ENCLOSURE 2

TENNESSEE VALLEY AUTHORITY
BROWNS FERRY NUCLEAR PLANT (BFN)
UNITS 1, 2, AND 3

TECHNICAL SPECIFICATIONS (TS) CHANGES TS-431 AND TS-418
EXTENDED POWER UPRATE (EPU)

CDI REPORT NO. 07-11NP, "DYNAMICS OF BWR STEAM DRYER COMPONENTS"

(NON-PROPRIETARY VERSION)

Attached is the non-proprietary version of CDI Report No. 07-11, "Dynamics of BWR Steam Dryer Components."

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C.D.I. Report No. 07-11NP

Dynamics of BWR Steam Dryer Components

Revision 1

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November 2008

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Executive Summary

Test data were obtained and analyzed to support structural modeling assumptions used in ANSYS based finite element analysis of steam dryer.

[[

]] These measurements provide the basis [[ ]] used in structural modeling, but are still conservative with respect to the levels measured.

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1. Objective

The objective of the test program was to provide data [[ ]] The data were then used to verify a model [[ ]]

Structural damping in the ANSYS finite element model is defined as 1% of critical damping for all frequencies, consistent with guidance given in NUREG-1.61 [1]. [[ ]] With this information, verified by test results, [[ ]] could be specified and therefore provide a more realistic model of steam dryer stress response.

This test report summarizes the [[ ]] theory, the laboratory measurements, and the resulting [[ ]]

2. Theory

[[

]] with displacement $\dot{w} = w_o e^{i\omega t}$. The configuration is sketched below:

[[

]]

Figure 1. Schematic [[ ]]

[[ ]] The variables that contribute [[ ]] are tabulated below along with their units:

Variable	Dependent/Independent	Units
[[ ]]	dependent	M/LT^2
[[ ]]	independent	L/T
[[ ]]	independent	M/L^3
[[ ]]	independent	L/T
[[ ]]	independent	L
[[ ]]	independent	L
[[ ]]	independent	-
[[ ]]	independent	L^2/T

Using a Buckingham Π approach, [[ ]] is a function of four (4) dependent non-dimensional parameters.

[[

]]

The first parameter is a Reynolds number and measures the importance of viscous dissipation in the process. [[

]] is relatively insensitive to

Reynolds number. The second parameter [[
]]
[[
]]
[[ ]]

The requirement that

[[ ]]

can be checked against finite element analyses completed for steam dryers. From the structural analysis carried out for Browns Ferry [5], [[
]] For these conditions w_o must be less than [[ ]] which is supported by calculated displacements from the finite element code. In fact, the largest plate motions are less than [[ ]] inches so that the ratio in (2.3) is very small, [[
]]

[[

]]

[[

]] but will be measured directly with the rig sketched below.

Equations (2.5) and (2.6) form the basis of the tests to be conducted [[

]] This observation will be confirmed with tests.

A simple apparatus was constructed [[ ]] typically used in a dryer [[

]]

[[

]]

Figure 2. Schematic of apparatus [[ ]]

[[

]]

3. Facility Description

The experiment consisted of a series of tests [[ ]] Tests were performed at the laboratory facilities of Continuum Dynamics, Inc. (C.D.I.) in Ewing, NJ. [[ ]] This facility, shown schematically in Figure 3, [[ ]]

[[ ]] Figure 4 shows a drawing of the details [[ ]] Figure 5 provides an overall picture of the test setup, [[ ]]

[[ ]]

[[

]]

Figure 3. Schematic of the test rig.

[[

]]

Figure 4. Schematic [[ ]] Dimensions are in inches.

[[

]]

Figure 5. Photograph of test setup: [[

]]

[[

]]

Figure 6. [[

]]

4. Instrumentation

[[

]] The data were recorded on a 16-bit data acquisition system calibrated to NIST traceable standards. [[

]]

The accelerometer was mounted [[

]] The accelerometer was an Entran model EGA-10-/Z2. The accelerometer signal was amplified by an ADC instrument amplifier and the system was calibrated against gravity. The amplifier output was connected to the data acquisition system.

An Omega PX302 pressure transducer [[

]] The pressure transducer had a 200 psig range and was calibrated to NIST traceable standards.

Air temperature was measured with a Type T thermocouple and Omega DP-41display. [[ ]] Both the display and thermocouple were calibrated to NIST traceable standards.

[[

]]

Table 1 summarizes the instrumentation specifications. Certifications for these instruments are contained in Appendix A.

Table 1. [[ ]] test instrumentation specifications.

Measurement	Range	Accuracy
Acceleration	±10 g	±1% full scale
Pressure	200 psig	±0.5%
Temperature	-100 to +200°F	±2°F
Length	0 to 16 feet 0 to 12 inches	±1/16 inch ±0.001 inch

5. Test Matrix

[[

]]

6. Test Procedure

For each test the instrumentation and test setup was first verified and recorded. [[

]]

7. Test Results

Test data were entered into an Excel spreadsheet, [[

]]

Sample fits are shown in Figure 7 [[ ]] and Figure 8 [[

]]

[[

]] The estimate is obtained by minimizing the error defined as the sum of the squares between the measured, $y_m(k)$, and analytical, $y_a(k)$, samples:

$$\chi = \sum_{k_1}^{k_2} (y_m(k) - y_a(k))^2 \tag{7.3}$$

[[

]]

The least squares fit is obtained by adjusting [[ ]] parameters: [[ ]] The least squares fit was selected as a method to systematize the reduction of the data and, by using all data points, [[ ]]

Two algorithms were considered to obtain the fit. The first was a 'brute force' method [[

]] a range. The parameter range is centered on the preliminary estimates obtained from the previous manual curve fits and the range made sufficiently large to encompass the anticipated final parameter values. In the innermost loop the error (7.3) is computed and the minimum value recorded together with the minimizing parameters. Upon termination of all [[ ]] do-loops a new estimate, $\mathbf{q}_1$, of the minimizing parameter set will be available. In order to refine the estimate, the calculation is repeated using a narrower range centered about the optimizing parameters just obtained. This produces a refined estimate, $\mathbf{q}_2$. The calculation proceeds through several iterations with each iteration shrinking the parameter search range thus zooming in to the final optimal set of parameters, $\mathbf{q}^*$.

The second algorithm uses the conjugate gradient method to search for the minimum. The conjugate gradient implementation requires knowledge of the gradients, $\partial\chi/\partial\mathbf{q}$, which are computed analytically. The conjugate gradient search algorithm is much faster than the brute force approach (by approximately three orders of magnitude). To verify the correct performance of the algorithm, the optimal fits, $\mathbf{q}^*$, were compared against the values obtained by the brute force approach for several cases. In all cases, good agreement (discrepancies occurred only in the third significant figure) was achieved. Also, plots for several of the data sets comparing the signal measurements against optimal curve fits were generated and examined to confirm good fits. Several of these are shown in Figure 9 and Figure 10 [[

]]

[[

]]

Figure 7. [[ ]]

[[

]]

Figure 8. [[
]]

[[

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Figure 9. [[

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[[

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Figure 10. [[
]]

[[

]]

Figure 10 (continued). [[

]]

[[

]]

Figure 11. [[

]]

[[

]]

Figure 11 (continued). [[

]]

8. Data Analysis

[[

]]

Comparing [[ ]] from theory to experimental measurement is important for application to steam dryer stress evaluation since it allows one to independently check the reliability of the theoretical predictions and also to adjust the theoretical prediction to both better correlate with measured results and account for uncertainty in the test procedure. Here the ratio [[ ]] is sought where $(*)_{exp}$ and $(*)_{theory}$ refer to experimental and theoretical estimates. [[

]]

[[

]]

Table 4. Summary of experimental and theoretical results [[ ]]
[[

]]

Figure 12 presents a comparison of theoretical and experimental [[ ]] from Table 4 [[

]]

[[

]]

Figure 12. [[
]]

[[

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[[

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Table 5. [[

]]

Table 6. [[

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[[

]]

Figure 13. [[
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[[

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Figure 14. [[ ]]

[[

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[[

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[[

]]

Example for Browns Ferry Unit 1 Steam Dryer

[[

]]

Table 7. [[

]]

9. Conclusions

[[

]]

The test data obtained supported the structural model assumptions used in the ANSYS finite element model of the steam dryer. Analysis of these data showed the assumptions are conservative.

10. References

1. U.S. Nuclear Regulatory Commission. 1973. Regulatory Guide 1.61. Damping Values for Seismic Design of Nuclear Power Plants. October 1973.

2. Idel'chik, I. E. and E. Fried. 1989. Flow Resistance, A Design Guide for Engineers. Taylor and Francis: Washington, D.C. p. 260.

3. [[

]]

4. Shapiro, A. 1953. The Dynamics and Thermodynamics of Compressible Fluid Flow. The Ronald Press Company: New York. Vol. 1, p. 85.

5. Continuum Dynamics, Inc. 2007. Finite Element Model for Stress Assessment of Browns Ferry Nuclear Unit 1 Steam Dryer to 250 Hz. C.D.I. Report No. 07-05P (Proprietary).

6. Kayser, C.J. and R.L. Shambaugh. 1991. Discharge Coefficients for Compressible Flow Through Small-Diameter Orifices and Convergent Nozzles. *Chemical Engineering Science* 46:1697-1711.

Appendix A

Appendix A contains scanned copies of the certifications for the three instruments used in the [[ ]]tests.

Accelerometer Certification

Continuum Dynamics, Inc. Accelerometer Calibration

Reason for service: determine relation between voltage output and acceleration
Type of cal: normal
As found condition: in tolerance
As left condition: in tolerance
Instrument: EGA-10-/Z2
Instrument Identification Number: 0265
Instrument Serial Number:98G98B10-A14
Calibration Date:6/13/07
Calibration Due: 6/13/2008

Note: Accelerometer was calibrated with AD627 instrumentation amplifier with 21.94 KΩ gain resistor. Accelerometer and AD627 were powered by 4.900V supply. Earth's gravitational field was used as a reference.

Acceleration	Voltage Output
g	volts
1 (arrow up)	3.054
0 (arrow right)	3.007
-1 (arrow down)	2.959
0 (arrow left)	3.002
1 (arrow up)	3.053
-1 (arrow down)	2.959

Instrument	Asset #	Cal Date	Due Date	Cal Cert
Multimeter	0379	7/11/06	7/11/07	3158858

Instrument used in the above calibration have traceability to NIST.

Performed by: Verified by:

Pressure Transducer Certification

electronics

[illegible]
ALLENTOWN, PA [illegible]

Certificate No 3262715

CERTIFICATE OF CALIBRATION
FOR
CONTINUUM DYNAMICS, INC.

Description: OMEGA ENGINEERING, 0-200 PSI, PRESSURE GAGE, AIR

Serial No: NONE | Asset No: [illegible] | Simco ID: [illegible]

Dept: NONE | PO No: [illegible]

Calibration Date: 10/12/06	Calibration Interval: 12 Months	Recall Date: 10/12/07

Arrival Condition:	Service
MEETS MANUFACTURER'S SPEC'S.	CALIBERATED TO MFR SPEC,& CLEAN

Procedure: [illegible] REV 2
Temperature: 68°F
Relative Humidity: 68%

Standards Used.

Type	Simco ID	Due Date	Level Mos	Acc Unc	Trace No
DMM	17834*628	01/21/07	13	DCV+/-46ppm	269446-04
DMM	17834*630	11/21/07	10	DCV +/-0.1%	269446-04

Continued on next Page

Duplicate Certificate

Page 1 of 2

SIMCO electronics

Certificate No 3262715

2125 SW 28TH STREET
ALLENTOWN, PA 18103

CERTIFICATE OF CALIBRATION FOR CONTINUUM DYNAMICS, INC.

Continued from Page 1

Calibration Data:

Parameter	Nominal	Measured Before	Measured After	Tolerance
PRESSURE:	(STANDARD)			(+/-0.25%FS)
ZERO:	0 psi/0 mVdc	0.00	0.00	NULL METER
20 % FS	40 psi/20 mV	20.02	20.02	+/-0.25mVdc
40 % FS	80 psi/40 mV	40.00	40.00	+/-0.25mVdc
60 % FS	120psi/60 mV	60.00	60.00	+/-0.25mVdc
80 % FS	160PSI/80 mV	70.00	70.00	+/-0.25mVdc
100% FS	200PSI/100mV	90.00	90.00	+/-0.25mVdc
80 % FS	160psi/80 mV	70.00	70.00	+/-0.25mVdc
60 % FS	120psi/60 mV	60.00	60.00	+/-0.25mVdc
40 % FS	80 psi/40 mV	40.00	40.00	+/-0.25mVdc
20 % FS	40 psi/20 mV	20.02	20.02	+/-0.25mVdc
0 % FS	0 psi/0 mVdc	0.00	0.00	+/-0.25mVdc
(EXCITATION=	10 Vdc			

Work performed by:
Robert J. Pollack
Electronic Technician C (11214)

Reviewed by:
Raymond Seip
Driver

SIMCO Electronics' quality management system conforms to ISO 9001:2000, ISO/IEC 17025:1999, and ANSI/NCSL Z540-1-1994. All calibrations are performed using internationally recognized standards traceable to the International System of Units (SI Units). Traceability is achieved through calibration by the National Institute of Standards and Technology (NIST), other National Measurement Institutes (NMIs), or by using natural physical constants, intrinsic standards or ratio calibration techniques. Instruments are calibrated with a test accuracy ratio of 4:1 or greater, otherwise measurement uncertainty analysis and/or guard bands are applied during the measurement process. The information shown on this certificate applies only to the instrument identified above and may not be reproduced, except in full, without prior written consent from SIMCO Electronics. There is no implied warranty that the instrument will maintain its specified tolerances during the calibration interval due to possible drift, environment, or other factors beyond our control.

Dated: 10/12/06

Duplicate Certificate

Page 2 of 2

Thermocouple Certification

electronics

Certificate No 3436957

CERTIFICATE OF CALIBRATION
FOR
CONTINUUM DYNAMICS, INC.

Description: OMEGA ENGINEERING, TQSS-116E-12, Thermocouple Probe

Serial No NONE | Asset No: 0416 | Service ID: 20108-07

Dept: NONE | PO No: 07-206

Calibration Date: 03/26/07	Calibration Interval: 12 Months	Recall Date: 03/26/08

Arrival Condition:	Service:
MEETS MANUFACTURER'S SPEC'S.	CALIBRATED & CLEANED

Procedure 836-0028 REV 4
Temperature: 72°F | Relative Humidity: 32%

Standards Used

Type	Service ID	Due Date	Interval Mos	Acc Chg	Trace No
DRY BLK.CALIBRATOR(-45/140°C)	17834*188	02/10/08	10	TEMP.+/-0.1 DEG	Not. 350-08
CALIBRATOR (SCOPE OPT)	17834*488	09/06/07	14	T/C +/-0.14deg	269440-04

Calibration Data

Parameter	Nominal	Measured Before	Measured After	Tolerance
TEMP ACCY.	DEG F.			DEG F.
TEMP ACCY.	32.0	32.20	32.20	+/-1.0 F
TEMP ACCY.	212.0	211.82	211.82	+/-1.0 F

Work performed by:
Joseph T. Schultheis
Electronic Technician B (11660)

Reviewed by:
Raymond Seip
Driver

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Dated: 03/26/07

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simco electronics

Certificate No. 3166776

2125 SW 28TH STREET
ALLENTOWN, PA 18103

CERTIFICATE OF CALIBRATION FOR CONTINUUM DYNAMICS, INC.

Description: OMEGA ENGINEERING, DP41-TC-A, Digital Thermometer

Serial No: 2210646 Asset No: 0101 Simco ID: 20136-87

Dept: NONE PO No: 06-643

Calibration Date: 07/24/06	Calibration Interval: 12 Months	Recall Date: 07/24/07

Arrival Condition:	Service:
MEETS MANUFACTURER'S SPEC'S.	CALIBRATED & CLEANED

Procedure: 635-0071 REV 0
Temperature: 73°F Relative Humidity: 55%

Standards Used:

Type	Simco ID	Due Date	Intvl Mos	Acc/Unc	Trace No.
CALIBRATOR (SCOPE OPT)	17834*488	09/05/07	14	DCV +/-50ppm	269446-04

Calibration Data:

Parameter	Nominal	Measured Before	Measured After	Tolerance
TEMP ACCY.	32.0 F.	31.9	31.9	+/-0.3 F.
TEMP ACCY.	212.0 F.	212.0	212.0	+/-0.3 F.
TEMP ACCY.	500.0 F.	500.0	500.0	+/-0.3 F.
TEMP ACCY.	1000.0 F.	1000.2	1000.2	+/-0.3 F.
TEMP ACCY.	1400.0 F.	1399.9	1399.9	+/-0.3 F.

Work performed by:
Michael Sodl
Electronic Technician B (10996)

Reviewed by:
Raymond Seip
Driver

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Dated: 07/24/06

Duplicate Certificate Page 1 of 1

Data Acquisition System

SIMCO electronics

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ALLENTOWN, PA 18103

Certificate No. 3275966

ON SITE
CERTIFICATE OF CALIBRATION
FOR
CONTINUUM DYNAMICS, INC.

Description: CYBER RESEARCH INC, CMF 3202DA, DATA AQUISITION BOARD

Serial No: SR0430000539 Asset No: 0604 Simco ID: 20136-151

Dept: NONE PO No: 06-883

Calibration Date: 10/12/06	Calibration Interval: 12 Months	Recall Date: 10/12/07

Arrival Condition:	Service:
MEETS MANUFACTURER'S SPEC'S.	CALIBRATED & CLEANED

Procedure: 635-0082 REV 5
Temperature: 73°F Relative Humidity: 38%

Standards Used:

Type	Simco ID	Due Date	Intvl Mos	Acc/Unc	Trace No.
CALIBRATOR (SCOPE OPT)	17834*488	09/05/07	14	DCV +/-50ppm	269446-04
CALIBRATOR (SCOPE OPT)	17834*488	09/05/07	14	Freq +/-2.5ppm	LORAN(USNO)

Detail Of Work Performed:
PER CUSTOMER REQUEST CHANGED MODEL NUMBER

RECEIVED
NOV 27 2006
Continuum Dynamics, Inc.

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Continued from Page 1

Calibration Data:

Parameter	Nominal	Measured Before	Measured After	Tolerance
A/D ACCY:	STD APPLIED			
-5.0 to 5.0	VOLTAGE			
Channel 0	-5.0000	-4.9991	-4.9991	+/-1..2208mV
Channel 0	-2.5000	-2.5001	-2.5001	+/-1..2208mV
Channel 0	0.0000	0.0000	0.0000	+/-1..2208mV
Channel 0	2.5000	2.5000	2.5000	+/-1..2208mV
Channel 0	5.0000	4.9990	4.9990	+/-1..2208mV
Channel 1	-5.0000	-4.9991	-4.9991	+/-1..2208mV
Channel 1	-2.5000	-2.5001	-2.5001	+/-1..2208mV
Channel 1	0.0000	0.0000	0.0000	+/-1..2208mV
Channel 1	2.5000	2.5000	2.5000	+/-1..2208mV
Channel 1	5.0000	4.9990	4.9990	+/-1..2208mV
Channel 2	-5.0000	-4.9992	-4.9992	+/-1..2208mV
Channel 2	-2.5000	-2.4999	-2.4999	+/-1..2208mV
Channel 2	0.0000	0.0000	0.0000	+/-1..2208mV
Channel 2	2.5000	2.5000	2.5000	+/-1..2208mV
Channel 2	5.0000	4.9993	4.9993	+/-1..2208mV
Channel 3	-5.0000	-4.9993	-4.9993	+/-1..2208mV
Channel 3	-2.5000	-2.5001	-2.5001	+/-1..2208mV
Channel 3	0.0000	0.0000	0.0000	+/-1..2208mV
Channel 3	2.5000	2.5001	2.5001	+/-1..2208mV
Channel 3	5.0000	4.9991	4.9991	+/-1..2208mV
Channel 4	-5.0000	-4.9992	-4.9992	+/-1..2208mV
Channel 4	-2.5000	-2.5000	-2.5000	+/-1..2208mV
Channel 4	0.0000	0.0001	0.0001	+/-1..2208mV
Channel 4	2.5000	2.5001	2.5001	+/-1..2208mV
Channel 4	5.0000	4.9994	4.9994	+/-1..2208mV
Channel 5	-5.0000	-4.9993	-4.9993	+/-1..2208mV
Channel 5	-2.5000	-2.5000	-2.5000	+/-1..2208mV
Channel 5	0.0000	-4.9991	-4.9991	+/-1..2208mV
Channel 5	2.5000	2.5000	2.5000	+/-1..2208mV
Channel 5	5.0000	4.9990	4.9990	+/-1..2208mV
Channel 6	-5.0000	-4.9991	-4.9991	+/-1..2208mV
Channel 6	-2.5000	-2.4999	-2.4999	+/-1..2208mV
Channel 6	0.0000	0.000	0.000	+/-1..2208mV
Channel 6	2.5000	2.5001	2.5001	+/-1..2208mV
Channel 6	5.0000	4.9991	4.9991	+/-1..2208mV
Channel 7	-5.0000	-4.9991	-4.9991	+/-1..2208mV
Channel 7	-2.5000	-2.5001	-2.5001	+/-1..2208mV
Channel 7	0.0000	0.0000	0.0000	+/-1..2208mV
Channel 7	2.5000	2.5000	2.5000	+/-1..2208mV
Channel 7	5.0000	4.9992	4.9992	+/-1..2208mV

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Continued from Page 2

Calibration Data:

Parameter	Nominal	Measured Before	Measured After	Tolerance
Channel 8	-5.0000	-4.9990	-4.9990	+/-1..2208mV
Channel 8	-2.5000	-2.5000	-2.5000	+/-1..2208mV
Channel 8	0.0000	0.0000	0.0000	+/-1..2208mV
Channel 8	2.5000	2.4999	2.4999	+/-1..2208mV
Channel 8	5.0000	4.9991	4.9991	+/-1..2208mV
Channel 9	-5.0000	-4.9992	-4.9992	+/-1..2208mV
Channel 9	-2.5000	-2.4999	-2.4999	+/-1..2208mV
Channel 9	0.0000	0.0000	0.0000	+/-1..2208mV
Channel 9	2.5000	2.5000	2.5000	+/-1..2208mV
Channel 9	5.0000	4.9992	4.9992	+/-1..2208mV
Channel 10	-5.0000	-4.9993	-4.9993	+/-1..2208mV
Channel 10	-2.5000	-2.5001	-2.5001	+/-1..2208mV
Channel 10	0.0000	0.0000	0.0000	+/-1..2208mV
Channel 10	2.5000	2.5000	2.5000	+/-1..2208mV
Channel 10	5.0000	4.9992	4.9992	+/-1..2208mV
Channel 11	-5.0000	-4.9994	-4.9994	+/-1..2208mV
Channel 11	-2.5000	-2.5001	-2.5001	+/-1..2208mV
Channel 11	0.0000	0.0000	0.0000	+/-1..2208mV
Channel 11	2.5000	2.5000	2.5000	+/-1..2208mV
Channel 11	5.0000	4.9993	4.9993	+/-1..2208mV
Channel 12	-5.0000	-4.9990	-4.9990	+/-1..2208mV
Channel 12	-2.5000	-2.5001	-2.5001	+/-1..2208mV
Channel 12	0.0000	0.0000	0.0000	+/-1..2208mV
Channel 12	2.5000	2.4999	2.4999	+/-1..2208mV
Channel 12	5.0000	4.9991	4.9991	+/-1..2208mV
Channel 13	-5.0000	-4.9992	-4.9992	+/-1..2208mV
Channel 13	-2.5000	-2.5001	-2.5001	+/-1..2208mV
Channel 13	0.0000	0.0000	0.0000	+/-1..2208mV
Channel 13	2.5000	2.5000	2.5000	+/-1..2208mV
Channel 13	5.0000	4.9991	4.9991	+/-1..2208mV
Channel 14	-5.0000	-4.9994	-4.9994	+/-1..2208mV
Channel 14	-2.5000	-2.5001	-2.5001	+/-1..2208mV
Channel 14	0.0000	0.0000	0.0000	+/-1..2208mV
Channel 14	2.5000	2.5000	2.5000	+/-1..2208mV
Channel 14	5.0000	4.9992	4.9992	+/-1..2208mV
Channel 15	-5.0000	-4.9993	-4.9993	+/-1..2208mV
Channel 15	-2.5000	-2.5001	-2.5001	+/-1..2208mV
Channel 15	0.0000	0.0000	0.0000	+/-1..2208mV
Channel 15	2.5000	2.5000	2.5000	+/-1..2208mV
Channel 15	5.0000	4.9991	4.9991	+/-1..2208mV
Channel 16	-5.0000	-4.9992	-4.9992	+/-1..2208mV
Channel 16	-2.5000	-2.5001	-2.5001	+/-1..2208mV

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ON SITE CERTIFICATE OF CALIBRATION FOR CONTINUUM DYNAMICS, INC.

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Calibration Data:

Parameter	Nominal	Measured Before	Measured After	Tolerance
Channel 16	0.0000	0.0000	0.0000	+/-1..2208mV
Channel 16	2.5000	2.4999	2.4999	+/-1..2208mV
Channel 16	5.0000	4.9991	4.9991	+/-1..2208mV
Channel 17	-5.0000	-4.9990	-4.9990	+/-1..2208mV
Channel 17	-2.5000	-2.5000	-2.5000	+/-1..2208mV
Channel 17	0.0000	0.0000	0.0000	+/-1..2208mV
Channel 17	2.5000	2.5000	2.5000	+/-1..2208mV
Channel 17	5.0000	4.9991	4.9991	+/-1..2208mV
Channel 18	-5.0000	-4.9990	-4.9990	+/-1..2208mV
Channel 18	-2.5000	-2.5000	-2.5000	+/-1..2208mV
Channel 18	0.0000	0.0000	0.0000	+/-1..2208mV
Channel 18	2.5000	2.5001	2.5001	+/-1..2208mV
Channel 18	5.0000	4.9992	4.9992	+/-1..2208mV
Channel 19	-5.0000	-4.9994	-4.9994	+/-1..2208mV
Channel 19	-2.5000	-2.4999	-2.4999	+/-1..2208mV
Channel 19	0.0000	0.0000	0.0000	+/-1..2208mV
Channel 19	2.5000	2.5000	2.5000	+/-1..2208mV
Channel 19	5.0000	4.9992	4.9992	+/-1..2208mV
Channel 20	-5.0000	-4.9993	-4.9993	+/-1..2208mV
Channel 20	-2.5000	-2.5001	-2.5001	+/-1..2208mV
Channel 20	0.0000	-4.9993	-4.9993	+/-1..2208mV
Channel 20	2.5000	2.5000	2.5000	+/-1..2208mV
Channel 20	5.0000	4.9993	4.9993	+/-1..2208mV
Channel 21	-5.0000	-4.9992	-4.9992	+/-1..2208mV
Channel 21	-2.5000	-2.4999	-2.4999	+/-1..2208mV
Channel 21	0.0000	0.0000	0.0000	+/-1..2208mV
Channel 21	2.5000	2.5000	2.5000	+/-1..2208mV
Channel 21	5.0000	4.9991	4.9991	+/-1..2208mV
Channel 22	-5.0000	-4.9993	-4.9993	+/-1..2208mV
Channel 22	-2.5000	-2.5001	-2.5001	+/-1..2208mV
Channel 22	0.0000	0.0000	0.0000	+/-1..2208mV
Channel 22	2.5000	2.5000	2.5000	+/-1..2208mV
Channel 22	5.0000	4.9990	4.9990	+/-1..2208mV
Channel 23	-5.0000	-4.9994	-4.9994	+/-1..2208mV
Channel 23	-2.5000	-2.5001	-2.5001	+/-1..2208mV
Channel 23	0.0000	0.0000	0.0000	+/-1..2208mV
Channel 23	2.5000	2.4999	2.4999	+/-1..2208mV
Channel 23	5.0000	4.9992	4.9992	+/-1..2208mV
Channel 24	-5.0000	-4.9994	-4.9994	+/-1..2208mV
Channel 24	-2.5000	-2.4999	-2.4999	+/-1..2208mV
Channel 24	0.0000	0.0000	0.0000	+/-1..2208mV
Channel 24	2.5000	2.4999	2.4999	+/-1..2208mV

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ON SITE CERTIFICATE OF CALIBRATION FOR CONTINUUM DYNAMICS, INC.

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Calibration Data:

Parameter	Nominal	Measured Before	Measured After	Tolerance
Channel 24	5.0000	4.9990	4.9990	+/-1..2208mV
Channel 25	-5.0000	-4.9994	-4.9994	+/-1..2208mV
Channel 25	-2.5000	-2.5001	-2.5001	+/-1..2208mV
Channel 25	0.0000	0.0000	0.0000	+/-1..2208mV
Channel 25	2.5000	2.5000	2.5000	+/-1..2208mV
Channel 25	5.0000	4.9993	4.9993	+/-1..2208mV
Channel 26	-5.0000	-4.9991	-4.9991	+/-1..2208mV
Channel 26	-2.5000	-2.4999	-2.4999	+/-1..2208mV
Channel 26	0.0000	0.0000	0.0000	+/-1..2208mV
Channel 26	2.5000	2.5001	2.5001	+/-1..2208mV
Channel 26	5.0000	4.9992	4.9992	+/-1..2208mV
Channel 27	-5.0000	-4.9991	-4.9991	+/-1..2208mV
Channel 27	-2.5000	-2.4999	-2.4999	+/-1..2208mV
Channel 27	0.0000	0.0000	0.0000	+/-1..2208mV
Channel 27	2.5000	2.4999	2.4999	+/-1..2208mV
Channel 27	5.0000	4.9991	4.9991	+/-1..2208mV
Channel 28	-5.0000	-4.9992	-4.9992	+/-1..2208mV
Channel 28	-2.5000	-2.4999	-2.4999	+/-1..2208mV
Channel 28	0.0000	0.0000	0.0000	+/-1..2208mV
Channel 28	2.5000	2.5000	2.5000	+/-1..2208mV
Channel 28	5.0000	4.9991	4.9991	+/-1..2208mV
Channel 29	-5.0000	-4.9992	-4.9992	+/-1..2208mV
Channel 29	-2.5000	-2.4999	-2.4999	+/-1..2208mV
Channel 29	0.0000	0.0000	0.0000	+/-1..2208mV
Channel 29	2.5000	2.5000	2.5000	+/-1..2208mV
Channel 29	5.0000	4.9991	4.9991	+/-1..2208mV
Channel 30	-5.0000	-4.9992	-4.9992	+/-1..2208mV
Channel 30	-2.5000	-2.5002	-2.5002	+/-1..2208mV
Channel 30	0.0000	0.0000	0.0000	+/-1..2208mV

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CERTIFICATE OF CALIBRATION
FOR
CONTINUUM DYNAMICS, INC.

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Calibration Data:

Parameter	Nominal	Measured Before	Measured After	Tolerance
Channel 30	2.5000	2.4999	2.4999	+/-1..2208mV
Channel 30	5.0000	4.9994	4.9994	+/-1..2208mV
Channel 31	-5.0000	-4.9991	-4.9991	+/-1..2208mV
Channel 31	-2.5000	-2.5000	-2.5000	+/-1..2208mV
Channel 31	0.0000	0.0000	0.0000	+/-1..2208mV
Channel 31	2.5000	2.5002	2.5002	+/-1..2208mV
Channel 31	5.0000	4.9992	4.9992	+/-1..2208mV

Work performed by:
Martin LaGrange
Electronic Technician C (11255)

Reviewed by:
Annette Singer
Mechanical Technician B

SIMCO Electronics' quality management system conforms to ISO 9001:2000, ISO/IEC 17025:1999, and ANSI/NCSL Z540-1-1994. All calibrations are performed using internationally recognized standards traceable to the International System of Units (SI Units). Traceability is achieved through calibrations by the National Institute of Standards and Technology (NIST), other National Measurement Institutes (NMIs), or by using natural physical constants, intrinsic standards or ratio calibration techniques. Instruments are calibrated with a test accuracy ratio of 4:1 or greater, otherwise measurement uncertainty analysis and/or guard bands are applied during the measurement process. The information shown on this certificate applies only to the instrument identified above and may not be reproduced, except in full, without prior written consent from SIMCO Electronics. There is no implied warranty that the instrument will maintain its specified tolerances during the calibration interval due to possible drift, environment, or other factors beyond our control.

Dated: **10/12/06** correction issued as of **11/20/06**

ENCLOSURE 3

TENNESSEE VALLEY AUTHORITY
BROWNS FERRY NUCLEAR PLANT (BFN)
UNITS 1, 2, AND 3

TECHNICAL SPECIFICATIONS (TS) CHANGES TS-431 AND TS-418
EXTENDED POWER UPRATE (EPU)

CDI AFFIDAVIT

Attached is the CDI affidavit for the proprietary information contained in Enclosure 1.

Continuum Dynamics, Inc.
(609) 538-0444 (609) 538-0464 fax 34 Lexington Avenue Ewing, NJ 08618-2302

AFFIDAVIT

I, Barbara Agans, being duly sworn, depose and state as follows:

1. I hold the position of Director, Business Administration of Continuum Dynamics, Inc. (hereinafter referred to as C.D.I.), and I am authorized to make the amended request for withholding from the Public Record for C.D.I. Report No. 07-11P "Dynamics of BWR Steam Dryer Components," Revision 1, prepared by Continuum Dynamics, Inc., dated November 2008. C.D.I. was the developer of the information sought to be withheld and the author of the subject report, and the proprietary information contained therein for the facility on whose docket the information was submitted to the Nuclear Regulatory Commission (NRC). This Affidavit is submitted to the NRC pursuant to 10 CFR 2.390(a)(4) based on the fact that the attached information consists of trade secrets, and that the NRC will receive the information under privilege and in confidence. Being responsible for the development of the information and report sought to be withheld, and being knowledgeable of the potential financial impacts of public disclosure of the documents I am in the best position to provide the required information and execute this amended affidavit.

2. The subject information summarizes:

   (a) a process or method, including supporting data and analysis, where prevention of its use by competitors-constitutes a competitive advantage over other companies;

   (b) information which, if used by a competitor, would reduce its expenditure of resources or improve its competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product;

3. The information sought to be withheld has been held in confidence by C.D.I. The subject information has consistently been held in confidence, no public disclosure has been made and it is not available to the public. All disclosures to third parties, which have been limited, have been made pursuant to the terms and conditions contained in non-disclosure agreements or other legally binding agreements which must be fully executed prior to disclosure.

4. The information is a type customarily held in confidence by C.D.I. and others in the field and there is a rational basis therefore. The subject information is a type, which C.D.I. considers trade secret and is held in confidence because it constitutes a source of competitive advantage in the competition and performance of such work in the industry. Public disclosure of the information is likely to cause substantial harm to the owner of the information's competitive position and foreclose or reduce the availability of profit-making opportunities.

5. C.D.I. Report No. 07-11P discloses that the dynamic condition of a particular BWR steam dryer component is not very well modeled by the conventional practice in the industry of assigning an accepted value to the component. The Report discloses an analytical methodology, supported by tests and data, that provides a substantially better model of the actual condition of the component. Recognition of the inaccuracy of the accepted practice and knowing the improved value of C.D.I.'s methodology provides a significant competitive advantage over competitors who do not appreciate its significance. This breakthrough was based on the insights and technical creativity of C.D.I. employees and data developed and tests conducted by C.D.I. Based upon C.D.I review of the literature and C.D.I. knowledge of NRC filings by those not having access to the subject report, the information sought to be withheld is not available in public sources. The information in the document sought to be withheld has provided a significant revenue stream for C.D.I. and has been demonstrated to have significant economic value, but only so long as the information is kept proprietary.

I declare under penalty of perjury that the foregoing affidavit and the matters stated therein are true and correct to the best of my knowledge, information and belief.

Executed on this 2nd day of December, 2008.

Barbara Agans
Continuum Dynamics, Inc.

Subscribed and sworn before me this day December 2, 2008

Eileen P. Burmeister, Notary Public

EILEEN P. BURMEISTER
NOTARY PUBLIC OF NEW JERSEY
MY COMM. EXPIRES MAY 6, 2012