DUKE ENERGY.

Brunswick Nuclear Plant
P.O. Box 10429
Southport, NC 28461

March 31, 2018

Serial: BSEP 18-0043

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

Subject: Brunswick Steam Electric Plant, Unit No. 1
Renewed Facility Operating License No. DPR-71
Docket No. 50-325
Application of Dissimilar Metal Weld Full Structural Overlay - Reactor Pressure Vessel Nozzles N4A and N4D

Reference: Letter from William R. Gideon (Duke Energy) to the U.S. Nuclear Regulatory Commission Document Control Desk, *Proposed In-service Inspection Alternative for Application of Dissimilar Metal Weld Full Structural Overlay – Nozzles N4A and N4D*, dated March 19, 2018, ADAMS Accession Number ML18078A804

Ladies and Gentlemen:

By letter dated March 19, 2018 (i.e., Reference), Duke Energy Progress, LLC (Duke Energy), proposed a 10 CFR 50.55a(z)(1) alternative to apply full structural weld overlays (FSWOLs) to dissimilar metal welds on the reactor pressure vessel (RPV) nozzles N4A and N4D for the Brunswick Steam Electric Plant (BSEP), Unit No. 1.

Prior to BSEP Unit 1 entering Mode 2, following completion of the FSWOLs, Duke Energy committed to provide a summary of the FSWOLs applied to the RPV nozzles N4A and N4D which demonstrates the as-built dimensions equal or exceed the minimum design dimensions of the overlays. Duke Energy also committed to provide the overall component shrinkages after the weld overlay applications. Enclosed is the summary comparing the as-built measurements to the minimum design dimensions and the overall component shrinkage measurements following application of the weld overlays.

Please refer any questions regarding this submittal to Mr. Lee Grzeck, Manager – Regulatory Affairs, at (910) 832-2487.

Sincerely,

for

Bryan B. Wooten
Director - Organizational Effectiveness
Brunswick Steam Electric Plant

MAT/mat

Enclosure:

Brunswick Steam Electric Plant, Unit No. 1 - Summary of the As-Built Data for the Reactor Feedwater Nozzles N4A and N4D Full Structural Weld Overlays

cc (with enclosure):

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Brunswick Steam Electric Plant, Unit No. 1 - Summary of the As-Built Data for the Reactor Feedwater Nozzles N4A and N4D Full Structural Weld Overlays

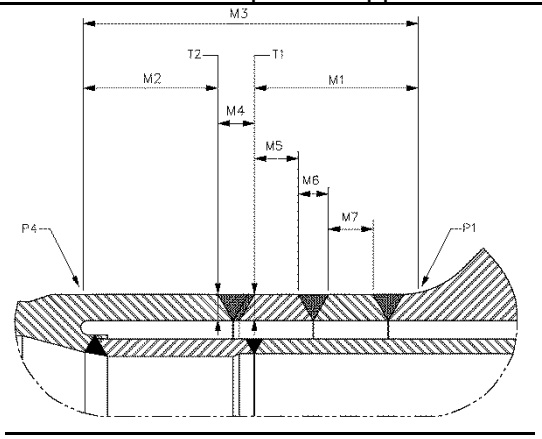
The purpose of this enclosure is to document the evaluation of the final weld overlay as-built dimensions and compare these to the design requirements contained in Calculation 1800389.310, Revision 0, and Design Drawings 1800389.510, Revision 0, and 1800389.520, Revision 0.

Additionally, this enclosure documents the measured axial shrinkage due to the application of the full structural weld overlay (FSWOL).

Documentation of Raw Measurements Obtained During the Weld Overlay Process for Reactor Feedwater Nozzle N4A

The applicable dimensions are shown in Figures 1 and 2 below.

Figure 1 - As-Built Dimensions prior to application of weld overlay



Linear Measurements

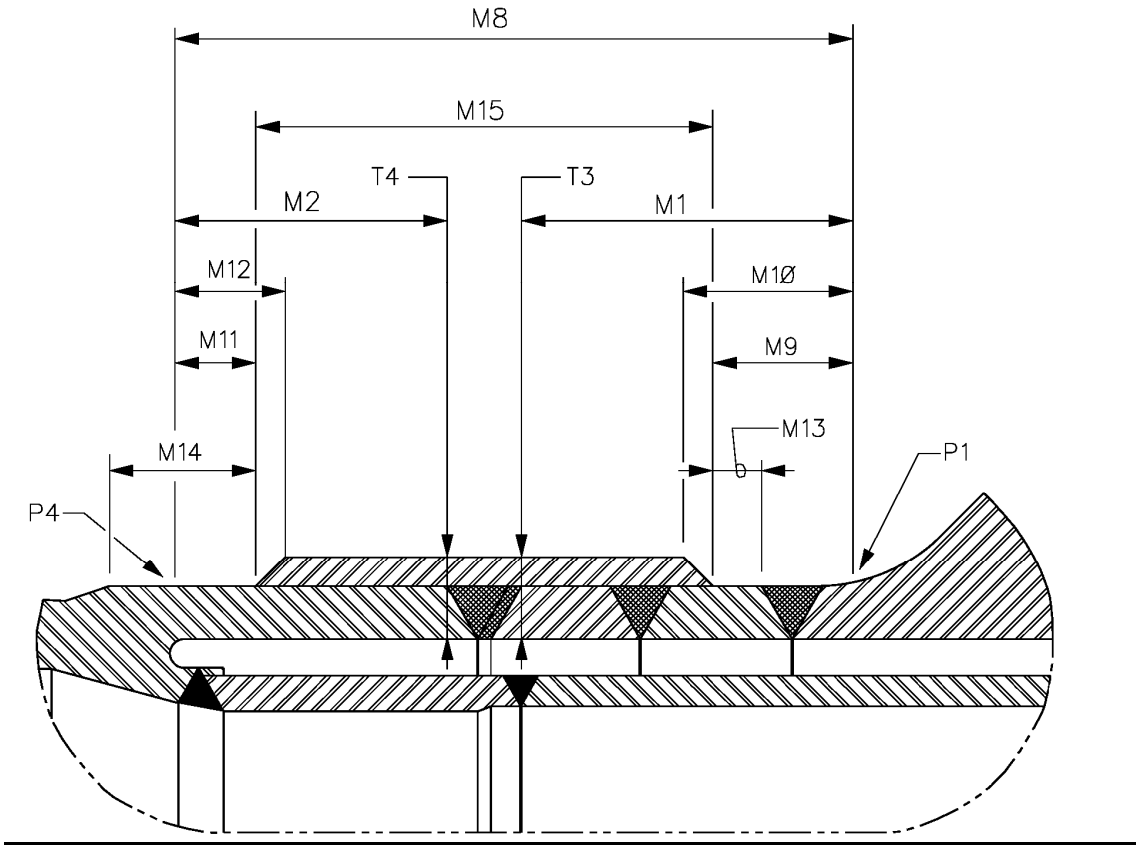
Location	M1 (in)	M2 (in)	M3 (in)	M4 (in)	M5 (in)	M6 (in)	M7 (in)
0°	5.62	4.62	11.62	1.37	1.37	1.25	1.50
90°	5.75	4.62	11.75	1.37	1.37	1.25	1.50
180°	5.62	4.62	11.62	1.37	1.37	1.25	1.50
270°	5.75	4.62	11.75	1.37	1.37	1.25	1.50

Thickness Measurements

Location	T1 (in)	T2 (in)
0°	0.850	0.845
90°	0.855	0.877
180°	0.855	0.872
270°	0.854	0.862

Documentation of Raw Measurements Obtained During the Weld Overlay Process for Reactor Feedwater Nozzle N4A

Figure 2 - As-Built Dimensions following application of weld overlay



Location	M1 (in)	M2 (in)	M8 (in)	M9 (in)	M10 (in)	M11 (in)	M12 (in)	M13 (in)	M14 (in)	M15 (in)
0°	5.62	4.62	11.611	2.153	2.684	0.988	1.576	0.65	2.108	8.536
90°	5.75	4.62	11.690	2.087	2.670	0.981	1.551	0.46	2.290	8.520
180°	5.62	4.62	11.580	2.002	2.580	1.006	1.579	0.50	2.290	8.555
270°	5.75	4.62	11.739	2.191	2.744	1.066	1.661	0.56	2.365	8.520

Thickness Measurements

Location	T3 (in)	T4 (in)
0°	1.349	1.380
90°	1.417	1.437
180°	1.44	1.46
270°	1.39	1.42

Dilution Layer Thickness

Location	TD (in)
0°	0.083
90°	0.084
180°	0.085
270°	0.086

Comparison of As-Built Data to Design Requirements for Feedwater Nozzle N4A

The tables below document the developed critical length and thickness dimensions from the process traveler raw data. These developed dimensions are compared to the Acceptance Criteria from the Design Drawing.

Critical Length Dimensions

Location	M1-M9 (in)	Acceptance Criteria (in)	Comment
0°	3.467	2.92 - 3.92	Criteria Met
90°	3.663	2.92 - 3.92	Criteria Met
180°	3.618	2.92 - 3.92	Criteria Met
270°	3.559	2.92 - 3.92	Criteria Met

Location	M2-M11 (in)	Acceptance Criteria (in)	Comment
0°	3.632	2.92 - 3.92	Criteria Met
90°	3.639	2.92 - 3.92	Criteria Met
180°	3.614	2.92 - 3.92	Criteria Met
270°	3.554	2.92 - 3.92	Criteria Met

Location	M1-M10 (in)	Acceptance Criteria (in)	Comment
0°	2.936	2.32 - 3.32	Criteria Met
90°	3.08	2.32 - 3.32	Criteria Met
180°	3.04	2.32 - 3.32	Criteria Met
270°	3.006	2.32 - 3.32	Criteria Met

Location	M2-M12 (in)	Acceptance Criteria (in)	Comment
0°	3.044	2.32 - 3.32	Criteria Met
90°	3.069	2.32 - 3.32	Criteria Met
180°	3.041	2.32 - 3.32	Criteria Met
270°	2.959	2.32 - 3.32	Criteria Met

Critical Thickness Dimensions

Location	T3-T1-TD (in)		T4-T2-TD (in)	Acceptance Criteria (in)	Comment
0°	**0.416**		**0.452**	0.35 to 0.60	Criteria Met
90°	**0.478**		**0.476**	0.35 to 0.60	Criteria Met
180°	**0.500**		**0.503**	0.35 to 0.60	Criteria Met
270°	**0.450**		**0.472**	0.35 to 0.60	Criteria Met

Included Transition Angle

The transition angle was verified by gauge measurement to ensure that the included angle at the transition to the overlay met or exceeded the acceptance criteria of 135 degrees or greater.

Weld Shrinkage Information

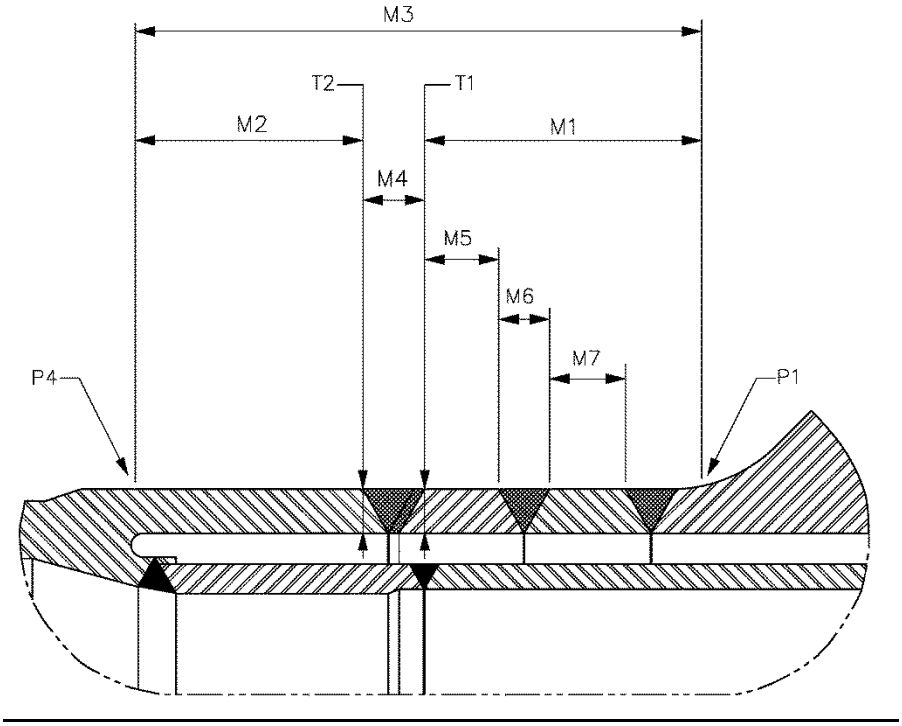
The following table documents the amount of weld shrinkage which occurred during the welding process.

Location	M8-M3 (in)
0°	**-0.01**
90°	**-0.06**
180°	**-0.04**
270°	**-0.01**

Documentation of Raw Measurements Obtained During the Weld Overlay Process for Reactor Feedwater Nozzle N4D

The applicable dimensions are shown in Figures 3 and 4 below.

Figure 3 - As-Built Dimensions prior to application of weld overlay



Linear Measurements

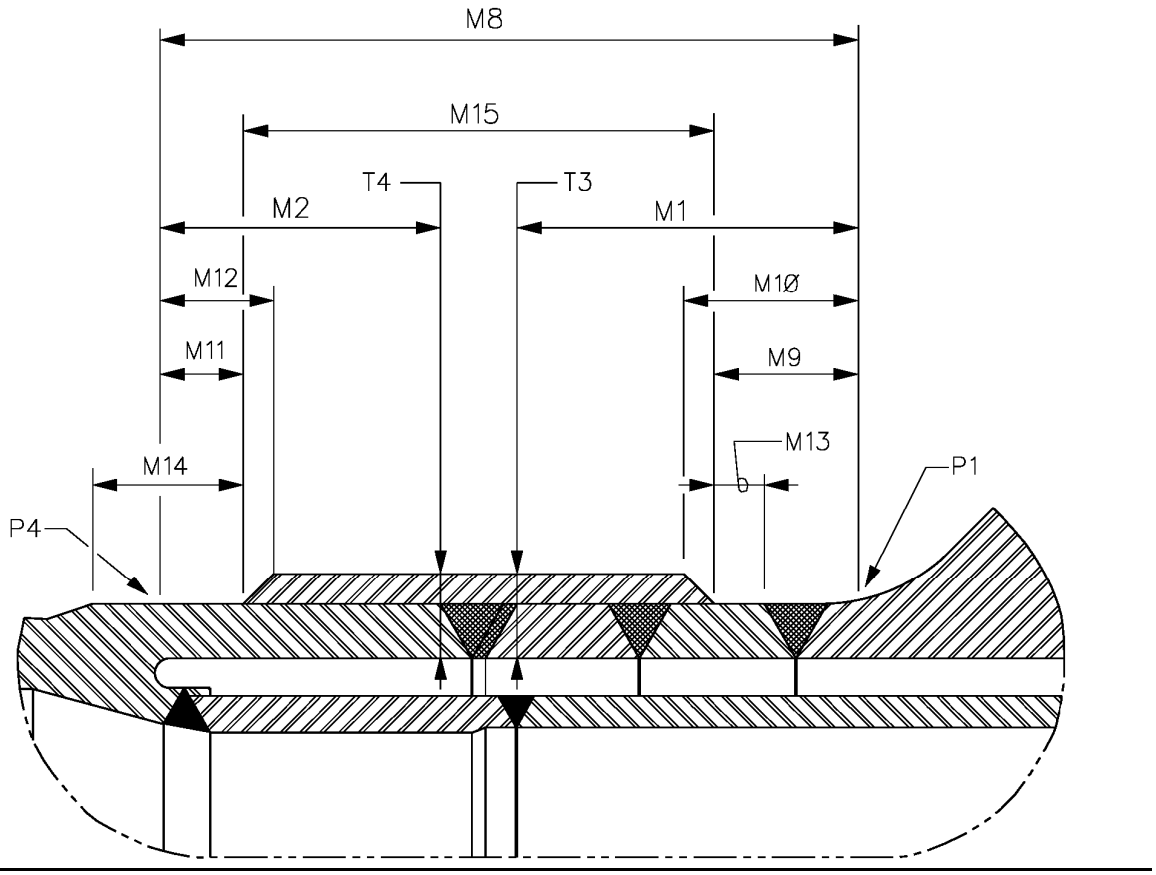
Location	M1 (in)	M2 (in)	M3 (in)	M4 (in)	M5 (in)	M6 (in)	M7 (in)
0°	5.62	4.62	11.62	1.37	1.12	1.50	1.62
90°	5.62	4.62	11.50	1.25	1.50	1.12	1.50
180°	5.62	4.62	11.50	1.25	1.37	1.25	1.25
270°	4.37	4.62	10.37	1.37	1.37	1.25	1.25

Thickness Measurements

Location	T1 (in)	T2 (in)
0°	0.822	0.860
90°	0.833	0.847
180°	0.831	0.862
270°	0.812	0.840

Documentation of Raw Measurements Obtained During the Weld Overlay Process for Reactor Feedwater Nozzle N4D

Figure 4 - As-Built Dimensions following application of weld overlay



Location	M1 (in)	M2 (in)	M8 (in)	M9 (in)	M10 (in)	M11 (in)	M12 (in)	M13 (in)	M14 (in)	M15 (in)
0°	5.62	4.62	11.530	2.184	2.733	1.049	1.614	0.80	1.692	8.405
90°	5.62	4.62	11.476	1.989	2.521	1.089	1.680	0.49	1.743	8.397
180°	5.62	4.62	11.440	2.033	2.542	1.101	1.689	0.28	1.853	8.344
270°	4.37	4.62	10.334	1.004	1.641	1.084	1.575	0.50	1.645	8.312

Thickness Measurements

Location	T3 (in)	T4 (in)
0°	1.364	1.352
90°	1.339	1.337
180°	1.512	1.480
270°	1.451	1.437

Dilution Layer Thickness

Location	TD (in)
0°	0.095
90°	0.086
180°	0.087
270°	0.087

Comparison of As-Built Data to Design Requirements for Feedwater Nozzle N4D

The tables below document the developed critical length and thickness dimensions from the process traveler raw data. These developed dimensions are compared to the Acceptance Criteria from the Design Drawing.

Critical Length Dimensions

Location	M1-M9 (in)	Acceptance Criteria (in)	Comment
0°	3.436	2.92 - 3.92	Criteria Met
90°	3.631	2.92 - 3.92	Criteria Met
180°	3.587	2.92 - 3.92	Criteria Met
270°	3.366	2.92 - 3.92	Criteria Met

Location	M2-M11 (in)	Acceptance Criteria (in)	Comment
0°	3.571	2.92 - 3.92	Criteria Met
90°	3.531	2.92 - 3.92	Criteria Met
180°	3.519	2.92 - 3.92	Criteria Met
270°	3.536	2.92 - 3.92	Criteria Met

Location	M1-M10 (in)	Acceptance Criteria (in)	Comment
0°	2.887	2.32 - 3.32	Criteria Met
90°	3.099	2.32 - 3.32	Criteria Met
180°	3.078	2.32 - 3.32	Criteria Met
270°	2.729	2.32 - 3.32	Criteria Met

Location	M2-M12 (in)	Acceptance Criteria (in)	Comment
0°	3.006	2.32 - 3.32	Criteria Met
90°	2.940	2.32 - 3.32	Criteria Met
180°	2.931	2.32 - 3.32	Criteria Met
270°	3.045	2.32 - 3.32	Criteria Met

Critical Thickness Dimensions

Location	T3-T1-TD (in)		T4-T2-TD (in)	Acceptance Criteria (in)	Comment
0°	**0.447**		**0.397**	0.35 to 0.60	Criteria Met
90°	**0.420**		**0.404**	0.35 to 0.60	Criteria Met
180°	**0.594**		**0.531**	0.35 to 0.60	Criteria Met
270°	**0.552**		**0.510**	0.35 to 0.60	Criteria Met

Included Transition Angle

The transition angle was verified by gauge measurement to ensure that the included angle at the transition to the overlay met or exceeded the acceptance criteria of 135 degrees or greater.

Weld Shrinkage Information

The following table documents the amount of weld shrinkage which occurred during the welding process.

Location	M8-M3 (in)
0°	**-0.09**
90°	**-0.02**
180°	**-0.06**
270°	**-0.04**