Comparison

a,c

a,c

Figure RAI-117-1 Stress Contours – Submodel and Global Model

[ ]a,c

Figure RAI-117-2 Submodel Cut Boundary Stress Comparison Locations

(b) *The submodel documented in 8.2.1 of WCAP-17549 is the skirt slot submodel. As stated in 8.2.1, the global model geometry [*

]a,c

MNGP EPU-EMCB-RSD-RAI-119

Section 5.0 of WCAP-17549-P, Rev. 1 provides the modal analysis results with four mode shapes near 40 Hz.
Please provide similar results for the modes for the skirt in the frequency range (0-40 Hz).

Response

Low-frequency skirt mode plots are shown in the response to MNGP EPU-EMCB-RSD-RAI-89.

ENCLOSURE 3

NORTHERN STATES POWER – MINNESOTA

RESPONSES TO NRC REQUESTS FOR ADDITIONAL INFORMATION

This enclosure provides responses from the Northern States Power Company, a Minnesota corporation (NSPM), doing business as Xcel Energy, to requests for additional information (RAI) # 93, 97 and 109 provided by the Nuclear Regulatory Commission (NRC) in References 1 and 2. References are identified at the end of this Enclosure.

MNGP EPU-EMCB-RSD-RAI-93

MSL strain gage calibration during plant pressurization

(Follow-up to MNGP EPU-EMCB-RSD-RAI-68)

During recent EPU reviews, the NRC staff encountered an issue regarding MSL strain gage under-prediction by a significant amount. Based on this, the staff issued an RAI (MNGP EPUEMCB- RSD-RAI-68) for Monticello and the response from the licensee did not address calibration of the MSL strain gages during plant (static) pressurization.

Therefore, while exiting from the current refueling outage at MNGP, the licensee is requested to determine the MSL strain gage under-prediction factor during plant (static) pressurization (comparing with the strain-to-pressure conversion factor currently used by the licensee), and account for any MSL strain gage under-prediction factor in the fluctuating dynamic pressure loading on the steam dryer.

Submit a summary report of the MSL strain gage calibration along with a revised response to MNGP EPU-EMCB-RSD-RAI-68.

NSPM Response

NSPM performed the requested main steam line (MSL) static strain gage calibration test as requested by the NRC. However, upon evaluation of the data obtained during the test, it was evident that the requested test could not provide a conclusive demonstration of MSL calibration accuracy. Additional laboratory testing was performed to provide some assurance of MLS strain gage accuracy.

See Enclosure 4 for a report detailing the testing results. Based on these test results a revision to MNGP EPU-EMCB-RSD-RAI-68 is not required.

MNGP EPU-EMCB-RSD-RAI-97

Monticello is the first U.S. nuclear power plant to use an RSD with the Westinghouse (Nordic) Design. This dryer was installed in the plant during the 2011 Refueling Outage (RFO). MNGP has already operated at current licensed thermal power (CLTP) for one fuel cycle.

Please provide the 2013 RFO inspection results for the RSD and summarize the inspection findings, especially regarding the presence of (i) IGSCC [Intergranular Stress Corrosion Cracking] indications and (ii) fatigue cracks. Also, describe what measures (leave-as-is or repair) will be taken for any indications and cracking found on this RSD along with a justification for the measures.

NSPM Response

NSPM performed and completed an inspection during the 2013 refueling outage in accordance with the inspection plan described in *"Westinghouse Recommendations for Inspections of the Monticello Replacement Steam Dryer"* provided to the staff in Enclosure 1 of Reference 3. There were no indications or flaws observed during the inspection.

Direct dryer instruments were removed from the steam dryer during the 2013 refueling outage. Locations where direct dryer instrumentation had been affixed to the steam dryer were satisfactorily inspected after removal.

MNGP EPU-EMCB-RSD-RAI-109:

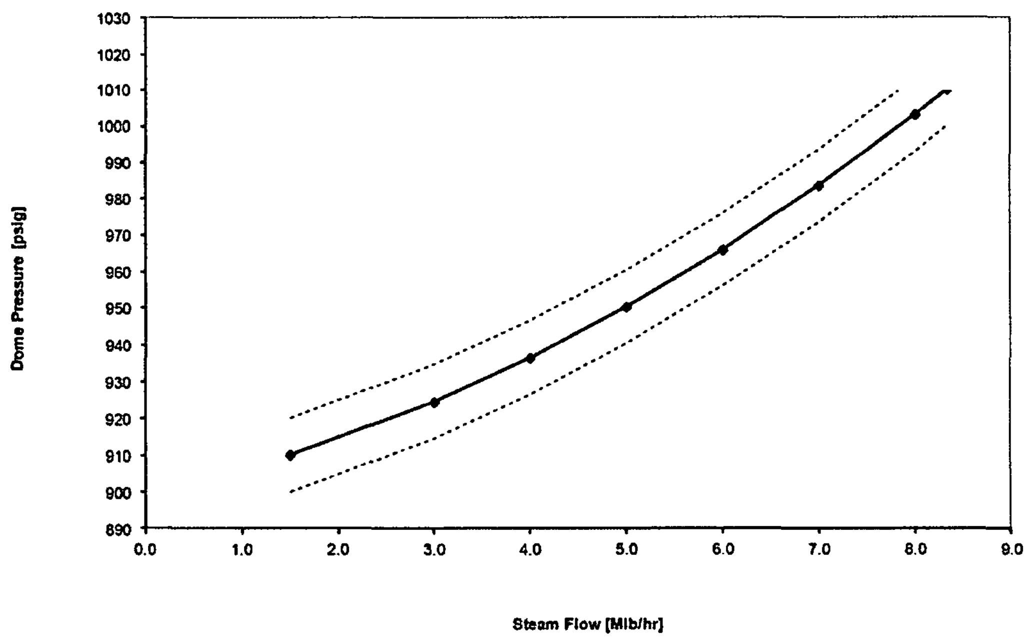
Please provide the expected range of plant static pressures and MSL flow rates at EPU conditions over the remaining life of the MNGP. Explain how you will determine worst-case dryer stresses over this range of conditions and assess the impact of these stresses on fatigue life.

In a telecom on 7/10/13 it was requested to also provide information on how much variation exists in reactor pressure during operation.

NSPM Response:

Figure 109-1 below shows the expected range of reactor pressure vs MSL flow rate at EPU conditions. Reactor pressure varies based on main steam line differential pressure due to system resistance. The operators establish a turbine inlet pressure setpoint with the electric pressure regulator at low power and do only minor adjustment to this setpoint as the unit ascends to full power. Turbine inlet pressure controls reactor pressure.

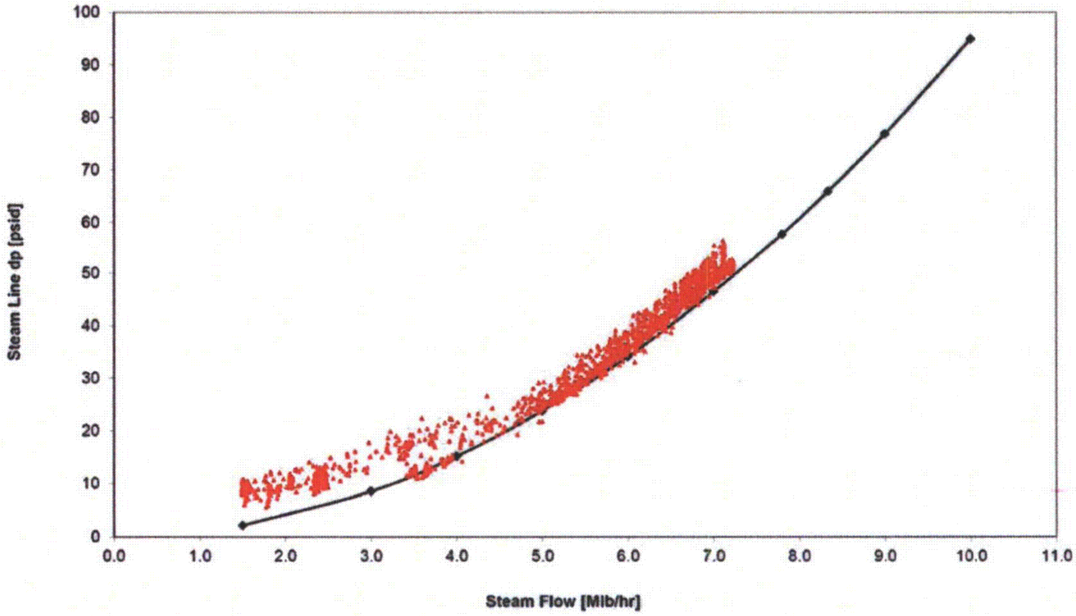
Figure 109-1, Reactor Dome Pressure Versus Steam Flow



Steam Flow (Mlb/hr)	Dome Pressure (psig) Nominal with a band of +/- 10 psi	Steam Flow (Mlb/hr)	Dome Pressure (psig) Nominal with a band of +/- 10 psi
1.5	910.2	6	965.9
3	924.5	7	983.5
4	936.4	8	1003.0
5	950.2	8.335	1010.0

Figure 109-2 below shows the historical and predicted variation in steam line differential pressure due to system resistance as the plant approaches EPU steam flow rates of 8.335 Mlbm/hr. This shows the scatter of actual reactor pressure values during a range of startups at MNGP. Some variation in data exists due to instrument accuracy and calibration.

Figure 109-2, Steam Line Pressure Drop Versus Steam Flow



Steam Flow (Mlbm/hr)	Pressure Drop (psid)	Steam Flow (Mlbm/hr)	Pressure Drop (psid)
1.5	2.1	7.0	46.5
3.0	8.5	7.8	57.7
4.0	15.2	8.335	65.9
5.0	23.7	9.0	76.8
6.0	34.1	10.0	94.9

Figure 109-3 below shows a typical range of reactor pressure during steady state operation over a time period from 10/18/12 to 10/22/12. Figure 109-4 below shows reactor thermal power over this time period. Reactor power defines the steam flow rate and therefore the load. Control of pressure is based on maintaining turbine inlet pressure at a constant setpoint.

Figure 109-3, Reactor Pressure Vs. Time

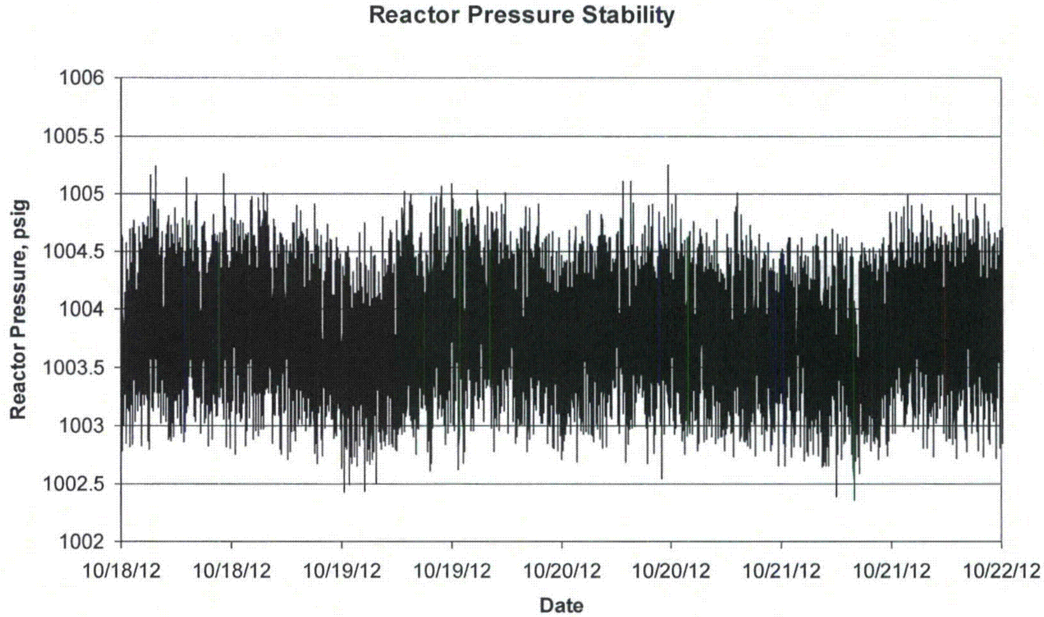
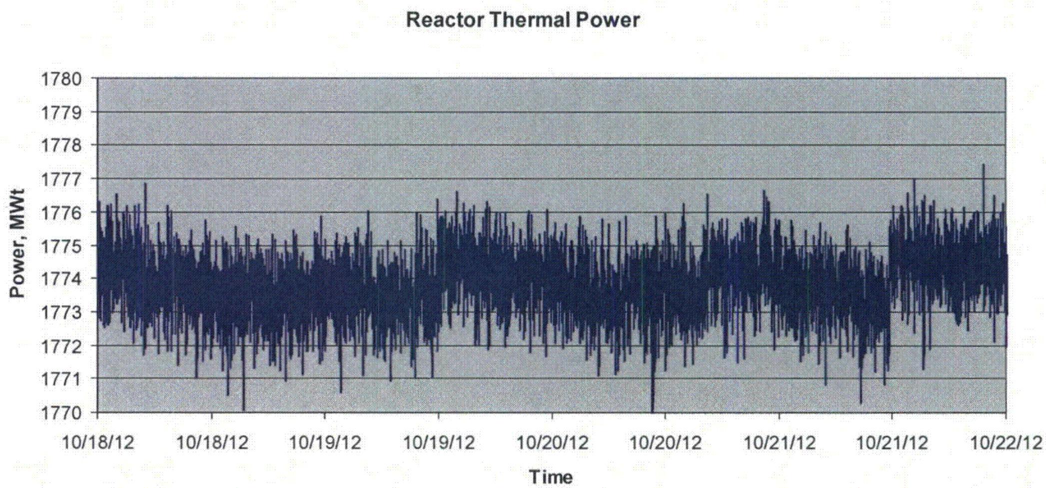


Figure 109-4, Reactor Thermal Power Vs. Time



To provide an indication of the frequency of the pressure control cycles, Figure 109-5 below shows reactor pressure and Figure 109-6 shows reactor power over a shorter time interval. Reactor power is recalculated only once per minute while the reactor pressure values are shown based on a 1 second sample rate.

Figure 109-5, Reactor Pressure Vs. Time

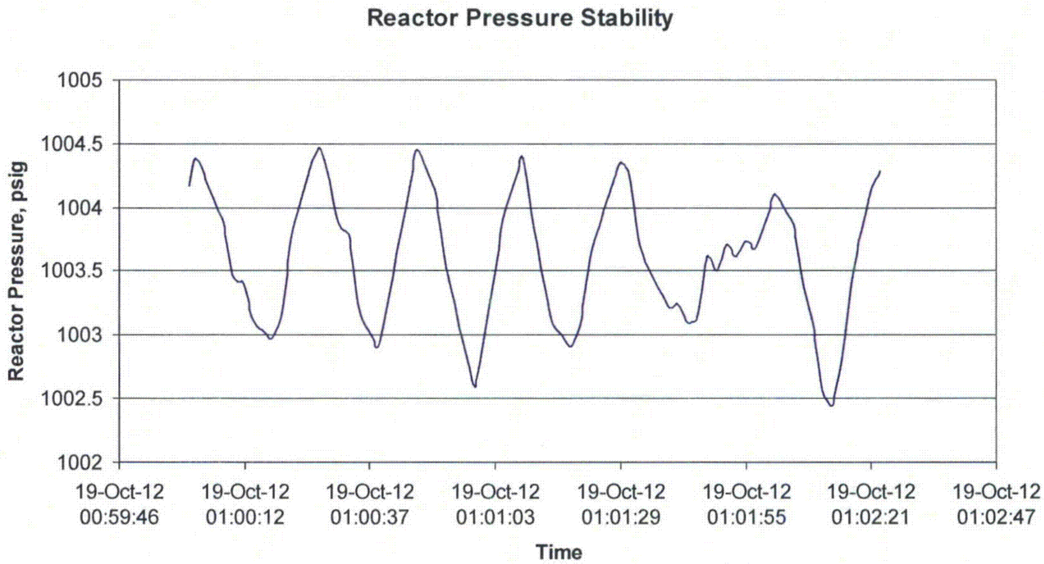
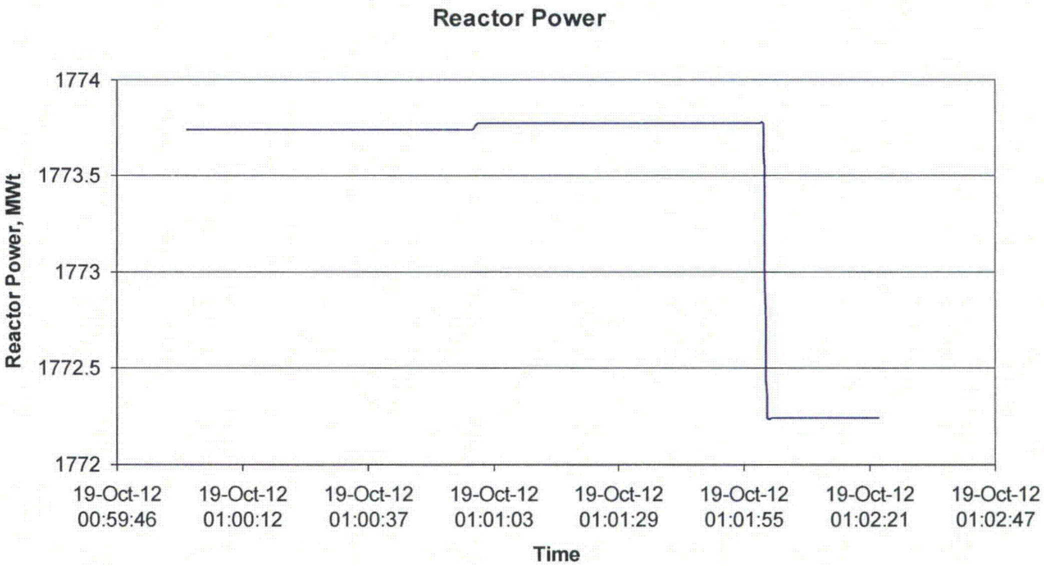


Figure 109-6, Reactor Power Vs. Time



Monitoring of the impact of variations of reactor pressure on steam dryer loads will be completed during power ascension testing to EPU. Plant procedures limit the amount of variation allowed in reactor pressure from the nominal expected value to +/- 10 psi as shown in Figure 109-1. Figure 109-3 shows normal expected variation from a defined setpoint. To maintain reasonable margin to procedural limits pressure can be varied by +/- 7 psig from the nominal value. Sensitivity of the dryer loads to reactor pressure changes while at -7 psi from nominal and +7 psi from nominal will be performed at 100% of CLTP, 105% of CLTP and at full EPU power. Compliance with the Limit Curves will be verified at these points.

The limit curves (provided in response to RAI-110) are based on the minimum alternating stress ratios (worst-case dryer stresses). Therefore, compliance with these limit curves includes the impact of the analyzed stresses on the fatigue life of the steam dryer.

References

1. Email from T Beltz (NRC) to J Fields (NSPM), "Monticello Nuclear Generating Plant - Draft Requests for Additional Information (MNGP EPU-EMCB-RSD-RAI-85 through 93) for the EPU Steam Dryer Review (TAC MD9990)," dated April 25, 2013.
2. Email from T Beltz (NRC) to J Fields (NSPM), "Monticello Nuclear Generating Plant - Draft Requests for Additional Information (EPU-EMCB-RSD-RAI-94 - 119) re: Extended Power Uprate Steam Dryer Review (TAC No. MD9990)," dated May 19, 2013.
3. Letter from M A Schimmel (NSPM) to Document Control Desk (NRC), "Monticello Extended Power Uprate: Replacement Steam Dryer – Inspection Criteria and Plan," L-MT-12-090, dated October 22, 2012. (ADAMS Accession No. ML12298A032).

L-MT-13-076

ENCLOSURE 4

STRUCTURAL INTEGRITY ASSOCIATES, INC.

REPORT NO. 1200978.404, REVISION 0

INTERPRETATION OF STATIC STRAIN RESULTS DURING HYDRO PRESSURIZATION TESTING (IN RESPONSE TO RAI-93)

37 pages follow

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July 22, 2013
Report No. 1200978.404, Revision 0
Quality Program: ☐ Nuclear ☒ Commercial

Mr. Steve Hammer
Xcel Energy
Monticello Nuclear Generating Plant
2807 W. County Road 75
Monticello, MN 55362

Subject: Interpretation of Static Strain Results during Hydro Pressurization Testing (In Response to RAI-93)

Dear Steve:

Based on recent discussions, Structural Integrity Associates, Inc. (SI) recently assisted Xcel Energy (Xcel) with collecting static-change data from the strain gages (SGs) installed on the main steam lines (MSLs) at the Monticello Nuclear Generating Plant (MNGP) during hydro pressurization. The intent of the data collection was to obtain information needed to respond to a request for additional information (RAI) from the Nuclear Regulatory Commission (NRC). This report documents SI's initial evaluation and observations on the acquired data, and the impact of those results on the RAI response.

BACKGROUND

Xcel has instrumented the MSLs at the MNGP with high-temperature, spot-welded strain gages (SGs), which are used to indirectly measure the dynamic pressure fluctuations inside of the piping during operation. The measured dynamic strains are converted to units of pressure using a set of conversion factors (PCFs) developed from basic solid mechanics principals, as demonstrated in Reference [2]. The data from the SGs has been used by Westinghouse Electric Company (WEC) to evaluate the effect of acoustic pressure pulsations in the MSLs on the steam dryer at extended power uprate (EPU) operating conditions. Eight (8) circumferentially-oriented SGs are installed in four (4) diametrically-opposed pairs at two (2) locations on each MS pipe, for a total of sixty-four (64) sensors. Each pair of SGs comprises one (1) measurement channel; all thirty-two (32) channels are connected to a high-speed, simultaneously-sampled data acquisition system (DAS).

The DAS and SG sensors were originally installed at MNGP during the spring 2007 refueling outage, and baseline (pre-EPU) data was obtained during the ensuing power ascension. The baseline data contained excessive electrical noise (at 60 Hz and its multiples) on virtually all channels. The source of the noise was eventually determined to be a high-voltage cable installed in the same electrical penetration used to pass the SG field cables through the drywell wall. As a result of the elevated electrical noise, the SG sensing configuration was refurbished during the spring 2011 refueling outage. All 64 of the original SGs were replaced with brand-new sensors, and the field cables were re-routed through a newly installed shielded instrument penetration.

During the same outage in spring 2011, MNGP installed a replacement steam dryer (RSD) manufactured by WEC. The RSD was instrumented with pressure transducers, accelerometers, and strain gages in order to correlate the MSL pressure data with the actual loading on the dryer. The SG DAS was reconfigured to also accept the signals from the RSD instrumentation, such that all measurements were recorded simultaneously. A revised set of baseline data was collected during the ensuing power ascension, and used by WEC to extrapolate the loading on the dryer at postulated EPU conditions.

Presently, MNGP is in the final stages of the EPU license review process, and completed the final installation of EPU-related equipment upgrades during the spring 2013 outage. A set of RAIs recently received from the NRC [1] raised several questions regarding the RSD analysis, including an inquiry related to the accuracy or "calibration" of the MSL SGs. RAI-93 indicates that the NRC staff previously encountered a case in which the MSL SGs under-predicted a known or calculated strain by a significant amount. The NRC requested that MNGP collect MSL SG data during plant pressurization, and compare the actual pressure change to predicted values obtained from the static strain results and the PCFs in Reference [2].

MNGP completed the requested test during the hydro pressurization (leak detection) test on June 25, 2013, near the end of the refueling outage. However, the sensing configuration and wiring configuration of the MSL SGs at MNGP is such that the accuracy of static measurements is highly unreliable. This limitation is evident in the data acquired during the hydro test; the strain response is aligned extremely well with changes in plant pressure, but the ratio of pressure to measured strain is significantly different than the established PCFs [2].

The remainder of this report presents the results from the hydro test, and describes the factors that impact the system's ability to accurately measure static changes in strain. In contrast, additional justification is provided concerning the ability of the MSL SGs to perform their intended function – accurate measurement of small-scale, dynamic strain fluctuations.

MEASUREMENT APPROACH

The system used to measure pressure pulsations via SGs was designed by SI explicitly for the purpose of performing high-speed, dynamic data acquisition. Each pair of SGs is connected to a Wheatstone Bridge circuit, with the two active sensors on opposite arms connected with two precision completion resistors (CRs), as shown in Figure 1. This arrangement is referred to as a Wheatstone Half-Bridge (WHB) configuration. Changes in the output voltage (V_{OUT}) are directly related to the change in strain measured by the SG-1 and SG-2 gages. The results from both gages are additive; both must be under tension to measure an increase in strain, and likewise both must be under compression to measure a decrease in strain. Combined with the diametrically-opposed arrangement of the SG pairs, the WHB configuration inherently minimizes bending strain (when one SG is under tension and the other is under compression, a net cancellation effect is achieved). This effect is typically enhanced by averaging the signals from the four (4) channels at each measurement location.

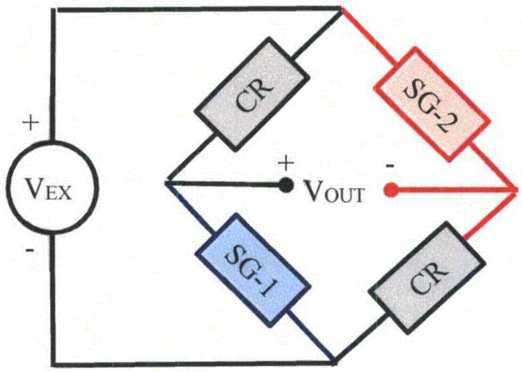


Figure 1: Example of Half-Bridge Wheatstone Measurement Circuit

The SGs used are a high-temperature, spot-welded design manufactured by Hitec Products, Inc. (HPI). The model number is HBWAK-35-250-6-10FG (SHLD), the nominal (unstrained) resistance is 350 Ω, and the nominal gage factor is 2.0. The gages include an integrated, 10-foot high-temperature cable with three signal conductors and separate shielding. The default wiring configuration is indicated by the red lines on the right-half of the WHB in Figure 1 – the three conductors are intended to equalize the lead resistance of the SG and CR arms. This configuration requires a separate three-conductor cable (plus shield) to transfer the signals from each SG to the measurement system.

For the EPU application, the number of signals conductors is limited by the number of available penetration connections. In order to reduce the number of required connections, a two-conductor cable (twisted, shielded pair) is used for field routing, and one of the signal leads from the SG is not used. This configuration is indicated by the blue lines on the left-half of the WHB in Figure 1 – the black lines indicate wiring that is internal to the DAS. This modification inherently results in an unbalanced WHB, where the legs with active SG elements are greater in resistance than the legs with CRs. For static strain measurements, this imbalance can introduce inaccuracy, primarily due to the effects of temperature change on individual SGs and their integrated cables (typically referred to as "apparent" strain).

For the EPU application, with 64 different sensors exposed to harsh operating environments, it is not uncommon to experience several SG failures during the installation and subsequent data collection period. When this occurs, the SG in question is bypassed by inserting an additional CR into the typical measurement circuit in Figure 1. The resulting arrangement is referred to as a Wheatstone Quarter-Bridge (WQB) configuration, and is useful for maintaining sensing capability when SG failures are experienced. However, WQB channels lose the bending-cancellation effect present in WHB channels, and thus are typically not included in combined channel averages.

In order to verify proper operation of WHB and WQB circuits, and to account for potential inaccuracies due to apparent strain, the DAS automatically performs null balancing and shunt calibration prior to collecting data. For the typical dynamic acquisition, wherein data is obtained over a two (2) minute duration, these adjustments are performed prior to each collection period. The null balancing routine uses a series of hardware-based potentiometers to normalize or "zero" the signal for each channel, eliminating bridge imbalance and apparent strain effects. The shunt calibration routine applies a known, fixed resistance in parallel across one arm of the WHB/WQB circuit, simulating a change in strain. The response during the test is observed and verified to be within a tight tolerance of expected values. A series of precision amplifiers are then used to make slight gain adjustments, ensuring uniform results across all channels.

ACQUISITION OF STATIC DATA AT MNGP

Prior to the hydro acquisition, SI performed two separate condition and functionality tests of the SG sensors and DAS. The first test [3], in December 2012, assessed the condition of the SG sensors and recommended refurbishments to be performed during refueling outage 26 (RFO26), in spring 2013. The assessment also included a complete checkout and field calibration of the SG measurement hardware in the DAS. A follow-up test [4] was conducted in May 2013, incorporating the SG refurbishments and verifying ongoing DAS functionality.

Data was acquired from the MSL SGs during three separate hydro-related events [5]: 1) pressurization from 0 to 100 psig, 2) pressurization from 100 to 1,000 psig, and 3) depressurization from 1,000 to 0 psig. In each case, the DAS was configured to continuously stream waveform data from the SGs at a rate of 2,500 samples per second (sps) and monitor the results. Prior to initiating each recording, the SG channels were null balanced and shunt calibrated using the routines built-in to the DAS; these adjustments were not performed again for the entire duration of the test. During acquisition, the static (average) strain value from each channel was captured every ten (10) seconds and recorded in a file. Detailed waveform data files were also captured periodically, with a two-minute file saved every ten (10) minutes during each test.

In addition to the SG data, MNGP collected information on a number of different plant parameters during the tests. Reactor vessel pressure and recirculation loop temperatures were obtained from MNGPs PI system [6], in ten (10) second intervals to match the DAS trend file. MSL temperatures were not available directly, so MNGP installed a set of thermocouples connected to portable data loggers, recording trend information in one-hour intervals throughout the tests [7].

EVALUATION OF STATIC DATA

Of the three events that were monitored, the data from the second test (pressurization from 100 to 1,000 psig) was judged to be the most useful for the purpose of this evaluation. The first test (pressurization to 100 psig) featured a smaller change in strain, and a hold period of 4 hours at approximately 8 psig. Likewise, the third test (depressurization) included an extended hold period of 13 hours at approximately 350 psig. These hold periods appear as discontinuities in plots, and make it more challenging to discern the actual relationship between static strain and pressure. Thus, while all of the tests exhibited similar results during periods of pressure change, data from the second test was used for all subsequent calculations, including resultant tables and plots.

To evaluate the results of the test, the trend data from the MSL SGs was compared to the pressures reported from PI in several ways. First, a set of unscaled trend plots was created, with strain and pressure plotted on different vertical axes; these plots are included in Attachment A. The unscaled plots indicate a strong level of relative correlation between measured strains and plant pressure. Step changes in pressure appeared to occur in a logarithmic fashion, with the rate of change decreasing from the start to the end of the step, and the unscaled strain results closely matched this behavior. The correlation is further confirmed by the scatter plots in Attachment B, which show that the relationship between strain and pressure is essentially linear.

The plots in Attachments A and B also indicate an appreciable level of variance between individual channels, even those at the same location. Although the curves for each channel compare favorably to the pressure data in a relative sense, the channels do not match one another in terms of scaling factor or absolute change in strain. This is in contrast to dynamic data collected during previous acquisitions, such as the one documented in Reference [8], which demonstrated a high degree of similarity between all channels at the same location.

Next, the trend data for each channel was scaled into units of pressure using the established PCFs [2]. A calculation was performed to determine the absolute change in strain (and therefrom, pressure) over the duration of the test. The values for individual channels were averaged together to get a sense of the predicted pressures at each SG measurement location. Those calculations are presented in Table 1. As shown in the table, the change in pressure predicted by the SGs is significantly less than 900 psig change that actually occurred in the plant – on average, the predicted pressures were approximately 418 psig.

A second set of trend plots was created to illustrate the above results graphically. The trend data from the SGs was combined (averaged) at each MSL location, and the results were scaled by the PCFs [2] and compared to the actual pressure. The resulting plots, which are included in Attachment B, illustrate the gap between predicted and actual pressure, which appears to grow consistently larger over time.

ADDITIONAL LABORATORY TESTING

Given the hydro pressurization results described above, SIA designed and performed a test to demonstrate the ability of the SGs to accurately measure static and quasi-dynamic strain in a laboratory environment. The test involved mounting four (4) of the HPI SGs in question to a steel plate mounted in a cantilevered fashion. The plate was then deformed by installing a known weight at its unsupported end, and the measurements from the SGs were compared to hand calculations. Figure 2 illustrates the entire test rig, and provides a close-up view of the installed SGs.

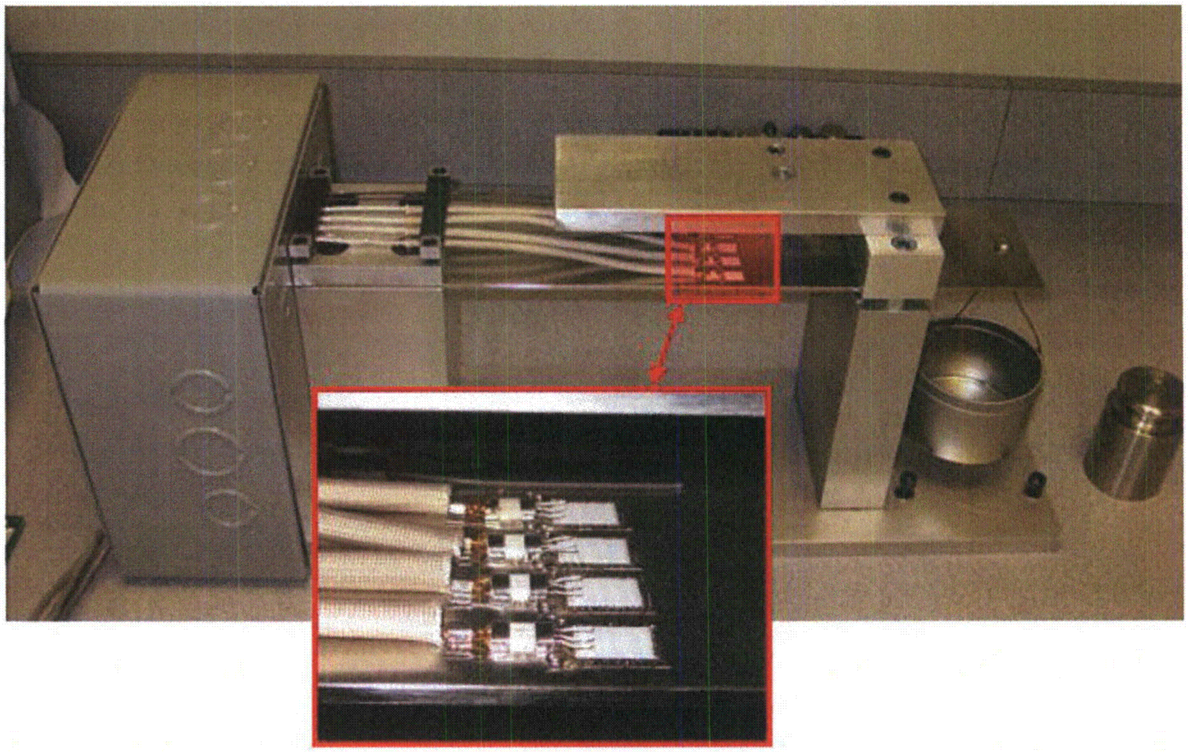


Figure 2: Static Strain Test Rig

The configuration of the test rig allows for calculation of expected strains using simple handbook solutions. Figure 3 is a plan view schematic, which doubles as a quasi-free body diagram (FBD) of the system. The bending stress at the SG location can be calculated from Equation 1, as follows:

$$\sigma_b = E\varepsilon_b = \frac{M_b c}{I_{CS}} \qquad (1)$$

Where:
- σ_b = Bending stress in beam (psi)
- E = Elastic modulus of beam material (psi)
- ε_b = Bending strain in beam (in/in by theory, $\mu\varepsilon$ in practice)
- M_b = Bending moment in beam (in-lb)
- c = Distance from beam centerline to point of interest (in)
- I_{CS} = Moment of inertia of beam cross section (in4)

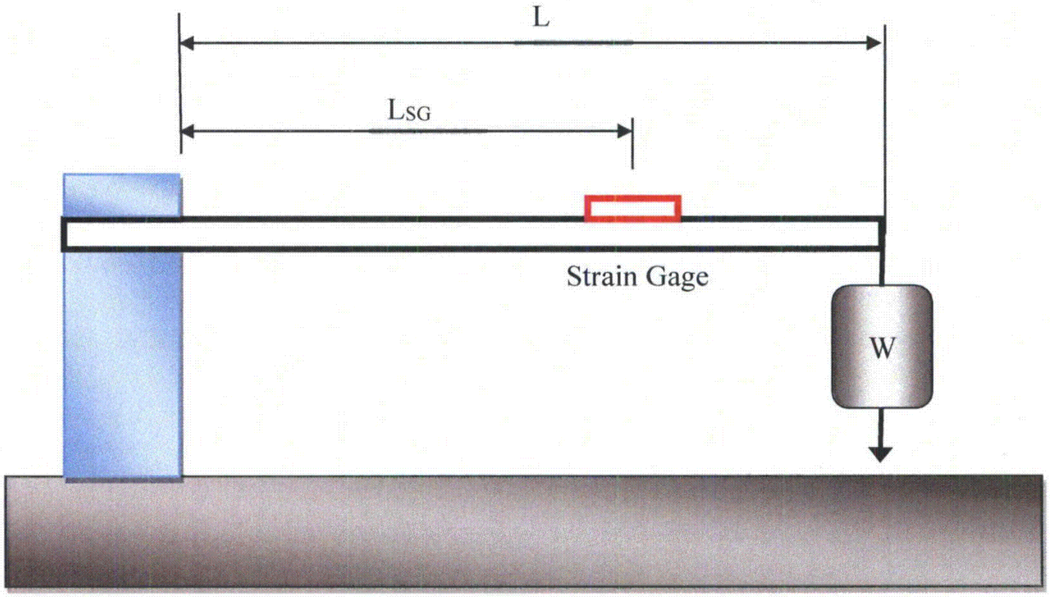


Figure 3: Schematic and FBD of Cantilevered Beam Test Setup

The bending moment, M_b, is a function of the applied load (weight), beam length, and SG installation location, as shown in the following expression:

$$M_b = W(L - L_{SG}) \qquad (2)$$

Where: W = Applied load (lb)
L = Total length of beam (in)
L_{SG} = Length from fixed beam attachment point to center of SG measurement axis (in)

Combining Equations 1 and 2, substituting the standard expression for moment of inertia of a rectangular beam ($I_{CS} = ab^3/12$), and rearranging gives the following expression for bending strain in terms of applied loads and geometry:

$$\varepsilon_b = \frac{6W(L - L_{SG})}{Eab^2} \qquad (3)$$

Where: a = Width of beam (in)
b = Thickness of beam (in)

For the test rig illustrated in Figure 2 and Figure 3, the beam is nominally 12 in long by 3 in wide, and 1/8 in thick. When measured with a caliper, the width and thickness are 2.9961 in and 0.1138 in, respectively. The SGs are mounted approximately 6-3/8 in from the attachment point. For a 1,000 gram applied load, assuming an elastic modulus of 30×10^6 psi for the stainless steel beam, the calculated strain at the SG location is 63.97 psi.

Figure 4 shows the response of the SGs during several loading cycles. The four (4) SGs on the beam were combined into two (2) WHB channels, and the data was collected using a set of hardware and software that is identical to the DAS at MNGP. The SGs were configured in the same two-wire configuration used at MNGP, inherently unbalancing the WHB and allowing for error due to temperature variation and differences in lead length. The 1000 gram load was added and removed from the beam four times over the course of 180 seconds, simulating repetitive or quasi-dynamic loading. The first pair of SGs measured an average response of 58.01 $\mu\varepsilon$ during the periods where the load was applied, while the second pair of SGs measured an average of 60.78 $\mu\varepsilon$. The variation in measurements between SGs pairs was approximately 4.5%.

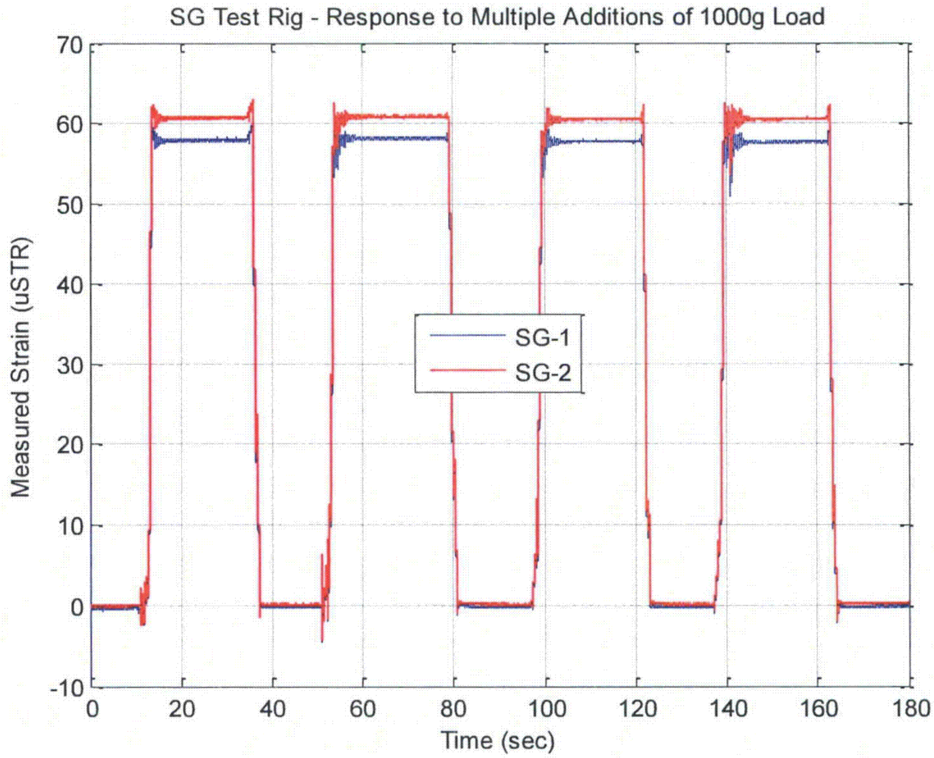


Figure 4: Test Rig Strain Response during Repeated Load Additions

Taking the average of the measured strains (59.40 $\mu\varepsilon$), the variation between measured and predicted values is approximately 7.2%. However, there are a number of uncertainties in the test rig setup, any of which could explain all or part of the difference. A list of the uncertainties with potential to influence results is provided below:

- The SGs installed on the beam (as shown in Figure 2) each have a different resistance, from inherent variations in the SGs and integral cables as well as imposed variation due to slight differences in installation. The test SGs are connected in the same two-wire WHB configuration as the MSL SGs at MNGP, and thus are subject to the same potential for measurement error.
- There is some amount of flexure in the clamping mechanism, such that the beam cannot behave as a theoretical, fully-fixed cantilever. In reality, the beam length and SG location may differ in applied length from the values specified above.

- The design of the test rig is such that the SG cables are routed along the beam, and secured near the beam clamping mechanism. The cables may provide a small amount of support, in addition to the strain-resistive properties of the beam.
- There may be some variation in cross-sectional area along the length of the beam, allowing for localized stress (strain) concentrations. In particular, the edges are somewhat rounded, and thus the beam is not perfectly rectangular.

Upon closer examination of the response plot in Figure 4, it is evident that application of the load on beam was neither uniform in timing nor instantaneous. The beam vibrates as the load is applied, and the measured response indicates that the accompanying fluctuations self-attenuate over the course of several seconds. Figure 5 provides a graphical representation of this effect.

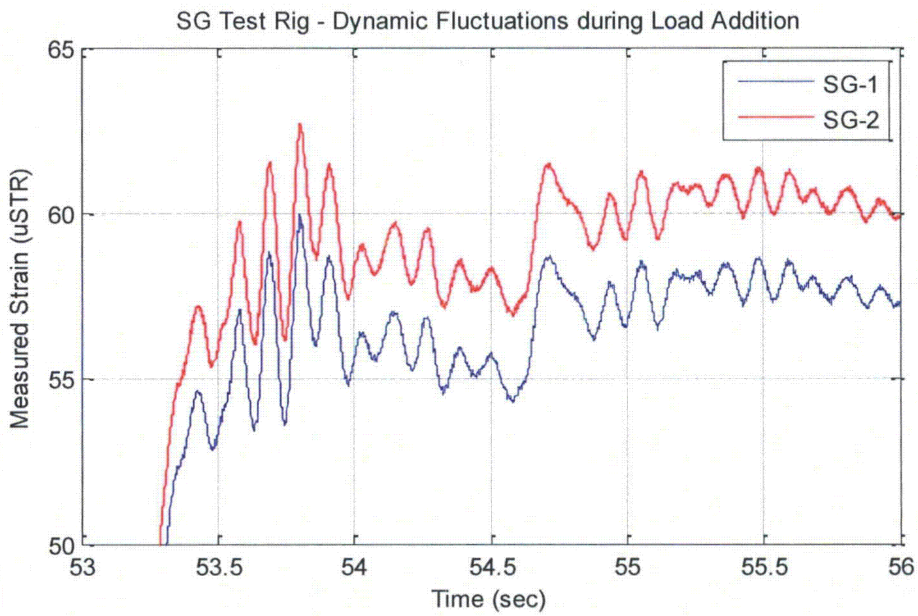


Figure 5: Fluctuations in Strain Response during Load Addition

As shown in Figure 5, the dynamic response measured by the test rig SGs is nearly identical for both SG pairs. The curves are offset slightly due to inaccuracies in the static strain measurements, as described in the list above. For dynamic measurements, the DAS would automatically compensate for this offset during the null balancing procedure that is performed prior to data acquisition. Small variations in WHB signal output would also be identified and addressed via the shunt calibration procedure.

OBSERVATIONS

Based on a cursory review of the results in Table 1 and Attachment B, it appears that the MSL SGs significantly under-predicted the static pressure change during the MNGP vessel hydro. On average, the SGs predicted a 418 psig change during the interval in which the vessel pressure increased from 100 to 1,000 psig, a factor of approximately 2.2. There was also considerable variation between individual SGs, as evidenced by a standard deviation of approximately 71 psi across all channels.

However, upon closer inspection, there are reasons to question the validity of the static strain results as a benchmark for dynamic testing, and whether the sensing configuration in place can even obtain the measurements requested by the NRC. As described in the "Measurement System" section above, the SGs at MNGP are not connected in the optimal three-wire arrangement, resulting in an unbalanced WHB configuration. This limitation is due to a lack of available instrument penetration connections, and was identified and accepted when the system was originally designed and installed in 2007. As a result of the unbalanced wiring configuration, changes in actual or apparent strain (resistance) may not affect both sides of the Wheatstone circuit in the same ratio. For small-scale changes, such as those observed during EPU dynamic strain measurements, the impact is negligible. For larger-scale changes, such as static pressurization, the results can be greatly impacted by inherent errors, rendering the results essentially meaningless.

The primary disadvantage to the MNGP wiring and installation configuration is that the impact of temperature changes on the SGs and integrated cables are not properly compensated. The integrated high-temperature cables in the SGs are extremely sensitive to temperature change, and can drift significantly when not connected in the optimal three-wire arrangement. The SG vendor (HPI) confirmed that it is "nearly impossible" to measure static strain without this wiring configuration. In addition, the ideal sensor configuration for accurate measurement of high-strain static change requires temperature-compensated SGs, with axially-oriented SG elements mounted to the same shim piece replacing the CR legs of the WHB in Figure 1. In this arrangement, thermal expansion stresses affect both legs equally, and thus cancel out. Neither of these recommended techniques was possible at MNGP, due to the aforementioned limitation on the number of penetration connections.

Despite the significant difference in magnitude between predicted and actual pressure, the relative response of the SGs correlates very well with the pressure change curve. As shown in the trend plots in Attachment A, the SGs track almost-perfectly (in a relative fashion) through varying rates of pressure increase. Furthermore, the plots in Attachment B demonstrate a linear relationship between strain and pressure, as expected. Although the plots indicate an appreciable variance in results between individual channels, which is corroborated by the calculations in Table 1, it is not immediately evident that the differences are due to discrepancies inherent in the SGs. Rather, data from previous dynamic acquisitions [8] indicates a high degree of similarity between coincident channels, suggesting that the variance is more an artifact of the static measurements than a flaw endemic to the instrumentation. In other words, for dynamic measurements, inherent static offset is ignored (subtracted out), after which the dynamic data compares very favorably between channels.

The laboratory test results in Figure 4 indicate excellent correlation between measured and predicted strain over a 180-second data acquisition period (longer than the 120-second typical interval for EPU measurements). The response does indicate some variation (approximately 4.5%) between multiple SGs installed at the same location. That disparity is likely due to a combination of error sources, including wiring configuration, minute variations in SG properties, and installation inconsistencies. However, as demonstrated by Figure 5, the pseudo-dynamic response immediately following load application is extremely similar between channels. That plot provides a good example of the difference between static and dynamic measurements – for a dynamic test, the DAS would have removed any static offset, and the curves would lie on top of one another.

CONCLUSIONS

Based on the results of the MSL SG data acquisition recently completed during hydro pressurization at MNGP, it is evident that the existing instrumentation configuration is not capable of accurately predicting large-scale, static pressure changes inside of the piping. However, given the information presented herein, it is not clearly evident that the SGs exhibit a tendency to under-predict dynamic strain results.

It is SI's opinion that the results exhibit a systemic bias in the static measurements, which is not present in current or previously-acquired dynamic test data. Several reasons for this determination are provided in the following list:

a. The SG wiring configuration is such that the conductors intended to equalize circuit resistance are not used. Consequently, the WHB circuits are unbalanced, an arrangement which is strongly discouraged for static measurements. A WHB imbalance introduces the potential for significant apparent strain bias, due to SGs that are not temperature-compensated and SG cables that are highly-susceptible to temperature changes.
b. The hydro test conditions do not reflect the actual stress state of the MSL piping during typical operation (steam flow). There is additional loading due to water weight, which could impart additional axial strain and thereby skew the hoop stress results (via the Poisson effect).

The ideal method for validating the performance of the HPI SGs would consist of an in-situ dynamic test. However, such validation is only possible for the MNGP sensing configuration if a dynamic pressure sensor could be installed on the MSLs, a modification that is highly invasive and extremely costly. In lieu of this explicit verification, there is substantial implicit evidence that the previously-collected dynamic data is of sufficient accuracy. A summary of these justifications is provided in the following list:

i. The plots in Attachments A and B show that the SGs are responsive to changes in pressure, particular over short durations.
ii. The capability of the SG instrumentation to measure static and quasi-dynamic signals was further substantiated through laboratory testing. As shown in Figure 4, the SGs were able to accurately predict repeated loadings applied over a relatively-short duration. Figure 5 indicates that multiple SG channels exhibited the same response to minute strain fluctuations.

iii. Static biases are removed from the dynamic data just prior to acquisition by the null balancing and shunt calibration routines built-in to the DAS. Channels which do fall within tolerance are flagged as erroneous, and repair / bypassed prior to proceeding with acquisition.

iv. The SGs in question (manufactured by HPI) have been used successful by multiple plants who are now operating at EPU conditions, including Vermont Yankee, Quad Cities, and Nine Mile Point.

v. The personnel performing the SG installations are consistent between sites, and are qualified to a very rigorous standard. SG installation is consistent and repeatable.

If you have any questions regarding the contents of this report please do not hesitate to contact me at (303) 792-0077.

Very truly yours,

Mark J. Jaeger, P.E.
Senior Engineer

/mjj

cc: B. Cheever (Xcel), J. Fields (Xcel), M. Murphy (Xcel)
D. Forsyth (WEC)
M. Trubelja (SI), R. Horvath (SI), L. Dorfman (SI)

Attachments:
A. Channel-by-Channel Trend Plots (Unscaled)
B. Strain vs. Pressure Scatter Plots
C. Averaged Trend Plots (PCF Scaled)

References:

1. NRC Request for Additional Information for the EPU Steam Dryer Review for Monticello Nuclear Generating Plant, TAC No. MD9990, MNGP EPU-EMCB-RSD-RAI-85 through 93, Transmitted April 25, 2013, SI File No. 1200978.203, **References Vendor Proprietary Information.**
2. SI Calculation No. MONT-11Q-302, Revision 0, “Evaluation of Monticello Strain Gage Uncertainty and Pressure Conversion Factors,” May, 2007.
3. SI Report No. 1200978.401, Revision 0, “Summary of Data Acquisition System Checkout and Sensor Verification,” February, 2013.

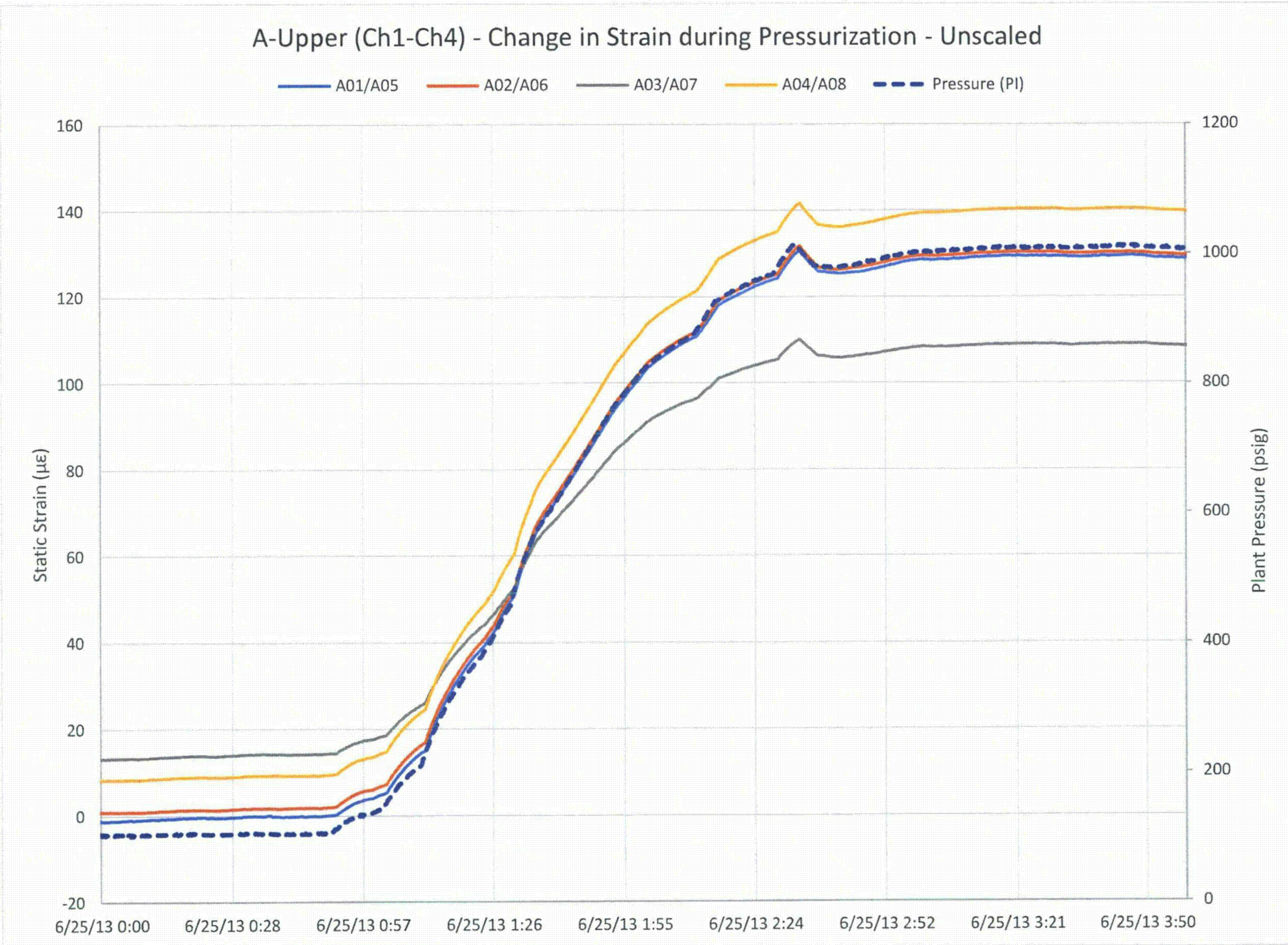
4. SI Report No. 1200978.403, Revision 0, "Status of EPU Monitoring DASs and Sensors Following Refueling Outage 26," July, 2013.
5. Hydro Pressurization Strain Data, SI File No. 1200978.206.
6. Email from B. Cheever (Xcel) to M. Jaeger (SI), "RE: Reactor Response on 6-24-13 – hydro test.xls," Received on 6/25/2013 at 1:48 pm MST, SI File No. 1200978.103, Including Attachment "PI DATA Copied from 06240000 to 0625131618.xls," SI File No. 1200978.207.
7. Email from B. Cheever (Xcel) to M. Jaeger (SI), "Emailing: MSL A, MSL B, MSL C, MSL D," Received on 6/27/2013 at 6:21 am MST, SI File No. 1200978.103, Including Attachments "MSL A.txt," "MSL B.txt," "MSL C.txt," and "MSL D.txt," SI File No. 1200978.207.
8. SI Calculation No. MONT-11Q-303, Revision 1, "Monticello Main Steam Strain Gage Data Reduction," January, 2009.

Table 1: Calculation of Predicted Pressure Change from SG Data

Channel Information				Absolute	PCF	Predicted ΔP (psi)		ΔP Multip. Factor	
No	Location	SG-1	SG-2	Change (με)	(psi/με)	Indiv.	Avg.	Indiv.	Avg.
1	A-Upper	A01	A05	130.2648	3.733	486.28	454.28	1.877	2.009
2		A02	A06	129.2983		482.67		1.891	
3		A03	A07	95.4398		356.28		2.562	
4		A04	A08	131.7731		491.91		1.855	
5	A-Lower	A09	A13	139.8477	3.603	503.87	437.15	1.811	2.088
6		A10	A14	130.2766		469.39		1.944	
7		A11	A15	117.8951		424.78		2.149	
8		A12	A16	97.3000		350.57		2.604	
9	B-Upper	B01	B05	97.4375	3.604	351.16	366.82	2.599	2.488
10		B02	B06	126.3358		455.31		2.005	
11		B03	B07	76.0143		273.96		3.332	
12		B04	B08	107.3371		386.84		2.359	
13	B-Lower	B09	B13	128.1623	3.616	463.43	433.23	1.969	2.107
14		B10	B14	127.6625		461.63		1.977	
15		B11	B15	124.3680		449.71		2.030	
16		B12	B16	99.0491		358.16		2.548	
17	C-Upper	C01	C05	97.2509	3.485	338.92	380.48	2.693	2.399
18		*C02*	C06	105.0634		366.15		2.493	
19		C03	C07	95.3674		332.36		2.746	
20		C04	C08	139.0255		484.50		1.884	
21	C-Lower	C09	C13	135.6768	3.581	485.86	469.69	1.879	1.943
22		*C10*	C14	156.2198		559.42		1.632	
23		C11	C15	99.6855		356.97		2.557	
24		C12	C16	133.0655		476.51		1.915	
25	D-Upper	D01	D05	120.3482	3.541	426.15	436.17	2.142	2.093
26		D02	D06	134.2742		475.46		1.920	
27		D03	D07	102.7374		363.79		2.509	
28		D04	D08	135.3532		479.29		1.904	
29	D-Lower	D09	D13	112.1751	3.538	396.88	368.70	2.300	2.475
30		D10	D14	89.3891		316.26		2.886	
31		D11	D15	87.4312		309.33		2.951	
32		D12	D16	127.8515		452.34		2.018	

ATTACHMENT A:

CHANNEL-BY-CHANNEL TREND PLOTS (UNSCALED)



Attachment A to 1200978.404

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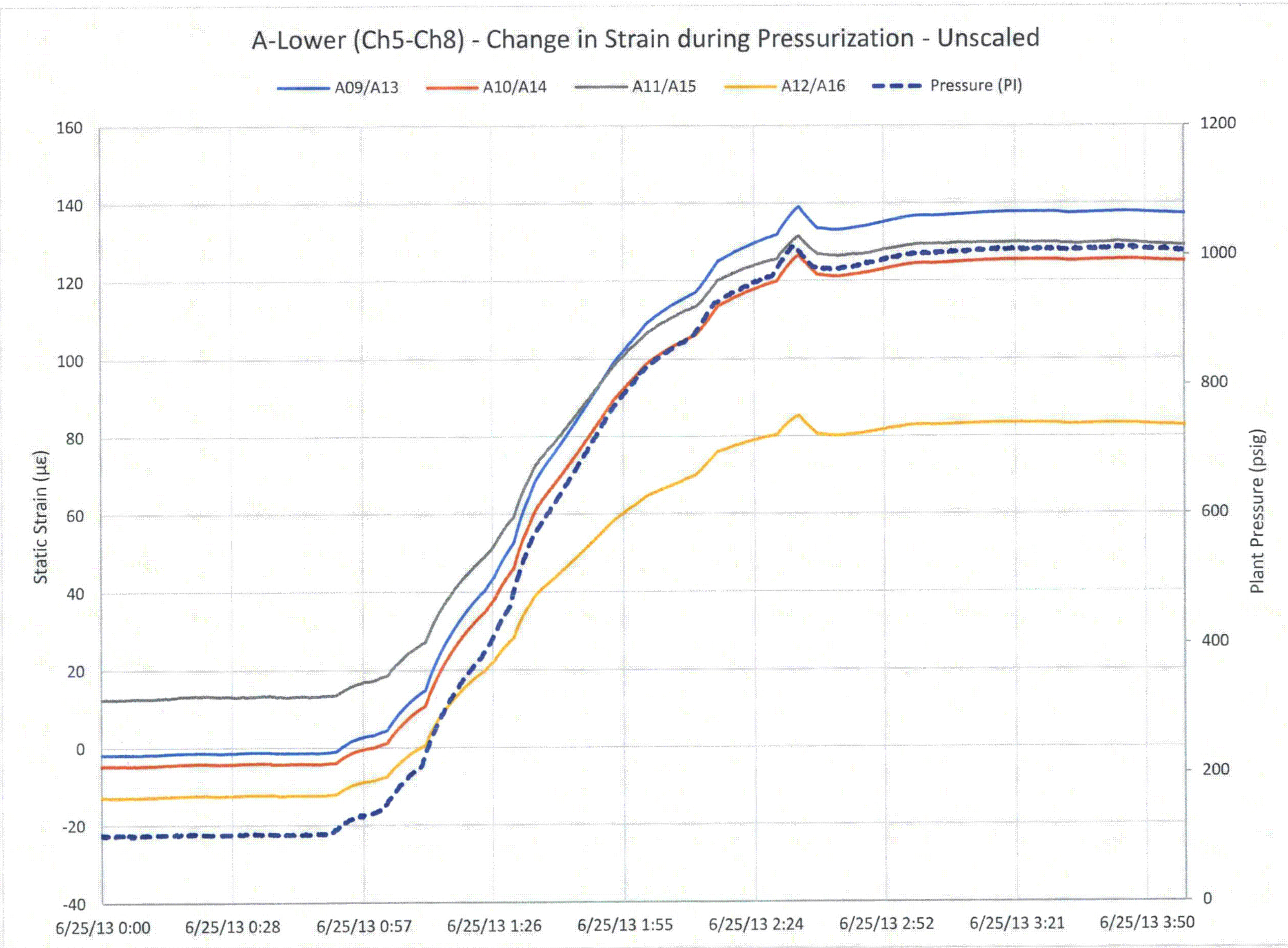

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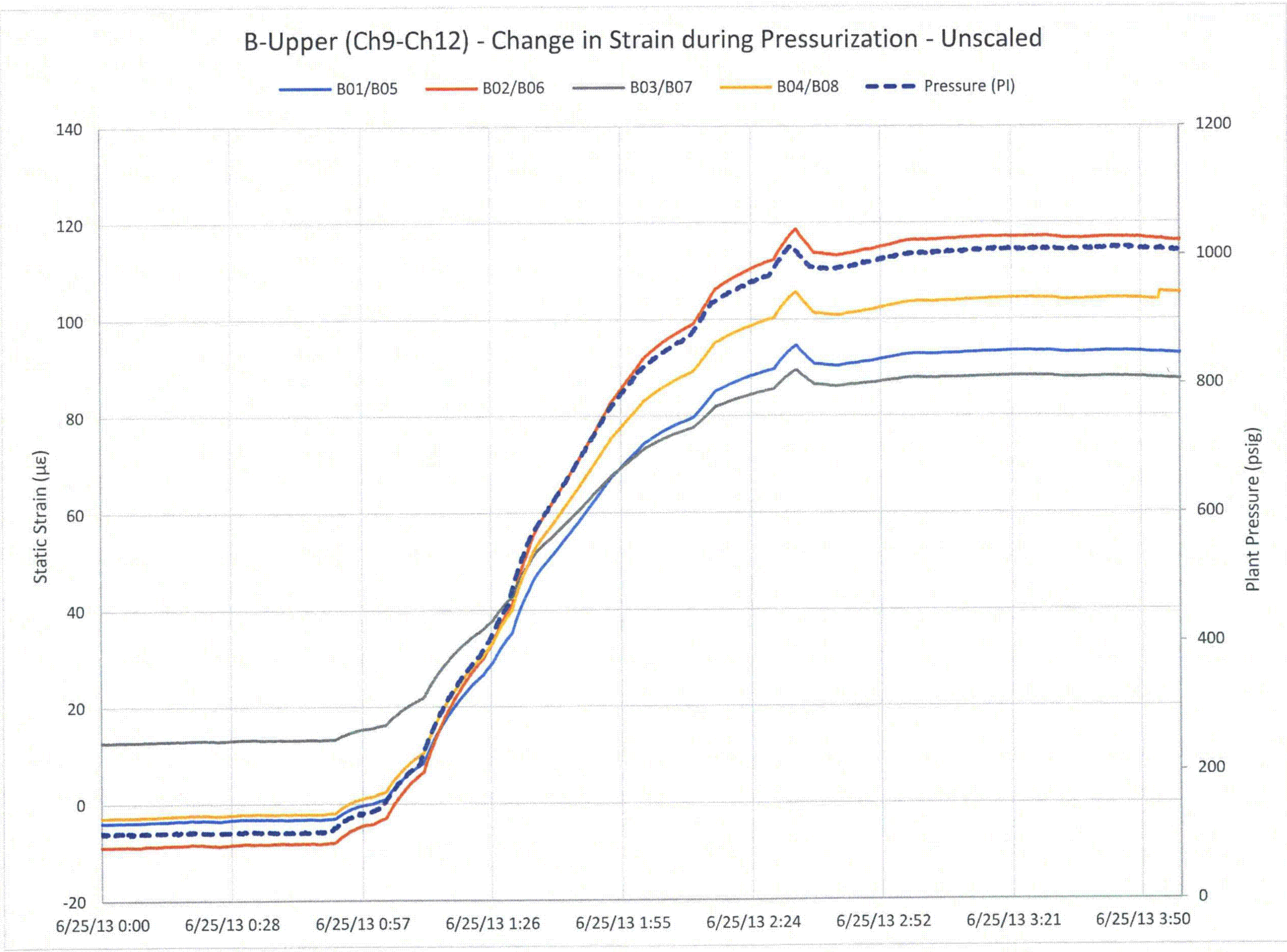

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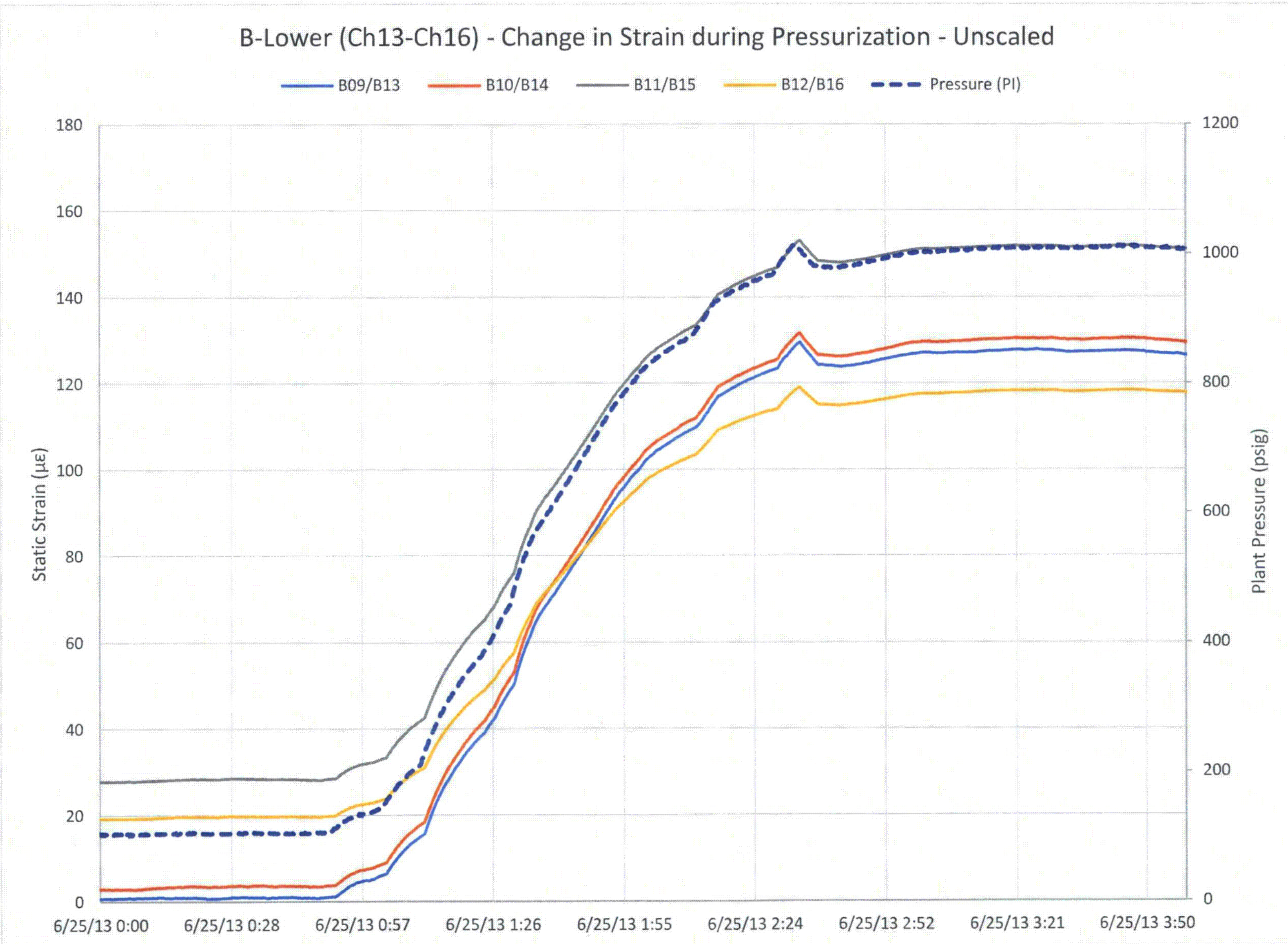

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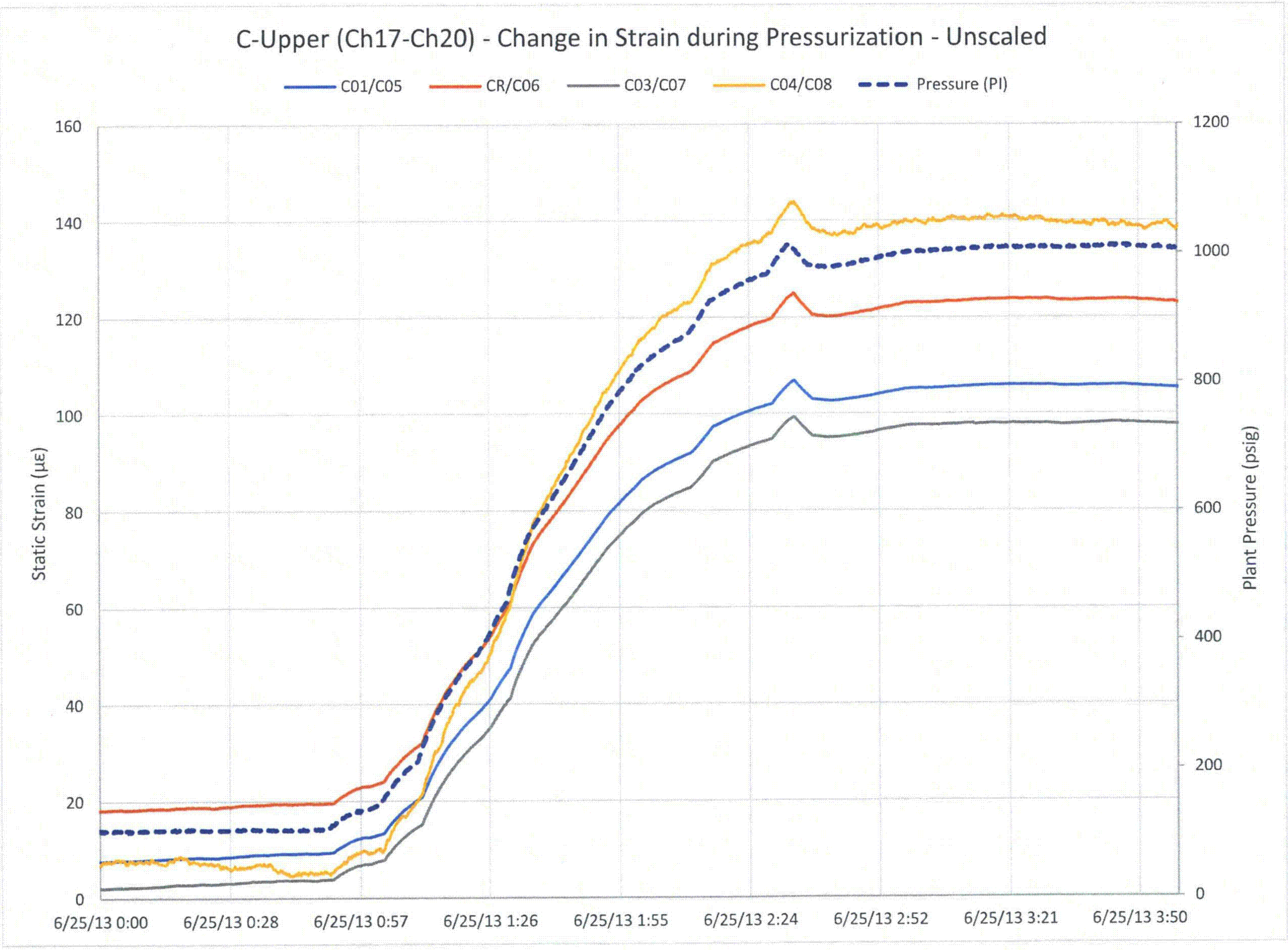

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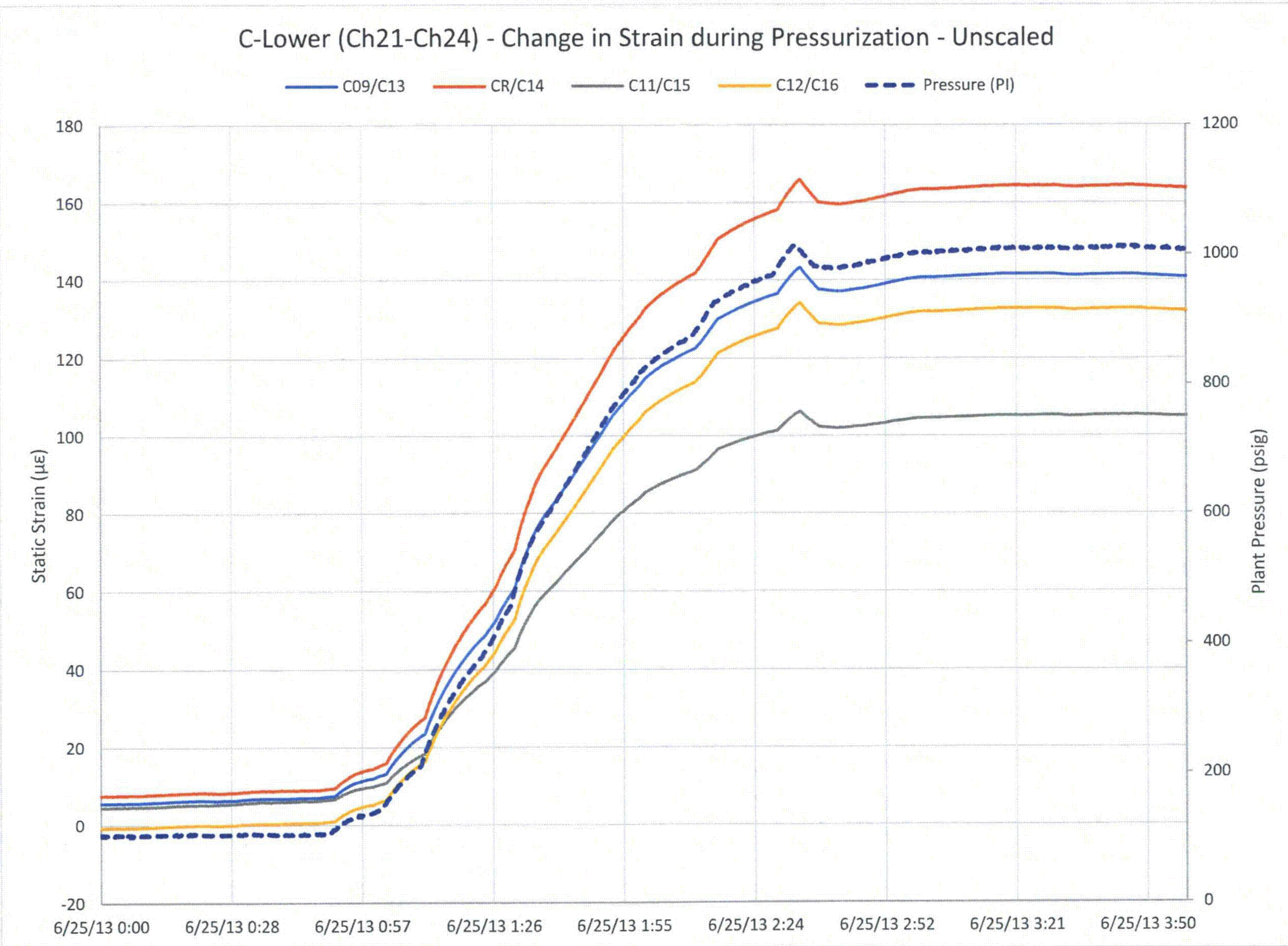
Attachment A to 1200978.404



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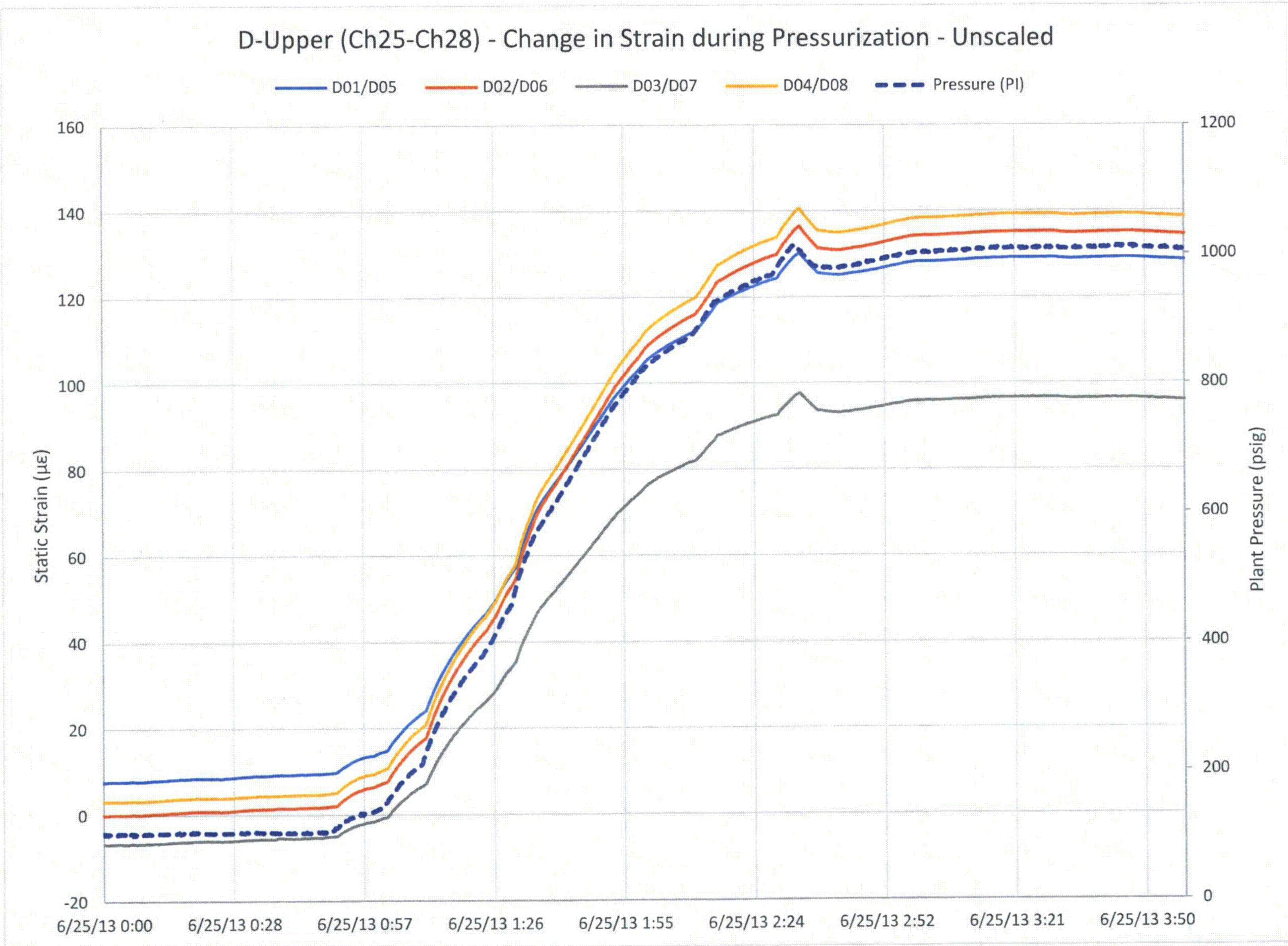

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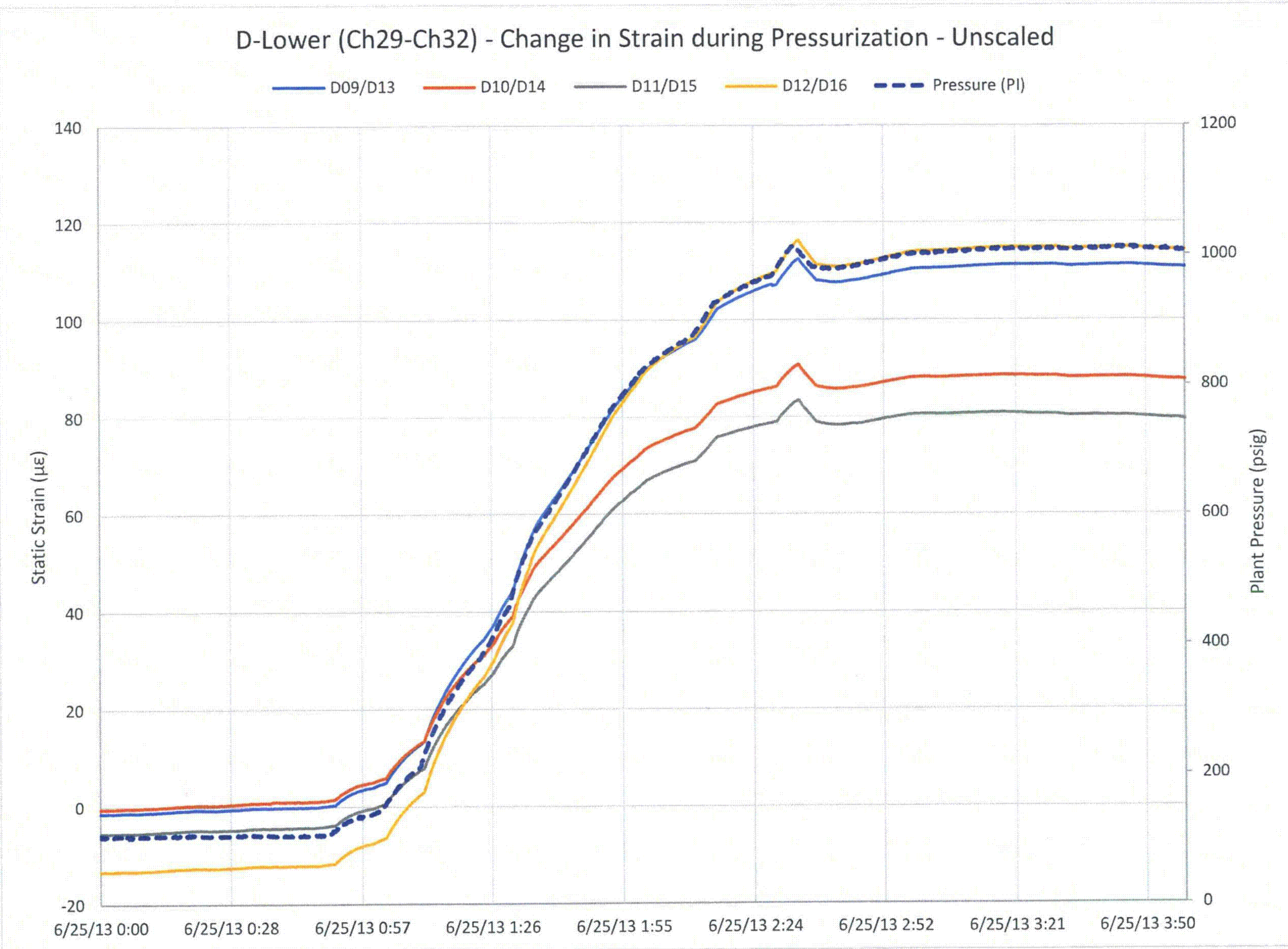

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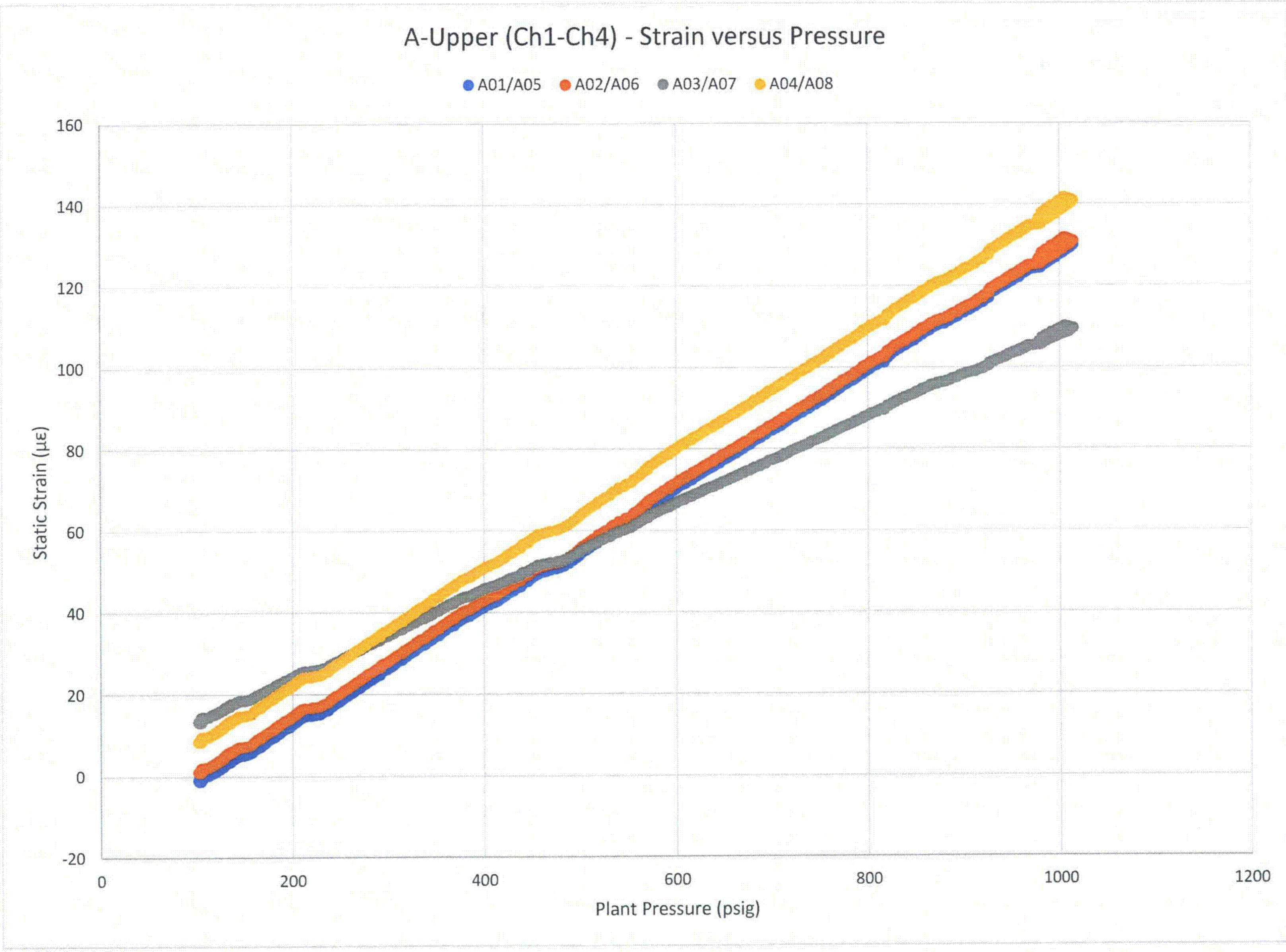
Attachment A to 1200978.404

ATTACHMENT B:

STRAIN VS. PRESSURE SCATTER PLOTS



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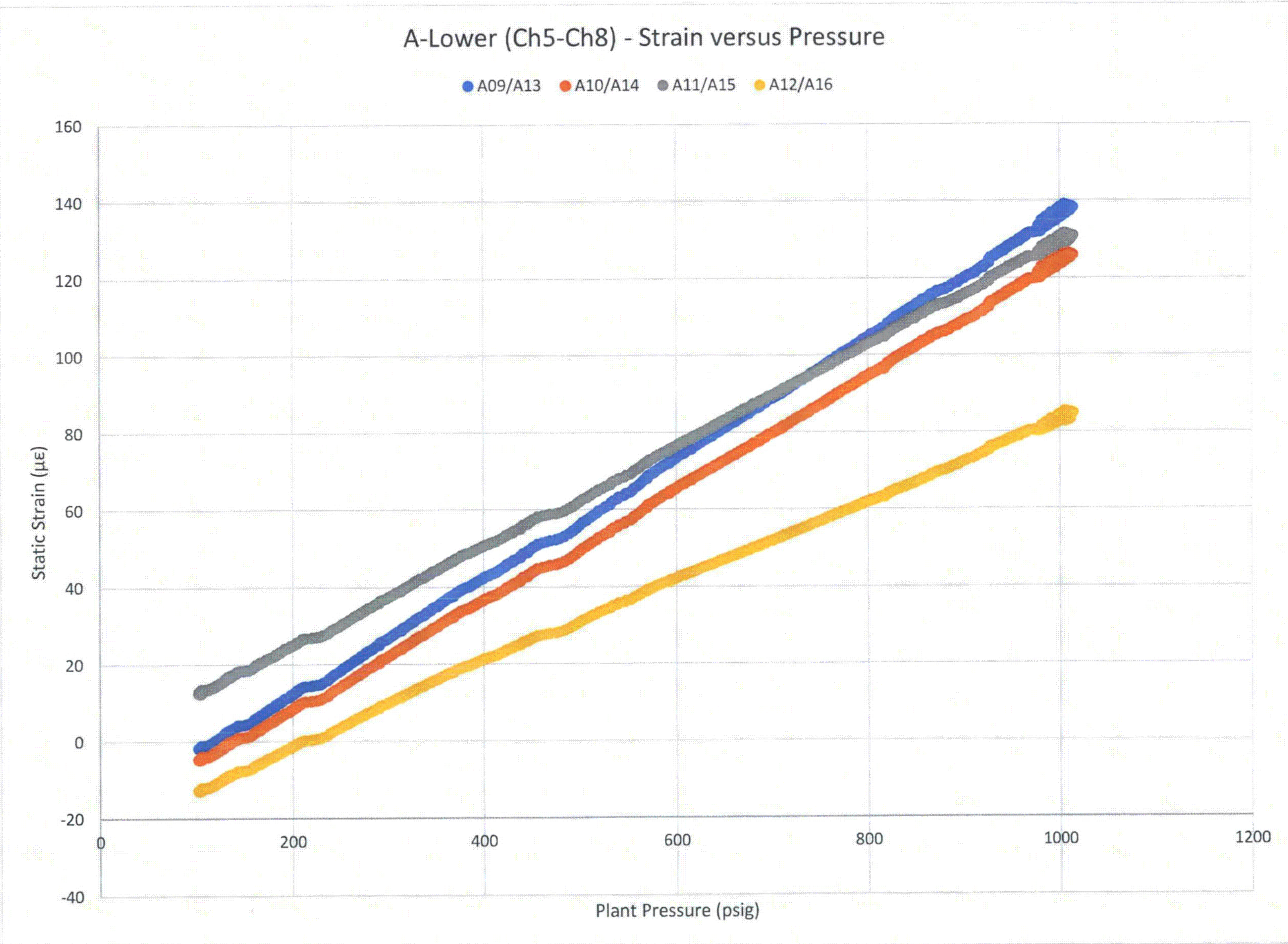

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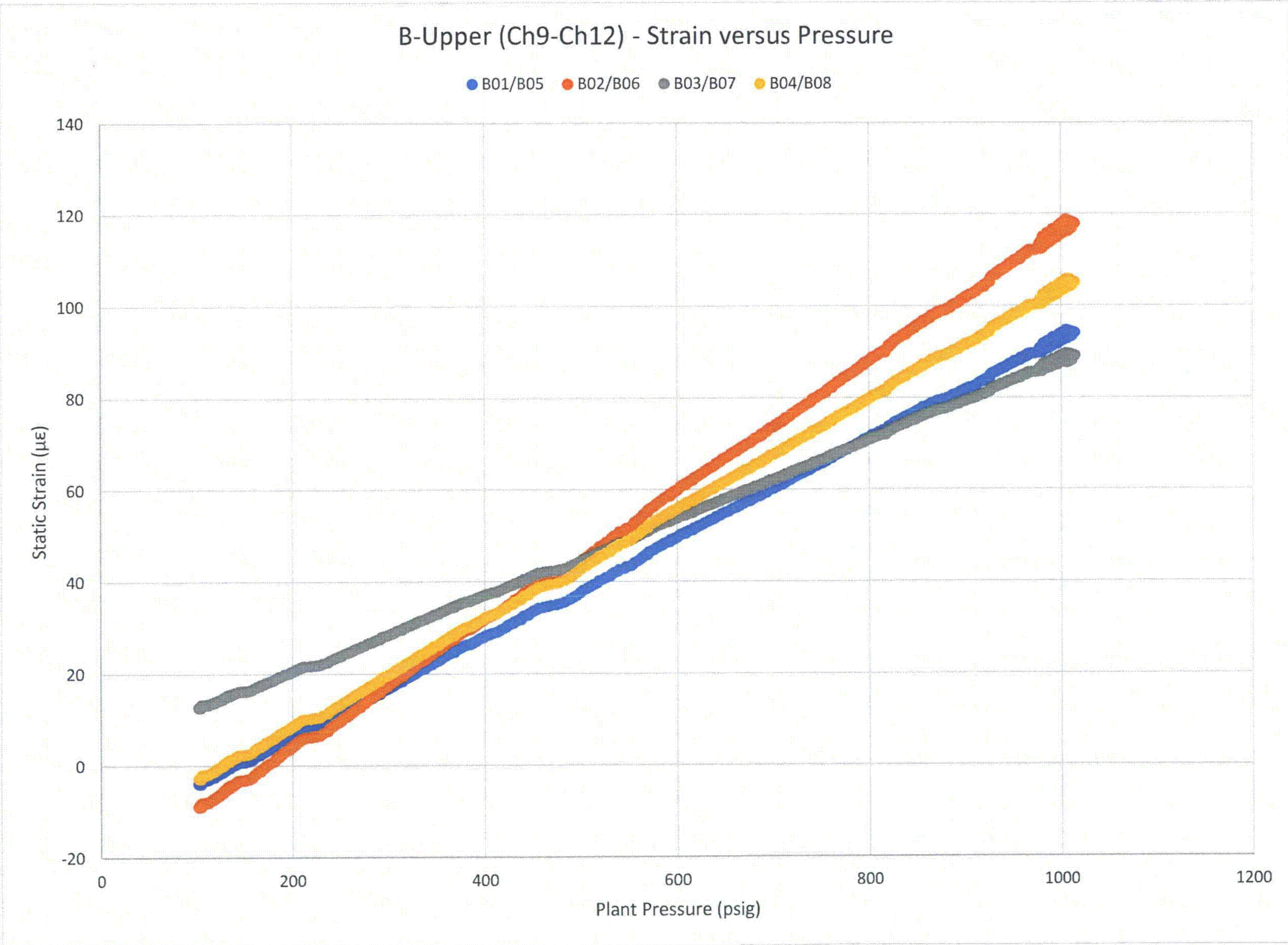

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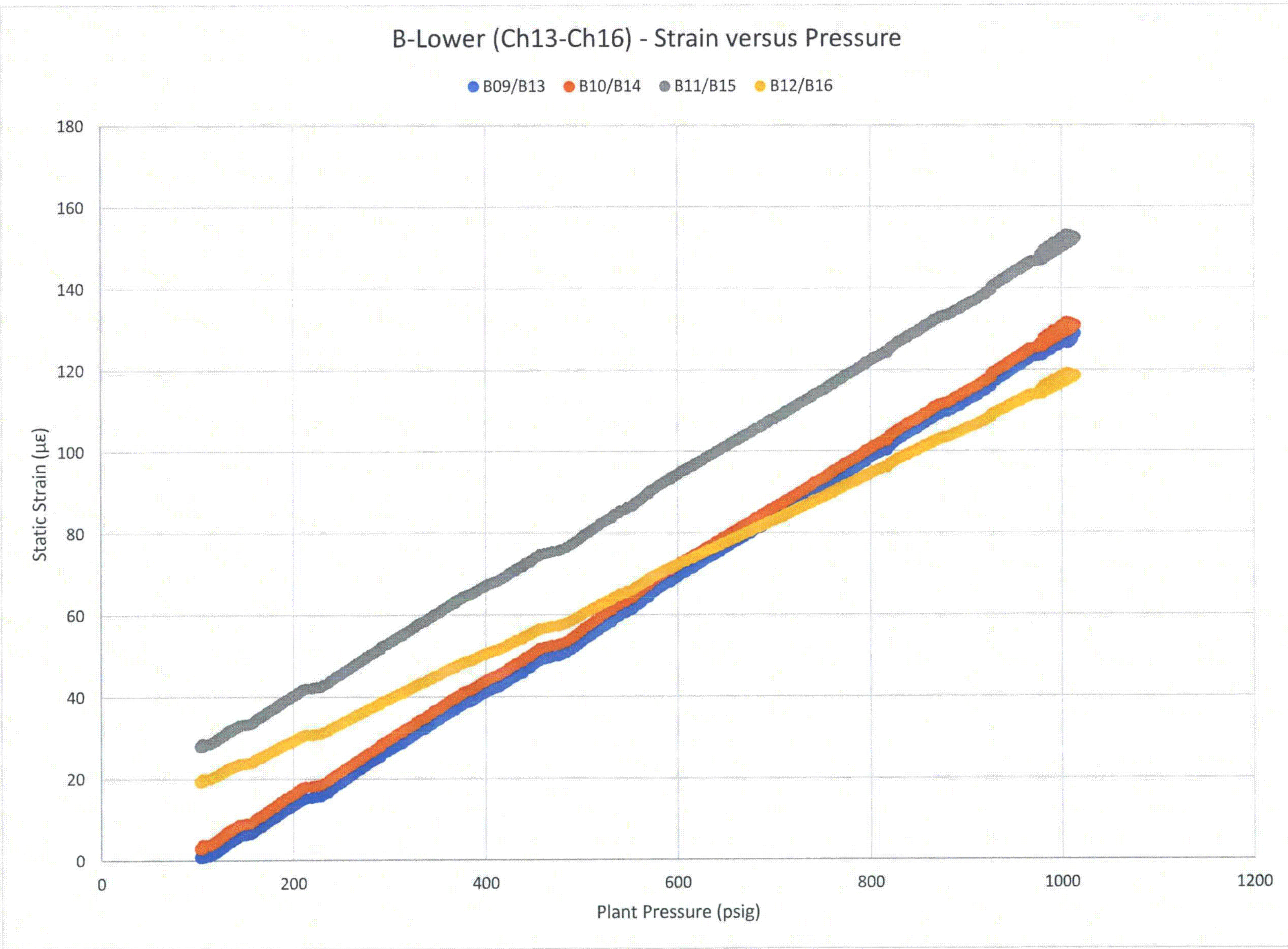

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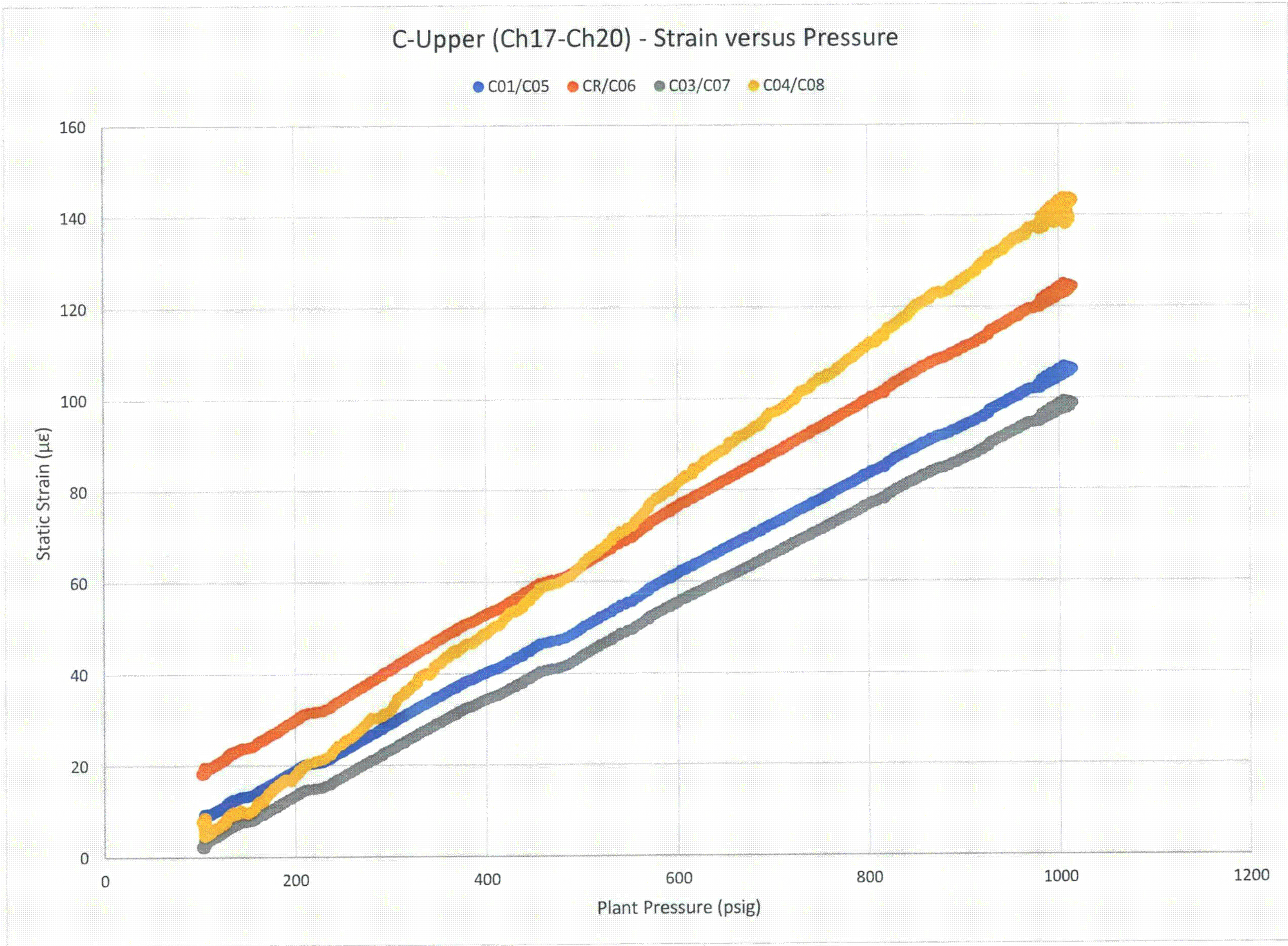

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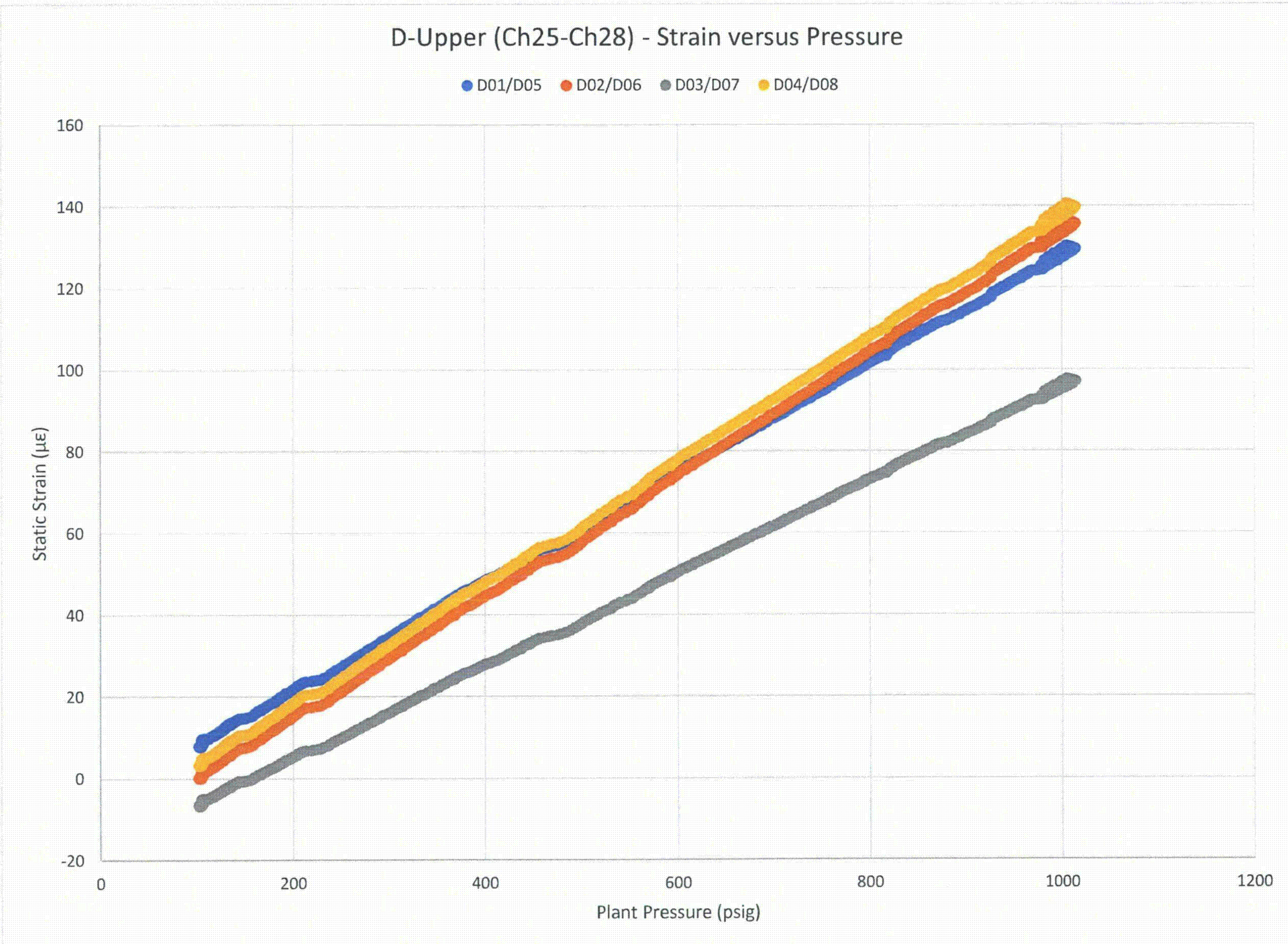

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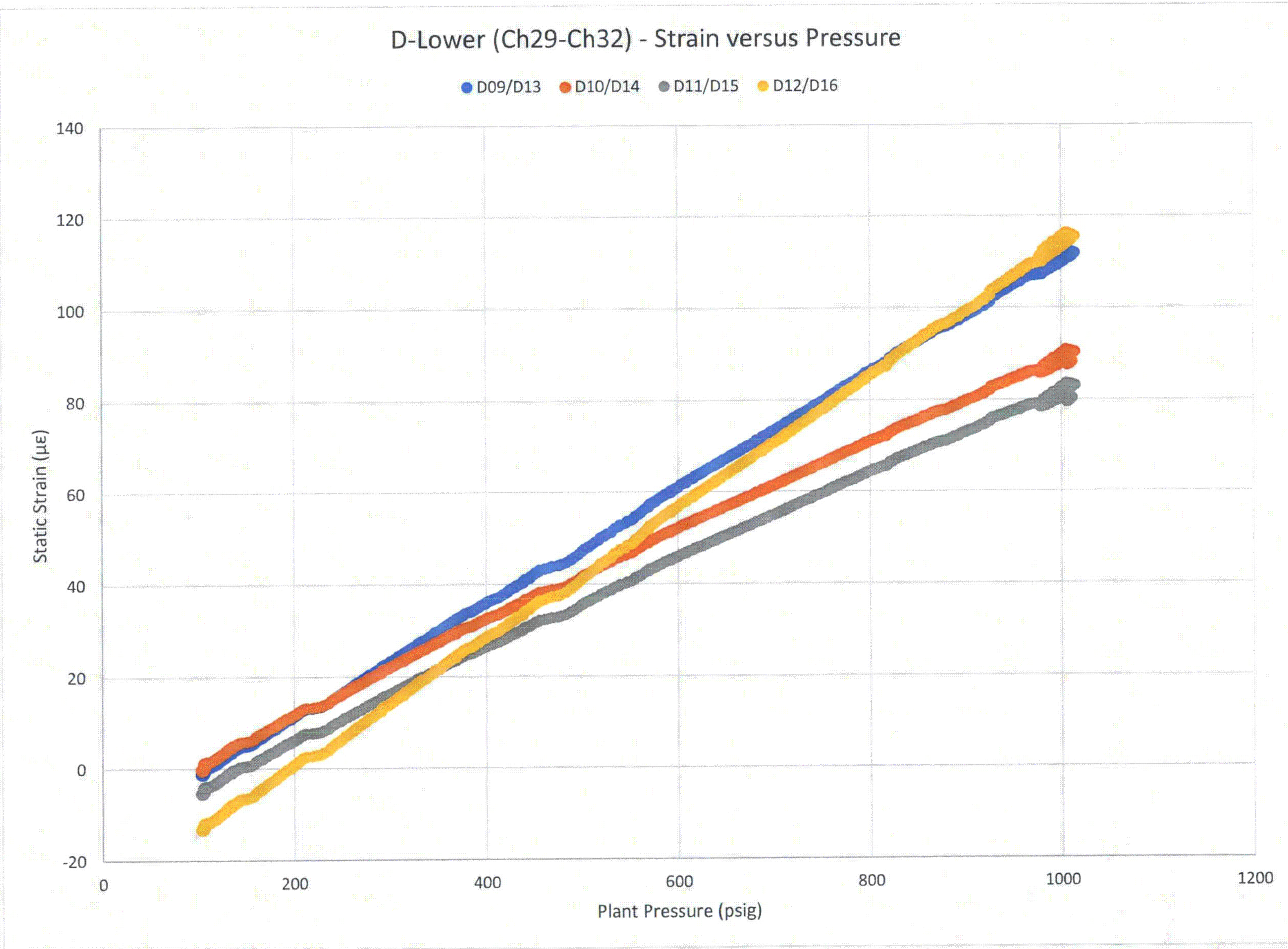

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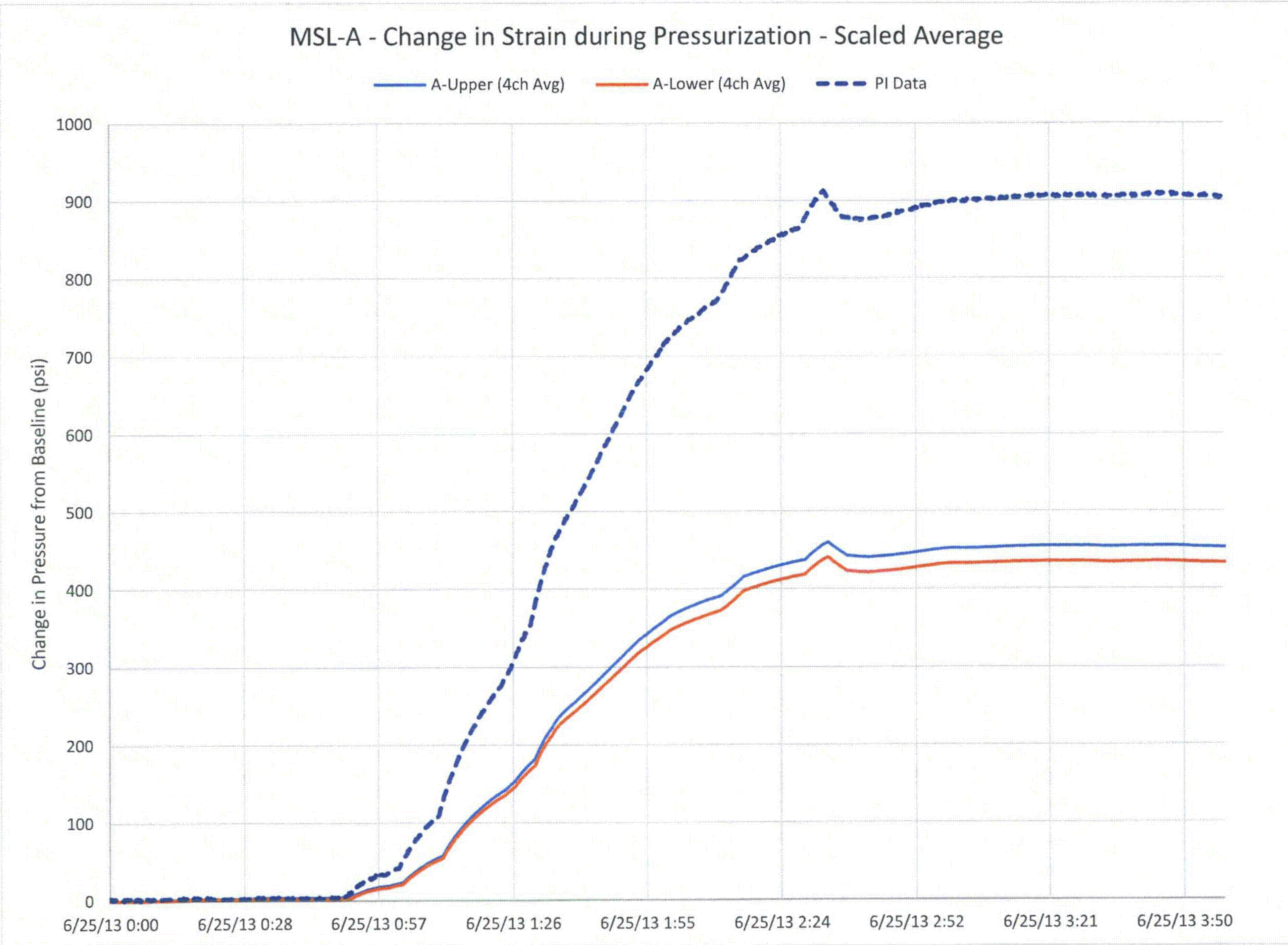
Attachment B to 1200978.404

ATTACHMENT C:

AVERAGED TREND PLOTS (PCF SCALED)



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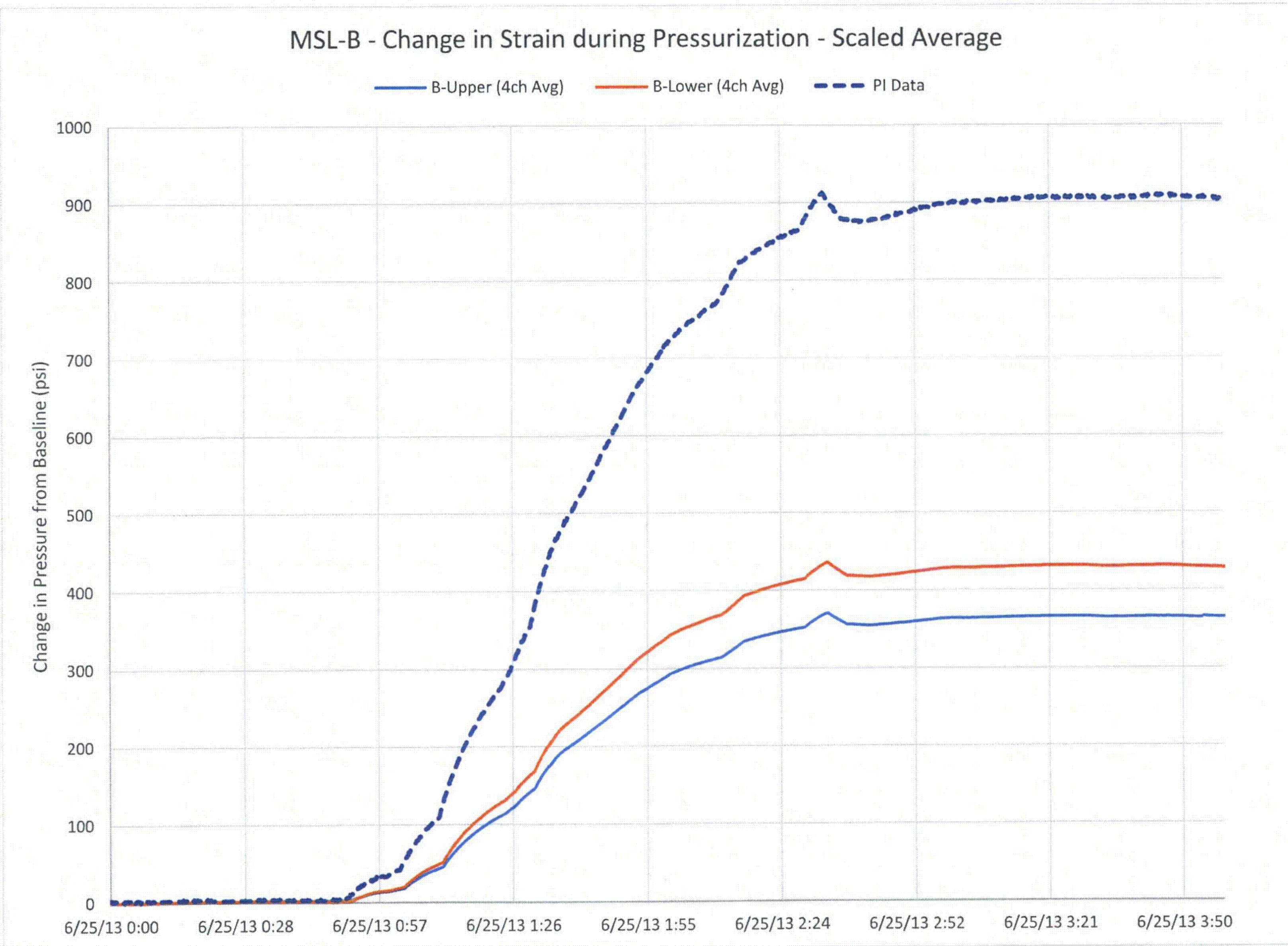
Attachment C to 1200978.404



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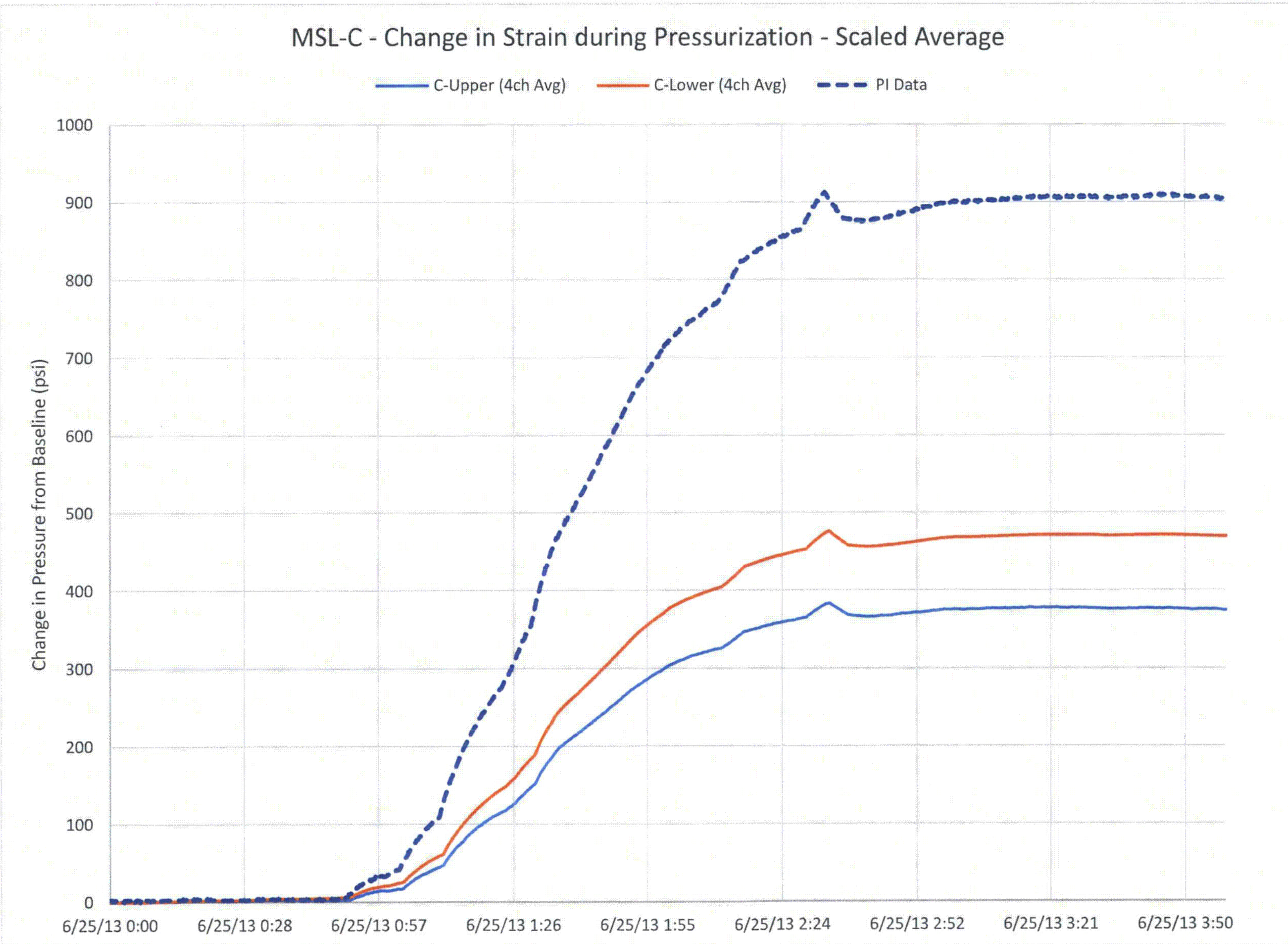
Attachment C to 1200978.404



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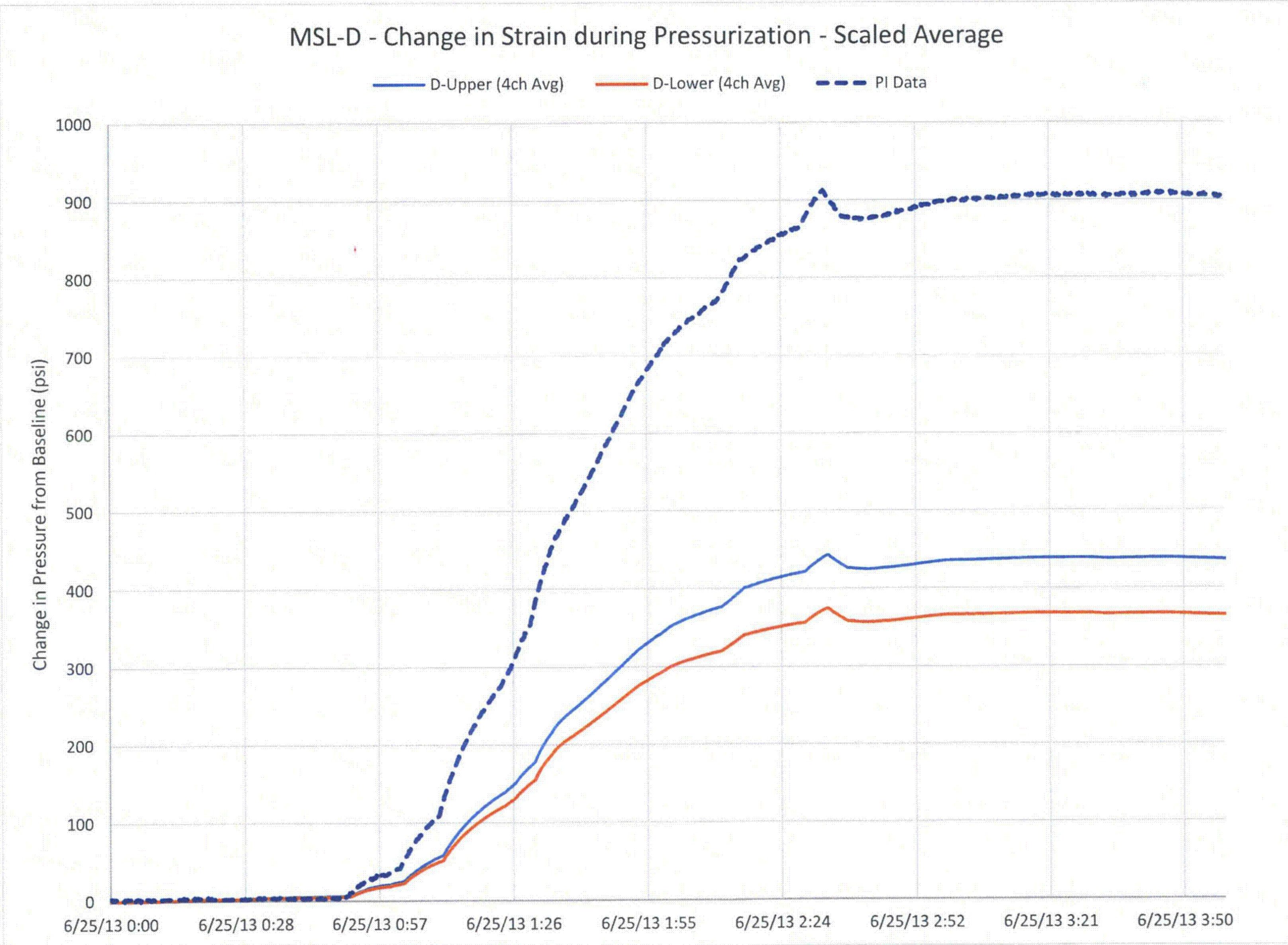

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ENCLOSURE 6

WESTINGHOUSE LETTER, LTR-A&SA-13-15, NP-ATTACHMENT (NON-PROPRIETARY)

MONTICELLO REPLACEMENT STEAM DRYER-

RESPONSE TO U.S. NRC CLARIFICATION QUESTIONS 2 AND 3

9 pages follow

LTR-A&SA-13-15 NP-Attachment

Monticello Replacement Steam Dryer- Response to U.S. NRC Clarification Questions 2 and 3

August 1, 2013

Westinghouse Electric Company LLC
1000 Westinghouse Drive
Cranberry Township, PA 16066 USA

NRC Clarification Question #2

[ ]^a,c application to MNGP RSD

- Uses MSL inputs

[

]^a,c

a,b,c

Figure 1 [ ]^{c}

[ ]a,b,c

Figure 2 [ ]c

[ ]a,b,c

Figure 3 [ ]c

NRC Clarification Question #3
Structural Analysis and Final Alternating Stress Ratios

A high-cycle fatigue evaluation of the Westinghouse replacement steam dryer for the Monticello plant has been completed with loads generated using the Acoustic Circuit Enhanced (ACE) Revision 2.0 [ ][a] Acoustic loads and stresses for extended power uprate (EPU) conditions have been evaluated for high-cycle fatigue and have been determined to meet the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (B&PV) Code Section III, Subsection NG criteria.

The results from these analyses indicate that for the Monticello replacement steam dryer at EPU operation, the smallest high-cycle fatigue stress ratio anywhere on the steam dryer is [ ][a,b,c] These results account for all of the following:

- [
-
-
-
-

][a,c]

ANALYSIS SUMMARY

In general, the harmonic structural analyses were performed exactly as documented in WCAP-17549-P, Rev. 1. [

][a,c]

[ ]a,b,c

The values in the table are defined as:

[ ]a,b,c

[ ]a,b,c

ALTERNATING STRESS CALCULATION

The calculation of the alternating stress intensity, following the ASME Code process (ASME B&PV Code, Section III, Division 1 – NG), is performed as follows:

1. Apply the stress concentration factors (geometric or FSRF), as applicable, to the component stresses.
2. Calculate the range of stress for each component of stress for two time points.
3. Calculate the stress intensity of the component ranges.

[ ]a,c

[

]a,b,c

L-MT-13-076

ENCLOSURE 7

WESTINGHOUSE AFFIDAVITS FOR WITHHOLDING PROPRIETARY INFORMATION

12 pages follow

AFFIDAVIT

COMMONWEALTH OF PENNSYLVANIA:

ss

COUNTY OF BUTLER:

Before me, the undersigned authority, personally appeared Hank A. Sepp, who, being by me duly sworn according to law, deposes and says that he is authorized to execute this Affidavit on behalf of Westinghouse Electric Company LLC (Westinghouse), and that the averments of fact set forth in this Affidavit are true and correct to the best of his knowledge, information, and belief:

Hank A. Sepp, Director, MCRE
MCRE-Engineering Services

Sworn to and subscribed before me
this 31st day of July 2013

Joyce A. Szepessy
Notary Public

COMMONWEALTH OF PENNSYLVANIA
Notarial Seal
Joyce A. Szepessy, Notary Public
Parks Twp., Armstrong County
My Commission Expires April 16, 2017
MEMBER, PENNSYLVANIA ASSOCIATION OF NOTARIES

(1) I am Director, MCRE-Engineering Services, in Engineering, Equipment and Major Projects, Westinghouse Electric Company LLC (Westinghouse), and as such, I have been specifically delegated the function of reviewing the proprietary information sought to be withheld from public disclosure in connection with nuclear power plant licensing and rule making proceedings, and am authorized to apply for its withholding on behalf of Westinghouse.

(2) I am making this Affidavit in conformance with the provisions of 10 CFR Section 2.390 of the Commission's regulations and in conjunction with the Westinghouse Application for Withholding Proprietary Information from Public Disclosure accompanying this Affidavit.

(3) I have personal knowledge of the criteria and procedures utilized by Westinghouse in designating information as a trade secret, privileged or as confidential commercial or financial information.

(4) Pursuant to the provisions of paragraph (b)(4) of Section 2.390 of the Commission's regulations, the following is furnished for consideration by the Commission in determining whether the information sought to be withheld from public disclosure should be withheld.

(i) The information sought to be withheld from public disclosure is owned and has been held in confidence by Westinghouse.

(ii) The information is of a type customarily held in confidence by Westinghouse and not customarily disclosed to the public. Westinghouse has a rational basis for determining the types of information customarily held in confidence by it and, in that connection, utilizes a system to determine when and whether to hold certain types of information in confidence. The application of that system and the substance of that system constitutes Westinghouse policy and provides the rational basis required.

Under that system, information is held in confidence if it falls in one or more of several types, the release of which might result in the loss of an existing or potential competitive advantage, as follows:

(a) The information reveals the distinguishing aspects of a process (or component, structure, tool, method, etc.) where prevention of its use by any of

Westinghouse's competitors without license from Westinghouse constitutes a competitive economic advantage over other companies.

(b) It consists of supporting data, including test data, relative to a process (or component, structure, tool, method, etc.), the application of which data secures a competitive economic advantage, e.g., by optimization or improved marketability.

(c) Its use by a competitor would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing a similar product.

(d) It reveals cost or price information, production capacities, budget levels, or commercial strategies of Westinghouse, its customers or suppliers.

(e) It reveals aspects of past, present, or future Westinghouse or customer funded development plans and programs of potential commercial value to Westinghouse.

(f) It contains patentable ideas, for which patent protection may be desirable.

There are sound policy reasons behind the Westinghouse system which include the following:

(a) The use of such information by Westinghouse gives Westinghouse a competitive advantage over its competitors. It is, therefore, withheld from disclosure to protect the Westinghouse competitive position.

(b) It is information that is marketable in many ways. The extent to which such information is available to competitors diminishes the Westinghouse ability to sell products and services involving the use of the information.

(c) Use by our competitor would put Westinghouse at a competitive disadvantage by reducing his expenditure of resources at our expense.

(d) Each component of proprietary information pertinent to a particular competitive advantage is potentially as valuable as the total competitive advantage. If competitors acquire components of proprietary information, any one component may be the key to the entire puzzle, thereby depriving Westinghouse of a competitive advantage.

(e) Unrestricted disclosure would jeopardize the position of prominence of Westinghouse in the world market, and thereby give a market advantage to the competition of those countries.

(f) The Westinghouse capacity to invest corporate assets in research and development depends upon the success in obtaining and maintaining a competitive advantage.

(iii) The information is being transmitted to the Commission in confidence and, under the provisions of 10 CFR Section 2.390, it is to be received in confidence by the Commission.

(iv) The information sought to be protected is not available in public sources or available information has not been previously employed in the same original manner or method to the best of our knowledge and belief.

(v) The proprietary information sought to be withheld in this submittal is that which is appropriately marked in LTR-A&SA-13-10 P-Attachment, "Responses to the U.S. NRC Request for Additional Information Relative to the Monticello Replacement Steam Dryer Acoustic/Structural Analyses Set #6" (Proprietary), for submittal to the Commission, being transmitted by Xcel Energy - Monticello letter and Application for Withholding Proprietary Information from Public Disclosure, to the Document Control Desk. The proprietary information as submitted by Westinghouse is that associated with the U.S. NRC request for additional information relative to the Monticello Replacement Steam Dryer Acoustic/Structural Analyses Set #6, and may be used only for that purpose.

This information is part of that which will enable Westinghouse to:

(a) Provide information to support the acceptance of the Monticello EPU Licensing Amendment Request by the U.S. NRC.

Further this information has substantial commercial value as follows:

(a) Westinghouse plans to sell the use of the information to its customers for the purpose of supporting the power ascension to the Extended Power Uprate condition.

(b) Westinghouse can sell support and defense of the information provided in these documents.

(c) The information requested to be withheld reveals the distinguishing aspects of a methodology which was developed by Westinghouse.

Public disclosure of this proprietary information is likely to cause substantial harm to the competitive position of Westinghouse because it would enhance the ability of competitors to provide similar technical evaluation justifications and licensing defense services for commercial power reactors without commensurate expenses. Also, public disclosure of the information would enable others to use the information to meet NRC requirements for licensing documentation without purchasing the right to use the information.

The development of the technology described in part by the information is the result of applying the results of many years of experience in an intensive Westinghouse effort and the expenditure of a considerable sum of money.

In order for competitors of Westinghouse to duplicate this information, similar technical programs would have to be performed and a significant manpower effort, having the requisite talent and experience, would have to be expended.

Further the deponent sayeth not.

PROPRIETARY INFORMATION NOTICE

Transmitted herewith are proprietary and/or non-proprietary versions of documents furnished to the NRC in connection with requests for generic and/or plant-specific review and approval.

In order to conform to the requirements of 10 CFR 2.390 of the Commission's regulations concerning the protection of proprietary information so submitted to the NRC, the information which is proprietary in the proprietary versions is contained within brackets, and where the proprietary information has been deleted in the non-proprietary versions, only the brackets remain (the information that was contained within the brackets in the proprietary versions having been deleted). The justification for claiming the information so designated as proprietary is indicated in both versions by means of lower case letters (a) through (f) located as a superscript immediately following the brackets enclosing each item of information being identified as proprietary or in the margin opposite such information. These lower case letters refer to the types of information Westinghouse customarily holds in confidence identified in Sections (4)(ii)(a) through (4)(ii)(f) of the affidavit accompanying this transmittal pursuant to 10 CFR 2.390(b)(1).

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AFFIDAVIT

COMMONWEALTH OF PENNSYLVANIA:

ss

COUNTY OF BUTLER:

Before me, the undersigned authority, personally appeared James A. Gresham, who, being by me duly sworn according to law, deposes and says that he is authorized to execute this Affidavit on behalf of Westinghouse Electric Company LLC (Westinghouse), and that the averments of fact set forth in this Affidavit are true and correct to the best of his knowledge, information, and belief:

James A. Gresham, Manager,
Regulatory Compliance

Sworn to and subscribed before me
this 1st day of August 2013

Notary Public

COMMONWEALTH OF PENNSYLVANIA
Notarial Seal
Anne M. Stegman, Notary Public
Unity Twp., Westmoreland County
My Commission Expires Aug. 7, 2016
MEMBER, PENNSYLVANIA ASSOCIATION OF NOTARIES

(1) I am Manager, Regulatory Compliance, in Engineering, Equipment and Major Projects, Westinghouse Electric Company LLC (Westinghouse), and as such, I have been specifically delegated the function of reviewing the proprietary information sought to be withheld from public disclosure in connection with nuclear power plant licensing and rule making proceedings, and am authorized to apply for its withholding on behalf of Westinghouse.

(2) I am making this Affidavit in conformance with the provisions of 10 CFR Section 2.390 of the Commission's regulations and in conjunction with the Westinghouse Application for Withholding Proprietary Information from Public Disclosure accompanying this Affidavit.

(3) I have personal knowledge of the criteria and procedures utilized by Westinghouse in designating information as a trade secret, privileged or as confidential commercial or financial information.

(4) Pursuant to the provisions of paragraph (b)(4) of Section 2.390 of the Commission's regulations, the following is furnished for consideration by the Commission in determining whether the information sought to be withheld from public disclosure should be withheld.

(i) The information sought to be withheld from public disclosure is owned and has been held in confidence by Westinghouse.

(ii) The information is of a type customarily held in confidence by Westinghouse and not customarily disclosed to the public. Westinghouse has a rational basis for determining the types of information customarily held in confidence by it and, in that connection, utilizes a system to determine when and whether to hold certain types of information in confidence. The application of that system and the substance of that system constitutes Westinghouse policy and provides the rational basis required.

Under that system, information is held in confidence if it falls in one or more of several types, the release of which might result in the loss of an existing or potential competitive advantage, as follows:

(a) The information reveals the distinguishing aspects of a process (or component, structure, tool, method, etc.) where prevention of its use by any of

Westinghouse's competitors without license from Westinghouse constitutes a competitive economic advantage over other companies.

(b) It consists of supporting data, including test data, relative to a process (or component, structure, tool, method, etc.), the application of which data secures a competitive economic advantage, e.g., by optimization or improved marketability.

(c) Its use by a competitor would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing a similar product.

(d) It reveals cost or price information, production capacities, budget levels, or commercial strategies of Westinghouse, its customers or suppliers.

(e) It reveals aspects of past, present, or future Westinghouse or customer funded development plans and programs of potential commercial value to Westinghouse.

(f) It contains patentable ideas, for which patent protection may be desirable.

There are sound policy reasons behind the Westinghouse system which include the following:

(a) The use of such information by Westinghouse gives Westinghouse a competitive advantage over its competitors. It is, therefore, withheld from disclosure to protect the Westinghouse competitive position.

(b) It is information that is marketable in many ways. The extent to which such information is available to competitors diminishes the Westinghouse ability to sell products and services involving the use of the information.

(c) Use by our competitor would put Westinghouse at a competitive disadvantage by reducing his expenditure of resources at our expense.

(d) Each component of proprietary information pertinent to a particular competitive advantage is potentially as valuable as the total competitive advantage. If competitors acquire components of proprietary information, any one component may be the key to the entire puzzle, thereby depriving Westinghouse of a competitive advantage.

(e) Unrestricted disclosure would jeopardize the position of prominence of Westinghouse in the world market, and thereby give a market advantage to the competition of those countries.

(f) The Westinghouse capacity to invest corporate assets in research and development depends upon the success in obtaining and maintaining a competitive advantage.

(iii) The information is being transmitted to the Commission in confidence and, under the provisions of 10 CFR Section 2.390, it is to be received in confidence by the Commission.

(iv) The information sought to be protected is not available in public sources or available information has not been previously employed in the same original manner or method to the best of our knowledge and belief.

(v) The proprietary information sought to be withheld in this submittal is that which is appropriately marked in LTR-A&SA-13-15 P-Attachment, "Monticello Replacement Steam Dryer – Response to U.S. NRC Clarification Questions 2 and 3" (Proprietary), for submittal to the Commission, being transmitted by Xcel Energy - Monticello letter and Application for Withholding Proprietary Information from Public Disclosure, to the Document Control Desk. The proprietary information as submitted by Westinghouse is that associated with Monticello Replacement Steam Dryer – Response to U.S. NRC Clarification Questions 2 and 3, and may be used only for that purpose.

This information is part of that which will enable Westinghouse to:

(a) Provide information to support the acceptance of the Monticello EPU Licensing Amendment Request by the U.S. NRC.

Further this information has substantial commercial value as follows:

(a) Westinghouse plans to sell the use of the information to its customers for the purpose of supporting the power ascension to the Extended Power Uprate condition.

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(c) The information requested to be withheld reveals the distinguishing aspects of a methodology which was developed by Westinghouse.

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