INFORMATION SHEET

PRESIDING: Chairman Finley; Commissioners Beatty, Brown-Bland, Dockham, Patterson, Gray and Clodfelter
PLACE: Dobbs Building, Room 2115, Raleigh, NC
DATE: November 6, 2017
TIME: 1:30 p.m. – 6:00 p.m.
DOCKET NO.: E-22, Sub 546
COMPANY: Virginia Electric and Power Company d/b/a Dominion Energy North Carolina
DESCRIPTION: Application for pursuant to G.S. 62-133.2 and Commission Rule R8-55 Regarding Fuel and fuel-Related Cost Adjustments for Electric Utilities
VOLUME:

APPEARANCES

VIRGINIA ELECTRIC AND POWER COMPANY d/b/a DOMINION ENERGY NORTH CAROLINA:
Mary Lynne Grigg, Esq.
Robert W. Kaylor, Esq.

FOR THE USING AND CONSUMING PUBLIC:
Lucy Edmondson, Esq.

WITNESSES
Please see attached witness list

EXHIBITS

Please see attached exhibit list

COPIES ORDERED: E-mail: Edmondson, Grigg
REPORTED BY: Kim Mitchell
TRANSCRIBED BY: Kim Mitchell
DATE TRANSCRIBED: November 17, 2017

TRANSCRIPT PAGES: 206
PREFILED PAGES: 228
TOTAL PAGES: 434

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NORTH CAROLINA UTILITIES COMMISSION
APPEARANCE SLIP

DATE 11/6/2017
DOCKET #: E-22, Sub 546
NAME OF ATTORNEY Joseph W. Eason
TITLE
FIRM NAME Nelson, Mullins, Riley & Scarborough, LLP
ADDRESS 4140 Parklake Avenue
CITY Raleigh, NC.
ZIP 27612

APPEARING FOR: Nucor Steel-Hertford

APPLICANT _____ COMPLAINANT _____ INTERVENO R ✓
PROTESTANT _____ RESPONDENT _____ DEFENDANT _____

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NORTH CAROLINA UTILITIES COMMISSION
PUBLIC STAFF - APPEARANCE SLIP

DATE November 6, 2017 DOCKET #: E-22, Sub 546

PUBLIC STAFF MEMBER Lucy E. Edmondson

ORDER FOR TRANSCRIPT OF TESTIMONY TO BE **EMAILED** TO THE PUBLIC STAFF - PLEASE INDICATE YOUR DIVISION AS WELL AS YOUR EMAIL ADDRESS BELOW:

ACCOUNTING _____
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GAS _____
TRANSPORTATION _____
ECONOMICS _____
LEGAL lucy.edmondson@psncuc.nc.gov
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Lucy E Edmondson

Signature of Public Staff Member

NORTH CAROLINA UTILITIES COMMISSION
APPEARANCE SLIP

DATE Nov. 6 2017
DOCKET #: E-22 Sub 546
NAME OF ATTORNEY Mary Lynne Grigg
TITLE
FIRM NAME
ADDRESS
CITY
ZIP

APPEARING FOR: Dominion Energy

APPLICANT ✓ COMPLAINANT _____ INTERVENO R _____
PROTESTANT_____ RESPONDENT _____ DEFENDANT _____

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NORTH CAROLINA UTILITIES COMMISSION
APPEARANCE SLIP

DATE Nov. 6, 2017
DOCKET #: E-22, Sub 546
NAME OF ATTORNEY Robert W. Kaylor
TITLE Attorney
FIRM NAME Law Office of Robert W. Kaylor, P.A.
ADDRESS 353 E. Six Forks Rd. Ste 260
CITY Raleigh NC 27609
ZIP 27609

APPEARING FOR: Dominion Energy N.C.

APPLICANT ✓ COMPLAINANT _____ INTERVENO R _____
PROTESTANT _____ RESPONDENT _____ DEFENDANT _____

PLEASE NOTE: Electronic Copies of the regular transcript can be obtained from the NCUC website at HTTP://NCUC.commerce.state.nc.us/docksr ch.html under the respective docket number.

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Signature: _____
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NORTH CAROLINA UTILITIES COMMISSION

APPEARANCE SLIP

DATE: **November 6, 2017** DOCKET NO. **E-22 Sub 546**

NAME AND TITLE OF ATTORNEY Warren K. Hicks

FIRM NAME Bailey & Dixon, L.L.P.

ADDRESS Post Office Box 1351

CITY Raleigh, NC ZIP 27602-1351

APPEARING FOR: **Carolina Industrial Group for Fair Utility Rates I (CIGFUR I)**

APPLICANT ___ COMPLAINANT _____ INTERVENER _X__
PROTESTANT ___ RESPONDENT ____

ORDER FOR TRANSCRIPT OF TESTIMONY:

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1A

Dominion Energy®

Application, Testimony, and Exhibits of Virginia Electric and Power Company, d/b/a Dominion Energy North Carolina

Before the North Carolina Utilities Commission

In the Matter of
Application by Virginia Electric and Power Company, d/b/a Dominion Energy North Carolina, for Authority to Adjust its Electric Rates and Charges and Revise its Fuel Factor Pursuant to N.C.G.S. § 62-133.2 and NCUC Rule R8-55

PUBLIC VERSION

Docket No. E-22, Sub 546

Filed: August 23, 2017

STATE OF NORTH CAROLINA
UTILITIES COMMISSION
RALEIGH

DOCKET NO. E-22, SUB 546

BEFORE THE NORTH CAROLINA UTILITIES COMMISSION

In the Matter of Application by Virginia Electric and Power Company, d/b/a Dominion Energy North Carolina, for Authority to Adjust its Electric Rates and Charges and Revise its Fuel Factor Pursuant to N.C.G.S. § 62-133.2 and NCUC Rule R8-55	)	APPLICATION FOR A CHANGE IN FUEL COMPONENT OF ELECTRIC RATES

Pursuant to North Carolina General Statutes ("N.C.G.S") § 62-133.2 and Rule R8-55 of the Rules and Regulations of the North Carolina Utilities Commission ("Commission"), Virginia Electric and Power Company, d/b/a Dominion Energy North Carolina ("Dominion Energy North Carolina" or the "Company"), by counsel, hereby applies to the Commission to adjust the fuel component of its electric rates to become effective January 1, 2018, and remain in effect for the calendar year 2018. In support thereof, the Company respectfully demonstrates as follows:

1. The Company's headquarters are located at 120 Tredegar Street, Richmond, Virginia 23219. The post office address of Dominion Energy North Carolina is P.O. Box 26666, Richmond, Virginia 23261.

2. The attorneys for the Company are:

Lisa S. Booth
Horace P. Payne, Jr.
Dominion Energy, Inc.
Legal Department
120 Tredegar Street, RS-2
Richmond, Virginia 23219
(804) 819-2288 (LSB phone)
(804) 819-2682 (HPP phone)
(804) 819-2183 (HPP fax)
lisa.s.booth@dominionenergy.com
horace.p.payne@dominionenergy.com

Mary Lynne Grigg
Andrea R. Kells
McGuireWoods LLP
434 Fayetteville Street, Suite 2600
PO Box 27507 (27611)
Raleigh, North Carolina 27601
(919) 755-6573 (MLG phone)
(919) 755-6614 (ARK phone)
(919) 755-6699 (MLG fax)
mgrigg@mcguirewoods.com
akells@mcguirewoods.com

Copies of all pleadings, testimony, orders, and correspondence in this proceeding should be served upon the attorneys listed above.

3. The Company is a public utility operating in the State of North Carolina as Dominion Energy North Carolina and is engaged in the business of generating, transmitting, distributing, and selling electric power and energy to the public for compensation. As such, the Company's operations in the State are subject to the jurisdiction of the Commission. The Company is also a public utility under the Federal Power Act, and certain of its operations are subject to the jurisdiction of the Federal Energy Regulatory Commission. The Company is an operating subsidiary of Dominion Energy, Inc.

4. Dominion Energy North Carolina serves approximately 120,000 customers in North Carolina, with a service territory of about 2,600 square miles in northeastern North Carolina; including Roanoke Rapids, Ahoskie, Williamston, Elizabeth City, and the Outer Banks. The Company serves major industrial facilities like Nucor Steel, Kapstone, Enviva, and Hospira, as well as commercial and residential customers.

5. Pursuant to Rule R8-55(b), Dominion Energy North Carolina's fuel adjustment hearing would normally be scheduled for the second Tuesday in November. However, due to a scheduling conflict, the hearing in this case is scheduled for November 6, 2017. Pursuant to Rule R8-55(f), the Company is to file its direct testimony, exhibits, and workpapers supporting its fuel adjustment 75 days prior to the hearing. Accordingly, Dominion Energy North Carolina hereby files the direct testimony, exhibits, and workpapers of the following witnesses in support of its proposed fuel adjustment: Bruce E. Petrie, James D. Merritt, Ronnie T. Campbell, Tom A. Brookmire, and Gregory A. Workman.

6. Pursuant to Rule R8-55(c), Dominion Energy North Carolina's test period for this proceeding is the 12-month period ending June 30, 2017 ("Test Period").

7. The last general rate case order for the Company was issued by the Commission on December 22, 2016, in Docket No. E-22, Sub 532 ("2016 Base Rate Case Order"). The Commission's last fuel adjustment proceeding order for the Company was issued on December 22, 2016, in Docket No. E-22, Sub 534 ("2016 Fuel Order"). The 2016 Base and 2016 Fuel Orders also set the marketer's percentage for this proceeding (and subsequent fuel adjustment proceedings through 2018 or until the Company's next general rate case) at 78% effective January 1, 2017.

8. In the 2016 Base Rate Case Order, the Commission reset the Company's system average base fuel factor applicable to the North Carolina jurisdiction to $0.02073/kWh including North Carolina gross receipts tax ("GRT") ($0.02070/kWh without GRT). In the 2016 Fuel Order, the Commission reset Rider A to zero and approved an updated Experience Modification Factor ("EMF"), Rider B, rate decrement of $0.00468/kWh including GRT ($0.00467/kWh without GRT) applicable to the North Carolina jurisdiction to be effective for the 12-months ending December 31, 2017.

9. As explained by the direct testimony of Company Witness Bruce E. Petrie, consistent with the methodology applied in the Company's fuel adjustment proceedings dating back to 2008, the Company's cost of fuel calculations are based on the 12-month historical average for fuel prices incurred during the Test Period. As Company Witness Petrie explains, this methodology is a fair representation of the expected expense rates during the calendar year 2018 rate period.

10. For the Test Period, the normalized system fuel expense is $1,758,608,978, which is then divided by system sales of 84,774,563,328 kWh, which reflect the normalization adjustments for change in usage, weather, and customer growth. The result is a normalized system average fuel factor of 2.077¢/kWh, which is an increase of 0.004¢/kWh, applicable to the North Carolina jurisdiction.

11. Dominion Energy North Carolina has over-recovered its fuel costs for the Test Period by $4,739,956. The total over-recovered fuel expense as of June 30, 2017, based on the current 78% marketer percentage, is provided in the direct testimony and exhibits of Company Witness Ronnie T. Campbell. This fuel over-recovery was primarily driven by mild weather, moderate commodity prices, and the addition of new

and efficient natural gas generation. In addition, the Company optimized its diverse fleet of generating assets to reduce system fuel expense.

12. The Company calculated the EMF Rider B, including interest, applicable to the North Carolina jurisdiction and to each customer class using the methodology approved in the 2016 Fuel Order. These calculations are addressed in the direct testimony and exhibits of Company Witness James D. Merritt.

13. In the 2014 fuel proceeding (Docket No. E-22, Sub 515), the Company had a large deferral balance due to extreme cold weather in January through March 2014. Therefore, the Company requested and the Commission approved a mitigation proposal (the "mitigation plan") that would recover, through EMF Rider B2, the prior period deferral balance established in that case over the 2015 and 2016 fuel rate years, without interest, subject to a final true-up to be determined in the 2017 fuel case and recovered over the 2018 fuel year. The Rider B2 rates were set to $0.00000/kWh for all classes for purposes of the 2016 fuel case and for the 2017 fuel year. As discussed in the testimony of Company Witness Merritt, the Company has calculated the proposed EMF Rider B2 of $0.00009/kWh to be applicable to the North Carolina jurisdiction for the 2018 fuel year, designed to recover the remaining under-recovery balance related to the approved mitigation plan.

14. The Company proposes that the total fuel rate (base fuel factor, Rider A, and EMF Riders B and B2) for each class be set as follows effective January 1, 2018:

Customer Class	
Residential	1.982¢/kWh
SGS & PA	1.980¢/kWh
LGS	1.964¢/kWh
Schedule NS	1.906¢/kWh
6VP	1.933¢/kWh
Outdoor Lighting	1.982¢/kWh
Traffic	1.982¢/kWh

15. For the North Carolina jurisdiction, the recovery increase for fuel year 2018 will be $15,220,111.

WHEREFORE, Dominion Energy North Carolina respectfully requests that the Commission: approve the proposed total fuel factor of 1.959¢/kWh, effective on January 1, 2018, which shall be allocated based on voltage differentiated adjustments, including the base fuel factor, Rider A, EMF Rider B, and EMF Rider B2, as follows:

(a) 1.982 ¢/kWh for the Residential class of customers,
(b) 1.980 ¢/kWh for the Small General Service and Public Authority classes of customers,
(c) 1.964 ¢/kWh for the Large General Service class of customers,
(d) 1.906 ¢/kWh for the Schedule NS class of customers,
(e) 1.933 ¢/kWh for the Schedule 6VP class of customers, and
(f) 1.982 ¢/kWh for the Outdoor Lighting and Traffic classes of customers; and

grant any other relief the Commission deems appropriate.

Respectfully submitted, this the 23rd day of August, 2017.

DOMINION ENERGY NORTH CAROLINA

By: */s/Mary Lynne Grigg*
Counsel

Counsel for Virginia Electric and Power Company, d/b/a Dominion Energy North Carolina

Lisa S. Booth
Horace P. Payne, Jr.
Dominion Energy, Inc.
Legal Department
120 Tredegar Street, RS-2 Richmond,
Virginia 23219
(804) 819-2288 (LSB phone)
(804) 819-2682 (HPP phone)
(804) 819-2183 (HPP fax)
lisa.s.booth@dominionenergy.com
horace.p.payne@dominionenergy.com

Mary Lynne Grigg
Andrea R. Kells
McGuireWoods LLP
434 Fayetteville Street, Suite 2600
PO Box 27507 (27611)
Raleigh, North Carolina 27601
(919) 755-6573 (MLG phone)
(919) 755-6614 (ARK phone)
(919) 755-6699 (MLG fax)
mgrigg@mcguirewoods.com
akells@mcguirewoods.com

VERIFICATION

E-22, Sub 546

I, J. Kevin Curtis, Vice President – Technical Solutions, for Virginia Electric and Power Company, do solemnly swear that the facts stated in the foregoing *Application Pursuant to G.S. 62-133.2 and Commission Rule R8-55 Regarding Fuel and Fuel-Related Costs Adjustments for Electric Utilities* insofar as they relate to Virginia Electric and Power Company d/b/a Dominion Energy North Carolina, are true and correct to the best of my knowledge and belief.

J. Kevin Curtis

COMMONWEALTH OF VIRGINIA)
) to wit:
City of Richmond)

The foregoing instrument was sworn to and acknowledged before me this 22nd day of August, 2017.

Notary Public

My registration number is 7296406 and my commission expires:
07/31/2021

Amy Leigh Bowers
NOTARY PUBLIC
Commonwealth of Virginia
Reg. #7296406
My Commission Expires 7/31/2021

I/A

Company Exhibit JDM-1
Schedule 1
Page 1 of 1

SUMMARY OF KWH ATTRIBUTABLE TO
CHANGE IN USAGE, WEATHER NORMALIZATION, AND CUSTOMER GROWTH
TWELVE MONTHS ENDED JUNE 30, 2017

SYSTEM

LINE	JURISDICTION	CHANGE IN USAGE KWH	WEATHER NORM. KWH	CUSTOMER GROWTH KWH	TOTAL KWH
1)	NORTH CAROLINA (A)	(30,654,481)	49,588,559	5,238,872	24,172,950
2)	VIRGINIA	660,591,710	161,616,013	145,890,423	968,098,146
3)	COUNTY	114,409,944	(33,142,312)	(22,413,932)	58,853,700
4)	STATE	(11,158,143)	(11,517,252)	9,910,576	(12,764,819)
5)	MS - GOVERNMENTAL	(12,242,614)	(41,277,315)	(58,035,643)	(111,555,572)
7)	FERC	0	27,455,685	0	27,455,685
8)	SYSTEM KWH AT SALES LEVEL	720,946,416	152,723,378	80,590,296	954,260,090
9)	SUBTOTAL - SYSTEM KWH AT GENERATION LEVEL (LINE 8 x 2016 EXPANSION FACTOR) (B)				996,840,129

NOTES

( ) DENOTES NEGATIVE VALUE

(A) NORTH CAROLINA BY CLASS	CHANGE IN USAGE KWH	WEATHER NORM. KWH	CUSTOMER GROWTH KWH	TOTAL KWH
RESIDENTIAL	1,912,184	42,343,840	845,659	45,101,683
SGS / PA	(6,709,574)	7,244,719	1,299,515	1,834,660
LGS	(25,529,551)	0	3,022,785	(22,506,766)
NS	(1,585,636)	0	0	(1,585,636)
6VP	1,362,609	0	0	1,362,609
ODL & ST LTS	(99,993)	0	70,913	(29,080)
TRAFFIC	(4,520)	0	0	(4,520)
TOTAL	(30,654,481)	49,588,559	5,238,872	24,172,950

(B) 2016 SYSTEM EXPANSION FACTOR IS 1.044621

DOMINION ENERGY NORTH CAROLINA
CALCULATION OF SYSTEM AVERAGE FUEL FACTOR
TWELVE MONTHS ENDED JUNE 30, 2017
TO BE EFFECTIVE JANUARY 1, 2018

EXPENSE:	12 MONTH NORMALIZED SYSTEM FUEL EXPENSE (A)	$1,758,608,978
SALES:	12 MONTHS SYSTEM KWH SALES ADJUSTED FOR CHANGE IN USAGE, WEATHER AND CUSTOMER GROWTH (B)	84,774,563,328
FEE:	NORTH CAROLINA REGULATORY FEE ADJUSTMENT FACTOR	1.0014

$$\text{FACTOR} = \frac{\$1,758,608,978}{84,774,563,328} \times 1.0014$$

FACTOR = $0.02077 / KWH (C) (D)

NOTES

(A) FROM COMPANY EXHIBIT NO. BEP-1 SCHEDULE 4

(B) SYSTEM KWH AT SALES LEVEL [COMPANY EXHIBIT RC-1, SCHEDULE 3]	83,820,303,238
PLUS: SYSTEM KWH USAGE, WEATHER, GROWTH ADJUSTMENT [COMPANY EXHIBIT NO. JDM-1, SCHEDULE 1, LINE 8]	954,260,090
TOTAL SYSTEM SALES	84,774,563,328

(C) THE NORTH CAROLINA JURISDICTIONAL BASE FUEL FACTOR IS $0.02073/KWH

(D) WITHOUT NC REGULATORY FEE $0.02074 /KWH

DOMINION ENERGY NORTH CAROLINA
CALCULATION OF FUEL COST RIDER A
TWELVE MONTHS ENDED JUNE 30, 2017
TO BE EFFECTIVE JANUARY 1, 2018

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
CUSTOMER CLASS	KWH SALES (A)	SYSTEM FUEL FACTOR (B)	FUEL REVENUE UNIFORM RATE (1) x (2)	CLASS EXPANSION FACTOR	CLASS KWH @ GENERATION LEVEL (1) x (4)	JURISDICTIONAL UNIFORM RATE @ GENERATION LEVEL (3a) / (5a)	JURISDICTIONAL VOLTAGE DIFFERENTIATED RATE @ SALES LEVEL (4) x (6)	VOLTAGE DIFFERENTIATED BASE FUEL RATE	FUEL COST RIDER A RATE (7) - (8)
RESIDENTIAL	1,601,013,554	$0.02077	$33,253,052	1.05204180	1,684,333,184	$0.01997	$0.02101	$0.02095	$0.00006
SGS & PA	817,305,119	$0.02077	$16,975,427	1.05087924	858,888,979	$0.01997	$0.02099	$0.02093	$0.00006
LGS	710,913,646	$0.02077	$14,765,676	1.04236129	741,028,867	$0.01997	$0.02082	$0.02079	$0.00003
SCHEDULE NS	880,048,860	$0.02077	$18,278,615	1.01138685	890,069,846	$0.01997	$0.02020	$0.02014	$0.00006
6VP	264,735,757	$0.02077	$5,498,562	1.02593554	271,601,822	$0.01997	$0.02049	$0.02043	$0.00006
OUTDOOR LIGHTING	17,207,930	$0.02077	$357,409	1.05204180	18,103,462	$0.01997	$0.02101	$0.02095	$0.00006
TRAFFIC	8,241,485	$0.02077	$171,176	1.05204180	8,670,387	$0.01997	$0.02101	$0.02095	$0.00006
TOTAL	4,299,466,351		$89,299,916 (3a)		4,472,696,545 (5a)				

NOTES

(A)

	TEST YR KWH	CHG IN USAGE, WEATHER CUST GROWTH ADJ	TOTAL*
RESIDENTIAL	1,555,911,871	45,101,683	1,601,013,554
SGS & PA	815,470,459	1,834,660	817,305,119
LGS	733,420,412	(22,506,766)	710,913,646
SCHEDULE NS	881,634,496	(1,585,636)	880,048,860
6VP	263,373,148	1,362,609	264,735,757
OUTDOOR LIGHTING	17,237,010	(29,080)	17,207,930
TRAFFIC	8,246,005	(4,520)	8,241,485
TOTAL	4,275,293,401	24,172,950	4,299,466,351

* CLASS KWH AT SALES LEVEL PLUS CHANGE IN USAGE, WEATHER NORMALIZATION, AND CUSTOMER GROWTH [COMPANY EXHIBIT NO. JDM-1 SCHEDULE 1]

(B) IN $/KWH

DOMINION ENERGY NORTH CAROLINA
CALCULATION OF EXPERIENCE MODIFICATION FACTOR - RIDER B
TWELVE MONTHS ENDED JUNE 30, 2017
TO BE EFFECTIVE JANUARY 1, 2018

EXPENSE:	JULY 1, 2016 - JUNE 30, 2017 NC JURISDICTIONAL FUEL EXPENSE UNDER RECOVERY (A)	($4,739,956)
INTEREST:	18 MONTHS AT 10%	($710,993)
NET:		($5,450,950)
SALES:	12 MONTHS JURISDICTIONAL KWH SALES ADJUSTED FOR CHANGE IN USAGE, WEATHER, AND CUSTOMER GROWTH (B)	4,299,466,351
FEE:	NORTH CAROLINA REGULATORY FEE ADJUSTMENT FACTOR	1.0014

$$\text{FACTOR} = \frac{(\$5,450,950)}{4,299,466,351} \times 1.0014$$

FACTOR = ($0.00127) / KWH (C)

NOTES

(A) FROM COMPANY EXHIBIT NO. RC-1 SCHEDULE 2

(B) FROM COMPANY EXHIBIT NO. JDM-1 SCHEDULE 2, PAGE 2

(C) WITHOUT NC REGULATORY FEE ($0.00127) /KWH

DOMINION ENERGY NORTH CAROLINA
CALCULATION OF EXPERIENCE MODIFICATION FACTOR - RIDER B
TWELVE MONTHS ENDED JUNE 30, 2017
TO BE EFFECTIVE JANUARY 1, 2018

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
CUSTOMER CLASS	KWH SALES (A)	NC JURISDICTIONAL EMF (B)	FUEL REVENUE UNIFORM EMF (1) x (2)	CLASS EXPANSION FACTOR	CLASS KWH @ GENERATION LEVEL (1) x (4)	UNIFORM EMF @ GENERATION LEVEL (3a) / (5a)	VOLTAGE DIFFERENTIATED EMF @ SALES LEVEL (4) x (6)
RESIDENTIAL	1,601,013,554	($0.00127)	($2,033,287)	1.05204180	1,684,333,184	($0.00122)	($0.00128)
SGS & PA	817,305,119	($0.00127)	($1,037,978)	1.05087924	858,888,979	($0.00122)	($0.00128)
LGS	710,913,646	($0.00127)	($902,860)	1.04236129	741,028,867	($0.00122)	($0.00127)
SCHEDULE NS	880,048,860	($0.00127)	($1,117,662)	1.01138685	890,069,846	($0.00122)	($0.00123)
6VP	264,735,757	($0.00127)	($336,214)	1.02593554	271,601,822	($0.00122)	($0.00125)
OUTDOOR LIGHTING	17,207,930	($0.00127)	($21,854)	1.05204180	18,103,462	($0.00122)	($0.00128)
TRAFFIC	8,241,485	($0.00127)	($10,467)	1.05204180	8,670,387	($0.00122)	($0.00128)
TOTAL	4,299,466,351		($5,460,322) (3a)		4,472,696,545 (5a)		

NOTES

(A) FROM COMPANY EXHIBIT NO. JDM-1 SCHEDULE 2, PAGE 2

(B) IN $/KWH

DOMINION ENERGY NORTH CAROLINA
CALCULATION OF APPROVED MITIGATION FACTOR - RIDER B2
TWENTY FOUR MONTHS ENDED DECEMBER 31, 2016
TO BE EFFECTIVE JANUARY 1, 2018

EXPENSE:	JANUARY 1, 2015 - DECEMBER 31, 2016 NC JURISDICTIONAL MITIGATION FUEL EXPENSE UNDER RECOVERY (A)	$381,535
INTEREST:	NO INTEREST AS PER FINAL COMMISSION ORDER IN DOCKET E-22, SUB 515 (D)	$0
NET:		$381,535
SALES:	12 MONTHS JURISDICTIONAL KWH SALES ADJUSTED FOR CHANGE IN USAGE, WEATHER, AND CUSTOMER GROWTH (B)	4,299,466,351
FEE:	NORTH CAROLINA REGULATORY FEE ADJUSTMENT FACTOR	1.0014

$$\text{FACTOR} = \frac{\$381,535}{4,299,466,351} \times 1.0014$$

FACTOR = $0.00009 / KWH (C)

NOTES

(A) FROM COMPANY EXHIBIT NO. RC-1 SCHEDULE 6, LINE 5.

(B) FROM COMPANY EXHIBIT NO. JDM-1 SCHEDULE 2, PAGE 2

(C) WITHOUT NC REGULATORY FEE $0.00009 /KWH

(D) FINAL ORDER IN DOCKET E-22, SUB 515 PAGE 26.

DOMINION ENERGY NORTH CAROLINA
CALCULATION OF APPROVED MITIGATION FACTOR - RIDER B2
TWENTY FOUR MONTHS ENDED DECEMBER 31, 2016
TO BE EFFECTIVE JANUARY 1, 2018

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
CUSTOMER CLASS	KWH SALES (A)	NC JURISDICTIONAL EMF B2 (B)	FUEL REVENUE UNIFORM EMF B2 (1) x (2)	CLASS EXPANSION FACTOR	CLASS KWH @ GENERATION LEVEL (1) x (4)	UNIFORM EMF B2 @ GENERATION LEVEL (3a) / (5a)	VOLTAGE DIFFERENTIATED EMF B2 @ SALES LEVEL (4) x (6)
RESIDENTIAL	1,601,013,554	$0.00009	$144,091	1.05204180	1,684,333,184	$0.00009	$0.00009
SGS & PA	817,305,119	$0.00009	$73,557	1.05087924	858,888,979	$0.00009	$0.00009
LGS	710,913,646	$0.00009	$63,982	1.04236129	741,028,867	$0.00009	$0.00009
SCHEDULE NS	880,048,860	$0.00009	$79,204	1.01138685	890,069,846	$0.00009	$0.00009
6VP	264,735,757	$0.00009	$23,826	1.02593554	271,601,822	$0.00009	$0.00009
OUTDOOR LIGHTING	17,207,930	$0.00009	$1,549	1.05204180	18,103,462	$0.00009	$0.00009
TRAFFIC	8,241,485	$0.00009	$742	1.05204180	8,670,387	$0.00009	$0.00009
TOTAL	4,299,466,351		$386,952 (3a)		4,472,696,545 (5a)		

NOTES

(A) FROM COMPANY EXHIBIT NO. JDM-1 SCHEDULE 2, PAGE 2

(B) IN $/KWH

DOMINION ENERGY NORTH CAROLINA
TOTAL FUEL COST LEVEL - PRESENT AND PROPOSED
TO BE EFFECTIVE JANUARY 1, 2018

	(1)	(2)	(3)	(4)	(5)
NC JURISDICTION	BASE FUEL COMPONENT $/KWH	RIDER A FUEL CHARGE $/KWH	RIDER B EMF $/KWH	RIDER B2 EMF $/KWH	TOTAL FUEL RATE $/KWH
PRESENT	$0.02073	$0.00000	($0.00468)	$0.00000	$0.01605
PROPOSED	$0.02073	$0.00004	($0.00127)	$0.00009	$0.01959
CHANGE	$0.00000	$0.00004	$0.00341	$0.00009	$0.00354
RESIDENTIAL	BASE FUEL COMPONENT $/KWH	RIDER A FUEL CHARGE $/KWH	RIDER B EMF $/KWH	RIDER B2 EMF $/KWH	TOTAL FUEL RATE $/KWH
PRESENT	$0.02095	$0.00000	($0.00473)	$0.00000	$0.01622
PROPOSED	$0.02095	$0.00006	($0.00128)	$0.00009	$0.01982
CHANGE	$0.00000	$0.00006	$0.00345	$0.00009	$0.00360
SGS & PA	BASE FUEL COMPONENT $/KWH	RIDER A FUEL CHARGE $/KWH	RIDER B EMF $/KWH	RIDER B2 EMF $/KWH	TOTAL FUEL RATE $/KWH
PRESENT	$0.02093	$0.00000	($0.00472)	$0.00000	$0.01621
PROPOSED	$0.02093	$0.00006	($0.00128)	$0.00009	$0.01980
CHANGE	$0.00000	$0.00006	$0.00344	$0.00009	$0.00359
LGS	BASE FUEL COMPONENT $/KWH	RIDER A FUEL CHARGE $/KWH	RIDER B EMF $/KWH	RIDER B2 EMF $/KWH	TOTAL FUEL RATE $/KWH
PRESENT	$0.02079	$0.00000	($0.00469)	$0.00000	$0.01610
PROPOSED	$0.02079	$0.00003	($0.00127)	$0.00009	$0.01964
CHANGE	$0.00000	$0.00003	$0.00342	$0.00009	$0.00354

NOTES

( ) DENOTES NEGATIVE VALUE

DOMINION ENERGY NORTH CAROLINA
TOTAL FUEL COST LEVEL - PRESENT AND PROPOSED
TO BE EFFECTIVE JANUARY 1, 2018

	(1)	(2)	(3)	(4)	(5)
SCHEDULE NS	BASE FUEL COMPONENT $/KWH	RIDER A FUEL CHARGE $/KWH	RIDER B EMF $/KWH	RIDER B2 EMF $/KWH	TOTAL FUEL RATE $/KWH
PRESENT	$0.02014	$0.00000	($0.00454)	$0.00000	$0.01560
PROPOSED	$0.02014	$0.00006	($0.00123)	$0.00009	$0.01906
CHANGE	$0.00000	$0.00006	$0.00331	$0.00009	$0.00346
6VP	BASE FUEL COMPONENT $/KWH	RIDER A FUEL CHARGE $/KWH	RIDER B EMF $/KWH	RIDER B2 EMF $/KWH	TOTAL FUEL RATE $/KWH
PRESENT	$0.02043	$0.00000	($0.00461)	$0.00000	$0.01582
PROPOSED	$0.02043	$0.00006	($0.00125)	$0.00009	$0.01933
CHANGE	$0.00000	$0.00006	$0.00336	$0.00009	$0.00351
OUTDOOR LIGHTING	BASE FUEL COMPONENT $/KWH	RIDER A FUEL CHARGE $/KWH	RIDER B EMF $/KWH	RIDER B2 EMF $/KWH	TOTAL FUEL RATE $/KWH
PRESENT	$0.02095	$0.00000	($0.00473)	$0.00000	$0.01622
PROPOSED	$0.02095	$0.00006	($0.00128)	$0.00009	$0.01982
CHANGE	$0.00000	$0.00006	$0.00345	$0.00009	$0.00360
TRAFFIC	BASE FUEL COMPONENT $/KWH	RIDER A FUEL CHARGE $/KWH	RIDER B EMF $/KWH	RIDER B2 EMF $/KWH	TOTAL FUEL RATE $/KWH
PRESENT	$0.02095	$0.00000	($0.00473)	$0.00000	$0.01622
PROPOSED	$0.02095	$0.00006	($0.00128)	$0.00009	$0.01982
CHANGE	$0.00000	$0.00006	$0.00345	$0.00009	$0.00360

NOTES

( ) DENOTES NEGATIVE VALUE

DOMINION ENERGY NORTH CAROLINA
TOTAL FUEL RECOVERY
TWELVE MONTHS ENDED JUNE 30, 2017
TO BE EFFECTIVE JANUARY 1, 2018

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
CUSTOMER CLASS	SALES(KWH)	BASE FUEL COMPONENT (A)	FUEL COST RIDER A (B)	EMF RIDER B (C)	EMF RIDER B2 (D)	TOTAL (2) + (3) + (4) + (5)	TOTAL REVENUE (1) x (6)
RESIDENTIAL	1,601,013,554	$0.02095	$0.00006	($0.00128)	$0.00009	$0.01982	$31,732,089
SGS & PA	817,305,119	$0.02093	$0.00006	($0.00128)	$0.00009	$0.01980	$16,182,641
LGS	710,913,646	$0.02079	$0.00003	($0.00127)	$0.00009	$0.01964	$13,962,344
SCHEDULE NS	880,048,860	$0.02014	$0.00006	($0.00123)	$0.00009	$0.01906	$16,773,731
6VP	264,735,757	$0.02043	$0.00006	($0.00125)	$0.00009	$0.01933	$5,117,342
OUTDOOR LIGHTING	17,207,930	$0.02095	$0.00006	($0.00128)	$0.00009	$0.01982	$341,061
TRAFFIC	8,241,485	$0.02095	$0.00006	($0.00128)	$0.00009	$0.01982	$163,346
TOTAL	4,299,466,351						$84,272,555

	SALES(KWH)	BASE FUEL COMPONENT	FUEL COST RIDER A	EMF RIDER B	EMF RIDER B2	TOTAL (2) + (3) + (4) + (5)	TOTAL REVENUE (1) x (6)
NORTH CAROLINA JURISDICTION	4,299,466,351	$0.02073	$0.00004	($0.00127)	$0.00009	$0.01959	$84,226,546

	SALES(KWH)	PRESENT TOTAL RATE	PROPOSED TOTAL RATE	TOTAL CHANGE (3) - (2)	TOTAL REVENUE CHANGE (4) x (1)
NORTH CAROLINA JURISDICTION REVENUE CHANGE	4,299,466,351	$0.01605	$0.01959	$0.00354	$15,220,111

NOTES

(A) FROM COMPANY EXHIBIT NO. JDM-1 SCHEDULE 2, PAGE 2

(B) FROM COMPANY EXHIBIT NO. JDM-1 SCHEDULE 2, PAGE 2

(C) FROM COMPANY EXHIBIT NO. JDM-1 SCHEDULE 3, PAGE 2

(D) FROM COMPANY EXHIBIT NO. JDM-1 SCHEDULE 4, PAGE 2

RIDER A

FUEL COST RIDER

The applicable cents per kilowatt-hour charge[1] shall be added to the base fuel cost contained in the energy charges within each of the following Dominion Energy North Carolina filed Rate Schedules.

Rate Schedule	Customer Class	Cents per kWh Charge
Schedule 1	Residential	0.006¢/kWh
Schedule 1DF	Residential	0.006¢/kWh
Schedule 1P	Residential	0.006¢/kWh
Schedule 1T	Residential	0.006¢/kWh
Schedule 1W	Residential	0.006¢/kWh
Schedule 5	SGS & Public Authority	0.006¢/kWh
Schedule 5C	SGS & Public Authority	0.006¢/kWh
Schedule 5P	SGS & Public Authority	0.006¢/kWh
Schedule 7	SGS & Public Authority	0.006¢/kWh
Schedule 30	SGS & Public Authority	0.006¢/kWh
Schedule 42	SGS & Public Authority	0.006¢/kWh
Schedule 6C	Large General Service	0.003¢/kWh
Schedule 6P	Large General Service	0.003¢/kWh
Schedule 6L	Large General Service	0.003¢/kWh
Schedule 10	Large General Service	0.003¢/kWh
Schedule 26	Outdoor Lighting	0.006¢/kWh
Schedule 30T	Traffic Control	0.006¢/kWh
Schedule 6VP	6VP	0.006¢/kWh
Schedule NS Tier 2-Type A and Tier 3 Energy Charges	Schedule NS	0.006¢/kWh
Schedule NS Tier 1 Type A & B, and Tier 2-Type B Energy Charges	Schedule NS	Rider A is Included in the Energy Charges

[1]This charge is not a part of the base fuel cost included in the energy prices stated in the Rate Schedules and should, therefore, be applied in addition to the prices stated in the Rate Schedules.

RIDER B

EXPERIENCE MODIFICATION FACTOR (EMF)

The applicable cents per kilowatt-hour charge[1] shall be added to the energy charges contained within each of the following Dominion Energy North Carolina filed Rate Schedules.

Rate Schedule	Customer Class	Cents per kWh Charge
Schedule 1	Residential	-0128¢/kWh
Schedule 1DF	Residential	-0.128¢/kWh
Schedule 1P	Residential	-0.128¢/kWh
Schedule 1T	Residential	-0.128¢/kWh
Schedule 1W	Residential	-0.128¢/kWh
Schedule 5	SGS & Public Authority	-0.128¢/kWh
Schedule 5C	SGS & Public Authority	-0.128¢/kWh
Schedule 5P	SGS & Public Authority	-0.128¢/kWh
Schedule 7	SGS & Public Authority	-0.128¢/kWh
Schedule 30	SGS & Public Authority	-0.128¢/kWh
Schedule 42	SGS & Public Authority	-0.128¢/kWh
Schedule 6C	Large General Service	-0.127¢/kWh
Schedule 6P	Large General Service	-0.127¢/kWh
Schedule 6L	Large General Service	-0.127¢/kWh
Schedule 10	Large General Service	-0.127¢/kWh
Schedule 26	Outdoor Lighting	-0.128¢/kWh
Schedule 30T	Traffic Control	-0.128¢/kWh
Schedule 6VP	6VP	-0.125¢/kWh
Schedule NS Tier 2-Type A and Tier 3 Energy Charges	Schedule NS	-0.123¢/kWh
Schedule NS Tier 1 Type A & B, and Tier 2-Type B Energy Charges	Schedule NS	Rider B is Included in the Energy Charges

[1]This charge is not a part of the base fuel cost included in the energy prices stated in the Rate Schedules and should, therefore, be applied in addition to the prices stated in the Rate Schedules.

RIDER B2

EXPERIENCE MODIFICATION FACTOR (EMF)

The applicable cents per kilowatt-hour charge[1] shall be added to the energy charges contained within each of the following Dominion Energy North Carolina filed Rate Schedules.

Rate Schedule	Customer Class	Cents per kWh Charge
Schedule 1	Residential	0.009¢/kWh
Schedule 1DF	Residential	0.009¢/kWh
Schedule 1P	Residential	0.009¢/kWh
Schedule 1T	Residential	0.009¢/kWh
Schedule 1W	Residential	0.009¢/kWh
Schedule 5	SGS & Public Authority	0.009¢/kWh
Schedule 5C	SGS & Public Authority	0.009¢/kWh
Schedule 5P	SGS & Public Authority	0.009¢/kWh
Schedule 7	SGS & Public Authority	0.009¢/kWh
Schedule 30	SGS & Public Authority	0.009¢/kWh
Schedule 42	SGS & Public Authority	0.009¢/kWh
Schedule 6C	Large General Service	0.009¢/kWh
Schedule 6P	Large General Service	0.009¢/kWh
Schedule 6L	Large General Service	0.009¢/kWh
Schedule 10	Large General Service	0.009¢/kWh
Schedule 26	Outdoor Lighting	0.009¢/kWh
Schedule 30T	Traffic Control	0.009¢/kWh
Schedule 6VP	6VP	0.009¢/kWh
Schedule NS Tier 2-Type A and Tier 3 Energy Charges	Schedule NS	0.009¢/kWh
Schedule NS Tier 1 Type A & B, and Tier 2-Type B Energy Charges	Schedule NS	Rider B2 is Included in the Energy Charges

[1]This charge is not a part of the base fuel cost included in the energy prices stated in the Rate Schedules and should, therefore, be applied in addition to the prices stated in the Rate Schedules.

I/A

Company Exhibit RTC-1
Schedule 1
Page 1 of 3

Dominion Energy North Carolina
Actual System Fuel and Purchased Power Expenses
July 2016 - June 2017

	System Expenses As Booked (1)	North Carolina System Expenses As Booked (2)
Steam Generation Fuel Cost		
July 2016	$ 91,905,517	$ 91,905,517
August	86,314,682	86,314,682
September	59,085,119	59,085,119
October	38,893,912	38,893,912
November	31,091,799	31,091,799
December	65,392,871	65,392,871
January 2017	63,688,351	63,688,351
February	29,915,029	29,915,029
March	44,178,828	44,178,828
April	28,650,104	28,650,104
May	44,312,947	44,312,947
June	58,371,148	58,371,148
FERC Account 501 - Steam Fuel Cost	$ 641,800,307	$ 641,800,307
Nuclear Generation Fuel Cost		
July 2016	$ 18,225,620	$ 16,126,060
August	17,174,620	15,756,594
September	14,045,676	12,760,665
October	13,488,969	12,470,420
November	18,011,010	17,109,935
December	17,773,826	16,860,915
January 2017	18,364,729	17,453,329
February	16,495,702	15,466,919
March	18,502,524	17,392,869
April	17,416,303	15,792,254
May	14,752,432	13,410,453
June	20,583,834	19,273,787
FERC Account 518 - Nuclear Fuel Cost	$ 204,835,243	$ 189,874,199

Dominion Energy North Carolina
Actual System Fuel and Purchased Power Expenses
July 2016 - June 2017

	System Expenses As Booked (1)	North Carolina System Expenses As Booked (2)
Other Generation Fuel Cost		
July 2016	$ 70,015,031	$ 70,015,031
August	75,319,691	75,319,691
September	44,007,478	44,007,478
October	26,023,074	26,023,074
November	56,109,073	56,109,073
December	71,898,722	71,898,722
January 2017	97,356,091	97,356,091
February	68,699,444	68,699,444
March	71,029,016	71,029,016
April	38,129,635	38,129,635
May	43,765,255	43,765,255
June	63,517,706	63,517,706
FERC Account 547 - Other Fuel Cost	$ 725,870,216	$ 725,870,216
Total Cost of Fuel Used in Current Generation	$ 1,572,505,766	$ 1,557,544,722
Purchased Power		
July 2016	17,247,178	$ 11,127,997
August	6,347,444	5,244,678
September	26,548,613	17,009,181
October	55,403,448	37,544,427
November	23,302,388	16,767,850
December	42,884,430	38,087,872
January 2017	16,550,886	15,940,812
February	20,049,705	14,678,110
March	19,921,188	16,105,527
April	34,934,237	24,227,516
May	37,615,995	28,527,293
June	32,956,714	9,694,325
FERC Account 555 - Purchased Power Cost	$ 333,762,226	$ 234,955,587

Dominion Energy North Carolina
Actual System Fuel and Purchased Power Expenses
July 2016 - June 2017

	System Expenses As Booked (1)	North Carolina System Expenses As Booked (2)
Total Fuel and Purchased Power Cost		
July 2016	$ 197,393,347	$ 189,174,605
August	185,156,437	182,635,645
September	143,686,887	132,862,443
October	133,809,402	114,931,833
November	128,514,269	121,078,657
December	197,949,849	192,240,380
January 2017	195,960,057	194,438,583
February	135,159,880	128,759,501
March	153,631,556	148,706,240
April	119,130,279	106,799,509
May	140,446,628	130,015,948
June	175,429,401	150,856,965
Total Fuel and Purchased Power Cos	$ 1,906,267,992	$ 1,792,500,309

Dominion Energy North Carolina
North Carolina Recovery Experience
Twelve Months Ended June 2017

PART I	July-16	August-16	September-16	October-16	November-16	December-16	January-17	February-17	March-17	April-17	May-17	June-17	Total
FERC Account 501 - Steam Fuel Cost	$ 91,905,517	$ 86,314,682	$ 59,085,119	$ 38,883,912	$ 31,091,799	$ 65,392,871	$ 63,688,351	$ 29,915,029	$ 44,178,828	$ 28,650,104	$ 44,312,947	$ 58,371,148	$ 641,800,307
FERC Account 518 - Nuclear Fuel Cost	$ 16,126,060	$ 15,756,594	$ 12,760,665	$ 12,470,420	$ 17,109,935	$ 16,860,915	$ 17,453,329	$ 15,466,919	$ 17,392,869	$ 15,792,254	$ 13,410,453	$ 19,273,787	189,874,199
FERC Account 547 - Other Fuel Cost	$ 70,015,031	$ 75,319,691	$ 44,007,478	$ 26,023,074	$ 56,109,073	$ 71,898,722	$ 97,356,091	$ 68,699,444	$ 71,029,016	$ 38,129,635	$ 43,765,255	$ 63,517,706	725,870,216
FERC Account 555 - Purchased Power Cost	$ 11,127,997	$ 5,244,678	$ 17,009,181	$ 37,544,427	$ 16,767,850	$ 38,087,872	$ 15,940,812	$ 14,678,110	$ 16,105,527	$ 24,227,516	$ 28,527,293	$ 9,694,325	234,955,587
Total NC System Fuel and Purchased Power Cost	$ 189,174,605	$ 182,635,645	$ 132,862,443	$ 114,931,833	$ 121,078,657	$ 192,240,380	$ 194,438,583	$ 128,759,501	$ 148,706,240	$ 106,799,509	$ 130,015,948	$ 150,856,965	$ 1,792,500,309
Exclude System AFUDC	(15,439)	(15,019)	(10,219)	(10,657)	(14,387)	(14,796)	(14,900)	(13,136)	(14,864)	(13,586)	(12,258)	(15,800)	(165,059)
Total NC System Fuel and Purchased Power Cost w/o AFUDC	$ 189,159,166	$ 182,620,627	$ 132,852,224	$ 114,921,176	$ 121,064,269	$ 192,225,584	$ 194,423,682	$ 128,746,365	$ 148,691,376	$ 106,785,923	$ 130,003,690	$ 150,841,165	$ 1,792,335,249
PART II													
NC Jurisdictional Fuel and Purchased Power Cost w/o AFUDC	$ 10,488,794	$ 8,587,423	$ 6,982,587	$ 6,013,868	$ 7,025,424	$ 9,211,030	$ 9,794,043	$ 5,672,633	$ 7,261,688	$ 5,586,988	$ 6,777,952	$ 7,841,120	$ 91,243,550
Credit for the fuel cost from Non-Requirement Sales	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 36	$ (36)	0
Credit for the fuel cost from PJM Off-system Sales	$ (484,060)	$ (269,048)	$ (126,124)	$ (145,166)	$ (219,184)	$ (1,307,116)	$ (563,360)	$ (245,830)	$ (738,778)	$ (108,615)	$ (23,306)	$ (112,064)	(4,342,652)
Other Fuel Related Adjustments [1]	10,895	10,582	6,933	8,252	8,777	9,701	9,668	8,277	9,853	8,632	8,186	11,372	111,127
Adjusted NC Jurisdiction Fuel and Purchased Power Cost	$ 10,015,629	$ 8,328,957	$ 6,863,396	$ 5,876,954	$ 6,815,017	$ 7,913,616	$ 9,240,350	$ 5,435,081	$ 6,532,762	$ 5,487,005	$ 6,762,869	$ 7,740,391	$ 87,012,025
PART III													
Adjusted NC Jurisdiction Fuel and Purchased Power Cost	$ 10,015,629	$ 8,328,957	$ 6,863,396	$ 5,876,954	$ 6,815,017	$ 7,913,616	$ 9,240,350	$ 5,435,081	$ 6,532,762	$ 5,487,005	$ 6,762,869	$ 7,740,391	$ 87,012,025
NC Jurisdictional Revenue	(10,804,860)	(9,110,917)	(8,420,540)	(7,273,833)	(7,284,589)	(7,296,790)	(7,606,257)	(5,856,661)	(6,908,387)	(6,424,753)	(6,865,193)	(7,899,201)	(91,751,981)
(Over)/Under Recovery	$ (789,232)	$ (781,960)	$ (1,557,144)	$ (1,396,880)	$ (469,573)	$ 616,826	$ 1,634,093	$ (421,580)	$ (375,625)	$ (937,748)	$ (102,324)	$ (158,810)	$ (4,739,956)
Cumulative (Over)/Under Recovery	$ (789,232)	$ (1,571,192)	$ (3,128,336)	$ (4,525,216)	$ (4,994,789)	$ (4,377,963)	$ (2,743,870)	$ (3,165,450)	$ (3,541,075)	$ (4,478,823)	$ (4,581,147)	$ (4,739,956)	

[1] Includes jurisdictional AFUDC and AFUDC tax credits.

Dominion Energy North Carolina
Actual Kilowatt-hour (kWh) Sales
Twelve Months Ended June 2017

(In Thousands)

	System kWh Sales* (1)	North Carolina Retail kWh Sales* (2)
July 2016	8,564,746	474,717
August	8,477,572	398,475
September	7,031,668	369,396
October	6,107,270	319,406
November	6,115,109	354,666
December	7,334,086	351,299
January 2017	7,286,825	366,934
February	6,405,127	282,107
March	6,847,126	334,240
April	5,934,711	310,359
May	6,370,797	332,014
June	7,345,267	381,681
Total kWh Sales	83,820,303	4,275,293
	83,820,303,238	

*Including unbilled kWh sales.

Dominion Energy North Carolina
Actual Fuel Related Revenues
Twelve Months Ended June 2017

	System Fuel Related Revenues As Booked* (1)	North Carolina Retail Fuel Factor Related Revenues* Current Period (2)	North Carolina Retail Fuel Factor Related Revenues* EMF Rider B (3)
July 2016	$171,702,193	$ 10,804,860	1,109,236
August	167,968,465	9,110,917	934,852
September	139,318,453	8,420,540	864,184
October	120,652,559	7,273,833	746,590
November	117,851,358	7,284,589	(1,758,795)
December	142,212,568	7,296,790	(1,646,415)
January 2017	141,320,775	7,606,257	(1,716,191)
February	124,598,837	5,856,661	(1,321,445)
March	132,855,968	6,908,387	(1,558,502)
April	115,556,699	6,424,753	(1,449,432)
May	124,243,709	6,865,193	(1,548,776)
June	143,108,221	7,899,201	(1,782,114)
Total Fuel Related Revenues	$ 1,641,389,804	$ 91,751,981	$ (9,126,807)

*Including unbilled kWh revenues.

Dominion Energy North Carolina
Inventories of Fuel Burned
As of June 30, 2017

Fuel	Inventory Measure		Inventory Volume	Inventory Value
(1)	(2)		(3)	(4)
Coal [b]	Tons	Coal Rec	1,351,113	$ 98,138,922
Wood [b]	Tons	Wood & Jet Fuel Rec	85,436	2,337,444
Light Oil [a]	Gallons	Oil Rec	59,789,838	125,462,694
Heavy Oil [a]	Barrels	Oil Rec	1,740,351	79,450,303
Jet Fuel [a]	Gallons	Wood & Jet Fuel Rec	50,030	130,978
Natural Gas [a]	Dth	Power Gen. Summary	2,346,810	5,191,404
Nuclear Fuel Stock [b]	N/A			453,438,411
Total				$ 764,150,156

(a) Inventories are held by Virginia Power Services Energy Corp, Inc.
(b) Inventories are held by Virginia Electric & Power Company.

Dominion Energy North Carolina
Actual Fuel Related Revenues From Mitigation Plan
Twenty Four Months Ended December 2016

(1) Total June 30, 2014 Under Recovery Balance:	$ 16,602,670.00
(2) Rider B Revenue for 2015:	$ 8,104,716.37
(3) Rider B2 Revenue for 2016:	$ 8,116,418.46
(4) Total 2015 and 2016 Mitigation Revenues:	$ 16,221,134.83
(5) Under Recovery Balance 24 Months Ended December 31, 2016:	$ 381,535.17

DOMINION ENERGY NORTH CAROLINA
SUMMARY REPORT OF FUEL TRANSACTIONS WITH AFFILIATES
FOR THE PERIOD JULY 2016 - JUNE 2017
(IN THOUSANDS)

Dominion Energy North Carolina Receiving from Affiliate:

Docket No. E-22, Sub 546

VP Services Energy Corp., Inc.
Sale Of Natural Gas And Oil Inventory

Month	Amount
July-16	$77,771
August-16	$81,756
September-16	$46,986
October-16	$26,795
November-16	$57,574
December-16	$71,992
January-17	$98,301
February-17	$69,434
March-17	$73,402
April-17	$39,223
May-17	$49,278
June-17	$70,209

DOMINION ENERGY NORTH CAROLINA
SUMMARY REPORT OF FUEL TRANSACTIONS WITH AFFILIATES
FOR THE PERIOD JULY 2016 - JUNE 2017

Dominion Energy Fuel Services, Inc. and Virginia Power Services Energy Corp., Inc.
Natural Gas Transaction Summary
Docket No. E-22, Sub 546

	Volume			Dollars			WACOG		
	Purchase	Sale	Difference	Purchase	Sale	Difference	Purchase	Sale	Difference
Jul-16	28,172,839	28,180,266	(7,427)	$ 64,920,146.54	$ 64,934,955.31	$ (14,808.77)	$ 2.304	$ 2.304	0.000
Aug-16	28,460,675	28,460,614	61	$ 62,138,106.02	$ 62,137,648.05	$ 457.97	$ 2.183	$ 2.183	0.000
Sep-16	22,056,751	22,058,557	(1,806)	$ 47,797,363.45	$ 47,799,157.27	$ (1,793.82)	$ 2.167	$ 2.167	0.000
Oct-16	21,795,037	21,798,401	(3,364)	$ 43,652,320.14	$ 43,655,967.87	$ (3,647.73)	$ 2.003	$ 2.003	0.000
Nov-16	17,347,304	17,350,385	(3,081)	$ 49,116,948.08	$ 49,125,652.73	$ (8,704.65)	$ 2.831	$ 2.831	0.000
Dec-16	18,140,048	18,148,048	(8,000)	$ 69,681,576.61	$ 69,681,501.91	$ 74.70	$ 3.841	$ 3.840	0.002
Jan-17	19,127,239	19,128,516	(1,277)	$ 87,537,131.91	$ 87,543,984.90	$ (6,852.99)	$ 4.577	$ 4.577	(0.000)
Feb-17	17,922,150	17,922,150	-	$ 64,925,643.23	$ 64,925,643.23	$ -	$ 3.623	$ 3.623	0.000
Mar-17	20,086,822	20,086,875	(53)	$ 64,106,232.10	$ 64,106,387.85	$ (155.75)	$ 3.191	$ 3.191	0.000
Apr-17	16,502,693	16,501,632	1,061	$ 45,921,954.28	$ 45,919,625.23	$ 2,329.05	$ 2.783	$ 2.783	(0.000)
May-17	16,846,266	16,847,390	(1,124)	$ 46,812,846.74	$ 46,816,084.85	$ (3,238.11)	$ 2.779	$ 2.779	(0.000)
Jun-17	23,099,456	23,101,401	(1,945)	$ 60,339,750.57	$ 60,344,604.87	$ (4,854.30)	$ 2.612	$ 2.612	0.000
Total	249,557,280	249,584,235	(26,955)	$ 706,950,019.67	$ 706,991,214.07	$(41,194.40)			

DOMINION ENERGY NORTH CAROLINA
SUMMARY REPORT OF FUEL TRANSACTIONS WITH AFFILIATES
FOR THE PERIOD JULY 2016 - JUNE 2017

Dominion Energy North Carolina Receiving and Providing to Dominion Energy Fuel Services, Inc.: Docket No. E-22, Sub 546

July 2016 - June 2017 Contracted Affiliated Fuel Transactions

There were no affiliate transactions of Fuel from July 2016 through June 2017.

I/A

E-22, Sub 546
DOMINION ENERGY NORTH CAROLINA
EQUIVALENT AVAILABILITY FACTORS (%)
NUCLEAR AND LARGE COAL UNITS

Company Exhibit BEP-1
Schedule 1

July 2016-June 2017

	Nuclear Units				Large Coal Units					
	North Anna		Surry		Mt. Storm			Chesterfield		VaCity
	Unit 1	Unit 2	Unit 1	Unit 2	Unit 1	Unit 2	Unit 3	Unit 5	Unit 6	Unit 1
Jul-16	99.0%	96.9%	100.0%	100.0%	98.3%	90.7%	97.1%	84.6%	87.3%	85.2%
Aug-16	99.2%	87.5%	100.0%	100.0%	93.1%	97.2%	95.8%	58.3%	86.4%	100.0%
Sep-16	31.9%	100.0%	100.0%	100.0%	35.8%	95.0%	74.7%	57.4%	88.5%	99.7%
Oct-16	45.9%	100.0%	67.6%	86.5%	23.5%	0.1%	96.0%	93.8%	64.2%	16.1%
Nov-16	100.0%	100.0%	62.7%	100.0%	94.0%	73.8%	39.8%	97.1%	51.2%	39.6%
Dec-16	100.0%	100.0%	96.5%	100.0%	94.6%	99.9%	98.6%	91.6%	98.7%	100.0%
Jan-17	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	99.9%	99.3%	98.4%	100.0%
Feb-17	100.0%	93.7%	100.0%	100.0%	69.2%	72.5%	99.9%	83.2%	84.2%	68.7%
Mar-17	100.0%	100.0%	99.9%	100.0%	0.0%	100.0%	90.5%	90.2%	41.1%	84.9%
Apr-17	100.0%	100.0%	100.0%	98.7%	18.9%	46.7%	15.0%	98.8%	0.0%	74.2%
May-17	100.0%	100.0%	100.0%	15.0%	96.5%	39.1%	43.4%	22.3%	38.3%	97.9%
Jun-17	100.0%	100.0%	100.0%	86.8%	86.7%	98.0%	74.6%	81.5%	85.0%	86.1%
12-Month Average	89.7%	98.2%	93.9%	90.5%	67.5%	76.1%	77.1%	79.8%	68.6%	79.4%

E-22, Sub 546
DOMINION ENERGY NORTH CAROLINA
NET CAPACITY FACTORS (%) NUCLEAR
AND LARGE COAL UNITS

Company Exhibit BEP-1
Schedule 2

July 2016-June 2017

	Nuclear Units				Large Coal Units					
	North Anna		Surry		Mt. Storm			Chesterfield		VaCity
	Unit 1	Unit 2	Unit 1	Unit 2	Unit 1	Unit 2	Unit 3	Unit 5	Unit 6	Unit 1
Jul-16	100.1%	95.8%	100.3%	100.5%	88.4%	81.9%	93.5%	70.2%	76.3%	78.4%
Aug-16	99.5%	88.1%	100.2%	100.1%	82.6%	84.4%	88.0%	52.0%	72.5%	86.1%
Sep-16	31.9%	101.3%	101.6%	101.8%	29.2%	77.7%	66.3%	47.3%	71.9%	83.2%
Oct-16	44.6%	102.9%	68.8%	89.4%	17.8%	0.0%	86.5%	80.3%	49.6%	13.3%
Nov-16	103.3%	103.6%	65.5%	104.3%	57.3%	42.7%	12.3%	45.3%	36.8%	31.5%
Dec-16	103.1%	103.5%	100.8%	104.7%	66.3%	78.2%	39.5%	64.0%	83.3%	90.8%
Jan-17	103.5%	103.8%	104.7%	104.8%	74.9%	75.3%	71.0%	69.5%	76.6%	87.0%
Feb-17	103.4%	96.9%	104.4%	104.2%	43.4%	43.8%	45.3%	41.3%	9.2%	56.6%
Mar-17	103.7%	103.8%	104.1%	104.2%	0.0%	80.6%	63.3%	54.6%	29.1%	77.2%
Apr-17	103.0%	103.5%	103.6%	102.0%	13.7%	38.6%	11.3%	82.1%	0.0%	65.4%
May-17	102.4%	102.8%	103.2%	14.5%	78.5%	33.6%	35.7%	13.8%	26.4%	82.4%
Jun-17	101.0%	101.4%	101.9%	88.0%	69.0%	75.9%	46.0%	57.2%	52.7%	72.3%
12-Month Average	91.6%	100.6%	96.6%	93.1%	51.8%	59.4%	54.9%	56.5%	48.7%	68.7%

E-22, Sub 546

Company Exhibit BEP-1
Schedule 3

DOMINION ENERGY NORTH CAROLINA

SYSTEM ENERGY SUPPLY

Actual 12-Month Ended June 2017

	Generation (MWhs)	% of Energy Supply
Nuclear	27,998,627	33.0%
Coal	18,885,985	22.3%
Heavy Oil	186,787	0.2%
Wood and Natural Gas Steam	1,530,691	1.8%
Combined Cycle and Combustion Turbine	28,477,922	33.6%
Solar and Hydro - Conventional and Pumped Storage	3,155,211	3.7%
Net Power Transactions	7,176,726	8.5%
Less Energy for Pumping	(2,563,530)	-3.0%
Total System	84,848,419	100.0%
Nuclear, Coal and Net Power Transactions		97.3%

Normalized and Adjusted Energy and Fuel Expense based on Actual 12-Months Ended June 2017
(Company Ownership Only)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)		(12)
	12-Months Ended June 2017							June 2017				
	Expense ($)	Generation (MWh)	Rate ($/MWh)	Supply (%)	Ratio of Coal Oil, CT & CC NUG & Other MWH To Total Sum	Coal, Oil, CT & CC, NUG, Other, Nuclear Adj. and Growth MWh	Adjusted Generation (MWh)	Expense ($)	Generation (MWh)	Rate ($/MWh)		Normalized & Adjusted Fuel Expense at Applicable Rate (8) x (11)
Coal (1)	625,244,290	20,416,677	30.62	24.1	0.3367	62,190,984	20,939,580	53,442,322	1,738,005	30.62	(5)	641,169,940
Nuclear												
Surry	95,494,632	13,919,279	6.86	16.4			13,523,434	11,017,946	1,145,668			
North Anna	94,379,567	14,079,348	6.70	16.6			13,919,074	8,242,373	1,218,545			
Total Nuclear	189,874,199 (4)	27,998,627	6.78	33.0			27,442,508	19,260,318	2,364,213	6.78	(5)	186,060,207
Heavy Oil	16,556,016	186,787	88.64	0.2	0.0031	62,190,984	191,548	4,928,825	57,322	88.64	(5)	16,978,815
CC & CT (2)	725,870,216	28,477,922	25.49	33.6	0.4696	62,190,984	29,207,250	63,515,375	2,776,453	25.49	(5)	744,492,803
Hydro	0	3,106,119		3.7			3,106,119	0	416,138			0
Solar		49,093		0.1			49,093		11,250			
Power Transactions												
NUG Fuel (6)	103,196,186	5,556,931	18.57	6.5	0.0916	62,190,984	5,699,244	3,962,034	207,549	18.57	(5)	105,839,040
Doswell/Spruance contracts												16,183,650
PJM Purchases	131,759,401	5,999,710	21.96	7.1	0.0989	62,190,984	6,153,363	5,732,290	391,729	21.96	(7)	135,133,779
Adjustments												
Sales for Resale	(87,249,255)	(4,379,915)	19.92	-5.2			(4,379,915)	(2,155,799)	(99,277)			(87,249,255) (3)
Net	147,706,332	7,176,726	20.58	8.5			7,472,692	7,538,526	500,001			169,907,214
Pumping	0	(2,563,530)		-3.0			(2,563,530)	0	(333,831)			0
Energy Supply	1,705,251,054	84,848,419	20.10	100.0			85,796,167	148,685,366	7,529,552	20.50 at gen level		1,758,608,978

NOTE: ALL VALUES REFLECT COMPANY'S OWNERSHIP OF NORTH ANNA, CLOVER AND BATH COUNTY

(1) Coal includes wood and natural gas steam generation
(2) CC & CT includes jet oil, light oil and natural gas generation
(3) Fuel expense is equal to 12 months ended June 2017
(4) Nuclear expense excludes interim storage
(5) Fuel expense rate based on average cost for 12 month period ending Jun 2017
(6) NUG fuel includes expenses related to dispatchable NUGs at 85%(July-Dec) and 78% (Jan-Jun) for those units subject to the marketer percentage
(7) Purchases include at 85% (July-Dec) and 78% (Jan-Jun) of the fuel expense and the impact of the FTRs.

Public Staff Dominion Petrale Cross Examination Exhibit 2
I/A

Rule R8-55(e)(11)

NORMALIZATION OF NUCLEAR GENERATION BASED ON EXPECTED NET CAPACITY FACTORS FOR RATE YEAR
COMPANY OWNERSHIP ONLY

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Unit	Actual Net Capacity Factor for 12 Months Ended June 2016	Expected Net Capacity Factor for 12 Months Ended Dec '17	MDC	Normalized Generation MDC x CF x 8760 Hrs. in Period (3) x (4) x8760	Va. Power North Anna Portion (88.4%) NA (5) x 0.884	Va. Power Expected Nuc. Gen. (5)Surry, (6)NA	Va. Power Actual Nuc. Gen. 12 mos. Ended 6/14	Increase (Decrease) in Nuclear (7) - (8)
North Anna 1	102.2%	90.7%	948	7,533,738	6,659,824	6,659,824		
North Anna 2	91.9%	99.7%	944	8,241,032	7,285,072	7,285,072		
Total North Anna					13,944,896	13,944,896	14,256,845	
Surry 1	89.4%	94.0%	838	6,899,685		6,899,685		
Surry 2	83.8%	94.3%	838	6,918,831		6,918,831		
Total Surry						13,818,516	12,755,185	
Grand Total				29,593,285		27,763,412	27,012,030	**751,382**

Public Staff Dominion Petrie Cross Examination Exhibit 1 FLA

Rule R8-55(e)(11)
Schedule 1

NORMALIZATION OF NUCLEAR GENERATION BASED ON EXPECTED NET CAPACITY FACTORS FOR RATE YEAR
COMPANY OWNERSHIP ONLY

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Unit	Actual Net Capacity Factor for 12 Months Ended June 2015	Expected Net Capacity Factor for 12 Months Ended Dec '16	MDC	Normalized Generation MDC x CF x 8760 Hrs. in Period (3) x (4) x8760	Va. Power North Anna Portion (88.4%) NA (5) x 0.884	Va. Power Expected Nuc. Gen. (5)Surry, (6)NA	Va. Power Actual Nuc. Gen. 12 mos. Ended 6/15	Increase (Decrease) in Nuclear (7) - (8)
North Anna 1	91.5%	90.5%	948	7,534,537	6,660,531	6,660,531		
North Anna 2	92.5%	92.2%	944	7,648,706	6,761,456	6,761,456		
Total North Anna					13,421,987	13,421,987	13,470,266	
Surry 1	91.0%	94.0%	838	6,921,136		6,921,136		
Surry 2	102.0%	100.2%	838	7,373,896		7,373,896		
Total Surry						14,295,032	14,169,568	
Grand Total				29,478,275		27,717,019	27,639,833	**77,186**

I/A

Johnson Exhibit 1
Schedule 1

DOMINON NORTH CAROLINA POWER
Docket E-22 Sub 546
North Carolina Annual Fuel Expenses
PUBLIC STAFF CALCULATION OF EXPERIENCE MODIFICATION FACTOR - COMPOSITE NC RETAIL
Test Period Ended June 30, 2017

Line No.	Month	Fuel Cost Incurred 1/ $ (a)	Composite Fuel Cost Billed ¢/kwh 2/ (b)	kwh Sales 1/ (c)	Fuel Cost Collections $ 1/ (d)	Reported Over (Under) Recovery 3/ (e)	Company Corrections & Adjustments (f)	Company Adjusted Over(Under) Recovery 4/ (g)	Public Staff Adjustments 5/ (h)	Public Staff Adjusted Over(Under) Recovery 6/ (i)
1	July-16	$10,015,628	0.02276	474,717,000	10,804,860	$ 789,232		$ 789,232		$ 789,232
2	August-16	$8,328,957	0.02286	398,475,000	9,110,917	781,960		781,960	113,645	895,605
3	September-16	$6,863,396	0.02280	369,396,000	8,420,540	1,557,144		1,557,144		1,557,144
4	October-16	$5,876,954	0.02277	319,406,000	7,273,833	1,396,880		1,396,880	118,829	1,515,709
5	November-16	$6,815,017	0.02054	354,666,000	7,284,589	469,573		469,573		469,573
6	December-16	$7,913,616	0.02077	351,298,595	7,296,790	(616,826)		(616,826)		(616,826)
7	January-17	$9,240,350	0.02073	366,934,000	7,606,257	(1,634,093)		(1,634,093)		(1,634,093)
8	February-17	$5,435,081	0.02076	282,106,849	5,856,661	421,580		421,580		421,580
9	March-17	$6,532,762	0.02067	334,240,033	6,908,387	375,625		375,625		375,625
10	April-17	$5,487,005	0.02070	310,358,780	6,424,753	937,748		937,748		937,748
11	May-17	$6,762,869	0.02068	332,014,449	6,865,193	102,324		102,324		102,324
12	June-17	$7,740,391	0.02070	381,680,695	7,899,201	158,810		158,810		158,810
13	Prior period outage adjustment	$0		-	-	-		-	1,575,422	1,575,422
14	Total Test Period	$ 87,012,024		4,275,293,401	$ 91,751,981	$ 4,739,957	$ -	$ 4,739,957	1,807,896	$ 6,547,853

15	Company Overcollection	$ 6,547,853
16	Normalized Test Period KWH Sales	4,299,466,351
17	Experience Modification Increment (Decrement) cents/KWh	(0.00152)
18	Annual Interest Rate	10.00000%
19	Monthly Interest Rate	0.8333%
20	Number of Months; mid-point of collection period to mid-point of billing period	18
21	Interest	$ 982,178
22	EMF Interest Increment (Decrement)	(0.00023)
23	Total over-recovery (L14+L20)	$ 7,530,031
24	Total EMF Rate (Decrement) (L16+L21)	(0.00175)
25	NCUC Regulatory Fee Factor	1.00140
26	Total EMF Rate (Decrement), including Regulatory Fee	(0.00175)

1/ Monthly Fuel Report, Schedule 4.
2/ Column (d) / Column (c)
3/ Column (d) - Column (a)
4/ Column (e) - Column (f)
5/ Section 4 of Public Saff witness Metz's testimony
6/ Column (g) + Column (h)

I/A

Johnson Exhibit 1
Schedule 2

DOMINON NORTH CAROLINA POWER
Docket No. E-22 Sub 546
North Carolina Annual Fuel Expenses
Proposed nuclear Capacity of 93.54%
CALCULATION OF FUEL COST RIDER B BY CUSTOMER CLASS
Test Period Ended June 30, 2017
Billing Period January 1, 2018 - December 31, 2018

EMF RATES INCLUDING NCUC REGULATORY FEE

Line No.	Customer Class	Adjusted NC Retail kwh Sales	Total EMF Rate Including System Fuel Factor	Fuel Revenue Uniform Rate	Class Expansion Factor	Class kwh @ Generation Level	Jurisdictional Voltage Differentiated EMF Rate @ Sales Level (Rider B)
		A	B	C	D	E	E
			Johnson Ex 1, Sch 1	C= A x B	Ex JDM-1, Sch 4, p 2	C= A x D	Uniform rate X D
1	Residential	1,601,013,554	(0.00175)	(28,057)	1.05204180	1,684,333,181	(0.00177)
2	SGS & PA	817,305,119	(0.00175)	(14,323)	1.05087924	858,888,982	(0.00177)
3	LGS	710,913,646	(0.00175)	(12,458)	1.04236129	741,028,865	(0.00175)
4	Schedule NS	880,048,860	(0.00175)	(15,422)	1.01138685	890,069,844	(0.00170)
5	6VP	264,735,757	(0.00175)	(4,639)	1.02593554	271,601,822	(0.00172)
6	Outdoor Lighting	17,207,930	(0.00175)	(302)	1.05204180	18,103,462	(0.00177)
7	Traffic	8,241,485	(0.00175)	(144)	1.05204180	8,670,387	(0.00177)
8	NC Retail	4,299,466,351		(75,346)		4,472,696,545	
					Jurisdictional Uniform Rate @ Generation Level		(0.00168)

Exhibit 4: Proposed Fuel and Fuel-Related Cost Factors in cents per kWh effective January 1, 2018 (includes regulatory fee, which currently has a multiplier of 1.0014)

Rate Class	Base	Rider A	Rider B[169]	Rider B2	Total
Residential	$0.02095	$0.00006	($0.00177)	$0.00009	$0.01933
Small General Service & Public Authority	$0.02093	$0.00006	($0.00177)	$0.00009	$0.01931
LGS (Large General Service)	$0.02079	$0.00003	($0.00175)	$0.00009	$0.01916
Schedule NS (Nucor Steel)	$0.02014	$0.00006	($0.00170)	$0.00009	$0.01859
6VP (LGS – Variable Pricing)	$0.02043	$0.00006	($0.00172)	$0.00009	$0.01886
Outdoor Lighting	$0.02095	$0.00006	($0.00177)	$0.00009	$0.01933
Traffic Control	$0.02095	$0.00006	($0.00177)	$0.00009	$0.01933

[169] My Rider B calculations reflect the application of the voltage differentiation factors used by the Company in its Application, which the Public Staff accepts.

Metz Exhibit No. 4S
Schedule 1

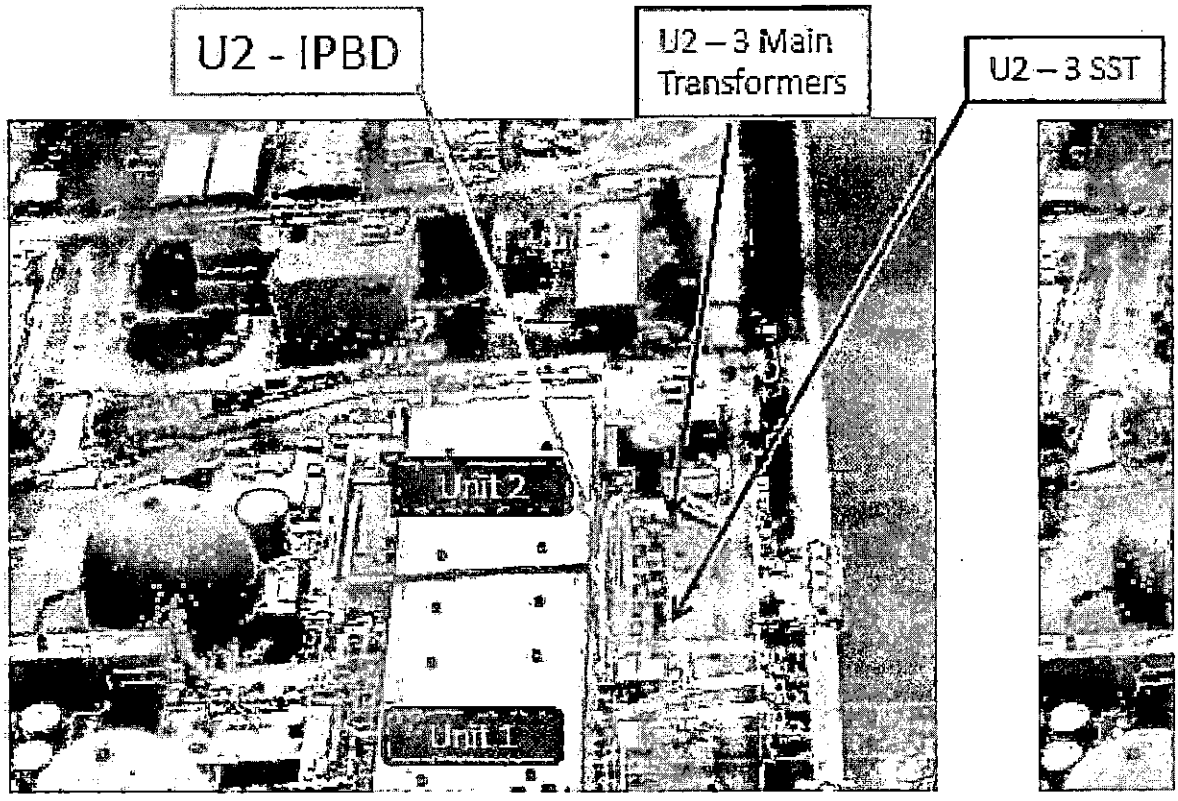
DOMINION NORTH CAROLINA POWER
Docket No. E-22 Sub 546
North Carolina Annual Fuel Expenses
Proposed Nuclear Capacity Factor of 93.54%
CALCULATION OF FUEL COST RIDER B BY CUSTOMER CLASS
Test Period Ended June 30, 2017
Billing Period January 1, 2019 - December 31, 2019

EMF RATES INCLUDE NCUC REGULATORY FEE

Line No.	Customer Class	Adjusted NC Retail kwh Sales	Total EMF Rate including System Fuel Factor	Fuel Revenue Uniform Rate	Class Expansion Factor	Class kwh @ Generation Level	Jurisdictional Voltage Differentiated EMF Rate @ Sales Level (Rider B)
		A	B	C	D	E	E
			Johnson Ex 1, Sch 1	C= A x B	Ex JDM-4, Sch 4, p 2	C= A x D	Uniform rate X D
1	Residential	1,601,013,554	(0.00175)	(28,057)	1.05204180	1,684,333,181	(0.00177)
2	GSD & PA	917,305,119	(0.00175)	(14,333)	1.05907824	969,039,992	(0.00177)
3	LGS	710,013,645	(0.00175)	(12,458)	1.04236120	741,028,665	(0.00175)
4	Schedule NS	880,088,860	(0.00175)	(15,422)	1.01136685	890,069,844	(0.00170)
5	SVP	264,735,757	(0.00173)	(4,639)	1.02393554	271,681,622	(0.00172)
6	Outdoor Lighting	17,207,938	(0.00175)	(302)	1.05204180	18,103,462	(0.00177)
7	Traffic	8,241,485	(0.00175)	(144)	1.05204180	8,670,387	(0.00177)
8	NC Retail	4,299,466,331		(75,346)		4,372,696,345	

Jurisdictional Uniform Rate @ Generation Level (0.00168)

Exhibit 7: IPDB and SST Location



Petrie Rebuttal Exhibit 1 I/A
Dominion Energy North Carolina
Docket No. E-22, Sub 546

NORTH CAROLINA
PUBLIC STAFF
UTILITIES COMMISSION

November 4, 2013

Ms. Gail L. Mount, Chief Clerk
North Carolina Utilities Commission
4325 Mail Service Center
Raleigh, North Carolina 27699-4325

Re: Docket No. E-22, Sub 502

Dear Ms. Mount:

In connection with the above-captioned docket, I transmit herewith for filing on behalf of the Public Staff twenty-one (21) copies of the following:

1. Testimony of Kennie D. Ellis, Electric Engineer, Electric Division; and the

2. Notice of Affidavit and Affidavit of Sonja R. Johnson, Staff Accountant, Electric Section, Accounting Division.

By copy of this letter, I am forwarding a copy of the above to all parties of record.

Sincerely yours,

Antoinette R. Wike

Antoinette R. Wike
Chief Counsel
antoinette.wike@psncuc.nc.gov

ARW/bll
Enclosures
c: Parties of Record

Executive Director	Communications	Economic Research	Legal	Transportation
733-2435	733-2810	733-2902	733-6110	733-7766
Accounting	**Consumer Services**	**Electric**	**Natural Gas**	**Water**
733-4279	733-9277	733-2267	733-4326	733-5610

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STATE OF NORTH CAROLINA
UTILITIES COMMISSION
RALEIGH

DOCKET NO. E-22, SUB 502

TESTIMONY OF KENNIE D. ELLIS ON BEHALF OF THE PUBLIC STAFF

November 4, 2013

Q. PLEASE STATE YOUR NAME AND ADDRESS FOR THE RECORD.

A. My name is Kennie D. Ellis. My business address is 430 North Salisbury Street, Raleigh, North Carolina.

Q WHAT IS YOUR POSITION WITH THE PUBLIC STAFF?

A. I am an engineer in the Electric Division of the Public Staff.

Q. WOULD YOU BRIEFLY DISCUSS YOUR EDUCATION AND EXPERIENCE?

A. Yes. My education and experience are outlined in Appendix A of my testimony.

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY IN THIS PROCEEDING?

A. The purpose of my testimony is to present the results of the Public Staff's investigation of the application filed by Virginia Electric & Power Company d/b/a Dominion North Carolina Power (DNCP or

the Company) in this docket on August 29, 2013, in the areas of power plant performance and fuel and fuel-related costs

Q. PLEASE DESCRIBE THE SCOPE OF THE PUBLIC STAFF'S INVESTIGATION.

A. The investigation included a review of following: (1) the Company's application, testimony, and voluminous responses to Public Staff data requests; (2) the performance of the Company's base load power plants, including the Company's fleet of nuclear facilities during the test year; (3) Company reports and Nuclear Regulatory Commission (NRC) documents; (4) the Company's purchased power transactions; (5) the cost of renewables and associated fuel prices; (6) the Company's coal, natural gas, nuclear, and reagent procurement practices and contracts; (7) the current state of coal, natural gas, nuclear fuel, and reagent markets; and (8) the Company's test period and projected fuel and fuel-related costs. I also had multiple discussions with Company personnel concerning the performance of its nuclear and fossil facilities.

Q. WHAT WAS THE FOCUS OF THE INVESTIGATION RELATING TO THE PERFORMANCE OF THE COMPANY'S NUCLEAR FLEET?

A. Under G.S. 62-133.2(d), the burden of proof as to the correctness and reasonableness of the charge and as to whether the cost of fuel

and fuel-related costs were reasonably and prudently incurred is on the utility, and the Commission is required to allow the Company to recover only that portion of fuel costs prudently incurred under efficient management and economic operations.

Commission Rule R8-55(k), which was adopted pursuant to G.S. 62-133.2(d1), provides that for purposes of determining the experience modification factor (EMF), a utility must achieve either (a) an actual system-wide nuclear capacity factor in the test year that is at least equal to the national average capacity factor for nuclear production facilities based on the most recent 5-year period available as reflected in the most recent North American Electric Reliability Corporation's (NERC) Generating Availability Report, appropriately weighted for size and type of plant, or (b) an average system-wide nuclear capacity factor, based upon a two-year simple average of the system-wide capacity factors actually experienced in the test year and the preceding year, that is at least equal to the national average capacity factor for nuclear production facilities based on the most recent 5-year period available as reflected in the most recent NERC Generating Availability Report, appropriately weighted for size and type of plant. If a utility does not achieve either standard, a rebuttable presumption is created that the utility incurred the

increased cost of fuel and fuel-related costs imprudently, and a disallowance of the increased costs is appropriate.

As stated by Company witness Petrie on page 3 of his direct testimony, the most recent NERC five-year average weighted for size and type of reactor in DNCP's nuclear generation system was 88.71%. Since the Company's nuclear generation system achieved an overall actual capacity factor of 95.6% during the test period, no presumption of imprudence or disallowance of increased fuel costs was created under Rule R8-55(k). However, the Company still has the burden of proving that its cost of fuel and fuel-related costs were reasonable and prudently incurred and of rebutting any evidence offered to the contrary.

In this case, the Company's proposed EMF includes increased fuel and fuel-related costs resulting from the purchase of replacement power during four North Anna Unit 2 forced outages, two in October of 2012 and two in May of 2013. Therefore, the Public Staff Electric Division undertook to investigate the events surrounding these outages in order to determine what caused the outages and whether the additional fuel costs were reasonable and prudently incurred.

Q. PLEASE DESCRIBE THE RESULTS OF YOUR INVESTIGATION INTO THE OUTAGES.

A. The Public Staff's investigation of the North Anna Unit 2 outages revealed the following information.

October 2012 North Anna 2 Outages

On October 8, 2012, North Anna Unit 2 was operating at full power when a degraded trend in seal leak-off flow necessitated that the unit be removed from service. Investigation by DNCP during the outage indicated that the seal failure was related to the deposition of particles on the seal face. Degradation of the seal surface based on particle deposition is common in the industry and is currently being addressed by the installation of small particle filter assemblies or modifications to seal designs that are less susceptible to performance degradation based on particle deposition. The total outage time was less than two days.

On October 24, 2012, North Anna Unit 2 again tripped, this time due to a low water level in the "C" steam generator that was caused by a circuit card failure in the steam generator level governor control system. The Company replaced the card and returned the unit to service. The total outage time was less than two days.

May 2013 North Anna 2 Outages

On May 10, 2013, during the start up following a scheduled refueling outage, North Anna Unit 2 was operating at 60% power when two indications necessitated tripping the reactor: (1) excessive exciter bearing vibration on the #9 exciter bearing and (2) the observation of luminous discharge on the Unit 2 exciter between the #9 bearing housing and the exciter fan. Upon inspection, significant damage to the bearing was evident. The total outage time was 12 days.

Turbine bearing work had been added to the scope of the just completed refueling outage to address higher than ideal vibration readings on the #9 bearing during the previous operating cycle. A contract for technical field assistance had been awarded to Siemens USA (Siemens), which manufactured the turbine and owns the design documents for the equipment. Inspection during the refueling outage failed to identify any damage or cause for the #9 bearing vibration, and the expectation had been that proper alignment and loading during the reassembly should address the vibration issue. However, there were some human performance problems involving Siemens during the reassembly which resulted in improper shimming of the frame feet and thus some delay. In addition, an undocumented modification of the housing (shim) was discovered. Company management expressed dissatisfaction with Siemens'

technical performance, and this dispute ultimately led to replacement of the Siemens engineer in charge of the reassembly.

DNCP's investigation identified the direct cause of the bearing was a combination of the alignment dowel causing a ground on the #9 pedestal which allowed electrical erosion to remove material from the bearing surface causing a hydraulic rub on the #9 bearing and improper bearing loading caused by the misalignment of the #9 bearing pedestal. The root cause of the event was identified as over reliance on, and inadequate challenging of, the turbine vendor. Corrective actions included benchmarking the fleet and the industry to determine any additional training requirements necessary to bring in-house knowledge to the desired level.

On May 28, 2013 North Anna Unit 2 was operating at full power when a manual trip was initiated in response to a secondary feed water transient caused by inadvertent closure of a discharge isolation valve of one of the running main feed water pumps. This valve closure was reported by DNCP to have been due to debris, hardening of grease and/or linkage misalignment, and binding related to the upper cell and truck operated cell switches of the controlling breaker. This situation was corrected and the plant was returned to service. The total outage time was less than two days.

Q. WHAT CONCLUSIONS DID THE PUBLIC STAFF REACH ABOUT THESE OUTAGES?

A. Based on its review of the causes and events surrounding the October 2012 North Anna 2 outages and the North Anna 2 outage that began on May 28, 2013, the Public Staff does not believe these outages may have been prevented by DNCP under efficient management. However, the Public Staff's review of the causes and events surrounding the North Anna Unit 2 forced outage on May 10, 2013, caused the Public Staff greater concern. The Public Staff acknowledges that the Company made efforts to mitigate the effects of the delays caused by Siemens' performance and that recovery plans for the project were developed in conjunction with Siemens. The Public Staff also recognizes that the company is limited on the technical resources that can be maintained "in-house" and that the vendor selected for this task would be expected to be the most proficient at the task and have the highest level of expertise. However, the Public Staff believes that DNCP is ultimately responsible for the performance of all personnel involved in performing work related to outages at its generating plants, including contracted vendors tasked with specific projects.

For these reasons, the Public Staff believes that the increased costs of fuel for replacement power during the outage days in question

were attributable, at least in part, to events that may have been prevented by DNCP under efficient management and oversight of Siemens' performance. In order that ratepayers not be charged higher rates due to the increased cost of fuel related to replacement power during the outage, the Public Staff recommends an adjustment to DNCP's test period fuel and fuel-related costs in the amount of $171,833.

Q. WHAT ARE THE PUBLIC STAFF'S CONCLUSIONS REGARDING THE COMPANY'S PROJECTED FUEL COSTS?

A. Based upon its investigation, the Public Staff has determined that the projected fuel prices set forth in the application were calculated appropriately for this proceeding. The projected cost for fuel and fuel-related costs was affected by a small projected increase over the next year in the price of natural gas as evidenced by the Henry Hub projected prices. In addition, nuclear fuel costs also increased from the test year. DEC's projected fuel and fuel-related costs are based on a 95.35% nuclear capacity factor, which is what DNCP anticipates for the twelve months from January 1, 2014, through December 31, 2014, the period the new rates will be in effect.

Q. DID THE PUBLIC STAFF REVIEW THE CALCULATIONS OF THE VARIOUS FUEL FACTOR COMPONENTS?

A. Yes. The prospective components of the total fuel factor have been calculated in accordance with the requirements of G.S. 62-133.2. The Public Staff has reviewed the calculations of the various fuel factor components and agrees with them.

Q. DID THE PUBLIC STAFF REVIEW THE EMF CALCULATIONS?

A. Yes. Public Staff witness Johnson has reviewed the calculation of DNCP's revenue overcollection of $706,369 and agrees with it. An adjustment of $171,833 was taken to remove the disallowed fuel cost associated with the May 10, 2013 North Anna Unit 2 forced outage. Public Staff Witness Johnson also has reviewed the 2% cap calculation pursuant to G.S. § 62-133.2 and also agrees with that calculation. This review is documented in her affidavit. This overcollection amount results in an EMF decrement of 0.021 ¢/kWh, excluding gross receipts tax and regulatory fee (GRT), and 0.022 ¢/kWh, including GRT for the North Carolina retail jurisdiction.

Q. WHAT IS THE PUBLIC STAFF'S RECOMMENDATION?

A. The Public Staff recommends approval of the following components and total fuel factors (excluding GRT) documented in Table 4 effective for the twelve months beginning December 1, 2013:

TABLE 1 – Base Fuel Rates (as approved in E-22, Sub 479)

Customer Class	Base (w/GRT)	Base (w/o GRT)
Residential	2.537 ¢/kWh	2.455 ¢/kWh
SGS & PA	2.536 ¢/kWh	2.454 ¢/kWh
LGS	2.513 ¢/kWh	2.432 ¢/kWh
NS	2.439 ¢/kWh	2.360 ¢/kWh
6VP	2.485 ¢/kWh	2.405 ¢/kWh
Outdoor Lighting	2.537 ¢/kWh	2.455 ¢/kWh
Traffic	2.537 ¢/kWh	2.455 ¢/kWh

TABLE 2 – Proposed Adjustment to Base Fuel Rates (Rider A)
(as proposed by Company Witness Anderson)

Customer Class	Prospective (w/GRT)	Prospective (w/o GRT)
Residential	0.044 ¢/kWh	0.043 ¢/kWh
SGS & PA	0.043 ¢/kWh	0.042 ¢/kWh
LGS	0.047 ¢/kWh	0.045 ¢/kWh
NS	0.042 ¢/kWh	0.041 ¢/kWh
6VP	0.043 ¢/kWh	0.042 ¢/kWh
Outdoor Lighting	0.044 ¢/kWh	0.043 ¢/kWh
Traffic	0.044 ¢/kWh	0.043 ¢/kWh

TABLE 3 – Proposed EMF Rates
(as recommended by Public Staff Witness Johnson)

Customer Class	EMF (w/GRT)	EMF (w/o GRT)
Residential	(0.022) ¢/kWh	(0.021) ¢/kWh
SGS & PA	(0.022) ¢/kWh	(0.021) ¢/kWh
LGS	(0.022) ¢/kWh	(0.021) ¢/kWh
NS	(0.021) ¢/kWh	(0.020) ¢/kWh
6VP	(0.022) ¢/kWh	(0.021) ¢/kWh
Outdoor Lighting	(0.022) ¢/kWh	(0.021) ¢/kWh
Traffic	(0.022) ¢/kWh	(0.021) ¢/kWh

TABLE 4 – Proposed Final Fuel Factors

Customer Class	Final Fuel Factors (w/GRT)	Final Fuel Factors (w/o GRT)
Residential	2.559 ¢/kWh	2.477 ¢/kWh
SGS & PA	2.557 ¢/kWh	2.475 ¢/kWh
LGS	2.538 ¢/kWh	2.456 ¢/kWh
NS	2.460 ¢/kWh	2.381 ¢/kWh
6VP	2.506 ¢/kWh	2.426 ¢/kWh
Outdoor Lighting	2.559 ¢/kWh	2.477 ¢/kWh
Traffic	2.559 ¢/kWh	2.477 ¢/kWh

In addition, for comparison with the previously approved rates, the Public Staff submits the following table (Table 2) to summarize the impact of the proposed changes including GRT.

Summary of Differences Sub 502 – Sub 485 (including GRT)

Rate Class	Prospective Component	EMF Component	Total Fuel Factor
Residential	0.044 ¢/kWh	0.070 ¢/kWh	0.114 ¢/kWh
SGS & PA	0.043 ¢/kWh	0.070 ¢/kWh	0.113 ¢/kWh
LGS	0.047 ¢/kWh	0.069 ¢/kWh	0.116 ¢/kWh
NS	0.042 ¢/kWh	0.067 ¢/kWh	0.109 ¢/kWh
6VP	0.043 ¢/kWh	0.068 ¢/kWh	0.111 ¢/kWh
Outdoor Lighting	0.044 ¢/kWh	0.070 ¢/kWh	0.114 ¢/kWh
Traffic	0.044 ¢/kWh	0.070 ¢/kWh	0.114 ¢/kWh

Q. DOES THIS COMPLETE YOUR TESTIMONY?

A. Yes, it does.

APPENDIX A

KENNIE D. ELLIS

I am a graduate of North Carolina State University with a Bachelor of Science Degree in Engineering with a concentration in nuclear power.

I began my employment with the Public Staff Electric Division in May of 2003. While with the Electric Division, my primary responsibilities have been fuel factor computation and inventory, generation adequacy, small power and utility generator Certificates of Public Convenience and Necessity, investigation of inquiries and complaints, and management of various tracking databases. I have also worked in the areas of rate analysis and design, revenue analysis and design, nuclear decommissioning, power plant performance, utility service rules and regulations, cost of service, analysis and review of conservation and load management programs, least-cost integrated resource planning, avoided cost, electromagnetic fields, electrical safety, customer growth analysis and validation, unbundling of service, review of wheeling and rates and depreciation analysis.

From October of 1984 until April of 2002, I was employed by Carolina Power & Light Company (Progress Energy Carolinas) primarily at the Shearon Harris Nuclear Power Plant in various capacities including Regulatory Specialist, Operating Experience Coordinator, Corrective Action Program Specialist, Pressure Test Engineer, and Health Physics Technician.

From 1978 until 1984, I was employed by the United States Navy in the Naval Nuclear Power Program. I was an instructor at the Navy's Nuclear Power Program S5G prototype providing instruction in the areas of Chemistry, Radiochemistry, Radiation Protection and Monitoring, Mechanical Systems, Mechanical Watchstanding, and Integrated Plant Operations. I also served aboard the SSBN-644 (USS Lewis & Clark) as Leading Engineering Laboratory Technician. I was qualified Engine Room Supervisor and all subordinate watchstations.

I have previously filed testimony before the Commission in new certificate applications for generating facilities, fuel proceedings, general rate cases, renewable energy portfolio standards recovery proceedings, and participated in several special investigations.

STATE OF NORTH CAROLINA
UTILITIES COMMISSION
RALEIGH

DOCKET NO. E-22, SUB 502

BEFORE THE NORTH CAROLINA UTILITIES COMMISSION

In the Matter of Application by Virginia Electric and Power Company, d/b/a Dominion North Carolina Power, Pursuant to G.S. 62-133.2 and Commission Rule R8-55 Regarding Fuel and Fuel-Related Costs Adjustments for Electric Utilities	NOTICE OF AFFIDAVIT

NOW COMES THE PUBLIC STAFF – North Carolina Utilities Commission, by and through its Executive Director, Christopher J. Ayers, as constituted by G.S. 62-15, and gives notice that the Affidavit of:

Sonja R. Johnson, Staff Accountant, Electric Section, Accounting Division
Public Staff – North Carolina Utilities Commission
430 North Salisbury Street – Dobbs Building
4326 Mail Service Center
Raleigh, North Carolina 27699-4326

will be used in evidence at the hearing in this docket scheduled for the 13th day of November, 2013, pursuant to G.S. 62-68. The affiant will not be called to testify orally and will not be subject to cross-examination unless an opposing party demands the right of cross-examination pursuant to G.S. 62-68.

WHEREFORE, the Public Staff moves that the Affidavit of Sonja R. Johnson be admitted into evidence in the absence of notice from any opposing party pursuant to G.S. 62-68.

Respectfully submitted this the 4th day November, 2013.

PUBLIC STAFF
Christopher J. Ayers
Executive Director

Antoinette R. Wike
Chief Counsel

430 North Salisbury Street
4326 Mail Service Center
Raleigh, North Carolina 27699-4326
Telephone: (919) 733-6110
Facsimile: (919) 733-9565
gisele.rankin@psncuc.nc.gov

CERTIFICATE OF SERVICE

I do hereby certify that I have this day served a copy of the foregoing NOTICE OF AFFIDAVIT on each of the parties of record in this proceeding or their respective attorneys of record by causing a copy of the same to be deposited in the United States Mail, postage prepaid, properly addressed to each, or by electronic delivery upon consent of the receiving party.

This the 4th day of November, 2013.

Antoinette R. Wike

DOCKET NO. E-22, SUB 502

BEFORE THE NORTH CAROLINA UTILITIES COMMISSION

In the Matter of Application by Virginia Electric and Power Company, d/b/a Dominion North Carolina Power Pursuant to G.S. 62-133.2 and Commission Rule R8-55 regarding Fuel and Fuel-Related Costs Adjustments for Electric Utilities	)	AFFIDAVIT OF SONJA R. JOHNSON

STATE OF NORTH CAROLINA

COUNTY OF WAKE

I, Sonja R. Johnson, first being duly sworn, do depose and say:

I am a Staff Accountant with the Accounting Division of the Public Staff - North Carolina Utilities Commission. A summary of my education and experience is attached to this affidavit as Appendix A.

The purpose of my affidavit is to present (1) the Public Staff's recommendation with respect to the appropriate fuel-to-energy percentage (marketer percentage) to be applied to the energy costs incurred by Virginia Electric and Power Company, d/b/a Dominion North Carolina Power (DNCP or the Company), for purchases of power for which actual fuel costs were not provided, and (2) the results of the Public Staff's investigation of the Experience Modification Factor (EMF) rider proposed by DNCP in this proceeding. The EMF rider is utilized to true up the recovery of fuel and fuel-related costs experienced during the test year (fuel revenues) to the actual amount of fuel and fuel-related

costs (fuel costs) incurred during the test year. DNCP's test year in this fuel proceeding is the twelve months ended June 30, 2013.

In its application filed on August 29, 2013, DNCP proposed an EMF decrement rider of 0.018 cents per kWh, including gross receipts tax (GRT), and 0.017 cents per kWh, excluding GRT. The proposed EMF decrement rider was based DNCP's asserted fuel cost overrecovery of $614,234. The Company then added an interest payment of $92,135 to the overrecovery balance. The overrecovery of $614,234 plus interest of $92,135, totaling $706,369, was then divided by DNCP's pro-forma North Carolina retail sales of 4,269,710,243 kWh to produce the EMF decrement rider.

The Public Staff's investigation of the EMF included procedures to evaluate whether the Company properly determined its per books fuel costs and fuel revenues during the test period. These procedures included review of the Company's filing, prior Commission Orders, the Monthly Fuel Reports filed by the Company with the Commission, and other Company data provided to the Public Staff. Additionally, the procedures included review of certain specific types of expenditures impacting the Company's test year fuel costs, including nuclear fuel disposal costs, payments to non-utility generators (NUGs), and payments for purchases of power from the markets administered by PJM Interconnection, LLC (PJM). The Public Staff's procedures also included a review of source documentation of fuel costs for certain selected Company generation resources. Finally, the Public Staff's investigation included the review of numerous responses to written and verbal data requests.

During the test year for this proceeding, DNCP purchased power through markets administered by PJM and from two dispatchable NUGs that did not provide DNCP with the actual fuel costs associated with the purchases. Because the Company does not have actual fuel costs for these purchases, a proxy marketer percentage was determined and applied to the total energy costs of the purchases. The use of a "proxy" for this purpose has been accepted by this Commission as reasonable in every fuel proceeding for which a proxy was necessary since 1997, when the Public Staff, Duke Energy Carolinas, LLC (DEC), Duke Energy Progress, Inc. (DEP), and DNCP agreed on a methodology to determine an appropriate marketer percentage to be used to apply to the total energy costs for suppliers that would not provide actual fuel costs (Marketer Percentage Methodology Agreement).

Because of the 2007 enactment of Senate Bill 3, which amended G.S. 62-133.2, the calculation of a marketer percentage is no longer necessary for DEC and DEP. However, it remains necessary for DNCP, due to the treatment of the Company's purchased power expense pursuant to G.S. 62-133.2(a3). The most current marketer percentage was approved by the Commission in the Order Granting General Rate Increase Approving Fuel Charge Adjustment, and Approving Stipulation and Supplemental Agreement (Order) issued in Docket No. E-22, Sub 479, which provides that 85% of the reasonable and prudent energy costs incurred during the fuel charge adjustment proceeding test period are to be recovered through DNCP's fuel factor and 15% of such energy costs are to be included in non-fuel base rates. The 85% marketer percentage is to remain in

effect until the sooner of DNCP's next general rate case or the fuel charge adjustment proceeding held in 2015 (with rates effective January 1, 2016). My review indicates that the Company applied the 85% marketer percentage in an appropriate manner in this proceeding.

As a result of its investigation, the Public Staff has found one item requiring adjustment in this proceeding. Specifically, as set forth in the testimony of Public Staff witness Ellis, the Public Staff is recommending an adjustment in the amount of $171,833 to test period fuel and fuel-related costs as a result of a forced outage in May 2013 at Unit 2 of the North Anna Nuclear Plant. This results in a fuel cost overrecovery of $786,067 and an associated interest amount of $117,910 (totaling $903,977), as shown on Johnson Exhibit I, attached to this affidavit. As also shown on Johnson Exhibit I, I have incorporated these amounts into the calculation of the EMF, resulting in an overall uniform EMF decrement of 0.021 cents per kWh (excluding GRT) and 0.022 (including GRT). I have then utilized the voltage differentiation methodology accepted by the Commission in prior cases to calculate voltage-differentiated EMFs by class. As shown on Johnson Exhibit II, the resulting voltage-differentiated EMFs by class are as follows:

Customer Class	EMF w/o GRT (cents per kWh)	EMF with GRT (cents per kWh)
Residential	0.021	0.022
SGS & PA	0.021	0.022
LGS	0.021	0.022
Schedule NS	0.020	0.021
6VP	0.021	0.022
Outdoor Lighting	0.021	0.022
Traffic	0.021	0.022

Based on the recommendation of Public Staff witness Ellis and the calculations set forth in Johnson Exhibits I and II, I recommend that the Commission approve an overall uniform EMF decrement rider of 0.021 cents per kWh, excluding GRT, and 0.022 cents per kWh, including GRT, as well as the voltage-differentiated EMFs set forth in the table above. I have provided these factors to Mr. Ellis for incorporation into his recommended total fuel factors.

I would also like to note that the Public Staff is still reviewing certain information related to test-year fuel costs. If this review results in any additional adjustments, the Public Staff will file additional information with the Commission prior to the hearing.

This completes my affidavit.

Sonja R. Johnson

Sworn to and subscribed before me
this the 4th day of November, 2013.

Laura D. Bradley
Notary Public

Laura D. Bradley
Typed or Printed Name of Notary Public

My Commission Expires: 8-28-2016

Laura D. Bradley
Notary Public
WAKE COUNTY
State Of North Carolina

APPENDIX A

SONJA R. JOHNSON

I am a graduate of North Carolina State University with a Bachelor of Science and Master of Science degree in Accounting. I was initially an employee of the Public Staff from December 2002 until May 2004, and rejoined the Public Staff in January 2006.

I am responsible for analyzing testimony, exhibits, and other data presented by parties before this Commission. I have the further responsibility of performing and supervising the examinations of books and records of utilities involved in proceedings before the Commission, and summarizing the results into testimony and exhibits for presentation to the Commission.

Since initially joining the Public Staff in December 2002, I have filed testimony or affidavits in several water and sewer general rate cases. I have also filed testimony in applications for certificates of public convenience and necessity to construct water and sewer systems and noncontiguous extension of existing systems. My experience also includes filing affidavits in several fuel rate cases of Duke Energy Carolinas, LLC.

While away from the Public Staff, I was employed by Clifton Gunderson, LLP. My duties included the performance of cost report audits of nursing homes, hospitals, federally qualified health centers, intermediate care facilities for the mentally retarded, residential treatment centers and home health agencies.

DOMINION NORTH CAROLINA POWER
DOCKET NO. E-22, SUB 502
CALCULATION OF EXPERIENCE MODIFICATION FACTOR (EMF)
TWELVE MONTHS ENDED JUNE 30, 2013

1	Test Year Overrecovery per Company	$ (614,234)	1/
2	Public Staff Adjustment to Test Year Overrecovery	(171,833)	2/
3	Test Year Overrecovery of Fuel Expense Per Public Staff (L1 + L2)	$ (786,067)	
4	Interest (L3 x 10% x 18 months)	(117,910)	3/
5	Total Overrecovery Including Interest (L3 + L4)	$ (903,977)	
6	NC Retail kWh Sales	4,269,710,243	4/
7	EMF excluding GRT (L5/L6)	$ (0.00021)	
8	EMF including GRT (L7 x 1.03327)	$ (0.00022)	

1/ Company Exhibit No. JCI-1, Schedule 2.
2/ Amount recommended by Public Staff witness Ellis, based on data provided by the Company.
3/ Interest at 10% per year for 18 months.
4/ Company Exhibit No. EJA-1, Schedule 3.

Johnson Exhibit II

DOMINION NORTH CAROLINA POWER
CALCULATION OF EXPERIENCE MODIFICATION FACTOR (EMF)
VOLTAGE DIFFERENTIATED RATES PER CUSTOMER CLASS
TWELVE MONTHS ENDED JUNE 30, 2013

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CUSTOMER CLASS	KWH SALES (A)	NC JURISDICTIONAL EMF W/GRT (B)	FUEL REVENUE UNIFORM EMF W/GRT (1) x (2)	CLASS EXPANSION FACTOR (A)	CLASS KWH @ GENERATION LEVEL (1) x (4)	UNIFORM EMF W/GRT @ GENERATION LEVEL (3a) / (5a)	VOLTAGE DIFFERENTIATED EMF W/GRT @ SALES LEVEL (4) x (6)	VOLTAGE DIFFERENTIATED EMF W/O GRT @ SALES LEVEL (7) / 1.03327 (C)
RESIDENTIAL	1,557,273,968	($0.00022)	($342,600)	1.05485096	1,642,691,941	($0.00021)	($0.00022)	($0.00021)
SGS & PA	854,929,587	($0.00022)	($188,085)	1.05387533	900,989,198	($0.00021)	($0.00022)	($0.00021)
LGS	549,035,008	($0.00022)	($120,788)	1.04624503	574,425,147	($0.00021)	($0.00022)	($0.00021)
SCHEDULE NS	881,855,000	($0.00022)	($194,008)	1.01398312	894,186,080	($0.00021)	($0.00021)	($0.00020)
6VP	401,720,500	($0.00022)	($88,379)	1.03290820	414,940,399	($0.00021)	($0.00022)	($0.00021)
OUTDOOR LIGHTING	24,352,591	($0.00022)	($5,358)	1.05485096	25,688,354	($0.00021)	($0.00022)	($0.00021)
TRAFFIC	543,589	($0.00022)	($120)	1.05485096	573,405	($0.00021)	($0.00022)	($0.00021)
TOTAL	4,269,710,243		($939,336) (3a)		4,453,494,524 (5a)			

(A) Company Exhibit No. EJA-1 Schedule 3, Page 2.
(B) Johnson Exhibit I, Line 8.
(C) Gross Receipts Tax Rate Factor = 1.03327 = [1/(1-.0322)].

Public Staff Stanley Cross Examination Exhibit 1

I/A

Nuclear Fleet

Dominion

Administrative Procedure

Title: Cause Evaluation

Procedure Number	Revision Number	Effective Date and Approvals On File
PI-AA-300	15	

North Anna Power Station Only: (Do not remove from Cover Page)

All revisions to this procedure, other than Administrative changes as defined in AD-AA-101, shall be reviewed by the North Anna 3 Project group prior to site approval. The purpose of this review is to determine if the proposed change will require other changes to North Anna 3 Project documents in order to remain in compliance with the Project QAPD, DOM-QA-2.

Revision Summary Revision 15

Administrative correction to delete reference to cancelled document ER-AA-SYS-1006 on Attachment 14, Equipment Reliability/PM Adequacy (733482(Jul 2017)), page 2 of 4

Revision Summary Revision 14

Revised Step 3.2.2, to change "biannually" to "biennially"-

(Training should be every two years, not twice per year).

Functional Area Manager: Manager Nuclear Organizational Effectiveness

INFORMATION USE

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1.0 PURPOSE

Provide programmatic requirements of Cause Evaluation Program and designate qualifications individuals must meet to perform the following:

- Root Cause Evaluations (RCEs)
- Apparent Cause Evaluations (ACEs)
- Equipment Apparent Cause Evaluations (E-ACEs)
- Quick Cause Evaluations (QCEs)

2.0 SCOPE

2.1 Describes and guides Cause Evaluation Program used at Dominion.

2.2 General directions are included for performing cause evaluations. Specific instructions for performing RCEs, ACEs, E-ACEs, QCEs, and preparing associated reports are contained in the following:

- PI-AA-300-3001, Root Cause Evaluation
- PI-AA-300-3002, Apparent Cause Evaluation
- PI-AA-300-3006, Equipment Apparent Cause Evaluation
- PI-AA-300-3005, Quick Cause Evaluation

3.0 INSTRUCTIONS

3.1 Root Cause Evaluation

Initiator

3.1.1 Initiation

INITIATE RCEs as required by the Corrective Action Program and in accordance with PI-AA-300-3001, Root Cause Evaluation.

3.1.2 Assignment of RCE Personnel

Director Nuclear Station Safety & Licensing

a. ASSIGN Responsible Manager and Lead RC Evaluator.

Responsible Manager

b. ENSURE appropriate resources and personnel dedicated to assigned RCE are made available.

RCE Manager

c. **ASSIGN** additional RCE team members:

1. **ENSURE** RCE team is comprised of the following individuals:
   - Individuals with different areas of expertise and knowledge of system/equipment.
   - Individuals should be independent of personnel directly involved with event or error.
   - Desirable to have at least one team member from department involved (RCE team comprised entirely of individuals from outside organization involved in event or error is not necessary).
   - Desirable to have at least one team member from Training Department.
2. **IF** objectivity or independence is a concern, **THEN CONSIDER** using respected independent party (non-Dominion) to conduct root cause evaluations.

NOTE: Organizational & Programmatic Advocates utilized for RCEs are designated by Station Management. Advocate may be assigned from any department and may fulfill collateral roles on RCE team (e.g., RCE Lead, Subject Matter Expert).

3. **ENSURE** RCE team includes Organizational & Programmatic Advocate assigned as integrated team member.

RCE Manager

4. **MAKE** RCE team member assignments within three working days of RCE assignment and **PRESENT** to Corrective Action Review Board (CARB) as part of problem statement.

d. **CONDUCT** pre-job brief defining investigation scope. Refer to ATTACHMENT 4.

3.1.3 Qualification of Team Members

a. Lead RC Evaluator

ENSURE Lead RC Evaluator is qualified in accordance with the following:

- Lead RC Evaluator must be qualified in accordance with following:
  - Successfully completing requirements of Form 730550 (ATTACHMENT 1)
  - Qualification shall be ensured by assigned Responsible Supervisor
- After initial qualification, Lead RC Evaluator must complete Cause Evaluation Continuing Training annually to retain qualification.
  - Cause Evaluation Continuing Training should emphasize significant Operating Experience, changes in cause evaluation process related to RCEs, etc.
  - Continuing training may be given as part of other training programs, periodic required reading, or Computer Based Training (CBT).

b. Team Members

UNLESS exempted by Director Nuclear Station Safety and Licensing and documented in Corrective Action Process, team members **MUST** be qualified in accordance with one of the following:

- Must be ACE qualified

  OR

- Must have completed Cause Evaluation training

Lead RC Evaluator

3.1.4 **PREPARE** RCE Problem Statement **and** **PRESENT** to CARB in accordance with PI-AA-300-3001, Root Cause Evaluation.

3.1.5 **PERFORM** root cause analysis in accordance with PI-AA-300-3001, Root Cause Evaluation.

3.1.6 Report Review and Approval

Station Cause Evaluation Coordinator (SCEC)

a. **CONDUCT** quality reviews in accordance with Root Cause Analysis Quality Index in PI-AA-300-3001, Root Cause Evaluation.

Responsible Manager

b. **REVIEW** and **APPROVE** in accordance with PI-AA-300-3001, Root Cause Evaluation.

3.1.7 Effectiveness Review of CAPRs

NOTE: Performance of effectiveness review will be based on threat and vulnerability, normally, within six to twelve months after last CAPR completion or as directed by CARB.

Assigned Manager

DETERMINE effectiveness of CAPR(s) in accordance with PI-AA-300-3001, Root Cause Evaluation:

3.2 Apparent Cause Evaluation

3.2.1 Initiation

Initiator

a. **INITIATE** ACE as required by the Corrective Action Program and in accordance with PI-AA-300-3002, Apparent Cause Evaluation.

Supervisor

b. **IF** desired, **THEN** **CONDUCT** pre-job and **ENSURE** investigation scope and problem statement is defined during brief. **REFER** to ATTACHMENT 4 as necessary.

ACE Evaluator

c. **PERFORM** ACE in accordance with PI-AA-300-3002, Apparent Cause Evaluation.

3.2.2 **ENSURE** ACE Evaluator is qualified as follows:

- Apparent Cause Evaluator must be qualified in accordance with following:
  - Successfully completing requirements of Form 730909 (ATTACHMENT 2)
  - Qualification shall be ensured by assigned Responsible Supervisor
- After initial qualification, Apparent Cause Evaluator must complete Cause Evaluation Continuing Training biennially to retain qualification.
  - Cause Evaluation Continuing Training should emphasize changes in cause evaluation process related to ACEs, etc.
  - Continuing training may be given as part of other training programs, periodic required reading, or Computer Based Training (CBT).

Responsible Department

3.2.3 **REVIEW** and **APPROVE** ACE in accordance with PI-AA-300-3002, Apparent Cause Evaluation.

3.3 Equipment Apparent Cause Evaluation

3.3.1 Initiation

Initiator

a. **INITIATE** E-ACEs as required by the Corrective Action program and in accordance with PI-AA-300-3006, Equipment Apparent Cause Evaluation (E-ACE).

Supervisor

b. IF desired, THEN **CONDUCT** pre-job brief and **ENSURE** investigation scope and problem statement is defined during brief. **REFER** to ATTACHMENT 4 as necessary.

E-ACE Evaluator

c. **PERFORM** E-ACE in accordance with PI-AA-300-3006, Equipment Apparent Cause Evaluation.

NOTE: No qualifications are required if E-ACE is assigned from Significance Level 3 CR.

3.3.2 IF E-ACE is assigned from Significance Level 1 or 2 CR, THEN **ENSURE** assigned evaluator meets ACE qualification requirements in accordance with Step 3.2.2.

Responsible Department

3.3.3 **REVIEW** and **APPROVE** EACE in accordance with PI-AA-300-3006, Equipment Apparent Cause Evaluation.

3.4 Quick Cause Evaluation

3.4.1 Initiation

Initiator

a. **INITIATE** Quick Cause Evaluation (QCE) as required by Corrective Action Program and in accordance with PI-AA-300-3005, Quick Cause Evaluation.

Supervisor

b. **IF** desired, **THEN CONDUCT** pre-job brief and **ENSURE** Investigation Scope and Problem Scope are defined during brief. **REFER** to ATTACHMENT 4 as necessary.

Quick Cause Evaluator

c. **PERFORM** QCE in accordance with PI-AA-300-3005, Quick Cause Evaluation.

NOTE: No qualifications are required if QCE assigned from Significance Level 3 CR.

Assigned Responsible Supervisor

3.4.2 **IF** QCE is assigned from Significance Level 1 or 2 CR, **THEN ENSURE** assigned evaluator meets ACE qualification requirements in accordance with Step 3.2.2.

Responsible Department

3.4.3 **REVIEW** and **APPROVE** QCE in accordance with PI-AA-300-3005, Quick Cause Evaluation.

4.0 RECORDS

4.1 The following record(s) completed as a result of this procedure are required to be transmitted to Nuclear Document Management (NDM). The records have been identified and retention requirements established for the Nuclear Records Retention Schedule (NRRS) per RM-AA-101, Record Creation, Transmittal, and Retrieval.

4.1.1 Quality Assurance Records

- The Cause Evaluation reports completed in accordance with this procedure (including attachments) when combined with associated CR contained within electronic Corrective Action database

4.1.2 Non-Quality Assurance Records

- ATTACHMENT 14, Equipment Reliability/PM Adequacy completed in accordance with this procedure is attached to the associated CR contained within the electronic Corrective Action database.

4.2 The following record(s) completed as a result of this procedure are **NOT** required to be transmitted to Nuclear Document Management (NDM), but are required to be retained as indicated below. The NRRS has been updated and Alternate Storage approved per RM-AA-101 for Quality Assurance Records.

4.2.1 Quality Assurance Records

- ATTACHMENT 1, Lead Root Cause Evaluator - Qualification Record maintained in the Training Vault (lifetime retention period).
- ATTACHMENT 2, Apparent Cause Evaluator - Qualification Record maintained in the Training Vault (lifetime retention period).

4.2.2 Non-Quality Assurance Records

None

4.3 The following item(s) completed as a result of this procedure are **NOT** records and are **NOT** required to be transmitted to Nuclear Document Management (NDM).

None

5.0 ADMINISTRATIVE INFORMATION

5.1 Commitments

5.1.1 KPS LA000876, MRC-08-020, RCE 40 CAPR 1 (CRS CAPR 158) to implement specific and defined expectations to change management behavior in area of PI&R (Includes CRS CAPRs 159 - 177, CRS CAPR 179, and CRS CACCs 103-105)

5.2 Responsibilities

5.2.1 Managers

All Managers are responsible for:

- Acting as Responsible Manager for RCEs.
- Providing support personnel, including lead evaluator, for RCEs, when requested by Responsible Manager or Director Nuclear Station Safety and Licensing.
- Ensuring proper review and approval of ACEs and E-ACEs performed under their cognizance.
- Ensuring evaluations and corrective actions are implemented as required.
- Reviewing and approving effectiveness reviews of CAPRs related to RCEs.

5.2.2 Manager Organizational Effectiveness (OR)

Manager OR is responsible for:

- Overall responsibility for implementing corrective action process.
- Serving on CARB and as Alternate CARB Chairperson.

5.2.3 E-ACE Evaluators

E-ACE Evaluators are responsible for:

- Ensuring personal ACE qualifications prior to starting Significance Level 1 or Level 2 E-ACE.
- Ensuring E-ACE is completed in accordance with PI-AA-300-3006.

5.2.4 QCE Evaluators

QCE Evaluators are responsible for:

- Ensuring personal ACE qualifications prior to starting Significance Level 1 or Level 2 QCE.
- Ensuring QCE is completed in accordance with PI-AA-300-3005.

5.2.5 ACE Evaluators

ACE Evaluators are responsible for:

- Ensuring they are ACE qualified prior to starting an ACE.
- Ensuring ACEs are completed in accordance with PI-AA-300-3002.

5.2.6 Director Nuclear Engineering

Director Nuclear Engineering is responsible for:

- Reviewing and approving items delineated in ATTACHMENT 3.
- Along with Site Vice President, Plant Manager (Nuclear), and Director Nuclear Station Safety and Licensing, ensuring appropriate resources and personnel dedicated to assigned RCE are available.

5.2.7 Plant Manager (Nuclear)

Plant Manager (Nuclear) is responsible for:

- Reviewing and approving items delineated in ATTACHMENT 3.
- Along with Site Vice President, Director Nuclear Station Safety and Licensing, and Director Nuclear Engineering, ensuring appropriate resources and personnel dedicated to assigned RCE are available.
- Activating the Event Review Team when the need arises (refer to PI-AA-300-3000).
- Assigning Lead Root Cause Evaluator and other team members if necessary.

5.2.8 Director Nuclear Station Safety and Licensing (S&L)

Director Nuclear Station S&L is responsible for:

- Authorizing RCEs and designating lead organization and Responsible RCE Manager.
- Reviewing and approving items delineated in ATTACHMENT 3.
- Along with Site Vice President, Plant Manager (Nuclear), and Director Nuclear Engineering, ensuring appropriate resources and personnel dedicated to assigned RCE are available.
- Notifying Vice President Nuclear Operations when extensive resources are required or when other station(s) may be affected by implementing RCE recommendations.
- Approving downgrades of RCEs to ACEs.
- Approving exemption for an RCE Team member training requirement, when appropriate.
- Assigning Lead Root Cause Evaluator and other team members if necessary.

5.2.9 Corrective Action Review Board (CARB)

CARB is responsible for reviewing and approving items on ATTACHMENT 3.

5.2.10 Department Corrective Action Coordinator (DCAC)

Each DCAC is responsible for facilitating assignment and tracking of Corrective Action Process tasks within assigned department in accordance with PI-AA-200 and PI-AA-300.

5.2.11 Lead Root Cause Evaluator

Lead Root Cause Evaluator is responsible for:

- Reporting to Responsible Manager for direction and scope of RCEs and ERT, when assigned.
- Drafting written Problem Statement for Responsible Manager and CARB approval within three business days after RCE assignment.
- Preparing RCE reports for approval when assigned.
- Providing copy of RCE report to Station and Corporate OE Coordinator and SCEC.
- Ensuring interim RCE report is submitted when due date extension is requested.

5.2.12 Organizational & Programmatic Advocate

Organizational & Programmatic Advocate is responsible for:

- Participating / assisting in evaluation focusing on organizational & programmatic issues associated with the event.
- Guiding team/evaluator in identification of organizational & programmatic factors and assist with development of associated corrective actions
- Ensuring personal requirements of RCE team member have been met.

5.2.13 RCE Team Members

RCE team members are responsible for:

- Participating on RCE teams as assigned.
- Unless exempted by Director Nuclear Station Safety and Licensing, ensuring personal completion of Cause Evaluation training before serving on RCE team.

5.2.14 RCE Responsible Manager

RCE Responsible Manager is responsible for:

- Conducting pre-job brief with RCE team.
- Concurring with report to ensure recommended corrective actions address root cause(s) and can be implemented.
- Clearly describing evaluator / team responsibilities.
- Providing expectations concerning priority in relation to other assignments.
- Instructing evaluator / team on what to do if problems are encountered.
- Providing input when management should receive status report.
- Providing team with any particular insight on event as appropriate.
- Discussing any safety issues to be considered as event is investigated.
- Approving RCE report within 30 days after department assignment.
- Obtaining concurrence for CAPRs and CAs from responsible department(s)
- Presenting RCE to CARB.
- Ensuring interim report is prepared and approved for extended RCE.
- Ensuring appropriate resources are provided to RCE.
- Ensuring RCE addresses organizational / programmatic issues and human performance issues as needed.
- Assuming line ownership of RCE process.
- Ensuring coordination of recommended Corrective Action with owner.

5.2.15 Station Cause Evaluation Coordinators (SCECs)

SCECs are responsible for:

- Providing RCE oversight.
- Reviewing and commenting on RCE Report (using Quality Index).
- Coordinating with Station/Corporate Nuclear Training Department scheduling of Cause Evaluation training for personnel.
- Providing periodic RCE status updates to management on open RCE and open RCE related corrective actions.
- Maintaining Cause Evaluation procedures current.
- Ensuring effectiveness reviews are performed.

5.2.16 Supervisors / Coordinators

Supervisors / Coordinators are responsible for ensuring proper departmental preparation, review, and approval of ACEs and E-ACEs, as necessary.

5.2.17 Supervisor Corrective Action (CA)

Supervisor CA is responsible for:

- Reviewing and concurring with corrective action plans for RCEs and ACEs, as necessary.
- Ensuring proper review of ACEs and RCEs.
- Administering Root Cause Program and appointing program coordinator.

5.3 Definitions

NOTE: This subsection includes some definitions key to Cause Evaluation Program and other PI-AA-300 series procedures.

5.3.1 Apparent Cause(s)

Most probable cause for event based on readily available information using systematic approach.

5.3.2 Apparent Cause(s) Evaluation (ACE)

Consists of systematic approach to determining Apparent Cause(s) and recommended Corrective Action(s) of human, programmatic, organization, and/or equipment performance problems.

5.3.3 Barrier

Administrative or physical control designed to detect, prevent, or inhibit undesirable action or result.

5.3.4 Barrier Analysis

Technique to study breakdown or lack of barriers resulting in unwanted problems. Unwanted problems occur when barriers break down or are not present to prevent problem from happening. Barrier Analysis is helpful in pinpointing subtle Causal Factors.

5.3.5 Causal Factor

Factors shaping event outcome by making event worse than otherwise would have been if Causal Factor had been absent.

5.3.6 Collective Significance Analysis

Analysis tool designed for self-assessment and for looking at trend of lower level issues/events for common issues, behaviors, etc. to enable correcting issues prior to occurrence of higher level event.

5.3.7 Common Cause Analysis

Systematic review and analysis of event to display one or more similar attributes for purpose of determining if identified patterns of similarity are result of Common Causal Factors and warrant more comprehensive Corrective Action.

5.3.8 Common Mode Failure

Specific kind of Generic Implication occurring when specific condition (hazard, weakness or behavior) has potential to cause multiple failures via same Failure Mechanism.

5.3.9 Compensatory Action (Short Term)

Action taken to temporarily address deficient condition until permanent Corrective Action(s) can be implemented.

5.3.10 Condition Adverse to Quality (CAQ)

All-inclusive term used in reference to any of the following. These conditions are required to be promptly identified and corrected.

- Failures
- Malfunctions
- Deficiencies
- Deviations
- Defective material and equipment and non-conformances.

5.3.11 Condition of Interest

Circumstances pertinent to process and warranting investigation or analysis.

5.3.12 Contributing Cause

Cause important enough to be recognized as needing Corrective Action, but if corrected would not alone have prevented event. Contributing Causes result from analysis of Causal Factors.

5.3.13 Corrective Action to Preclude Repetition (CAPR)

Actions designed to preclude repetition of Root Cause.

5.3.14 Corrective Action Program

Program providing necessary processes and methodology to identify, evaluate, correct, and trend undesirable events or conditions.

5.3.15 Cross-Cutting Area

Fundamental performance attributes extending across all Reactor Oversight Process cornerstones of safety.

5.3.16 Cross-Cutting Area Components

Component of safety culture directly related to one of the cross-cutting areas.

5.3.17 Cross-Cutting Aspect

Performance characteristics comprising cross-cutting area component.

5.3.18 Cross-Cutting Theme

Multiple inspection findings (i.e., four or more) with causes sharing same cross-cutting aspect.

5.3.19 Culpability

Term most commonly associated with legal ramifications of being 'guilty' or 'meriting condemnation or blame.' Culpability is used to suggest some malfeasance or error of ignorance, omission, or negligence.

5.3.20 Direct Cause

Immediate human action or equipment failure mechanism that triggered event or condition. Direct Cause is not the Apparent or Root Cause of event, which requires further assessment to determine underlying drivers.

5.3.21 Equipment Apparent Cause Evaluation (E-ACE)

Consist of systematic approach to determining direct or most probable cause for equipment-related failure based on readily available information. E-ACE is performed in accordance with PI-AA-300-3006.

5.3.22 Effectiveness Review

Review of Corrective Actions to determine if implementation of Corrective Action(s) from Root Cause Evaluation are fully implemented and effectively address problem created to address.

5.3.23 Event

Unwanted, undesirable change in state of plant structures, systems, or components or human/organizational conditions (health, behavior, administrative controls, environment, etc.) exceeding established significance criteria. Events involve serious degradation or termination of equipment ability to perform required function.

5.3.24 Events and Causal Factor (E&CF) Charting

Visual tool providing charted display of entire case under study. Chart allows event data to be organized, investigation plan to be developed, and results checked. Chart provides pictogram of issue and can guide investigation by showing holes required to be filled. Chart is also often used to illustrate final report findings and conclusions.

5.3.25 Extent of Cause

Extent to which cause(s) of identified problem have (or may have) impacted other plant processes, equipment, or human performance. Expectation is level of effort in determining and documenting extent of cause is commensurate with level of investigation and significance of event.

5.3.26 Extent of Condition

Extent to which actual condition exists (or may exist) with other plant equipment, organizations, processes or human performance. Expectation is level of effort in determining and documenting Extent of Condition is commensurate with level of investigation and significance of event. Impact on opposite unit, related or similar equipment, and related documents should be considered.

5.3.27 Failure Mechanism

Fundamental behavioral, physical or chemical processes involved in (or responsible for) FAILURE MODE under evaluation.

5.3.28 Failure Mode

Failure or human behavior triggering Event - what is seen or observed.

5.3.29 Failure Scenario

Sequence of Events leading up to FAILURE MODE. Usually defined as series of chronological Events starting with initiating Event and ending with identified Failure Mode.

5.3.30 Hazard (Threat)

Circumstance or condition that can, by itself or in conjunction with other circumstances, adversely affect target.

5.3.31 Interim Action (Remedial Action)

Actions taken to minimize or mitigate immediate risk.

5.3.32 Primary Effect

Most significant undesirable Event or happening critical for situation being evaluated to occur and are those Events which justify classification as Significant Condition Adverse to Quality. Primary effects are shown as diamonds in E&CF Chart.

5.3.33 Quarantine

Preservation of scene of event, equipment, or records in undisturbed condition to prevent loss of evidence which supports failure evaluations.

5.3.34 Quick Cause Evaluation (QCE)

Consists of systematic approach, performed in accordance with PI-AA-300-3005, to determine most probable cause for human performance, organizational, or process related failure based on readily-available information.

5.3.35 Repeat Event

Previously identified issue (failure, problem, or deficiency) evaluated by an RCE that had the same/similar cause and recurred due to failure to implement or ineffective CAPR.

5.3.36 Repeat Issue

Previously identified issue (failure, problem, or deficiency) evaluated by an ACE, E-ACE, QCE, or RCE that had same/similar cause and recurred.

5.3.37 Root Cause(s)

Most basic reason for failure, problem, or deficiency, which if corrected, will preclude repetition. Root Cause must meet these three criteria:

a. Problem would not have occurred had Root Cause not been present.

b. Problem will not recur if Root Cause is corrected or eliminated.

c. Additionally, correction or elimination of Root Cause should preclude repetition of similar conditions.

5.3.38 Root Cause Evaluation (RCE)

Consists of systematic approach to determining underlying Root Cause(s) and recommended Corrective Actions to preclude repetition. RCE considers all causal factors and provides logical determination of Root Cause(s).

5.3.39 Safety-Conscious Work Environment (SCWE)

Environment in which employees feel free to raise safety concerns, both to management and NRC, without fear of retaliation and where such concerns are promptly reviewed, given proper priority based on potential safety significance, and appropriately resolved with timely feedback to employees.

5.3.40 Nuclear Safety Culture

Assembly of characteristics and attitudes in organizations and individuals which establishes, as overriding priority, nuclear plant safety issues receive attention warranted by significance.

5.3.41 Safety Significance

In most situations, applies to nuclear risk as applied to protection of public and plant personnel from hazards or exposure to radioactive materials. However, can also include industrial safety & non-radiological environmental conditions.

5.3.42 Secondary Event

Action or happening impacting Primary Event, but not directly involved in failure or event of interest. Secondary Events are shown as rectangles below or above Primary Event line and are connected to each other by arrows in E&CF Chart.

5.3.43 Target

In Barrier analysis, anything worth protecting from threat (e.g., relative to threat of impact with street, a child's head would be a target protected by barrier of a bicycle helmet. Training wheels might also be a barrier, as might an accompanying parent).

5.3.44 Terminal Event

End point of evaluation, which is shown as a circle on Primary Event line in E&CF Chart.

5.3.45 Verification

For Root Cause of event, process used to determine if all parties agree on particular point or piece of evidence. Typically requires use of independent source to ensure data or evidence is correct.

Should answer the question: Can information be supported from independent source?

5.4 References

5.4.1 NRC INSPECTION MANUAL CHAPTER 0305 Issued January 2009

5.4.2 NRC INSPECTION MANUAL INSPECTION PROCEDURE 95001, 95002,

5.4.3 PI-AA-100-1004, Self Assessments

5.4.4 OP-AP-300, Reactivity Management

5.4.5 OP-AA-101, Operational Decision Making

5.4.6 ER-AA-MRL-10 Maintenance Rule Program

5.4.7 ER-AA-MRL-100 Implementing Maintenance Rule

5.4.8 OP-AA-1300, Quarantine

5.4.9 PI-AA-100-1007, Operating Experience Program

5.4.10 PI-AA-200, Corrective Action

5.4.11 PI-AA-100-1003, Self Evaluation and Trending

5.4.12 PI-AA-300-3000, Event Review

5.4.13 PI-AA-300-3001, Root Cause Evaluation

5.4.14 PI-AA-300-3002, Apparent Cause Evaluation

5.4.15 PI-AA-300-3004, Cause Evaluation Methods

5.4.16 PI-AA-300-3005, Quick Cause Evaluation

5.4.17 PI-AA-300-3006, Equipment Apparent Cause Evaluation

5.4.18 Surry Corrective Action Program - CACC000230

5.4.19 North Anna Corrective Action Program - CR1014988/CA3013639

5.4.20 CA3028413, Add direction to review completed Equipment Operating and Maintenance History for Aggregate Impact of changes in Operating Conditions or Methods of Operation

ATTACHMENT 1
Lead Root Cause Evaluator - Qualification Record
(Page 1 of 1)

Dominion

Lead Root Cause Evaluator – Qualification Record

PI-AA-300 – Attachment 1 **Page 1 of 1**

Individual (Print Name)	Employee ID

In order to serve as Lead Root Cause Evaluator, the following requirements must be met:

1. Individual must complete the Dominion Cause Evaluation course or equivalent industry standard (examples of equivalent courses include: Dominion Problem Identification and Correction (PIC) Course, INPO Event Investigation Course, TapRooT, or DOE Management Oversight Risk Tree (MORT) Analysis course).

Course Title	Instructor	Completion Date

2. Individual must read and understand PI-AA-300, PI-AA-300-3001, and PI-AA-300-3004.

I certify I have read and understand PI-AA-300, PI-AA-300-3001, and PI-AA-300-3004.

Individual (Signature)	Date

3. Individual has participated in at least one previous RCE as a Lead RC Evaluator under instruction.

RCE Participation	Team Leader (Mentor)	Assessment Date

Director Nuclear Station Safety and Licensing has approved this individual as Lead Root Cause Evaluator by signing below:

Director Nuclear Station Safety and Licensing (Print Name)	Director Nuclear Station Safety and Licensing (Signature)	Date

Form No. 730550(May 2015)

ATTACHMENT 2
Apparent Cause Evaluator - Qualification Record
(Page 1 of 1)

Dominion

Apparent Cause Evaluator – Qualification Record

PI-AA-300 – Attachment 2 Page 1 of 1

Individual (Print Name)	Employee ID

To serve as Apparent Cause Evaluator, the following requirements must be met:

1. Individual must complete Dominion Cause Evaluation course, or computer based training, or equivalent industry standard (examples of equivalent courses include: Dominion Problem Identification and Correction (PIC) Course, INPO Event Investigation Course, TapRooT, or DOE Management Oversight Risk Tree (MORT) Analysis course).

Course Title	Instructor	Completion Date

2. Individual must read and understand PI-AA-300, PI-AA-300-3002, PI-AA-300-3004, PI-AA-300-3005, and PI-AA-300-3006.

I certify I have read and understand PI-AA-300, PI-AA-300-3002, PI-AA-300-3004, PI-AA-300-3005, and PI-AA-300-3006.

Individual (Signature)	Date

3. Individual has participated in at least one previous ACE under instruction or mentorship.

ACE Participation	Mentor	Assessment Date

Individual is approved as Apparent Cause Evaluator by signing below:

Supervisor (Print Name)	Supervisor (Signature)	Date

Form No. 730909(April 2017)

ATTACHMENT 3
Corrective Action Review Board Charter

(Page 1 of 3)

Purpose:

The Corrective Action Review Board (CARB) provides management oversight of the corrective action program to ensure the following:

- Significant conditions adverse to quality are corrected and recurrence is prevented
- Corrective action program is being effectively implemented

Membership:

- Chairperson - Director Nuclear Safety and Licensing, Plant Manager (Nuclear), Engineering Director, or Designee
- Member - Organizational Effectiveness Manager
- Member - Operations Manager
- Member - Radiological Protection Manager
- Member - Engineering Manager
- Member - Maintenance Manager
- Member - Outage and Planning Manager
- Member - Manager Nuclear Site Services
- Member - Training Manager

Quorum:

A quorum shall consist of the Chairperson, and at least three other members. Alternates may be designated; however, no more than two of the minimum four may be alternates unless approved by the Chairperson.

ATTACHMENT 3
Corrective Action Review Board Charter
(Page 2 of 3)

Scope:

Review and Approve

- Root Cause Evaluation (RCE) Problem Statements
- Interim RCE reports
- Interim / compensatory corrective actions from RCEs
- Completed RCEs
- Completed CAPRs, CACCs, STCAs, and EFRs
- RCE extension requests
- Completed significance level 2 and higher Cause Evaluations
- Significance level 2 and higher Cause Evaluations extension requests
- Scope changes for Corrective Action assignments from Significance Level 1 & 2 Cause Evaluations.
- Extension requests, including justification and risk assessment, for Level 1 and 2 CAs. CARB Chairperson may perform this without full CARB quorum
- OE evaluations of other Dominion station root cause evaluations in accordance with PI-AA-100-1007
- Independent review of ODMs, if requested, in accordance with OP-AA-101
- Other items as requested

Review and Re-Direct

These documents will be reviewed periodically:

- Corrective Action Performance Indicators

These documents will be reviewed as received:

- Corrective Action Program assessments and reviews from internal sources (e.g., self-assessments)

Corrective Action Program assessments and reviews from external organizations (e.g., NRC, INPO)

Meeting Conduct and Logistics:

1. CARB will meet at periodicity determined by Chairperson.

ATTACHMENT 3
Corrective Action Review Board Charter
(Page 3 of 3)

2. CARB members are expected to review agenda items prior to meeting.

3. Chairperson will designate someone to record meeting minutes. Minutes will be kept in order to support continuity of CARB. Minutes will be high level and reflect topic and outcome. Minutes are not controlled documents.

ATTACHMENT 4
Pre-Investigation Briefing Sheet for Cause Evaluations

(Page 1 of 2)

NOTE: This briefing sheet was designed to help management staff provide CR investigating teams with specific expectations and information prior to starting Cause Evaluation investigations. Recognizing discussion items listed below are limited, this sheet should be used as a guide only.

1.0 MANAGEMENT AND TEAM RESPONSIBILITIES

- Clearly **DESCRIBE** team responsibilities.
- **PROVIDE** expectations concerning priority in relation to other assignments.
- **INSTRUCT** team what to do if problems jeopardizing investigation are encountered.
- **PROVIDE** expectations for team as to when management should receive status report.
- **PROVIDE** team with any additional information obtained from other sources, e.g. Operations Focus meeting, CRT, etc.
- **PROVIDE** team with any particular insight regarding event/issue, including potential scope.
- **ENSURE** all Cause Evaluations meet the qualification requirements of PI-AA-300.

2.0 ADHERENCE TO ALL SAFETY EXPECTATIONS

DISCUSS any safety issues to consider as team investigates subject event or issue.

ATTACHMENT 4
Pre-Investigation Briefing Sheet for Cause Evaluations
(Page 2 of 2)

3.0 CAUSAL EVALUATIONS

- **REMIND** team/individual conducting RCE, ACE, E-ACE, or QCE the requirements for causal investigation and analysis are defined in the following procedure and associated GaRDs:
    - PI-AA-300, Cause Evaluation Program
    - PI-AA-300-3001,Root Cause Evaluation
    - PI-AA-300-3002, Apparent Cause Evaluation
    - PI-AA-300-3006, Equipment Apparent Cause Evaluation
    - PI-AA-300-3005, Quick Cause Evaluation
- **DISCUSS** expectation to review above documents to ensure full understanding of required attributes.
- **ENSURE** causal investigators meet qualification requirements in accordance with PI-AA-300.
- **DISCUSS** expectations for evaluation quality and timeliness of completion, as well as coordination of other assigned duties.
- **ENCOURAGE** team to contact Station Cause Evaluation Coordinator for assistance.
- **DETERMINE** valid causes, and **ENSURE** information documented in investigation is sufficient to support cause determination.
- **DETERMINE** appropriate causal trend codes using ATTACHMENT 7 through ATTACHMENT 11.
- **REVIEW** need to address immediate Extent of Condition for interim actions.
- **DISCUSS** need to submit new Condition Report (CR) if any potential 'prior operability' concerns are identified for technical specification related equipment.
- **DISCUSS** need to consider industry or subject matter expert (SME) involvement.
- For RCEs with recurring equipment issues, **REVIEW** complete equipment operating and maintenance history for aggregate impact of changes in operating conditions and methods of operation. (Ref. 5.4.20)

ATTACHMENT 5
Corrective Action S.M.A.R.T.S. Model

(Page 1 of 4)

Model used to ensure CAs contain enough detail and description to be implemented effectively. The S.M.A.R.T.S. Model steps are as follows:

1. **S**pecific: Level of detail should allow individual assigned to carry-out action to understand both the reason(s) for the action and each step, task, or behavior required to effectively implement action or expectation.

> **NOTE:** Field decision exists when individual attempting to implement action is required to decide between multiple methods and some methods will not adequately accomplish task.

   - Decision should not contain field decisions.
      - Description must contain elements of who performs action (or who action applies to), what action is trying to accomplish, and how action needs to be completed.
      - Unless action is provided for what to do with information obtained and where to document result(s), terms such as 'evaluate', 'determine' and 'assess' should be avoided.
   - Level of detail should be based on knowledge level of target audience related to subject matter. In addition, level of detail should address the following:
      - Are sentences short, concise, and self-explanatory?
      - Is description of action free of words and phrases which could imply a double meaning?
      - Does action effectively integrate non-task step information with subsequent task steps?
      - Does action directly conflict with another (higher level) expectation or action?

2. **M**easurable: Desired outcome or behavior should be clearly described so outcome/behavior can be seen physically (during observation) or physical outcome is obvious. For example, if Corrective Action described a change to a procedure step, action should contain the wording change required so action can be checked to meet intended action once complete.

3. **A**chievable: When describing action(s) or behavior(s), write in 'active' voice (not in 'passive voice).
   - Active voice avoids terms such as 'shall', 'should', 'may', and so on, and describes physical action or behavior to be performed.
   - For example, action would say 'Deliver Chemistry release forms to Shift Manager for signature' instead of 'Shift Manager shall sign all Chemistry release forms'.

ATTACHMENT 5
Corrective Action S.M.A.R.T.S. Model
(Page 2 of 4)

4. Realistic: Individual or organization responsible for completing action or implementing expectation must be capable of completing the task.
   - For example:
     - A generally unrealistic expectation would be 'ALL PERSONNEL are responsible for safety'. Each individual may be responsible for HIS OR HER safety, but cannot be responsible for the safety of 'ALL OTHERS'.
     - A more realistic expectation may be 'Each site individual is responsible for their own safety and identifying safety issues for those around them when working'.
5. Timely:
   a. Actions need to have specific time for completion and must meet both the following: and expectations should contain a time element s
      - Actions must be realistic for the task required to be performed, based on workload and resources available.
      - Actions must commensurate with significance of problem to be fixed.
   b. Expectations should contain a time element to allow, after a specific time, management observations to routinely determine if expectation is being met.
6. Sustainable: Desired outcome or behavior should be sustainable over time.
   - Actions should have long-term affect.
   - Graded approach to sustainability should be based on risk and significance of the issue.

ATTACHMENT 5
Corrective Action S.M.A.R.T.S. Model
(Page 3 of 4)

Examples and Guidance for Corrective Actions

Examples of proven Corrective Actions are listed below. These examples are only for reference, and are NOT applicable in every situation. These examples are NOT all-inclusive to possible Corrective Actions. Each example requires specific action(s) to make them S.M.A.R.T.S.

1. **Methods to correct Skill Based Errors are:**
   - Simplifying tasks by procedure simplification, limiting memory requirements, and standardizing similar tasks by using signs, procedure format. and forms
   - Reducing distractions by enhancing workplace professionalism, not interrupting critical work and preparing needed tools and information before work begins
   - Reducing pressure through good vertical communication, developing high degree of trust among organizations, and maintaining effective communications
   - Providing awareness tools such as signs, pre-job meetings, and caution statements in procedures
   - Ensuring performers maintain alert mental state through good supervisory techniques including effective pre-job briefs
   - Increasing experience
   - Self Checking (Stop Think Act Review, 'STAR')
   - Visualization techniques
   - Practicing/mock-up use
   - No more than 2 tasks at a time
   - Relaxation-meditation exercise
2. **Methods to correct Rule Based Errors include:**
   - Organizing work specialization groups (e.g., System Engineers, Component Engineers, sales, Technical Advisors, System Planners)
   - Using training or effective supervision to ensure Verification process - check-off sheets, repeat-backs, etc. are used as part of normal performer task completion
   - Training on fundamentals
   - Qualification, Validation, and Verification Training (QV&V)
   - Clarification of vague rules

ATTACHMENT 5
Corrective Action S.M.A.R.T.S. Model
(Page 4 of 4)

3. **Methods to correct Knowledge Based Errors Include:**
   - Improving problem solving skills / Cause Analysis
   - Familiarization with Work Process
   - Knowledge oriented training
   - Improving communication
   - Work specialization
   - Avoiding over-confidence
   - Consultation and networking
   - Assessing all options
4. **Proven corrective actions for Organizational and Process Failures Include:**
   - Simplifying overly complex Work Processes
   - Repairing inadequate interfaces between organizations and between processes
   - Performing continuous or periodic monitoring of organizational and process performance
   - Improving personnel skills and knowledge
   - Implementing simple and effective accountability systems
   - Assuring organizations and personnel are compatible with work assigned
   - Implementing simple and effective work prioritization systems
   - Implementing processes to attend effectively to emerging issues
   - Assigning adequate resources to lateral integration between organizations
   - Implementing rigorous self improvement programs

Organizational collapse or program failure can occur if organizational and programmatic improvements are made piecemeal to address isolated human errors. Since this could result in high expense and ineffective corrective actions, it is important for analyst to distinguish isolated human errors and human errors involving culpability, from human errors with organizational/programmatic origins when determining causes for event.

Significance Level 1 and Significance Level 2 CR corrective actions addressing Condition Adverse to Quality must be tracked in Corrective Action Program. Significance Level 3 CR corrective actions can be closed to Work Management Process, tracked in station corrective action database, or closed to auditable, trackable process/program in accordance with PI-AA-200, Corrective Action.

ATTACHMENT 6
Cause Evaluation Comparison Chart

(Page 1 of 1)

	Root Cause	Apparent Cause	Quick Cause	E-ACE
Problem Statement	Yes	Yes	Yes	Yes
Investigation	Yes	Yes	Yes	Yes
Cause Identification	Root & Contributing	Apparent & Contributing	Most Probable	Most Probable
Recommended Corrective Action(s)	Yes *(CAPR & EFR required)*	Yes	Yes	Yes
Equipment Reliability Review	Yes (for equip. issues only)	Yes (for equip. issues only)	No	Yes
HU / Organizational / Programmatic Review	Yes	Yes	Yes	No
Repeat Review	Yes	Yes	No	No
Extent of Condition	Yes	Yes	Yes	Yes
Extent of Cause	Yes	Yes (Sig Level 2) No (Sig Level 3)	No	No
Operating Experience	Yes	Yes (Sig Level 2) No (Sig Level 3)	No	Yes
Safety Culture Review	Yes	No	No	No
Safety Consequences Review	Yes	No	No	No
Attach Casual Tools	Yes	Yes (Sig Level 2) No (Sig Level 3)	No	No
Team Participation	Yes	Not typically, however a Team is allowed	No	No
Quality Grading	Yes, by CAP	No	No	No

ATTACHMENT 7
Process Related Failure Modes
(Page 1 of 4)

CODE	TITLE	PROCESS RELATED FAILURE MODE DEFINITIONS
Roles & Responsibilities Related (RR)		
RR0	Roles & Responsibilities Related	
RR1	Actions Not Specified	The action(s) that an individual or group must perform to accomplish a task are not contained in the document or instruction. · Many errors involving "missed" expectations · Administrative procedures not including applicability or responsibilities · Process missing necessary steps *Example: New drawings were developed outside of the design process, but their impact on procedures or equipment databases were not addressed because the drawing change process did not address evaluating the impact on existing procedures or databases.*
RR2	Actions Not Clear	The action(s) that an individual or group must perform to accomplish a task are not clearly described in the document or instruction. · Many errors involving execution of the process · Human error traps within the process · Technical procedure steps (what to do) are vague or complicated (multiple actions) · High procedure revision rate *Example: A plant that had been relying upon an experienced work force to "do the right thing" suddenly experiences a large number of errors following additional staffing. The new workers had to rely upon procedures that did not contain the appropriate level of detail for their level of knowledge.*
RR3	Actions Not W/in Control of the Individual	The action(s) that an individual or group must perform to accomplish a task cannot be performed as specified (physical constraints, do not have authority to dictate results, etc.). *Example: A Maintenance procedure directs the worker to secure a pump and then add oil, however, only plant operators are authorized to operate plant equipment.*
RR4	Actions Conflict W/Another Process	The action(s) that an individual or group must perform to accomplish a task conflict or contradict the actions specified by another document or instruction. · Conflicting requirements or directions between processes or procedures · Ineffective technical review or verification *Example: Operations returned a component cooling pump to service with high vibration level. The vibration level was within the IT criteria, but was not with the post maintenance test criteria.*

ATTACHMENT 7
Process Related Failure Modes
(Page 2 of 4)

CODE	TITLE	PROCESS RELATED FAILURE MODE DEFINITIONS
Roles & Responsibilities Related (RR)		
RR5	Actions Not Tied to Another Process When Necessary	The action(s) contained within one document or instruction does not reference supporting documents or instructions when necessary. · Many errors occur at interface points between processes or programs · Requests or feedback between processes or program are informal, not tracked *Example: Lagging was not being replaced after the completion of Work Orders. A different group than the one performing the maintenance under the Work Order performed the lagging removal & installation. The planning process did not address the work hand-off.*
RR6	Methods Not Clearly Described	Action(s) are required by the document or instruction, but the method to accomplish the actions is not clearly specified by the document or instruction. · Directions on "how to" accomplish the task are not clear. *Example: The coating process steps conducted by the vendor were not covered in the procedure.*
RR7	Unnecessary Actions Required	The document or instruction require the performance of certain actions that is not really necessary to successfully perform the action. · Excessive number of controls to perform activity · Less safety significant work is required to be done with the same level of controls as safety significant work · Controls or checks have little added value or quality *Example: RP survey procedure requires the same requirements or level of effort for performing surveys in non-radiation areas as high radiation areas.*
RR8	Wrong Information	The information provided in the document or instruction is incorrect. Technical errors or sequencing errors.

ATTACHMENT 7
Process Related Failure Modes
(Page 3 of 4)

CODE	TITLE	PROCESS RELATED FAILURE MODE DEFINITIONS
Accountability Related (AR)		
AR0	Accountability Related	This category is intended primarily for apparent causes for cases where data is not available to determine the next level of trend coding.
AR1	Critical Actions Not Verified	Critical actions required to successfully perform a task are not verified within the process. · Reviews and verification did not identify a problem and were not bypassed · Inadequate validation of the quality, completion, correctness and documentation of an activity · Verification should be required (forced by the process) at critical points to prevent a single error from causing a failure of the overall process *Example: The access control process requires completion of several activities prior to granting unescorted access. These activities are tracked with a completion date, but there is no requirement to verify all source documentation prior to granting access. A single data entry error resulted in granting access inappropriately.*
AR2	Excessive Verifications	The document or instruction requires excessive verification of completed steps or tasks. Actions are verified, regardless of criticality to the task or the task has multiple reviews and verifications instead of a single, specific review. *Ex: The work tracking process requires a second review to verify that all completed work activities, regardless of significance, was completed properly. This resulted in a backlog increase; staff work overload, and a reduced sensitivity to important work.*
AR3	No Process Monitoring	There is no established means of monitoring the success or failure of the process. · Lack of program/process monitoring, evaluation & improvement · Extended period of lowering or poor performance *Example: There was no requirement for monitoring the outside buildings for housekeeping although conditions had been deteriorating for years.*
AR4	Only Monitoring Problems	The only method of monitoring process performance is to observe problems when they occur. *Example: The trouble shooting of issues with the annunciator system for an intermittent problems requires monitoring to see if the issue returns.*
AR5	No Acceptance Criteria	No acceptable performance parameters have been established for the process, procedure, or task. · No guidance specified for what constitutes acceptable or unacceptable performance · No guidance for when the task should be stopped *Example: The Calibration procedure for the radiation monitors does not contain specific acceptance criteria.*

ATTACHMENT 7
Process Related Failure Modes
(Page 4 of 4)

CODE	TITLE	PROCESS RELATED FAILURE MODE DEFINITIONS
Individual Related (IR)		
I0	Individual Related	This category is intended primarily for apparent causes for cases where data is not available to determine the next level of trend coding
I1	No One Specified to Perform Task	No one is specified (either by title, group, or other means) as responsible for completion of the actions required by a document or instruction. · Boundaries of responsibility not properly defined - a gap exists *Example: Gas bottles were not being properly returned and stored because no single group was responsible for this portion of the process or was responsible for the storage facility.*
I2	More Than One Person Specified to Perform Task	More than one person or group is specified (either by title, group, or other means) as responsible for completion of the actions required by a document or instruction. · Boundaries of responsibility not properly defined - too much overlap exists *Example: During winter conditions all employees are responsible by procedure for applying sand/salt to slippery spots, however, in many instances employees relied upon "someone else" to apply the sand/salt.*
I3	Person Specified Not Able to Perform Task	The person or group specified (either by title, group, or other means) as responsible for completion of the required actions in a document or instruction is unable to perform the action. Typically because they do not have the skill or knowledge (not trained or qualified). · Personnel affected by the process are unaware of requirements, responsibilities or expectations · Fragmented responsibility for program/process *Example: A commercial grade dedication program was implemented in the Procurement group, however, the needed expertise to determine critical characteristics and safety functions resided in the Design Engineering group. Because the program was not well defined (authority & responsibility) among the participating groups, a high failure rate occurred.*

ATTACHMENT 8
Organizational and Management Failure Codes
(Page 1 of 4)

CODE	TITLE	ORGANIZATIONAL & MANAGEMENT FAILURE MODES DEFINITIONS
Functional Issues (F)		
F0	Functional Issues	This category is intended primarily for apparent causes for cases where data is not available to determine next level of trend coding.
F1	Inadequate Communication within an Organization	Breakdown in communication (written or verbal) within one organization or work group. Often leads to important issues not being addressed and critical process breakdown. • Many committed actions not carried out in timely manner • Supervisors not having direct communication channels to senior management • No routine meetings to communicate standards & expectations • Problems not solved because they are not communicated or the right personnel are not involved Example: Manager not having periodic staff communications/meetings results in high error rate because expectations and key information needed for job were not understood or known.
F2	Inadequate Communication among Organizations	Breakdown in communication (written or verbal) among two or more organizations or work groups. Often leads to breakdown in processes requiring several groups to participate. • Lack of defined interface requirements, expectations or responsibilities • Lack of teamwork or trust amongst organizations or work groups • Problems that transcend multiple organizations or groups are not solved Example: Inadequate response to concerns raised during NRC Fire Protection assessment because of mis-communication between Licensing and Engineering.
F3	Inadequate Prioritization	Deficiencies in determining which work takes precedence over other work. Often leads to unexpected equipment failures or failure to meet regulatory requirements. • Events recur due to slow implementation of corrective actions • High backlog of work • In conflict with station mission & goals • Work activity missing due dates or priority Example: Engineering organization is excessively over-worked during extended outage due to large influx of lower priority jobs that were not prioritized. As a result, very high human error rate occurred consisting of review errors, communication errors, and calculation errors.
F4	Inadequate Planning	Deficiencies in determining what work must be done, by whom, when, and how long work will take. Often leads to staff work overload, budget over-runs, and low morale. Example: Annual budgeting process did not properly account for extended work hours (only 50 hours was accounted for instead of 60) for craft personnel during refueling outages causing budget shortfall.

ATTACHMENT 8
Organizational and Management Failure Codes
(Page 2 of 4)

CODE	TITLE	ORGANIZATIONAL & MANAGEMENT FAILURE MODES DEFINITIONS
Functional Issues (F)		
F5	Inadequate Emerging Issues Management	Deficiencies in determining how to deal effectively with unexpected issues. Often leads to continual 'crisis management' and low morale. • Lack of self-assessment process • Poor performance monitoring and trending • Lack of attention to emerging issues, significance not recognized Example: Failure to treat loss of shutdown cooling ability as significant event, when issue has been recognized by nuclear industry as being significant.
F6	Inadequate Program Management	Inadequate oversight of critical work processes to ensure processes function smoothly and effectively. Often results in program degradation over time or increased problems within processes. • Insufficient support of program or process • Extended period of lowering or poor performance • Long term issues not adequately addressed or resolved • Line management unfamiliar with process Example: Equipment isolation process experienced high failure rate, but was not monitored to identify problem areas. Corrective actions did not improve process performance.
F7	Less than adequate written instructions/communications	Procedures, program guidance, memos, or other written communications provided either incorrect or misleading information. This includes failure to require adequate controls such as verification activities and/or less than adequate program/process detail.
F8	Less than adequate training	Workers were not provided adequate knowledge, skill, or experience to perform task correctly.
F9	Less than adequate change management	Change in either organizational process, functions, or personnel, that did not consider effect upon stakeholders, culture, etc. Actions inconsistent with change management procedure.
F10	Less than adequate program or process implementation	Situations where adequate program or process causes issues due to implementation details such as lack of follow-through, not implemented as written or other organizational failures.

ATTACHMENT 8
Organizational and Management Failure Codes
(Page 3 of 4)

CODE	TITLE	ORGANIZATIONAL & MANAGEMENT FAILURE MODES DEFINITIONS
Structural Issues (S)		
S0	Structural Issues	This category is intended primarily for apparent causes for cases where data is not available to determine next level of trend coding.
S1	Inadequate Span of Control	Horizontal organizational design - number of personnel which a supervisor is responsible for is too large or too few for group oversight and responsibilities. Often creates problems with task assignment and accountability. • Inadequate organizational structure and planning • Mixing short term and long term mission groups under single manager Example: Single organization consisting of Design and System Engineers results in manager continually fire-fighting system-related issues (short term) with little time or resources left for design projects (long term).
S2	Inadequate Levels in Organization	Vertical organizational design - number of levels or layers, from senior manager to employee is too many or too few for given activity. Creates problems with communication of expectations. • Excessive layers of management • Inadequate organizational structure and planning Example: Large number of layers in organization hampers timely and accurate communication to lower levels.
S3	Insufficient Staffing	Comprehensive organizational design - total number of employees for which company or group is designed are not filled. Often causes staff work overload and poor accountability. • High time pressure • Work overload in organization Example: Addition of maintenance rule and component reliability activities to System Engineers resulted in staff work overload and stress, and ultimately caused high rate of human error.
Cultural Issues (C)		
C0	Cultural Issues	This category is intended primarily for apparent causes for cases where data is not available to determine next level of trend coding.
C1	Inadequate Trust	Lack of confidence in workgroup or members of workgroup, or disbelief in information shared. Often results in fractured work completion and high stress levels.

ATTACHMENT 8
Organizational and Management Failure Codes
(Page 4 of 4)

CODE	TITLE	ORGANIZATIONAL & MANAGEMENT FAILURE MODES DEFINITIONS
Cultural Issues (C)		
C2	Inadequate Teamwork	Constant friction among workforce, or unwillingness to work with one another. Problem could exist within organizations or between organizations. Results in confusion within ranks and lack of information flow among groups. • Management infighting or friction between organizations • Requests for feedback, interaction or information are informal (no process), not tracked or are lost • Organizational boundaries of responsibility not properly defined (either gap or too much overlap exists) Example: QA attempts to elevate performance expectations beyond expectations established by workgroups in governing procedures and programs.
C3	Inadequate Knowledge	Inadequate understanding of work to be performed and how work ties into overall goals. Often causes individual errors to occur. •Not providing workforce with necessary skills and knowledge to do job
C4	Lack of Commitment	Lack of Commitment or lack of dedication to work. Often results in inconsistent or unreliable individual or group performance. • Inadequate resources assigned to program or process • Excessive amount of time to implement/develop program • Missing program or process elements (Process owner, sufficient staff, procedure, process requirements known by personnel, process performance monitoring) • Inadequate management support of program or process Example: Repeat failures associated with ISI Program. Investigation showed ISI Program Coordinator overworked with collateral duties. Insufficient staffing impacted ability to effectively implement and monitor program. Senior management, by inaction, was not committed to program implementation.
C5	Inadequate Self Assessment	Failure to continually encourage feedback, listen to customer input, or look at better ways to perform. Often creates false sense of security and leads to complacency. • Ineffective process monitoring (monitoring areas include backlog status, failure rate, resources available to support process, effectiveness of process) • Long term issues not being resolved or addressed • Extended period of lowering or poor performance

ATTACHMENT 9
Human Performance Failure Codes

(Page 1 of 3)

CODE	TITLE	HUMAN PERFORMANCE FAILURE MODE DEFINITIONS
A0	Human Performance	This category is intended primarily for apparent causes for cases where data is not available to determine next level of trend coding
A1	Back Shift/Shift Change	Work performed/scheduled near shift change. Workers held over into next shift to complete task. Complex or critical tasks performed/scheduled during back shift.
A2	Repetitive Action/Monotony	Inadequate level of mental activity due to performance of repetitive actions or lack of activity. Insufficient information exchange at job-site to help individual reach and maintain acceptable level of alertness. • Errors not detected in problems gradually occurring (slow changing conditions) Example: Office assistant performing validation and update to several controlled document manuals misses updating procedure page.
A3	Habit Patterns	Ingrained or automated pattern of actions attributed to repetitive nature of well-practiced task or natural response. Inclination formed for particular train/unit due to similarity to past situations or recent work experience. Example: Contractor has been working in Unit 2 for several months, then is asked to erect scaffold by Unit 1 component, but actually builds in Unit 2.
A4	Illness or Fatigue; General Health	Degradation of personal physical or mental abilities due to sickness, disease, or debilitating injury. Lack of adequate physical rest to support acceptable mental alertness and function.
A5	Distraction/ Interruption	Conditions of task or work environment require individual to stop and restart task, diverting attention from task at hand. • Errors occur due to interruptions, distractions, or work overload. Example: Operator is tasked with isolating a transformer, and has 'STARed' action of opening supply breaker. Control Room asks Operator a question. After answering question, Operator turns to board and opens wrong breaker.
A6	Simultaneous Multiple Tasks	Performance of two or more activities, either mentally or physically, possibly resulting in divided attention, mental overload, or reduced vigilance on one or other task Example: Chemistry technician must take sample by 1600, but forgot to document backup sample analysis results. Tech must obtain authorization, align system, draw sample, draw backup sample, restore system, perform analysis, and document results.
A7	Changes/Departure from Routine	Departure from well-established routine. Unfamiliar or unforeseen task or jobsite conditions that potentially disturb individual understanding of task or equipment status.
A8	Facilities/Physical Environment	Work location lighting, temperature, humidity, high noise area, etc.

ATTACHMENT 9
Human Performance Failure Codes
(Page 2 of 3)

CODE	TITLE	HUMAN PERFORMANCE FAILURE MODE DEFINITIONS
A9	Time Pressure	Urgency or excessive pace required to perform task. No spare time allotted or perception tight schedule exists by individual. • Too many assigned tasks to work on at once • Perception task must be completed in less time than normal Example: Attempting to complete test before shift change, Operator opened wrong valve because Operator did not adequately check valve label.
A10	Stress	Mind response to perception of threat to health, safety, self-esteem, or livelihood if task not performed to standard. Response may involve anxiety, degradation in attention, reduction in working memory, poor decision-making, and transition from accurate to fast. Degree of stress reaction dependent on individual experience with task.
A11	Pre-Job Brief Less Than Adequate	Pre-Job Brief either failed to cover appropriate information, did not exist, provided incorrect information, or failed to apply appropriate emphasis.
A12	Verbal Communications or Instructions	Verbal communications either face-to-face, phone, or other medium failed to transfer important information to task accomplishment. This can be either sender or receiver related.
J0	Judgement	This category is intended primarily for apparent causes for cases where data is not available to determine next level of trend coding.
J1	High Workload	Mental demands on individual to maintain high level of concentration (e.g., scanning, interpreting, deciding, while requiring recall of excessive amounts of information) either from training or earlier in task. Example: During outage, Operator who was overloaded with alarms from I&C testing activities and phone calls to Control Room overlooked actual plant alarm.
J2	Mindset (Intentions)	Tendency to 'see' only what mind is tuned to see (intention); preconceived idea. Information that doesn't fit mind set may not be noticed and vice versa; may miss information not expected or may see something not really there; contributes to difficulty in detecting own error(s). Example: Operating crews failed to take timely actions to lowering circulating water injection temperature and ideal weather conditions to prevent intake freezing due to belief intake could not freeze up.
J3	Unclear Goal/Role/Responsibility	Unclear work objectives or expectations. Uncertainty about duties individual is responsible for in a task, which involves other individuals. Duties incompatible with other individuals
J4	Work Place Norms/Culture	Longstanding site beliefs that drive current performance resulting in negative consequences.

ATTACHMENT 9
Human Performance Failure Codes
(Page 3 of 3)

CODE	TITLE	HUMAN PERFORMANCE FAILURE MODE DEFINITIONS
J5	Mental Shortcuts/Bias	Human tendency to look for or see patterns in unfamiliar situations; application of thumb-rules or 'habits of mind' (heuristics) to explain unfamiliar situations: • Confirmation bias • Frequency bias • Similarity bias • Oversimplification bias • Overload bias • Order bias • Close in time
J6	Vague/Interpretation Guidance	Situations requiring in-field diagnosis potentially leading to misunderstanding or application of wrong rule or procedure.
J7	Less than adequate monitoring/oversight	Failures to observe, coach, or monitor individual worker performance. This includes procedural coaching and observation expectations.
J8	Self-checking/peer checking less than adequate	No observable self-checking/peer checking behavior was employed in a situation where activity is expected or required. (This behavior cannot be assumed.)
K0	Knowledge	This category is intended primarily for apparent causes for cases where data is not available to determine next level of trend coding.
K1	Overconfidence/ Complacency	'Pollyanna' effect leading to presumption all is well in the world and everything is ordered as expected. Self-satisfaction or overconfidence with situation. Unaware of actual hazards or dangers, particularly evident after 7-9 years on job. Underestimating task difficulty or complexity based upon past experiences with task. Inadequate risk perception.
K2	Unfamiliarity with Task/First Time Evolution	Unawareness of task expectations or performance standards. First time to perform task (never, not performed in given time). Significant procedure change. Example: Newly qualified Control Operator is assigned task of performing primary plant cool down during solid plant operations. RCS letdown is secured, but makeup is not adjusted properly resulting in lifting of LTOP.
K3	Lack of Knowledge	Unaware of factual information necessary for successful completion of task. Lack of practical knowledge about task performance. Example: Mechanic installed slinger ring incorrectly because previous training instructed how to install differently configured slinger ring.
K4	Lack of Proficiency/ Inexperience	Degradation of knowledge or skill with task due to infrequent activity performance.
K5	Inadequate Design Basis Documentation	Hidden system responses, unavailable DBD, drawings, specifications, vendor info, procedure inadequacies, etc. Example: Unit trip is caused by I&C technician while placing jumper for SSPS PT due to use of drawing not showing all feeds to each card.

ATTACHMENT 10
Equipment Failure Modes
(Page 1 of 4)

CODE	TITLE	EQUIPMENT FAILURE DEFINITIONS
General Equipment Failure Modes		
GIN	Incomplete Installation	Installation activity (maintenance or new) fails to complete all aspects of installation
GDI	Damaged on Installation	Installation activity (maintenance or new) results in damage to equipment
GNI	Equipment Not Installed or Missing	Installation activity (maintenance or new) fails to install all required parts
GIT	Improper Testing	Testing activity results in damage to equipment or failure to identify defect
GIP	Improper Inspection	Inspection activity fails to identify equipment defect
GID	Items Left Loose or Disconnected	Installation activity (maintenance or new) fails to complete tighten or terminate contact points
GFU	Fastenings Undone or Incomplete	Installation activity (maintenance or new) fails to apply fasteners adequately
GLL	Items Left Locked or Pins Not Removed	Installation activity (maintenance or new) fails to remove mechanical or electrical blocks
GCL	Caps Loose or Missing	Installation activity (maintenance or new) fails to tighten or replace caps
GPO	Panels Left Off	Installation activity (maintenance or new) fails to reinstall panel covers
GIE	Inadequate Environmental Protection	Failure attributable directly to environment where failed component was located
GIL	Inadequate Lubrication	Failure directly attributable to improper or insufficient lubrication
GIM	Incorrect Material Specified	Failure attributable to use of material inappropriate for application
GOV	Overloaded	Placing too much load on piece of equipment or component, often attributed to low material strength, over-torque, or water hammer
GPE	Programming Error	Error in machinery operating code
GSS	Shipping/storage deficiencies	Failure attributable to inadequate shipping and handling practices, or inadequate equipment or component storage
GED	System/Equipment Design Less Than Adequate	Operating parameters exceed system/component ability to function effectively
GTS	Tolerances Not Specified or Wrong	Tolerance, or limits for operation, have not been specified, or are inappropriate for application or use
GUU	Unintended use	Failure attributable to use of part or component in application not intended
GVB	Vibration	Failure due to equipment or components vibration, often as a result of unbalanced loading, mechanical looseness, excessive clearances, or unexpected harmonics
GWP	Wrong part specified	Part not belonging in component was specified, or authorized for use

ATTACHMENT 10
Equipment Failure Modes
(Page 2 of 4)

CODE	TITLE	EQUIPMENT FAILURE DEFINITIONS
Mechanical Equipment Failure Modes		
MBS	Binding/Sticking	Failure attributable to component piece part binding or sticking to another part or device such that movement did not occur as expected.
MBR	Broken	Equipment is damaged or altered by breaking into two or more pieces.
MCO	Contaminated	Failure due to buildup of suspended solids in fluid systems.
MCR	Corroded	Failure attributable of loss of material or buildup of chemical reaction products from electrochemical or stress-aided corrosion.
MDI	Dirty	Loss of function due to extraneous material (such as dirt) on operating surfaces such as diesel engine fuel injector control racks.
MDR	Drift	Failure is attributable to poor stability of control setpoint. This applies to components with some type of actuation or trip function at a specific value (trip point, relief valve setting, etc.).
MEM	Embrittled	Equipment is affected in a manner where equipment becomes brittle (such as 'caramelized' appearance of rubber softeners).
MER	Eroded	Slow destruction of substance over time, typically due to action of liquid or gases against substance.
MFA	Fatigued	Time-related degradation of mechanical properties without significant loss of material.
MFR	Fractured/Cracked	Equipment or parts become split apart with fissures appearing on surface or completely through part.
MIN	Interference	Loss of flow function due to loss of, or unacceptable, movement caused by mechanical interference other than binding.
MLE	Leaked	Materials typically contained within boundary through undesired openings in boundary.
MLO	Loose	Failure is attributable to loose mechanical parts or fasteners.
MPL	Plugged	Loss of flow function due to lodged objects or solids
MRU	Ruptured	To burst in violent manner
MWB	Warped/Bent	Turned or twisted out of shape; distorted
MWO	Worn	Loss of function due to expected gradual change in configuration or loss of material.

ATTACHMENT 10
Equipment Failure Modes
(Page 3 of 4)

CODE	TITLE	EQUIPMENT FAILURE DEFINITIONS
Electrical Equipment Failure Modes		
EIF	Improper Fault Isolation	Failure due to malfunction or lack of adequate fault isolation components
ECR	Corroded	Failure attributable to loss of material or buildup of chemical reaction products from electrochemical or stress-aided corrosion.
EDI	Dirty	Loss of function due to extraneous material (such as dirt) on operating surfaces, such as electrical contacts, circuit cards, and circuit breaker moving parts.
EDR	Drift	Failure attributable to poor stability of control setpoint. This applies to components with some type actuation or trip function at specific value (trip point, bistable actuation setting, etc.)
EFC	Fails to Close	Failure typically associated with contacts, limit switches, etc when devices fail to close when called upon to close
EFZ	Fails to De-energize	Failure typically associated with coils, relays, etc when device fails to de-energize when necessary
EFE	Fails to Energize	Failure typically associated with coils, relays, etc when device fails to energize when necessary
EFO	Fails to Open	Failure typically associated with contacts, limit switches, etc when devices fail to open when called upon to open
EFS	Fails to Start	Failure typically associated with motors, when device fails to start when called upon to start
EFL	Fails to Stay Closed	Failure typically associated with contacts, limit switches, etc when devices fail to remain closed when called upon to remain closed
EFI	Fails to Stay De-energized	Failure typically associated with coils, relays, etc when device fails to remain de-energized when necessary
EFN	Fails to stay energized	Failure typically associated with coils, relays, etc when device fails to remain energized when necessary
EFT	Fails to Stay Open	Failure typically associated with contacts, limit switches, etc when devices fail to remain open when called upon to remain open
EFP	Fails to Stop	Failure typically associated with motors, when device fails to stop when called upon to trip, or stop
EHO	High Output	Amount of signal, voltage, amperage, etc. produced exceeds desired amount
ELO	Loose	Electrical terminal connection loose or containing intermittent contact or high electrical resistance.
ELW	Low output	Amount of signal, voltage, amperage, etc. produced is less than desired amount
EOC	Open circuit	Inoperability of electrical circuit due to break in conductor or contacts not made up.
ESG	Shorted/grounded	Loss of electrical circuit integrity due to shorted or grounded circuit.

ATTACHMENT 10
Equipment Failure Modes
(Page 4 of 4)

CODE	TITLE	EQUIPMENT FAILURE DEFINITIONS
Digital Hardware Failure Modes		
HMS	Mass Storage Device Failure	Examples include hard drives, optical recording devices
HMF	Memory Failure	EEPROM, RAM, NVRAM
HPS	Power Supply Failure	Failure due to loss of primary power, secondary power out of spec., via spiking, hi/lo, inability to push rated load
HCE	Communication Error	Examples include modems, network interface cards, network unavailability, network errors
HOH	Overheating	Cooling fan, loss of A/C, improper heat sink
HMI	Media Interface	Broken CD-ROM drive, floppy drive, USB port
HMF	Human Machine Interface Failure	Track Balls, mice, touch screens, monitors, keyboards
HIO	Input/Output Module Failure	Machine fails to correctly sense or input required values.
HCP	Central Processor Failure	Main processor freezes, or slows enough to effect system performance.
HPC	Printed Circuit Card Faults	Motherboards failures, faulty capacitors, tin/solder whiskers
HCO	Connections	Pin connectors, ethernet jacks, PC card slots failures, cable faults
Digital Software Failure Modes		
SFF	Firmware Fault	Wrong version installed or not compatible, or programming error to correct version.
SOS	Operating System Fault	System freezes, viruses, failure to initiate communication, error logs
SAP	Application Program Fault	Executable incorrectly programmed, application freezes but O/S still functions
SCF	Configuration Faults	Incorrect definitions, constants, drivers, designated variables, IP addresses
SHM	Human Machine Interface Fault	Mislabeled soft keys, Graphics errors, failure to alarm, failure to update display
SCO	Corruption Faults	Files are in place, but are unreadable by the system

ATTACHMENT 11
Safety Culture Codes
(Page 1 of 5)

Individual Commitment to Safety	Trend Codes
a. **Personal Accountability** - All individuals take personal responsibility for safety. Responsibility and authority for nuclear safety are well defined and clearly understood. Reporting relationships, positional authority, and team responsibilities emphasize overriding importance of nuclear safety.	PA
1. Standards: Individuals understand importance of adherence to nuclear standards. All levels of organization exercise accountability for shortfalls in meeting standards.	PA.1
2. Job Ownership: Individuals understand and demonstrate personal responsibility for behaviors and work practices supporting nuclear safety.	PA.2
3. Teamwork: Individuals and work groups communicate and coordinate activities within and across organizational boundaries to ensure nuclear safety is maintained.	PA.3
b. **Questioning Attitude** - Individuals avoid complacency and continuously challenge existing conditions, assumptions, anomalies, and activities in order to identify discrepancies that might result in error or inappropriate action. All employees are watchful for assumptions, values, conditions, or activities that can have undesirable effect on plant safety.	QA
1. Nuclear is Recognized as Special and Unique: Individuals understand complex technologies can fail in unpredictable ways.	QA.1
2. Challenge the Unknown: Individuals stop when faced with uncertain conditions. Risks are evaluated and managed before work proceeds.	QA.2
3. Challenge Assumptions: Individuals challenge assumptions and offer opposing views when they believe something is not correct.	QA.3
4. Avoid Complacency: Individuals recognize and plan for possibility of mistakes, latent issues, and inherent risk, even while expecting successful outcomes.	QA.4
c. **Safety Communication** - Communications maintain focus on safety. Safety communication is broad and includes plant-level communication, job-related communication, worker-level communication, equipment labeling, operating experience, and documentation. Leaders use formal and informal communication to convey importance of safety. Flow of information up the organization is seen as important as flow of information down the organization.	CO
1. Work Process Communications: Individuals incorporate safety communications in work activities.	CO.1
2. Bases for Decisions: Leaders ensure bases for operational and organizational decisions are communicated in timely manner.	CO.2
3. Free Flow of Information: Individuals communicate openly and candidly, both up, down, and across organization and with oversight, audit, and regulatory organizations.	CO.3
4. Expectations: Leaders frequently communicate and reinforce expectation that nuclear safety is organizations overriding priority.	CO.4

ATTACHMENT 11
Safety Culture Codes
(Page 2 of 5)

Management Commitment to Safety	Trend Codes
a. **Leadership Safety Values and Actions** - Leaders demonstrate commitment to safety in decisions and behaviors. Executive and senior managers are leading advocates of nuclear safety and demonstrate commitment both in word and action. Nuclear safety message is communicated frequently and consistently, occasionally as standalone theme. Leaders throughout nuclear organization set example for safety. Corporate policies emphasize overriding importance of nuclear safety.	LA
1. Resources: Leaders ensure personnel, equipment, procedures, and other resources are available and adequate to support nuclear safety.	LA.1
2. Field Presence: Leaders are commonly seen in working areas of plant observing, coaching, and reinforcing standards and expectations. Deviations from standards and expectations are corrected promptly.	LA.2
3. Incentives, Sanctions, and Rewards: Leaders ensure incentives, sanctions, and rewards are aligned with nuclear safety policies and reinforce behaviors and outcomes reflecting safety as overriding priority.	LA.3
4. Strategic Commitment to Safety: Leaders ensure plant priorities are aligned to reflect nuclear safety as overriding priority.	LA.4
5. Change Management: Leaders use systematic process for evaluating and implementing change so nuclear safety remains overriding priority.	LA.5
6. Roles, Responsibilities, and Authorities: Leaders clearly define roles, responsibilities, and authorities to ensure nuclear safety.	LA.6
7. Constant Examination: Leaders ensure nuclear safety is constantly scrutinized through variety of monitoring techniques, including assessments of nuclear safety culture.	LA.7
8. Leader Behaviors: Leaders exhibit behaviors that set standard for safety.	LA.8
b. **Decision-Making**- Decisions supporting or affecting nuclear safety are systematic, rigorous, and thorough. Operators are vested with authority and understand expectation, when faced with unexpected or uncertain conditions, to place plant in safe condition. Senior leaders support and reinforce conservative decisions.	DM
1. Consistent Process: Individuals use consistent, systematic approach to make decisions. Risk insights are incorporated as appropriate.	DM.1
2. Conservative Bias: Individuals use decision-making practices that emphasize prudent choices over practices that are simply allowable. Proposed action is determined to be safe in order to proceed, rather than unsafe in order to stop.	DM.2
3. Accountability for Decisions: Single-point accountability is maintained for nuclear safety decisions.	DM.3

ATTACHMENT 11
Safety Culture Codes
(Page 3 of 5)

Management Commitment to Safety (continued)	Trend Codes
c. **Respectful Work Environment**- Trust and respect permeate organization, creating respectful work environment. High level of trust is established in organization, fostered, in part, through timely and accurate communication. Differing professional opinions are encouraged, discussed, and resolved in timely manner. Employees are informed of steps taken in response to concerns.	WE
1. Respect is Evident: Everyone is treated with dignity and respect.	WE.1
2. Opinions are Valued: Individuals are encouraged to voice concerns, provide suggestions, and raise questions. Differing opinions are respected.	WE.2
3. High Level of Trust: Trust is fostered among individuals and work groups throughout organization.	WE.3
4. Conflict Resolution: Fair and objective methods are used to resolve conflicts.	WE.4

ATTACHMENT 11
Safety Culture Codes
(Page 4 of 5)

Management Systems	Trend Codes
a. **Continuous Learning**- Opportunities to continuously learn are valued, sought out, and implemented. Operating experience is highly valued, and capacity to learn from experience is well developed. Training, self-assessments, and benchmarking are used to stimulate learning and improve performance. Nuclear safety is kept under constant scrutiny through variety of monitoring techniques, some of which provide independent 'fresh look'.	CL
1. Operating Experience: Organization systematically and effectively collects, evaluates, and implements lessons from relevant internal and external operating experience information in timely manner.	CL.1
2. Self-Assessment: Organization routinely conducts self-critical and objective assessments of programs, practices, and performance.	CL.2
3. Benchmarking: Organization learns from other organizations to continuously improve knowledge, skills, and safety performance.	CL.3
4. Training: High-quality training maintains knowledgeable workforce and reinforces high standards for maintaining nuclear safety.	CL.4
b. **Problem Identification and Resolution**- Issues potentially impacting safety are promptly identified, fully evaluated, and promptly addressed and corrected commensurate with significance. Identification and resolution of broad spectrum of problems, including organizational issues, are used to strengthen safety and improve performance.	PI
1. Identification: Organization implements corrective action program with low threshold for identifying issues. Individuals identify issues completely, accurately, and in timely manner in accordance with program.	PI.1
2. Evaluation: Organization thoroughly evaluates issues to ensure problem resolutions and solutions address causes and extents of conditions commensurate with safety significance.	PI.2
3. Resolution: Organization takes effective corrective actions to address issues in timely manner commensurate with safety significance.	PI.3
4. Trending: Organization periodically analyzes information from corrective action program and other assessments in aggregate to identify adverse trends or conditions.	PI.4
c. **Environment for Raising Concerns and Resolution**- Safety-conscious work environment (SCWE) is maintained where personnel feel free to raise safety concerns without fear of retaliation, intimidation, harassment, or discrimination. Station creates, maintains, and evaluates policies and processes allowing personnel to freely raise concerns.	RC
1. SCWE Policy: Organization implements policy supporting individual rights and responsibilities to raise safety concerns and does not tolerate harassment, intimidation, retaliation, or discrimination for doing so.	RC.1
2. Alternate Process for Raising Concerns: Organization implements process for raising and resolving concerns independent of line management influence. Safety issues may be raised in confidence and are resolved in timely and effective manner.	RC.2

ATTACHMENT 11
Safety Culture Codes
(Page 5 of 5)

Management Systems (continued)	Trend Codes
d. **Work Process**- Process of planning and controlling work activities is implemented so safety is maintained. Work management is deliberate process in which work is identified, selected, planned, scheduled, executed, closed, and critiqued. Entire organization is involved in and fully supports process.	WP
1. Work Management: Organization implements process of planning, controlling, and executing work activities such that nuclear safety is overriding priority. Work process includes identification and management of risk commensurate with work.	WP.1
2. Design Margins: Organization operates and maintains equipment within design margins. Margins are carefully guarded and changed only through systematic and rigorous process. Special attention is placed on maintaining fission product barriers, defense-in-depth, and safety-related equipment.	WP.2
3. Documentation: Organization creates and maintains complete, accurate, and up-to-date documentation.	WP.3
4. Procedure Adherence: Individuals follow processes, procedures, and work instructions.	WP.4

ATTACHMENT 12
Extent of Condition Evaluation
(Page 1 of 3)

The purpose of an extent of condition evaluation is to perform a risk assessment of additional objects that may have the potential for pending, and as yet, unrevealed failures.

The evaluation identifies the population (people, equipment, or processes) that could potentially be affected and then determines if the population actually is affected. The intent is to identify additional vulnerabilities and take prompt corrective actions before onset of additional consequences.

The evaluation shall be bounded (limited) and the basis for this bounding described, including a discussion of risk and consequences of the bounding logic. Identified vulnerabilities shall have corrective actions created.

To complete an extent of condition evaluation, the evaluator must have defined the problem and understand the direct cause, such as the failure mechanism or initiating action. Understanding the cause allows the suspect population to be bounded at an appropriate level.

Any potential downstream effects of the event under evaluation should also be identified and evaluated.

NOTE: There are numerous acceptable ways to perform an extent of condition evaluation. Other methods may be used as deemed appropriate by the evaluating department, as long as all tiers are conceptually evaluated.

One method of performing and documenting this evaluation is by using the tool shown below. This approach is based on understanding the direct cause and application where the problem occurred. This is then assessed in other areas in tiered manner, first evaluating the most closely related object and applications and continuing through other similar objects and applications in which the condition is less likely to occur.

For Significance Level 1 and 2 cause evaluations, conceptually address through Tier 4 even if the tiered questions are not specifically used to present the evaluation. For Significance Level 3 cause evaluations, conceptually address through Tier 2 as a minimum.

ATTACHMENT 12
Extent of Condition Evaluation
(Page 2 of 3)

Object of Condition: (Object of condition in direct cause)

Condition: (Condition of object in direct cause)

Application: (Application of condition)

- Tier 1 - Same Object - Same Application: Are other (Same Object) in same condition in (Same Application)?
- Tier 2 - Same Object - Other Application(s): Are other (Same Object) in same condition in other (Other Applications)?
- Tier 3 - Similar Object - Same Application: Are similar (Similar Object) in same condition in (Same Application)?
- Tier 4 - Similar Object - Other Application(s): Are any closely related (Similar Object) in same condition in other (Other Applications)?

Extent of Condition Basis: Describe basis for bounding as well as associated risk and consequence.

Identified Vulnerabilities: Summarize identified vulnerabilities and recommend corrective actions.

ATTACHMENT 12
Extent of Condition Evaluation
(Page 3 of 3)

Listed below are examples of extent of condition questions:

Example #1 - Equipment Failure

Condition: Failed Condensate Pump Bearing

- Tier 1 - On identical equipment in same or redundant train - If investigating pump bearing failure in Condensate Pump, check same bearings in other Condensate Pumps.
- Tier 2 - On identical equipment in other similar applications - If investigating pump bearing failure in Condensate Pump, check for same bearings on High Pressure Heater Drain Pump.
- Tier 3 - On similar component - in same application. If investigating pump bearing failure in Condensate Pump - check other similar bearings on Condensate Pumps and/or Motors.
- Tier 4 - On similar component - in another application. If investigating pump bearing failure in Condensate Pump - check similar bearings in other systems with vertical pumps.

Example # 2 - Human Performance

Condition: Operator operated wrong valve during valve lineup.

- Tier 1 - Did same operator operate other valves incorrectly in same valve lineup?
- Tier 2 - Did same operator operate other valves incorrectly on other valve lineups?
- Tier 3 - Did other operators operate valves incorrectly on same system valve lineups?
- Tier 4 - Did operators misalign equipment incorrectly for other systems?

Example #3 - Organizational & Programmatic Error

Condition: Inadvertent system actuation due to inadequate maintenance procedure or step.

- Tier 1 - Do other maintenance procedures contain same error?
- Tier 2 - Do other maintenance procedures contain similar errors?
- Tier 3 - Do other technical procedures contain same error?
- Tier 4 - Do other technical procedures contain other similar errors?

ATTACHMENT 13
Extent of Cause Evaluation
(Page 1 of 2)

The purpose of an extent of cause evaluation is to determine the extent to which the cause of the identified problem has impacted or has the potential to impact other plant processes, equipment, or human performance.

This evaluation shall determine if the identified cause exists in other equipment, procedures, processes, or organizations, as well as where the cause could result in similar consequences. The intent is to identify additional vulnerabilities and take prompt corrective actions before onset of additional consequences.

The evaluation shall be bounded to limit scope to a manageable level and the basis for this bounding described, including a discussion of risk and consequences of the bounding logic. Identified vulnerabilities shall have corrective actions created.

Apply the following to each identified cause:

- "Where else has the same cause produced evident consequences?
- "Where else could the same cause produce future consequences?

NOTE: There are numerous acceptable ways to perform an extent of cause evaluation. Other methods may be used as deemed appropriate by the evaluating department, as long as all tiers are conceptually evaluated.

One method of performing and documenting this evaluation is by using the tool shown below.

For Significance Level 1 and 2 cause evaluations, conceptually address through Tier 4 even if the tiered questions are not specifically used to present the evaluation. For Significance Level 3 cause evaluations, conceptually address through Tier 2 as a minimum.

ATTACHMENT 13
Extent of Cause Evaluation
(Page 2 of 2)

Object of Cause: (Object of cause in cause statement)

Cause: (Cause of object of cause in cause statement)

Application: (Application of cause)

- Tier 1 - Same Object - Same Application: Are other (Same Object) with same cause in (Same Application)?
- Tier 2 - Same Object - Other Application(s): Are other (Same Object) with same cause in other (Other Applications)?
- Tier 3 - Similar Object - Same Application: Are similar (Similar Object) with same cause in (Same Application)?
- Tier 4 - Similar Object - Other Application(s): Are any closely related (Similar Object) with same cause in other (Other Applications)?

Extent of Cause Basis: Describe basis for bounding as well as associated risk and consequence.

Identified Vulnerabilities: Summarize identified vulnerabilities and recommend corrective actions.

Listed below is an example of extent of cause questions:

Example #1 - Equipment Failure

Cause: Inadequate selection process used to choose gasket material - Inappropriate gasket selection (inappropriate gasket material) resulted in leaking joint in cooled fluid side (CC side) of CC Heat Exchanger.

- Tier 1 - Are any other inappropriate gaskets installed elsewhere in CC system using same selection criteria?
- Tier 2 - Are any inappropriate gaskets installed in other systems using same selection criteria?
- Tier 3 - Are any inappropriate material installed elsewhere in CC system using same selection criteria method?
- Tier 4 - Are any inappropriate materials installed elsewhere in station using same selection criteria method?

ATTACHMENT 14
Equipment Reliability/PM Adequacy
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Equipment Reliability/PM Adequacy

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Parent CR #:

1.	**Event Description / Problem Statement** *(Include applicable equipment location numbers):*

2.	**Failure Mechanism**			
	Reference: MA-AA-103, Conduct of Troubleshooting and PI-AA-300-3004, Cause Evaluation Methods			
	What is the mechanical, chemical, physical, or other process that resulted in the failure? Why and how did the component fail? Use a logical, systematic approach to identify the failure mode and determine the failure mechanism. *If unknown, continue troubleshooting, write actions to troubleshoot when plant conditions permit, or discuss with management to document risk acceptance of unknown.*			
	Response:			

3.	**Check Correctness of Criticality Classification**			
	Reference: ER-AA-PRS-1003, Equipment Reliability Component Classifications and ER-AA-PRS-1005, Single Point Vulnerability Reviews	**YES**	**NO**	**N/A**
a.	What is the current Criticality Classification assigned for this component?			
b.	Is the Component Criticality Classification correct? *Consult with system and component engineers to check the equipment criticality is correct.*	☐	☐	☐
c.	Is the component SPV designation accurate?	☐	☐	☐
d.	Is the Component Duty Cycle correct? *For example, is the duty cycle listed as low, but severe rotational wear was observed? Has the duty cycle changed from that assumed when the PM was developed?*	☐	☐	☐
e.	Is the Component Service Condition correct? *For example, is the service condition listed as mild, but severe heat degradation was observed. Has the service condition changed from that assumed when the PM was developed?*	☐	☐	☐
	If any answer above is No, define correct classifications per ER-AA-PRS-1003, Equipment Reliability Component Classifications and ER-AA-PRS-1005, Single Point Vulnerability Reviews below, correct PM scope, PM frequency, maintenance procedure and work order instructions.			
	Action to address:			

4.	**Adequacy of System and Component Monitoring**			
	Reference: ER-AA-SYS-1003, System Performance Monitoring *Review the applicable performance monitoring and trending plan and operating parameters (levels, flow, temperature, pressure, etc.). Consider the scope, frequency, and execution.*	**YES**	**NO**	**N/A**
a.	For condition monitoring performed (System or Component Monitoring Plan), are the appropriate parameters being monitored at the optimum frequency to detect the degradation mechanisms/influences that resulted in this component failure?	☐	☐	☐
b.	If not performed, should it be? *(If Yes, initiate actions and document below)*	☐	☐	☐
c.	If performed, is the monitoring and threshold for action adequate? *(If No, initiate actions and document below)*	☐	☐	☐
d.	If performed, is there improvement needed in collecting or trending the data? *(If Yes, initiate actions and document below)*	☐	☐	☐
	Did any of the above contribute to this component failure?	☐	☐	☐
	If Yes, explain basis (why) below:			
	Action to address:			

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Equipment Reliability/PM Adequacy
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5.	**Adequacy of System or Component Health, Life Cycle Management Plan, and Long Range Plan**			
	Reference: ER-AA-SYS-1001, System Health Report, ER-AA-5003, Life Cycle Management Planning, ER-AA-5004, Long Range Planning, and ER-AA-PRS-1001, Plant Health Committee.	**YES**	**NO**	**N/A**
a.	Are actions present in the System Health Report Action Plan and/or Life Cycle Management Plan and/or Long Range Plan (LRP) which would mitigate this failure? *(If No, initiate actions and document below)*	☐	☐	☐
b.	Has the issue that led to equipment failure been previously presented to the Plant Health Committee (PHC)? *(If No, initiate actions and document below)*	☐	☐	☐
	If yes, is the issue appropriately prioritized, scheduled, and funded?	☐	☐	☐
c.	Is the failure attributed to an aging/obsolescence concern . If No, select N/A.	☐	☐	☐
d.	Is this failure currently addressed in the corrective actions or addressed in the long range plan? If no, describe actions required.	☐	☐	☐
Did any of the above contribute to this component failure?		☐	☐	☐
If Yes, explain basis (why) below:				
Action to address:				

6.	**Adequacy of Preventive (PM) and Predictive (PdM) Maintenance Programs**			
	Reference: ER-AA-PRS-1010, Preventive Maintenance Task Basis & Maintenance Strategy. Review PM template in IQ Review for scope, failure type, PM/PdM tasks, frequencies, and work instructions.	**YES**	**NO**	**N/A**
a.	Does a PM task exist?	☐	☐	☐
b.	Is the PM/PdM task content adequate and consistent with the current PM Template/Basis/Maintenance Strategy to defend against the degradation mechanisms/influences that resulted in this failure?	☐	☐	☐
c.	Is the PM/PdM frequency adequate and consistent with the current PM Template/Basis to defend against the degradation mechanisms/influences that resulted in this failure?	☐	☐	☐
d.	Is the current PM Template/Basis adequate and consistent with the current EPRI PM Template and/or Industry guidance including vendor recommendation?	☐	☐	☐
e.	Was applicable PM feedback adequately implemented?	☐	☐	☐
f.	If performed, is the PdM monitoring and threshold for action adequate?	☐	☐	☐
If any of the above were answered No, initiate actions and document below				
g.	Was a PM which addresses this failure mechanism previously deferred? *(If Yes, initiate actions and document below)*	☐	☐	☐
h.	Is there a new first-time PM or significant PM change which addresses this failure mechanism that has not yet been performed on the component? *(If Yes, initiate actions and document below)*	☐	☐	☐
Did any of the above contribute to this component failure?		☐	☐	☐
If Yes, explain basis (why) below:				
Action to address:				

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7.	**Adequacy of Work Practices**			
	Reference: WM-AA-100, Work Management, MA-AA-100, Conduct of Maintenance	**YES**	**NO**	**N/A**
a.	Does the most recently performed maintenance activity (work order or procedure work instructions), which could mitigate this failure mechanism, have adequate scope, instructions, content, and detail?	☐	☐	☐
b.	Was the Post Maintenance Test (PMT) performed and was it adequate?	☐	☐	☐
If any of the above were answered No, initiate actions and document below.				
c.	Determine if failures in the work planning process allowed poor quality or incomplete Work Orders to be developed. Include missed milestones, scope change after planning, late restraint closure and late parts receipt.	☐	☐	☐
d.	Are there any outstanding Work Orders (Corrective, Deficient, Modification, etc.) that if worked could have prevented this failure? *(If Yes, initiate actions and document below)*	☐	☐	☐
e.	Are there any outstanding actions or evaluations (CAs, DC, ET, etc.) that if implemented or performed could have prevented this failure? *(If Yes, initiate actions and document below)*	☐	☐	☐
Did any of the above contribute to this component failure?		☐	☐	☐
If Yes, explain basis (why) below:				
Action to address:				

8.	**Adequacy of Design and Operation**			
	Reference: CM-AA-DDC-201, Design Changes, DNES-AA-GN-1003, Design Effects and Considerations *Review drawings, calculations, design margin, and codes. Determine if the original design of subsequent design changes yielded components appropriate for its configuration/application. Review operating procedures, operating practice, and observation of identical component.*	**YES**	**NO**	**N/A**
a.	Is the design of this component appropriate for the application?	☐	☐	☐
b.	If there was a Design Change, was it appropriate for the application?	☐	☐	☐
c.	Was Design Change implementation adequate?	☐	☐	☐
d.	Is the component appropriate for its configuration/application?	☐	☐	☐
e.	Are the operating procedures and practices appropriate?	☐	☐	☐
f.	Was the component operated within design?	☐	☐	☐
If any of the above were answered No, initiate actions and document below				
g.	Is there any outstanding design change that if performed could have prevented this failure? *(If Yes, initiate actions and document below)*	☐	☐	☐
Did any of the above contribute to this component failure?		☐	☐	☐
If Yes, explain basis (why) below:				
Action to address:				

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9.	**Adequacy of Parts**			
	Review vendor's design/manufacturing issues, shelf life, storage environment, shipping practice and off-site lab testing. Also determine if procurement specifications were adequate.	**YES**	**NO**	**N/A**
a.	Were parts availability and quality adequate?	☐	☐	☐
b.	Was receipt, inspection, and storage adequate (e.g., environment, shelf life, control of scavenged parts, storage PM)?	☐	☐	☐
c.	Was Vendor quality or workmanship adequate (i.e., no manufacturing defects)?	☐	☐	☐
d.	Was Procurement adequate (e.g., specification, equivalence)?	☐	☐	☐
If any of the above were answered No, initiate actions and document below.				
Did any of the above contribute to this component failure?		☐	☐	☐
If Yes, explain basis (why) below:				
Action to address:				

Form No. 733482(Jul 2017)

Public Staff Stanley Cross
Examination Exhibit 2

Attachment Public Staff Set 17-2(b) (BLS) Rebuttal

I/A

Nuclear Fleet

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Guidance and Reference Document

Title: Root Cause Evaluation

Procedure Number	Revision Number	Effective Date and Approvals On File
PI-AA-300-3001	11	

Revision Summary Rev 11

Administrative correction to change "e" to "the" in Step 3.3.11.

Revision Summary Rev 10

Made the following changes, based on markup from Organizational Effectiveness.

- Changed responsibility from "RCE Team Lead" to "Lead RC Evaluator" throughout.
- Added step 3.2.2, step 3.3.5.a, and 3.3.5.b.
- Deleted note before steps 3.3.1 and 3.3.5. Deleted reference step 5.4.6. Deleted Attachments 3, 4, and 7 (being incorporated into PI-AA-300).
- Deleted unnecessary wording from note before step 3.3.3.
- Changed reference from Attachments 2, 4, and 7 to PI-AA-300.
- Added "and causal factors" to step 3.3.8.
- Changed "CAPRs are approved and implemented" to "completion of formal root cause evaluation" in step 3.3.10.
- Replaced step 3.3.14.
- Re-wrote and/or added steps 3.3.19 - 3.5.13.
- Changed Attachment 2 to a outline style format and removed Approval Date from cover.
- Added "Interim Monitoring Actions" column to Attachment 9 (now Attachment 6).
- Added Attachment 8 from PI-AA-200-2002.
- Changed title of third column in Attachment 9 (now Attachment 6).
- Changed scoring criteria for step 8.1 of Attachment 7.

Made administrative changes to update cross-references within FrameMaker and bring up to Writer's Guide standards. No change bars used for administrative changes Examples of these changes made:

- Changed "PI-AA-200, Corrective Action" to "PI-AA-200" due to being in the same functional area.
- Changed branches to ATTACHMENTS to all caps.
- Changed **NOT**s and **NO**s to bold/underline/capital.

Functional Area Manager: Director Nuclear Safety and Licensing

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1.0 PURPOSE

Provide instructions for conducting root cause analysis and documenting results.

2.0 SCOPE

This Guidance and Reference Document (GaRD) applies to all Dominion Nuclear facilities and support locations. This GaRD is to be used in conjunction with requirements of PI-AA-300.

3.0 INSTRUCTIONS

3.1 General

3.1.1 **REFER** to the following for primary elements for each root cause evaluation:

- Team Assignment
- Development of the Problem Statement
- Investigation
- Evaluation and Analysis
- Development of Corrective Action
- Report Writing
- Report Approval
- Effectiveness Review

> **NOTE:** Each section requires response with level of detail necessary to address event/condition being evaluated. This form meets requirements of PI-AA-300 and expectations as outlined in this GaRD. Other format variations may be used, provided they meet minimum requirements of PI-AA-300 and minimum guidance provided in this GaRD.

3.1.2 **WHEN** performing Root Cause Evaluations, **REFER** to RCE report template often.

RCE Manager

3.1.3 **REFER** to PI-AA-300, ATTACHMENT 4, Pre-Investigation Briefing Sheet for Apparent/Root Causes, and **CONDUCT** pre-job brief to define investigation scope.

3.2 Problem Statement

NOTE: Problem Statement describes issue to be resolved and issue intended to preclude. This subsection should give reader enough information to understand problem, how long problem existed, and impact to site. Initial CR Number as well as RCE Number should be included for clarity. For complex issues, another paragraph bounding issue scope or condition to be evaluated may be needed.

Lead RC Evaluator

3.2.1 **DEVELOP** brief statement (one or two paragraphs) clearly describing:

- Event
- Item or process affected
- Specific condition which is departure from required or expected standard of performance
- Consequences

3.2.2 **ADDRESS** regulatory impact if related to a finding, including consideration of elements contained in NRC inspection procedure 95002 if applicable.

3.2.3 **PRESENT** Problem Statement to responsible manager and CARB for approval within three working days of RCE assignment.

3.2.4 **REFER** to ATTACHMENT 1 for example of RCE Problem Statement.

3.3 Investigation

RCE Team

3.3.1 **PERFORM** investigation:

a. IF Event Review Team was established, THEN **OBTAIN** all information gathered by team as evidence to support cause analysis.

b. IF quarantine of equipment is necessary, THEN **PERFORM** the following:

1. **CONTACT** Operations to determine if quarantine is possible.
2. IF possible, THEN **REQUEST** Operations quarantine equipment in accordance with OP-AA-1300, Quarantine.

c. For equipment and/or components NOT installed in plant, **ENSURE** all necessary precautions are taken to ensure access to equipment/ components under investigation is restricted to prevent tampering.

3.3.2 **GATHER** the following minimum physical evidence and historical data to assist analysis, (see PI-AA-300-3004, ATTACHMENT 1, Collecting Physical Evidence & Historical data Review, for guidance):

- Unit
- Date of Event
- Time of Occurrence
- Brief Description of Event
- Personnel Involved
- Evolutions in progress at time of event
- Plant Status at time of event
- System(s)/Component(s) involved
- Time from event to detection (i.e. 10 minutes, 1-4 hours, 1 day)
- How was event detected (i.e. Local Monitoring, Documentation Review)
- Post Trip Data per OP-AP-105, Post Trip Review, if a reactor trip has occurred

NOTE: See PI-AA-300-3004 for guidance to be used to conduct successful interview.

3.3.3 **CONDUCT** interviews.

NOTE: Sequence of events is always required for adequate understanding of event. Sequence of events should include the following:

- Initial timeline of events
- Conditions
- Human actions
- Equipment failures
- Other circumstances preceding event or issue being evaluated, followed by immediate consequences of event/issue.

3.3.4 **DETERMINE** sequence of events.

3.3.5 **PERFORM** Extent of Condition (EOC) evaluation in accordance with PI-AA-300.

a. **PERFORM** evaluation as early as possible in the investigation to assist in determining any needed interim actions.

b. **INITIATE** and necessary corrective actions.

3.3.6 **DETERMINE** initial analysis focus and need for outside expertise to determine cause or conduct analysis to support identified cause:

a. IF knowledge or skill weakness is identified, **THEN ENSURE** analysis is conducted per TR-AA-100, Analysis.

b. To ensure timely data gathering and analysis, **CONTACT** appropriate vendors or Dominion Material Engineering Lab for assistance as soon as possible.

3.3.7 **ENGAGE** appropriate peer groups associated with event, e.g. industry user groups and fleet peers, during conduct of cause evaluation.

3.3.8 **PERFORM** Cause Evaluation using guidance in PI-AA-300-3004:

a. **DETERMINE** direct, root, contributing cause(s), and causal factors using systematic approach including organizational and programmatic aspects.

b. **SELECT** at least two analysis methods.

c. **INCLUDE** discussion of evaluation methods selected and conclusions reached in RCE report.

NOTE: Lead evaluator may choose to use other cause analysis techniques to complement those provided in PI-AA-300-3004, which is acceptable as long as analysis used is appropriate for identified condition and complete description of analysis method is included in RCE report.

d. **ENSURE** the methods selected lead to agreement as to the root cause(s).

e. **ENSURE** the root cause process determines the specific behavior, condition, or process which resulted in the problem as described in the problem statement.

NOTE: Valid root causes are **NOT** failed barriers, failure modes, generic deficiencies, or causal factor categories.

Examples of poor root causes include the following:

- Inadequate procedure
- Inadequate change management
- Inadequate supervisory oversight
- Inadequate training
- Failed Design Change Process

Better root causes include the following:

- Inadequate rigor in procedure review process
- Failure to develop and implement adequate Change Management Plan
- Training Program content did not address required skills and behaviors

NOTE: Contributing causes are defined as causes that, by themselves, would **NOT** create the problem, but are important enough to be recognized as needing corrective action. A valid contributing cause is a specific behavior, condition, or process. Examples are similar to those described above for root cause. Contributing cause would be considered valid if analysis logic supports the cause and it passes test which determines elimination of cause would have resulted in problem **NOT** occurring to degree or extent to which it did occur.

f. **ENSURE** root cause passes the following three tests:

- Problem would **NOT** have occurred had root cause(s) **NOT** been present.
- Problem will **NOT** recur if root cause(s) is corrected or eliminated.
- Correction or elimination of root cause should preclude repetition of similar conditions.

g. For RCEs with recurring equipment issues, **REVIEW** complete equipment operating and maintenance history for aggregate impact of changes in operating conditions and methods of operation. (Ref. 5.4.17)

3.3.9 **REVIEW** existing immediate corrective actions, interim compensatory actions, and interim corrective actions for adequacy and alignment with identified root/contributing causes.

a. **ENSURE** immediate and interim corrective actions as implemented are sufficient to provide reasonable assurance identified condition will **NOT** recur before Corrective Actions to Preclude Repetition (CAPRs) are implemented.

b. **DEVELOP** and **IMPLEMENT** additional interim corrective or compensatory actions as necessary to control emergent detrimental conditions until final corrective actions are in place.

NOTE: Monitoring activities are intended to provide method to ensure actions taken remain effective and provide reasonable assurance emergent conditions detrimental to any of the following are identified and controlled until final corrective/ compensatory actions are in place:

- Systems
- Structures
- Components
- Processes
- Personnel
- Environment

3.3.10 **REFER** to ATTACHMENT 5 and **DEVELOP** monitoring activities to ensure effectiveness of immediate/ interim corrective actions until completion of formal root cause evaluation.

3.3.11 **PERFORM** review of Organizational and Programmatic issues associated with event in accordance with the guidance in PI-AA-300-3004, ATTACHMENT 15, Organizational and Programmatic Issues.

3.3.12 **PERFORM** review of safety consequences of event in accordance with ATTACHMENT 3.

3.3.13 **PERFORM** review of nuclear safety culture aspects to determine if behaviors revealed in RCE were consistent with positive nuclear safety culture in accordance with ATTACHMENT 4 and **INCLUDE** reviewing results of latest nuclear safety culture survey and summarizing applicable behaviors that may have been evident in root cause event.

3.3.14 **PERFORM** repeat review:

a. **REVIEW** previously completed cause evaluations (ACEs, QCEs, EACEs, or RCEs) based on availability of historical data and consequences of event for at least the previous five years.

1. **IDENTIFY** Repeat Issues and Repeat Events as defined in PI-AA-300.

2. **IF** it is determined a corrective action from an ACE, EACE, or QCE failed to reduce the frequency of an event either because the action was **NOT** implemented in a timely manner **OR** because the implemented action was ineffective, **THEN CONSIDER** ineffective corrective action a potential causal factor for the current analysis.

b. **IF** it is determined a CAPR failed to prevent an event either because the CAPR was **NOT** implemented in a timely manner **OR** because the implemented CAPR was ineffective, **THEN DESIGNATE** the event as a Repeat Event and consider ineffective corrective action a causal factor for the current analysis.

c. **DOCUMENT** the following for Repeat Issues or Events:

- Description
- Cause if known
- Corrective action taken or statement if none was taken
- Discussion of effectiveness of corrective actions

3.3.15 **PERFORM** Operating Experience (OE) review:

NOTE: OE is obtained from searches of the following for subjects related to event being investigated or for causes identified during conduct of root cause evaluation investigation process:

- INPO OE
- EPRI/NMAC
- HSIN (Homeland Security Information Network)
- NRC event reports and Licensee Event Reports

Additional OE sources can be obtained from station Root Cause Coordinators (e.g. Previous Root/Probable Cause Evaluations conducted for similar events). Logical keyword searches must be used when performing database reviews.Keywords or phrases used must be documented.

a. **CONDUCT** analysis of operating experience that may be related to event being investigated and **ENSURE** significant and important OE, such as SOERs, IERs and MUST-KNOW OE are also included.

b. **INCORPORATE** applicable OE documents into RCE process and reference in RCE report, with particular emphasis on causes of and lessons learned from these reports representing missed opportunities that could have prevented current event or condition.

c. For reactor scrams, **PERFORM** review to identify and document any applicable OE that would have prevented scram:

   - **REVIEW** applicability of any Scram Analysis IERs (currently IER L2-11-2, 2009-2010 Scram Analysis, recommendations (including additional recommendations) and IER L4-12-69, 2011 Scram Analysis, recommendations as of October 2015).
   - **CHECK** for any new Scram Analysis IERs that may have been issued.

d. IF OE is identified that could have been used to predict/prevent event or was used and was NOT successful in preventing event, THEN **PERFORM** the following as applicable:

- IF OE was available but NOT evaluated, THEN **INITIATE** corrective actions to evaluate OE as well as identify and correct any organizational, programmatic, or human performance-related deficiencies.
- IF OE was available and previously evaluated, THEN **DETERMINE** why OE NOT successful in preventing event AND **INITIATE** corrective actions to address any organizational, programmatic, or human performance-related deficiencies.

e. **REVIEW** applicable OE for useful lessons learned and **CONSIDER** the following to develop corrective action recommendation:

- Are learning opportunities available from OE that can be applied to this causal analysis?
- Should similar corrective actions in OE be implemented for this causal analysis?

f. **COMMUNICATE** event and lessons learned to industry via INPO Nuclear Network (as deemed applicable per PI-AA-100-1014).

3.3.16 **PERFORM** Extent of Cause evaluation in accordance with PI-AA-300.

3.3.17 **PERFORM** Equipment Reliability/PM Adequacy review for equipment related RCEs in accordance with PI-AA-300.

3.3.18 **DEVELOP** corrective actions in accordance with PI-AA-200 and **ANNOTATE** corrective actions to preclude repetition (CAPR) and corrective action for contributing causes (CACC) as necessary to link corrective action and cause. Refer to ATTACHMENT 6:

a. IF crediting existing action, THEN **ENSURE** the following:

- Owner of existing item concurs
- Scope of existing item is updated to refer to additional scope
- Existing item is same or greater significance than source of item crediting that action

b. IF existing action can NOT be credited, THEN **DEVELOP** new action.

c. **ENSURE**, per PI-AA-200, actions recommending use of training are written to NOT bypass training processes.

d. **ENSURE** actions impacting fleet are approved by appropriate peer group.

NOTE: The effectiveness goal should **NOT** focus on the completion of specific actions but also on the results achieved. A goal to simply complete the actions is **NOT** sufficient.

Quantitative criteria are desirable. When appropriate, based on the issue, qualitative measures may also be used.

Examples of an effectiveness goal include but are **NOT** limited to:

- **NO** PM deferrals without appropriate reviews
- **NO** new equipment failures
- **NO** failures of the specific EP drill criteria

3.3.19 **ESTABLISH** specific criteria (effectiveness goal) to be met during the effectiveness review in order to demonstrate the effectiveness of the CAPR.

NOTE: For example, if the corrective action was to provide training, the effectiveness review should **NOT** stop at reviewing the lesson plan, attendance records, or class test results. The review should include determining the practical knowledge of the people who were trained by interviewing a sample of trained people with open-ended questions such as "Explain the purpose of..." or observing jobs or tasks where the training is applied.

If the action was to implement a policy or procedure change, the review should determine whether the affected people understand and implement the change as intended, **NOT** simply verifying the policy or procedure change was issued.

Examples of data include but are **NOT** limited to:

- Key performance indicators
- The number of successes / opportunities for a given evolution or activity
- Number of events over time
- Results of interviews to determine training retention
- Review of behaviors

Sources of data include but are **NOT** limited to:

- Assessments / Audits
- CAP
- Observations
- Tests
- Trending of plant data
- Follow-up discussions with plant staff

3.3.20 **ESTABLISH** quantitative and / or qualitative data to review to determine if goal has been met.

3.3.21 **PREPARE** a cause to corrective action matrix (ATTACHMENT 6) and **INCLUDE** cause, Corrective Action, interim monitoring actions from step 3.3.10, and effectiveness goal and data to be reviewed for CAPRs from steps 3.3.19 and 3.3.20.

NOTE: Most events and adverse conditions can be divided into broad categories of:

- Human performance problems
- Equipment performance problems
- Organizational and Programmatic issues

Causes of these broad categories of problems can be divided into causal factor categories and subcategories which facilitate trending. Causal factor categories and subcategories are provided in PI-AA-300.

Lead RC Evaluator

3.3.22 **IDENTIFY AND DOCUMENT** cause codes from PI-AA-300 in report for trend coding purposes.

3.3.23 **ENSURE** assignment of corrective actions.

Responsible Manager

3.3.24 **APPROVE** completed RCE. **DOCUMENT** approver name and signature (may be electronic signature as part of corrective action database work flow).

NOTE: RCE Shall achieve quality index of 85% or better to be approved by Station Cause Evaluation Coordinator.

Station Cause Evaluation Coordinator

3.3.25 **GRADE** RCE in accordance with ATTACHMENT 7 and **ATTACH** copy of completed grading sheet to RCE (electronically in Corrective Action Process).

CARB

3.3.26 **REVIEW** and **APPROVE** completed RCE.

Lead RC Evaluator

3.3.27 **IF** RCE Report **CANNOT** be approved within 30 days, **THEN REQUEST** an extension in accordance with section 3.4.

3.3.28 **IF** approved RCE report is to be revised or deleted, **THEN REVISE** or **DELETE** in accordance with the following:

- Individual or organization requesting revision or deletion shall make every effort to obtain concurrence from RCE team lead and / or members.
- Revisions / deletions to RCEs, CAPRs, and CACCs, shall be documented in associated corrective action process record and presented to CARB for approval.
- Non-administrative revisions to RCE and associated corrective actions shall also be presented to CARB for approval.
- The individual or organization revising an approved RCE is responsible for notifying Station Licensing of revision to determine if change affects correspondence or commitments to NRC.

3.4 RCE Extensions

NOTE: Extensions should be granted only for cases where extenuating circumstances preclude meeting the 30 day requirement. Any extension requires CARB approval.

3.4.1 IF extension is requested because required information is **NOT** available or plant is **NOT** in a condition to allow investigation, **THEN PRESENT** interim RCE report to CARB prior to original due date. Interim report shall include the following as a minimum:

a. Most probable cause

b. Recommended actions to address most probable cause

c. Current assement of Extent of Condition

d. Interim actions (to be created following CARB approval of interim report)

CARB — 3.4.2 **REVIEW** and **APPROVE** Interim Report.

Lead RC Evaluator — 3.4.3 **PERFORM** and **COMPLETE** RCE when information is available or plant is in a safe condition to perform RCE.

3.5 Effectiveness Reviews

NOTE: Performance of the effectiveness review will be based on threat and vulnerability, normally within six to twelve months after the last CAPR is completed or as directed by CARB.

3.5.1 **DETERMINE** whether each CAPR was implemented as assigned.

3.5.2 **DETERMINE** whether circumstances or conditions similar to those in the original problem or failure have challenged the CAPR.

NOTE: If any of the following are true, the review is indeterminate and the effectiveness review assignment may need to be extended.

- CAPR has **NOT** been fully implemented.

  OR

- Sufficient time has **NOT** elapsed.

  OR

- CAPR has **NOT** been challenged.

This extension will **NOT** be counted against the department or Corrective Action Program performance indicators. **NO** CR is required for indeterminate effectiveness reviews.

3.5.3 **DETERMINE** whether sufficient time has elapsed or plant conditions have occurred since implementation of the CAPR for a problem or failure to occur.

3.5.4 For non-equipment situations where CAPRs will be infrequently challenged, **CONSIDER** a tabletop walkthrough of a challenge or a similar method to determine likelihood of a successful outcome should a challenge have occurred.

3.5.5 **IF** adequately challenged, **THEN RESEARCH** CR database to determine if additional failures or events have occurred.

3.5.6 **IF** additional failures or events have occurred, **THEN EVALUATE** whether actions taken and circumstances surrounding challenge(s) are similar to identified cause(s).

3.5.7 **IF** in the process of performing the effectiveness review any of the following conditions are met, **THEN INITIATE** a CR to document this deficiency.

- It is determined a CAPR was **NOT** implemented per the latest approved schedule.

  OR

- A CAPR has been closed without implementation.

  OR

- A CAPR has been implemented improperly.

3.5.8 **REFER** to Cause to Corrective Action Matrix of RCE for effectiveness goal and data to be retrieved.

3.5.9 **EVALUATE** the effectiveness of each CAPR.

3.5.10 **IF** CAPRs are **NOT** effective, **THEN INITIATE** a CR.

3.5.11 In determining why CAPRs were **NOT** effective, **CONSIDER** identifying any additional corrective actions needed to resolve the issue. Possible areas to evaluate include:

- Root causes were incorrectly identified.
- Root causes were correctly identified, but corrective actions were incorrectly identified.
- Corrective actions were **NOT** fully implemented or **NOT** implemented as intended.
- Corrective actions where **NOT** implemented in a timely manner.
- Corrective actions created new or different problems.
- Corrective actions were implemented and then eliminated or defeated.
- Organization does **NOT** understand the issue or accept ownership.

3.5.12 **IF** at any time during an effectiveness review a Condition Adverse to Quality or any question of either current or past Operability/Reportability arises **AND** a CR has **NOT** been generated that specifically addressed this issue, **THEN INITIATE** a CR.

3.5.13 **DOCUMENT** the results of the effectiveness review using ATTACHMENT 8.

4.0 RECORDS

4.1 The following Non-Quality Assurance record(s) completed as a result of this guidance and reference document are required to be transmitted to Nuclear Document Management (NDM). The records have been identified and retention requirements established for the Nuclear Records Retention Schedule (NRRS) per RM-AA-101, Record Creation, Transmittal, and Retrieval.

- Root Cause Evaluation reports completed in accordance with this procedure (including attachments) when combined with associated CR contained within electronic Corrective Action database

4.2 The following Non-Quality Assurance records completed as a result of this guidance and reference document are **NOT** required to be transmitted to Nuclear Document Management (NDM), but are required to be retained as indicated below.

None

4.3 The following item(s) completed as a result of this guidance and reference document are **NOT** records and are **NOT** required to be transmitted to Nuclear Document Management (NDM).

None

5.0 ADMINISTRATIVE INFORMATION

5.1 Commitments

None

5.2 Responsibilities

See PI-AA-300 and PI-AA-200.

5.3 Definitions

See PI-AA-300 and PI-AA-200.

5.4 References

5.4.1 PI-AA-200, Corrective Action

5.4.2 PI-AA-300, Cause Evaluation

5.4.3 OP-AA-1300, Quarantine

5.4.4 MA-AA-103, Conduct of Troubleshooting

5.4.5 OP-AP-105, Post Trip Review

5.4.6 PI-AA-300-3000, Event Review

5.4.7 PI-AA-300-3004, Cause Evaluation Methods

5.4.8 TR-AA-100, Analysis

5.4.9 PI-AA-100-1014, INPO Consolidated Event System (ICES) Reporting

5.4.10 ER-AA-10, Equipment Reliability

5.4.11 ER-AA-PRS-1003, Equipment Reliability Component Classifications

5.4.12 ER-AA-PRS-1005, Single Point Vulnerabilities Review

5.4.13 ER-AA-PRS-1010, Preventive Maintenance Task Basis & Maintenance Strategy

5.4.14 ER-AA-SYS-1003, System Performance Monitoring

5.4.15 INPO 12-012, Traits of Healthy Nuclear Safety Culture

5.4.16 PA3010168, Update PI-AA-300-3001, Root Cause Evaluation Procedure

5.4.17 CA3028413, Add direction to review completed Equipment Operating and Maintenance History for Aggregate Impact of changes in Operating Conditions or Methods of Operation

ATTACHMENT 1

(Page 1 of 1)

Root Cause Evaluation Problem Statement (Example)

Problem Statement

Root Cause Evaluation

CR0000001

RCE CA0000007

Improperly Set Trip Set Points for Breakers 1-EP-BKR-1H-1B-2D and 2-EP-BKR-2H1-1-4A

Engineering walkdown on April 26, 2007 found instantaneous over-current devices for breakers 1-EP-BKR-1H-1B-2D and 2-EP-BKR-2H1-1-4A improperly set, such that breakers could trip at a lower current. Walkdown was in response to Engineering corrective action assignment made on November 1, 2006.

The purpose of this Root Cause Evaluation (RCE) is to:

- Identify equipment failure mechanism or human performance initiating action which resulted in instantaneous over-current devices being set improperly (direct cause).
- Determine whether flawed defenses exist in process for controlling and setting breaker trip set points (root and contributing causes).
- Determine whether relevant human performance, programmatic or organizational, or nuclear safety culture weaknesses (root or contributing causes) are present.
- Recommend CAPRs.
- Recommend corrective actions for contributing and other causes.

Responsible Manager:

Lead Evaluator:

Team Members:

Submitted

Lead Evaluator: _____
(Signature)

Responsible Manager: _____
(Signature)

CARB Chairperson: _____
(Signature)

ATTACHMENT 2
(Page 1 of 6)
Root Cause Evaluation Report Template

Dominion®

Site:

RCE #:

Condition Report #:

Significance Level:

Title:

Event Date:

Lead Evaluator:

Responsible Manager:

Revision Number:

ATTACHMENT 2
(Page 2 of 6)
Root Cause Evaluation Report Template

1.0 EXECUTIVE SUMMARY

1.1 Problem Statement

1.2 Root Cause(s)

1.3 Contributing Cause(s)

1.4 Corrective Action(s)

1.4.1 Action(s) to Preclude Repetition:

- Action
- Owner
- Priority
- Due Date
- Accepted

1.4.1.1 Effectiveness Review:

1.4.2 Actions to Address Contributing Cause:

- Action
- Owner
- Priority
- Due Date
- Accepted

1.4.3 Compensatory or Short Term Corrective Action:

- Action
- Owner
- Priority
- Due Date
- Accepted

ATTACHMENT 2
(Page 3 of 6)
Root Cause Evaluation Report Template

1.4.3 Additional Corrective Action(s):

- Action
- Owner
- Priority
- Due Date
- Accepted

1.4.3 Enhancement Action(s):

- Action
- Owner
- Priority
- Due Date
- Accepted

2.0 DETAILED REPORT

2.1Team Members

2.2 Event Investigation & Analysis

2.3 Organizational and Programmatic Review

2.4 Extent of Condition

2.5 Assessment of Safety Consequences

ATTACHMENT 2
(Page 4 of 6)
Root Cause Evaluation Report Template

2.6 Assessment of Nuclear Safety Culture

Nuclear Safety Culture Assessment				
Nuclear Safety Culture Traits	Root Cause	Significant Contributor	Weakness	Satisfactory
1.Personal Accountability				
Analysis details and actions taken to address: (N/A if Satisfactory)				
2. Questioning Attitude				
Analysis details and actions taken to address: (N/A if Satisfactory)				
3. Safety Communication				
Analysis details and actions taken to address: (N/A if Satisfactory)				
4. Leadership Safety Values and Actions				
Analysis details and actions taken to address: (N/A if Satisfactory)				
5. Decision Making				
Analysis details and actions taken to address: (N/A if Satisfactory)				

ATTACHMENT 2
(Page 5 of 6)
Root Cause Evaluation Report Template

2.6 Assessment of Nuclear Safety Culture (continued)

6. Respectful Work Environment				
Analysis details and actions taken to address: (N/A if Satisfactory)				
7. Continuous Learning				
Analysis details and actions taken to address: (N/A if Satisfactory)				
8. Problem Identification and Resolution				
Analysis details and actions taken to address: (N/A if Satisfactory)				
9. Environment for Raising Concerns				
Analysis details and actions taken to address: (N/A if Satisfactory)				
10. Work Processes				
Analysis details and actions taken to address: (N/A if Satisfactory)				

2.7 Repeat Review

2.8 Operating Experience

2.9 Extent of Cause

2.10 Equipment Reliability/PM Adequacy (Equipment-Related RCE Only)

Complete in accordance with PI-AA-300.

ATTACHMENT 2
(Page 6 of 6)
Root Cause Evaluation Report Template

2.11 Personnel Interviewed

Name	Title	Affiliation

2.12 Documents Reviewed

Document	Revision	Date

2.13 Causal Factors (Trend Coding)

Cause	Code(s) from PI-AA-300

Attachments

At a minimum, attachments will include display or narrative of analysis techniques used to determine cause(s).

ATTACHMENT 3

(Page 1 of 2)

Safety Consequences Evaluation

Root Cause Evaluations are frequently conducted in support for preparation of Licensee Event Reports. 10CFR50.73(b)(3) requires LER contain: An assessment of safety consequences and implications of event. Because of this, each RCE is required to contain assessment of safety consequences. At minimum, evaluation should decide if event could be precursor for more significant event and, if so, evaluate mitigating factors. Consider corrective actions that will re-enforce any mitigating factors. Include evaluation of causes identified by RCE (i.e., root/contributory causes) for relationship among different causes. Purpose of collective review is to determine if combination of root and contributing causes point to more fundamental, systemic, or programmatic breakdown.

The following questions should be considered in assessment of safety consequences:

1. Did root and contributing causes have reasonable potential to or have reduced defense-in-depth to nuclear safety? If so, explain how this occurs, including assessment of plant specific qualitative or quantitative risk consequences. Use of station PRA, Reactivity Management practices, and other resources is encouraged.
2. Did root and contributing causes have reasonable potential to or have reduced defense-in-depth to industrial safety? If so, explain how this occurs, including assessment of plant specific qualitative or quantitative risk consequences.
3. Did root and contributing causes have reasonable potential to or have reduced defense-in-depth to radiation safety? If so, explain how this occurs, including assessment of plant specific qualitative or quantitative risk consequences.
4. Review is to provide summary assessment of actual and potential safety consequences and implications of event, and includes assessment of event under alternative conditions if incident would have been more severe under reasonable and credible alternative conditions, such as different operating mode. For example if event occurred at 10% power, would consequences be worse if event had occurred at 100% power? Reasonable and credible alternative conditions may include normal plant operating conditions, potential accident conditions, or additional component failures, depending on event. Normal alternative operating conditions and off-normal conditions expected to occur during life of plant should be considered. Intent of this section is to obtain result of considerations typical in conduct of routine operations, such as event reviews.

Did root and contributing causes have reasonable potential to or have impacted a regulatory cornerstone? If so, include evaluation of risks associated with following applicable nuclear safety cornerstones:

1. Initiating Events - Did event result in increase in frequency of those events that upset plant stability and challenge critical safety functions during power operations. Such events include reactor trip due to turbine trip, loss of feedwater, loss of off-site power, and other reactor transients.

ATTACHMENT 3

(Page 2 of 2)

Safety Consequences Evaluation

2. Mitigating Systems - Did event affect availability, reliability, and capability of systems that mitigate initiating events to prevent reactor accidents. Mitigating systems include those associated with safety injection, residual heat removal, and their support systems, such as emergency AC power. The following systems are included in this cornerstone:
   - Emergency AC power systems
   - High pressure safety injection systems
   - Auxiliary feedwater systems
   - Residual heat removal systems (or equivalent function)
   - Cooling water support systems for above systems
3. Barrier Integrity - Has integrity of physical barriers designed to protect public from radionuclide releases caused by accidents been compromised by event. These barriers are fuel cladding, reactor coolant system boundary, and containment.
4. Emergency Preparedness - Did event reduce assurance actions taken in accordance with Emergency Plan provide adequate protection of public health and safety during radiological emergency. Cornerstone does not include off-site actions, which are covered by Federal Emergency Management Agency. The following indicators are included in this cornerstone:
   - Drill/Exercise Performance
   - Emergency Response Organization Drill Participation
   - Alert and Notification System Reliability
5. Occupational Radiation Safety - Did event affect protection of worker health and safety from exposure to radiation and radioactive materials during routine civilian nuclear reactor operations?
6. Public Radiation Safety - Did event affect ability to ensure adequate protection of public health and safety from exposure to radiation and radioactive materials released into public domain as a result of routine reactor operations. These releases include routine gaseous and liquid radioactive effluent discharges, inadvertent release of solid contaminated materials, and offsite transport of radioactive materials and wastes?
7. Safeguards, Physical Protection - Did event challenge ability to provide assurance Physical Protection System can protect against design basis threat of radiological sabotage. Threat could come from either external or internal sources?

For events that occurred when reactor was shutdown, assess availability of systems or components needed to maintain safe shutdown conditions, remove residual heat, control release of radioactive material, or mitigate consequences of an accident.

ATTACHMENT 4
(Page 1 of 5)
Safety Culture Evaluation

After determining root and contributing factors in root cause investigation, determine if causal factors are found to demonstrate behaviors consistent with performance attributes of a positive nuclear safety culture. If causal factors exist that fall within nuclear safety culture attributes but are not tied to root or contributing causes and subsequent corrective actions, then action is needed to address causal factors either as corrective action within root cause or as new Condition Report (CR).

Ensure all 10 Traits and Attributes have been considered and any determined to have caused or contributed to event or conditions in more than a minor way are thoroughly addressed by RCE.

1. **Individual Commitment to Safety**

   a. **PA. Personal Accountability**

   All individuals take personal responsibility for safety. Responsibility and authority for nuclear safety are well defined and clearly understood. Reporting relationships, positional authority, and team responsibilities emphasize overriding importance of nuclear safety.

   Attributes:

   PA.1 Standards: Individuals understand importance of adherence to nuclear standards. All levels of organization exercise accountability for shortfalls in meeting standards.

   PA.2 Job Ownership: Individuals understand and demonstrate personal responsibility for behaviors and work practices supporting nuclear safety.

   PA.3 Teamwork: Individuals and work groups communicate and coordinate activities within and across organizational boundaries to ensure nuclear safety is maintained.

   b. **QA. Questioning Attitude**

   Individuals avoid complacency and continuously challenge existing conditions, assumptions, anomalies, and activities in order to identify discrepancies that might result in error or inappropriate action. All employees are watchful for assumptions, values, conditions, or activities that can have undesirable effect on plant safety.

   Attributes:

   QA.1 Nuclear is Recognized as Special and Unique: Individuals understand complex technologies can fail in unpredictable ways.

   QA.2 Challenge the Unknown: Individuals stop when faced with uncertain conditions. Risks are evaluated and managed before work proceeds.

   QA.3 Challenge Assumptions: Individuals challenge assumptions and offer opposing views when they believe something is not correct.

   QA.4 Avoid Complacency: Individuals recognize and plan for possibility of mistakes, latent issues, and inherent risk, even while expecting successful outcomes.

ATTACHMENT 4
(Page 2 of 5)
Safety Culture Evaluation

c. **CO. Safety Communication**

Communications maintain focus on safety. Safety communication is broad and includes plant-level communication, job-related communication, worker-level communication, equipment labeling, operating experience, and documentation. Leaders use formal and informal communication to convey importance of safety. Flow of information up the organization is seen as important as flow of information down the organization.

Attributes:

CO.1 Work Process Communications: Individuals incorporate safety communications in work activities.

CO.2 Bases for Decisions: Leaders ensure bases for operational and organizational decisions are communicated in timely manner.

CO.3 Free Flow of Information: Individuals communicate openly and candidly, both up, down, and across organization and with oversight, audit, and regulatory organizations.

CO.4 Expectations: Leaders frequently communicate and reinforce expectation that nuclear safety is organizations overriding priority.

2. **Management Commitment to Safety**

a. **LA. Leadership Safety Values and Actions**

Leaders demonstrate commitment to safety in decisions and behaviors. Executive and senior managers are leading advocates of nuclear safety and demonstrate commitment both in word and action. Nuclear safety message is communicated frequently and consistently, occasionally as stand-alone theme. Leaders throughout nuclear organization set example for safety. Corporate policies emphasize overriding importance of nuclear safety.

Attributes

LA.1 Resources: Leaders ensure personnel, equipment, procedures, and other resources are available and adequate to support nuclear safety.

LA.2 Field Presence: Leaders are commonly seen in working areas of plant observing, coaching, and reinforcing standards and expectations. Deviations from standards and expectations are corrected promptly.

LA.3 Incentives, Sanctions, and Rewards: Leaders ensure incentives, sanctions, and rewards are aligned with nuclear safety policies and reinforce behaviors and outcomes reflecting safety as overriding priority.

LA.4 Strategic Commitment to Safety: Leaders ensure plant priorities are aligned to reflect nuclear safety as overriding priority.

ATTACHMENT 4
(Page 3 of 5)
Safety Culture Evaluation

LA.5 Change Management: Leaders use systematic process for evaluating and implementing change so nuclear safety remains overriding priority.

LA.6 Roles, Responsibilities, and Authorities: Leaders clearly define roles, responsibilities, and authorities to ensure nuclear safety.

LA.7 Constant Examination: Leaders ensure nuclear safety is constantly scrutinized through variety of monitoring techniques, including assessments of nuclear safety culture.

LA.8 Leader Behaviors: Leaders exhibit behaviors that set standard for safety.

b. **DM. Decision-Making**

Decisions supporting or affecting nuclear safety are systematic, rigorous, and thorough. Operators are vested with authority and understand expectation, when faced with unexpected or uncertain conditions, to place plant in safe condition. Senior leaders support and reinforce conservative decisions.

Attributes:

DM.1 Consistent Process: Individuals use consistent, systematic approach to make decisions. Risk insights are incorporated as appropriate.

DM.2 Conservative Bias: Individuals use decision-making practices that emphasize prudent choices over practices that are simply allowable. Proposed action is determined to be safe in order to proceed, rather than unsafe in order to stop.

DM.3 Accountability for Decisions: Single-point accountability is maintained for nuclear safety decisions.

c. **WE. Respectful Work Environment**

Trust and respect permeate organization, creating respectful work environment. High level of trust is established in organization, fostered, in part, through timely and accurate communication. Differing professional opinions are encouraged, discussed, and resolved in timely manner. Employees are informed of steps taken in response to concerns.

Attributes:

WE.1 Respect is Evident: Everyone is treated with dignity and respect.

WE.2 Opinions are Valued: Individuals are encouraged to voice concerns, provide suggestions, and raise questions. Differing opinions are respected.

WE.3 High Level of Trust: Trust is fostered among individuals and work groups throughout organization.

WE.4 Conflict Resolution: Fair and objective methods are used to resolve conflicts.

ATTACHMENT 4
(Page 4 of 5)
Safety Culture Evaluation

3. **Management Systems**

   a. **CL. Continuous Learning**

   Opportunities to continuously learn are valued, sought out, and implemented. Operating experience is highly valued, and capacity to learn from experience is well developed. Training, self-assessments, and benchmarking are used to stimulate learning and improve performance. Nuclear safety is kept under constant scrutiny through variety of monitoring techniques, some of which provide independent 'fresh look'.

   Attributes:

   CL.1 Operating Experience: Organization systematically and effectively collects, evaluates, and implements lessons from relevant internal and external operating experience information in timely manner.

   CL.2 Self-Assessment: Organization routinely conducts self-critical and objective assessments of programs, practices, and performance.

   CL.3 Benchmarking: Organization learns from other organizations to continuously improve knowledge, skills, and safety performance.

   CL.4 Training: High-quality training maintains knowledgeable workforce and reinforces high standards for maintaining nuclear safety.

   b. **PI. Problem Identification and Resolution**

   Issues potentially impacting safety are promptly identified, fully evaluated, and promptly addressed and corrected commensurate with significance. Identification and resolution of broad spectrum of problems, including organizational issues, are used to strengthen safety and improve performance.

   Attributes:

   PI.1 Identification: Organization implements corrective action program with low threshold for identifying issues. Individuals identify issues completely, accurately, and in timely manner in accordance with program.

   PI.2 Evaluation: Organization thoroughly evaluates issues to ensure problem resolutions and solutions address causes and extents of conditions commensurate with safety significance.

   PI.3 Resolution: Organization takes effective corrective actions to address issues in timely manner commensurate with safety significance.

   PI.4 Trending: Organization periodically analyzes information from corrective action program and other assessments in aggregate to identify adverse trends or conditions.

ATTACHMENT 4
(Page 5 of 5)
Safety Culture Evaluation

c. **RC. Environment for Raising Concerns**

Safety-conscious work environment (SCWE) is maintained where personnel feel free to raise safety concerns without fear of retaliation, intimidation, harassment, or discrimination. Station creates, maintains, and evaluates policies and processes allowing personnel to freely raise concerns.

Attributes:

RC.1 SCWE Policy: Organization implements policy supporting individual rights and responsibilities to raise safety concerns and does not tolerate harassment, intimidation, retaliation, or discrimination for doing so.

RC.2 Alternate Process for Raising Concerns: Organization implements process for raising and resolving concerns independent of line management influence. Safety issues may be raised in confidence and are resolved in timely and effective manner.

d. **WP. Work Processes**

Process of planning and controlling work activities is implemented so safety is maintained. Work management is deliberate process in which work is identified, selected, planned, scheduled, executed, closed, and critiqued. Entire organization is involved in and fully supports process.

Attributes:

WP.1 Work Management: Organization implements process of planning, controlling, and executing work activities such that nuclear safety is overriding priority. Work process includes identification and management of risk commensurate with work.

WP.2 Design Margins: Organization operates and maintains equipment within design margins. Margins are carefully guarded and changed only through systematic and rigorous process. Special attention is placed on maintaining fission product barriers, defense-in-depth, and safety-related equipment.

WP.3 Documentation: Organization creates and maintains complete, accurate, and up-to-date documentation.

WP.4 Procedure Adherence: Individuals follow processes, procedures, and work instructions.

ATTACHMENT 5
(Page 1 of 1)
Monitoring Actions Guidelines

Following an event, personnel take immediate action(s) to arrest condition or mitigate condition consequences. Subsequent to any immediate action(s), additional interim or compensatory action(s) may be necessary until Event Response Team or Root Cause Evaluation Team is established. During root cause evaluation, additional compensatory actions may be warranted based on investigation results designed to minimize threat or vulnerability of another similar event occurring.

During time frame between establishing immediate, interim, and/or compensatory actions and completion of formal root cause evaluation, monitoring activities should be established for purposes described above. Monitoring activities, though established before root cause evaluation report approval, should be documented in final root cause evaluation report in Cause to Corrective Action Matrix (Attachment 6).

The following time line illustrates process:

Event	Immediate Action	Comp Measure	Evaluation	CAPR	EFR
			Monitoring Action Starts at Comp Measure =========> continues to EFR completion		

Monitoring activities are to be selected and implemented based on specific circumstances of each event; including length of time conditions associated with event remain as threat until remediated via corrective actions. The following provides examples of monitoring activities for consideration but is not comprehensive or complete listing of all possibilities.

- Operator rounds
- Management reviews
- Verification of tagging boundaries
- Addition management oversight
- Periodic document or log reviews
- Fire watch, dedicated operator
- Installed plant instrumentation

Responsible manager for either Event Response Team or Root Cause Team has responsibility for establishing monitoring activities in accordance with this attachment. Monitoring activities should include the following minimum elements:

1. Method for monitoring, including frequency (e.g. continuous, daily, weekly, etc.)
2. Indicator, if any, used in method for monitoring (e.g. process measurements, component position)
3. Standard for action establishing thresholds for additional action to mitigate degrading performance or negative outcomes.

ATTACHMENT 6

(Page 1 of 1)

Cause To Corrective Action Matrix (Example)

Problem Statement: Scaffolding has been erected in close proximity to Safety-Related equipment without appropriate Engineering Evaluation for seismic concerns leading to inoperability of some Safety-Related equipment and increased regulatory scrutiny for procedure noncompliance.

RCE 2008-XXX Cause to Corrective Action Matrix

Cause	Corrective Action	Effectiveness Goal and Data Reviewed for CAPRs (Steps 3.3.19 and 3.3.20)	Interim Monitoring Actions (Step 3.3.10)
Kewaunee Power Station (KPS) oversight of scaffolding program was inadequate in involving KPS personnel in scaffolding building and inspection. Transfer of scaffold building from KPS Mechanical Maintenance to contracting organization Day & Zimmermann NPS was done without Change Management Plan in place. Turnover of scaffold building and inspections by KPS to contracting organization with limited KPS knowledge led to not consistently identifying equipment as Safety-Related, which resulted in Engineering Evaluation not being performed.	CAPR-1 Due Date: 90 Days Revise KPS scaffold erection process to require the following for scaffold to be built within power block: - Pre-scaffold build walkdown by Operations shall be conducted with exception of inside containment above 200°F. Scaffold built in containment when RCS temperature is greater than 200°F will all be built to meet Safety-Related Area Scaffold Stabilization requirements of Scaffold Build procedure. - Scaffold Orders must be reviewed and approved by Operations and Engineering. Scaffold Orders must be authorized for implementation through Work Control Center in accordance with procedural requirements. - Scaffold builds within two inches of any Safety-Related equipment/components or equipment/components within plant seismic areas must be evaluated by Engineering.	EFRxxxxxxx Due Date: 6-12 Months after CAPR complete Effectiveness Goals: 1. An operator is included in the pre-build walkdowns for scaffolding as required by procedure. Data to be reviewed is interviews with scaffold builders/ operations and CRs. 2. Operations and Engineering are in the review and approval process for scaffold building. Data to be reviewed is interviews with scaffold builders/operations/civil engineering and CRs. 3. Scaffold orders are authorized for implementation by operations as required by procedure. Data to be reviewed is interviews with scaffold builders/ operations and CRs. 4. Any scaffold builds within two inches of any equipment or components are evaluated by Engineering. Data to be reviewed is interviews with scaffold builders/operations and CRs. Perform walkdowns paired with Civil Engineering to verify currently erected scaffolding meets procedural requirements.	Perform monthly observation/ interviews to: 1. VERIFY scaffold builds within the power block are performed with an Operations representative present during the walk-down to identify the safety-related equipment in the area and other operational considerations to be addressed during the scaffold build as directed by the procedure. 2. VERIFY that if the scaffold builders identified issues during the build they were to contact the scaffold coordinator or designee. 3. VERIFY Operations also performs a walkdown of the scaffolding after it has been built to ensure safety-related equipment is not impacted and operational concerns are not created as directed by the procedure.

ATTACHMENT 7

(Page 1 of 10)

Root Cause Quality Index

Quality Index weight for grading specific attributes/criteria of Root Cause Evaluations (RCE) is divided into four categories. Categories are Mandatory, High, Medium, and Low. Expectation is each attribute from Quality Index will be included in Root Cause Report. However, attribute with weight of Mandatory must meet specific criteria for attribute and will receive more scrutiny during review than attribute with weight of low.

To establish measurable value of quality for Root Cause Evaluation Reports and further identify areas for improvements, this guideline establishes numerical value for grading RCEs.

Numerical value for each category associated with specific quality attribute/criteria will be as follows:

Mandatory has value of 4

High has value of 3

Medium has value of 2

Low has value of 1

Each quality attribute will be graded based on criteria for specific attribute/criteria from Quality Index. Value will be assigned based on how well intent of criteria was met for specific attribute. Numerical value will be assigned as listed below. Example: Category with value of 4 (Mandatory) meeting intent of criteria being evaluated will receive value of 2. Score for this area will be eight ($4 \times 2 = 8$). RCE that is deficient in an area, specifically in a mandatory area is unacceptable. Per PI-AA-300, a minimum score of 85% must be achieved.

Values for each attribute are as follows:

2 - Meets criteria for attribute

1 - Partially meets criteria for attribute

0 - Does not meet criteria for attribute

RCE reports not containing RCE elements with Mandatory or High weighting factor, or which do not adequately address mandatory or high elements are subject to rejection by Root Cause Coordinators or designated Corrective Action Program reviewers during RCE Report review.

Root Cause Analysis Quality Index is also posted on Organizational Effectiveness website.

ATTACHMENT 7

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Root Cause Quality Index

ROOT CAUSE EVALUATION QUALITY INDEX; RCE#_____	SCORING: 2=FULLY MET; 1=PARTIALLY MET; 0=NOT MET				
ATTRIBUTE	**CRITERIA**	Weighting	Wtg Factor	Score	Total
1. PROBLEM DESCRIPTION					
1.1 Event / Problem Statement	Easy to read, free from technical jargon, and approved by CARB. Contains clear description of deviation (performance gap) between desired and actual performance. Problem statement clearly focuses RCE team on what should be evaluated. If problem statement is confusing and/or not focused, assign 1 point. If problem statement was not reviewed and approved by CARB, assign 0 points.	Mandatory	4		
1.2 Problem Description	Reader can obtain clear picture of event as related to Problem Statement. Significance and/or consequences are clearly described. Pertinent facts, conditions, times included. If some pertinent facts are missing, assign 1 point. If event/problem description does not relate to Problem Statement, assign 0 points.	High	3		
1.3 Scope	Scope is appropriate for Condition Adverse to Quality being investigated. Review details in initial Condition Report. If evaluation scope appears too narrow or too broad, assign 1 point. If scope is not defined and results in poor evaluation, assign 0 points.	High	3		
Section 1 comments:					

ATTACHMENT 7

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Root Cause Quality Index

ROOT CAUSE EVALUATION QUALITY INDEX; RCE#_____	SCORING: 2=FULLY MET; 1=PARTIALLY MET; 0=NOT MET				
ATTRIBUTE	CRITERIA	Weighting	Wtg Factor	Score	Total
2. CAUSE IDENTIFICATION					
2.1 Valid Root Cause(s)	Listed cause is specific behavior, condition, or process. Listed cause is not failed barrier, failure mode, generic deficiency, or causal factor category. Examples of poor root causes: inadequate procedure, change management, supervisory oversight, less than adequate training, failed design change process. Better root causes: inadequate rigor in procedure review process, failure to develop and implement Change Management Plan, supervisor reinforced incorrect task performance standard, training program content did not address required skills or behaviors, failure mode effects analysis was not performed as part of Design Change. Assign 1 point for poor root cause statement; assign 0 points if you feel one or more root causes have been missed.	Mandatory	4		
2.2 Root Cause(s) Test #1	Problem would not have occurred had root cause(s) not been present. Score 1 point if questionable or poorly documented. If you completely disagree BASED ON EVIDENCE PROVIDED, score 0 points. Provide justification.	Mandatory	4		
2.3 Root Cause(s) Test #2.	Problem will not recur if root cause(s) is corrected or eliminated. Score 1 point if questionable or poorly documented. If you completely disagree BASED ON EVIDENCE PROVIDED, score 0 points. Provide justification.	Mandatory	4		
2.4 Root Cause(s) Test #3	Correction or elimination of root cause(s) should preclude repetition of similar conditions. Score 1 point if questionable or poorly documented. If you completely disagree BASED ON EVIDENCE PROVIDED, score 0 points. Provide justification.	High	3		
2.5 Valid Contributing Cause(s)	Listed cause is specific behavior, condition, or process. Similar criteria as item 2.1. BASED ON EVIDENCE PROVIDED, Assign 1 point for poor cause statements. Assign 0 points if you feel one or more contributing causes have been missed.	High	3		

ATTACHMENT 7

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Root Cause Quality Index

ROOT CAUSE EVALUATION QUALITY INDEX; RCE#_____	SCORING: 2=FULLY MET; 1=PARTIALLY MET; 0=NOT MET				
ATTRIBUTE	CRITERIA	Weighting	Wtg Factor	Score	Total
2.6 Contributing Cause(s) Test	Problem would not have occurred to same degree had contributing cause(s) not been present. Score 1 point if questionable or poorly documented. If you completely disagree BASED ON EVIDENCE PROVIDED, score 0 points. Provide justification.	High	3		
Section 2 comments:					

ATTACHMENT 7

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Root Cause Quality Index

ROOT CAUSE EVALUATION QUALITY INDEX; RCE#_____	SCORING: 2=FULLY MET; 1=PARTIALLY MET; 0=NOT MET				
ATTRIBUTE	CRITERIA	Weighting	Wtg Factor	Score	Total
3. RECOMMENDED CORRECTIVE ACTIONS					
3.1 Appropriate Corrective Action To Preclude Repetition (CAPR)	Corrective action to preclude repetition (CAPR) will correct identified root cause. Measures of effectiveness are included for each CAPR. Score 1 point if CAPR is not SMARTS or no measures of effectiveness are included. Score 0 points if one or more CAPRs are missing or if CAPR(s) do not completely address identified root cause(s).	Mandatory	4		
3.2 Compensatory Corrective Actions	Compensatory corrective actions address each CAPR and provide reasonable compensatory measures considering PRA risk until completion of CAPRs. Immediate or compensatory (short term) corrective actions are established to protect from threat and vulnerability of repeat issue, as required. Procedure revision or suspension shall be considered, if appropriate, if no other corrective action addresses threat or vulnerability. Score 1 point if compensatory actions are not robust. Score 0 points if compensatory actions are needed, but missing.	Mandatory	4		
3.3 Appropriate Corrective Actions	Each contributing cause has associated corrective action or separate CR. Score 1 point if contributing cause actions are spun off to other condition reports for evaluation. Score 0 points if corrective actions for contributing causes are missing.	High	3		
3.4 Corrective Actions Are Valid	Corrective actions are SMARTS (specific, measurable, achievable, realistic, timely, sustainable) and consistent with management expectations. Manager agreeing to CA assignment is noted for each CA. If one or two actions are less than SMARTS, score 1 point. If most of CA plan is not SMARTS, score 0 points. NOTE: Plant design changes will NOT be timely, and therefore should be addressed through compensatory actions - do not detract points as long as this is fully addressed.	Mandatory	4		
3.5 Corrective Actions for Other Issues	Items/issues not considered root or contributing causes, but identified as deficiencies are captured in corrective action program for disposition. Score 1 point if other deficiencies are noted, but one CA is missing. Score 0 points if multiple corrective actions are missing and no other resolution of deficiencies exists.	High	3		
3.6 Effectiveness Reviews	Effectiveness reviews cover all CAPRs specified in report and contains performance criteria.	High	3		
Section 3 comments:					

ATTACHMENT 7

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Root Cause Quality Index

ROOT CAUSE EVALUATION QUALITY INDEX; RCE#_____	SCORING: 2=FULLY MET; 1=PARTIALLY MET; 0=NOT MET				
ATTRIBUTE	CRITERIA	Weighting	Wtg Factor	Score	Total
4. INVESTIGATION					
4.1 Analysis Method(s)	Report uses two reasonable root cause methods to determine causes. Score 1 point if one analysis method appears to be flawed, poorly described, or manipulated to provide answer. Score 0 points if all analysis methods are flawed, or only one method is used, or method(s) is questionable.	Mandatory	4		
4.2 Causal Factor Identification	Valid causal factors are identified via analysis. Analysis methods should clearly identify each causal factor. If only some are identified through analysis, score 0 points.	Mandatory	4		
4.3 Failure Scenario Identification	Report contains reasonable discussion of failure scenario as defined by investigation scope. If key parts of scenario or timeline are missing, score 1 point. If no timeline is provided and timeline is needed to be consistent with investigation scope, score 0 points.	Medium	2		
4.4 Causal Factor Relationships	Identified causal factors are logically dispositioned into root and contributing causes. Score 0 points if contributing cause is not identified via causal factor from analysis. Score 0 points if root cause is not identified via causal factor from analysis.	Mandatory	4		
4.5 Cause and Effect Relationships	Cause and effect relationships are thoroughly examined. Cause and effect string identifies lower level causes less significant and/or less consequential than cause selected as root or contributing. Score 0 points if either analysis did not go deep enough to adequately identify true cause.	Mandatory	4		
4.6 Non-adverse Conditions	Factors investigated and found to be satisfactory are also listed. Score 1 point if factors were just listed, but not discussed. Score 0 points if no factors were listed or discussed.	Medium	2		
Section 4 comments:					

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Root Cause Quality Index

ROOT CAUSE EVALUATION QUALITY INDEX; RCE#_____	SCORING: 2=FULLY MET; 1=PARTIALLY MET; 0=NOT MET				
ATTRIBUTE	CRITERIA	Weighting	Wtg Factor	Score	Total
5. HUMAN PERFORMANCE & ORGANIZATIONAL FACTORS					
5.1 Organizational Weaknesses	Deficiencies in management control processes or work place values which were previously undetected (vulnerability factors) are identified. If some organizational weaknesses were missed or poorly discussed, score 1 point. If key (root or contributing) organizational weaknesses were missed, score 0 points.	Mandatory	4		
5.2 Process Weaknesses	Sequence of events has been evaluated to determine weaknesses in procedures or processes encountered during course of event. If some procedure/process weaknesses were missed or poorly discussed, score 1 point. If key (root or contributing) procedure/process weaknesses were missed, score 0 points.	High	3		
5.3 Human Error	Human errors are clearly identified. If some minor human errors were missed, score 1 point. If key (root or contributing) human errors were missed, score 0 points.	High	3		
5.4 Initiating Actions / Events	Behavior or event which triggered event has been clearly identified as well as any error-likely situations. Otherwise known as direct cause. If direct cause is not identified, score 0 point. If error-likely situations are involved, but not discussed or resolved through corrective actions or other means, score 0 points.	Mandatory	4		
5.5 Flawed Defenses	Failed design, administrative, or people barriers have been identified. Human error near-miss and breakthrough events have been evaluated for barrier failures. Otherwise known as barrier analysis, this is needed for many RCEs but not necessarily required. If failed barriers are missed or poorly documented, assign 1 point. If no discussion of failed barriers, score 0 points.	Medium	2		
Section 5 comments:					

ATTACHMENT 7

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Root Cause Quality Index

ROOT CAUSE EVALUATION QUALITY INDEX; RCE#_____	SCORING: 2=FULLY MET; 1=PARTIALLY MET; 0=NOT MET				
ATTRIBUTE	**CRITERIA**	Weighting	Wtg Factor	Score	Total
6. OE, PREVIOUS CAs, E.O.C.					
6.1 Operating Experience	Report contains discussion and evaluation of operating experience as related to Problem Statement. Score 0 points if OE reviewed is just listed, not discussed in relationship to RCE learning or OE questions were not addressed. Score 0 points if no OE evaluation.	Mandatory	4		
6.2 Previous Corrective Actions	Effectiveness of previous corrective actions (internal operating experience) for similar events at site has been evaluated for effectiveness of precluding repetition of Problem Statement. Score 0 points if previous events and corrective actions were just listed, not discussed in relationship to RCE learning, or repeat review questions were not answered. Score 0 points if no previous events and corrective actions evaluation.	Mandatory	4		
6.3 Extent of Condition	Extent of Condition evaluated to assess degree actual condition (e.g., failed valve, inadequate procedure, improper action, etc.) may exist in other plant equipment, processes or human performance. Score 0 point if Extent of Condition evaluation is narrow, incomplete, or poorly documented. Score 0 points if Extent of Condition is not addressed.	Mandatory	4		
6.4 Safety Significance/Consequences	Actual or potential safety consequences and implications of event are discussed including impact on NRC cornerstone indicators. Risk is evaluated from both qualitative and PRA perspective. Score 0 points if safety significance evaluation is narrow, incomplete, or poorly documented. Score 0 points if safety significance is not addressed.	High	3		
6.5 Extent of Cause	Extent of cause is evaluated to assess applicability of root cause(s) across disciplines or departments, for different programmatic activities, for human performance, or for different types of equipment. Score 0 points if Extent of Cause evaluation is narrow, incomplete, or poorly documented. Score 0 points if Extent of Cause is not addressed.	Mandatory	4		
6.6 Nuclear Safety Culture	Evaluation is included of any Nuclear Safety Culture issue that may have caused or significantly contributed to root cause. Score 1 point if nuclear safety culture evaluation is narrow, incomplete, or poorly documented. Score 0 points if nuclear safety culture is not addressed.	Mandatory	4		
Section 6 comments:					

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Root Cause Quality Index

ROOT CAUSE EVALUATION QUALITY INDEX; RCE#_____	SCORING: 2=FULLY MET; 1=PARTIALLY MET; 0=NOT MET				
ATTRIBUTE	CRITERIA	Weighting	Wtg Factor	Score	Total
7. DATA SOURCES,& REPORT LAYOUT					
7.1 Valid Sources	Documentation required to support analysis is included or referenced to retrievable documents. If reference section is incomplete, score 1 point. If no reference section, score 0 points.	Medium	2		
7.2 Critical Data	Critical data used in report is checked with independent source (qualification, validation and verification). If data used to identify some causal factors comes from only one source - score 1 point. If data used to identify root or contributing causes comes from only one source - score 0 points. Will need to use some judgment here - if lab analysis is basis for causes, probably satisfactory to go with one source. If personal testimony or eyewitness account is only source, probably not satisfactory.	High	3		
7.3 Comprehensive Sources	Analysis uses sources other than interviewee statements to identify organizational and programmatic issues. Interview statements may identify potential O&P issues, but analysis should not rely on statements to validate issues. Score 1 point if this occurs for one issue. Score 0 points if this occurs for more than one issue.	Medium	2		
7.4 Technical Content - Language	Analysis uses accurate root cause terminology. Minor terminology issues - score 1 point. If report names persons rather than titles or makes unfounded accusations/statements or uses unprofessional language - score 0 points.	Medium	2		
7.5 Technical Content - Readability	Presentation of evidence is appropriate, convincing, and logically presented. Executive summary is succinct and believable without having to read entire document. Causes are succinctly numbered, listed, and described - corresponding corrective actions are succinctly numbered, listed, and described. Minor readability issues - score 1 point. Incomprehensible, illogical or informal - score 0 points.	High	3		
Section 7 comments:					

ATTACHMENT 7

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Root Cause Quality Index

ROOT CAUSE EVALUATION QUALITY INDEX; RCE#_____	SCORING: 2=FULLY MET; 1=PARTIALLY MET; 0=NOT MET				
ATTRIBUTE	**CRITERIA**	Weighting	Wtg Factor	Score	Total
8. EQUIPMENT FAILURE FACTORS					
8.1 Equipment Reliability	Report contains discussion of equipment failure factors/system reliability, predictive analysis/equipment monitoring, system health report issues. Incomplete discussion - score 1 point. No discussion, but discussion is warranted - score 0 points.	Mandatory (for equipment related RCEs)	4		
Section 8 comments:					
				Score	
				AVAIL	254
				PCT	%
Parent CR #	NOTE: If score of zero (0) is assigned for mandatory attribute, RCE is unacceptable.				
RCE Acceptable= Yes or No					
QI Review Performed by:					
Date:					

ATTACHMENT 8
(Page 1 of 2)
Effectiveness Review

Dominion

Effectiveness Review

PI-AA-300-3001 - Attachment 8 Page 1 of 2

Effectiveness Review Tracking Number:	Original CR Number / RCE:
Evaluated By:	
Summary of Issue(s), Cause(s) / CAPR(s):	

Effectiveness Review Results: ***Answer the following questions, providing appropriate evidence for each answer.***

1A.	Have all CAPR(s) been implemented?	☐ YES ☐ NO
1B.	If NOT, are there compensatory measures implemented and have extensions been properly approved?	☐ YES ☐ NO
2A.	Were new CAPR(s) created or existing CAPR(s) revised or deleted?	☐ YES ☐ NO
2B.	If so, are the changes/deletions justified and properly approved?	☐ YES ☐ NO
3.	Were additional problems or any unintended consequences created due to implementation of the CAPR(s)?	☐ YES ☐ NO
4.	Have any new or similar conditions been discovered and actions taken since evaluation completion?	☐ YES ☐ NO
5A.	Has opportunity existed for recurrence of same or similar issue(s)?	☐ YES ☐ NO
5B.	If so, has it recurred?	☐ YES ☐ NO
6A.	Has CAPR(s) addressed problem it was intended to and is it effective?	☐ YES ☐ NO
6B.	Describe what monitoring actions were used to ensure action effective. (reference RCE Cause to Corrective Action Matrix)	
7A	Are the results as expected?	☐ YES ☐ NO
7B.	If NOT, is additional action required?	☐ YES ☐ NO

ATTACHMENT 8
(Page 2 of 2)
Effectiveness Review

Effectiveness Review

PI-AA-300-3001- Attachment 8 -Page 2 of 2

In summary, the CAPR(s) are considered:

☐ Effective - NO further action required.

☐ Ineffective - Initiate Condition Report. Condition Report #: _____

☐ Indeterminate - Reschedule effectiveness review. New due date: _____

- The corrective actions are effective if questions 1A, 5A, 6, and 7A are answered 'Yes' AND question 5B is answered 'No'.
- The corrective actions are ineffective if question 6 OR 7A is answered 'No' OR question 4 OR 5B is answered 'Yes'.
- The corrective actions are indeterminate if question 1A or 5A is answered 'No'.

Comments:

I/A

EXHIBIT JAW-1

J. A.WRIGHT, PhD

Julius A. "Chip" Wright is the President of J. A. Wright and Associates, 45A Cabrita Point, St. Thomas, VI, 00802; 770-956-1225; jawright@mindspring.com.

Experience Overview

Prior to starting his firm, Dr. Wright was a Client Partner for AT&T Solutions Utilities and Energy Practice and before that a Principal in EDS' Management Consulting Services. Dr. Wright has also just recently (2011) completed a semester as a visiting instructor in Micro and Macro Economics at the University of the Virgin Islands. Prior to this Dr. Wright served an eight-year term as a Utility Commissioner for the state of North Carolina. Prior to that, he served three terms in the North Carolina State Senate while he was a senior project engineer for Corning Glass Works on their optical wave guide project in Wilmington, North Carolina. While serving on the North Carolina Utility Commission, he served four years on the National Association of Regulatory Utility Commissioners (NARUC) Electricity Committee. He has served in various other advisory capacities, including the Keystone Committee on Externalities; the North Carolina Radiation Protection Committee, and on an Oversight Committee for a joint North Carolina/New York/ Department of Energy (DOE) project.

Electric Competition Natural Gas, and Regulatory Strategy

- Provided a report to a Fortune 500 utility on the use and efficacy of both gas and coal financial derivatives (2011).
- Provided a study to a Fortune 500 utility analyzing the potential costs verses the benefits from using coal derivatives in that utility's coal purchasing practices (2010).
- *"Energy Deregulation,"* March 2001, report of the California State Auditor on the causes of the problems related

  to high electric prices and blackouts (from May, 2000 through June 2001, and ongoing) in California's restructured electric marketplace. Dr. Wright was one of three consultants who essentially researched and prepared the State Auditor's report.
- Principal author with Dr. Al Danielsen of *"Reliability of Electric Supply In Georgia,"* published by

The Bonbright Utilities Center, University of Georgia, June, 2001.

- Presented testimony before the North Carolina Public Utilities Commission on behalf of SCANA Corporation regarding issues related to market power in its merger with Public Service Company of North Carolina, Docket No. G-5, Sub 400; G-3, Sub 0.

- Was the principal author of a report and investigation titled *"An Analysis of Commonwealth Edison's Planning Process For Achieving Reliability of Supply,"* which was an investigation of the Company's planning process to meet its statutory obligation for supplying electricity as Illinois transitions to a competitive retail electric market, Illinois Commerce Commission Docket No. 98-0514.

- Co-authored a national study that used computer modeling techniques to quantify the impact of electric competition on the aggregate economy in each of the 48 continental United States.

- Presented testimony to Louisiana Legislative Committee on behalf of Entergy Corporation regarding the various regulatory and technical issues that need to be addressed in the transition to competition.

- Was a panelist on a Southern Gas Association national televised forum on performance based regulation for the natural gas industry.

- Was the lead policy witness for South Carolina Electric and Gas on obtaining regulatory approval to transfer depreciation reserve from a nuclear plant to T&D depreciation reserve. This is a critical issue in preparing for competition and limiting stranded investment.

- Public Service Company's power and resource acquisitions over a five year period. Developed an overview of Niagara Mohawk Gas' integrated resource planning efforts. This engagement was under a contract from Oak Ridge National Laboratories.

Presentations and Publications

"The Economic and Rate Implications from AN Electric Utility's Loss of Large Load Customers," presented in rebuttal testimony for Progress Energy Carolinas, North Carolina Utility Commission Docket No. E-2, Sub 1023, March 4, 2013.

"Energy Deregulation," March 2001, report of the California State Auditor on the causes of the problems related to high electric prices and blackouts (from May, 2000 through June 2001, and ongoing) in California's restructured electric marketplace.

Dr. Wright was one of three consultants who essentially researched and prepared the State Auditor's report.

"Low Cost States and Electric Restructuring - The Issue is the Price!" presented to the 1999 Miller Forum on Government, Business and the Economy, University of Southern California, April 19, 1999.

An Analysis of Commonwealth Edison's Planning Process For Achieving Reliability of Supply, Illinois Commerce Commission Docket No. 98-0514.

The Impact of Competition on the Price of Electricity, author, published by L. A. Wright and Associates, November, 1998.

"Retail Competition in the Electric Industry: The Impact on Prices," presented at the 18th Annual Bonbright Center Energy Conference, Atlanta, Georgia, Sept. 10, 1998.

Potential Economic Impacts of Restructuring the Electric Utility Industry, co-author, published by the Small Business Survival Committee, Washington, DC, November, 1997.

"How Deregulation Will Affect Power Quality and Energy Management," presented at the Power Quality and Energy Management Conference co-sponsored by Entergy and EPRI, New Orleans, LA, Nov. 14, 1997.

"Deregulation of the Electric Industry," *Proceedings: National Business Energy Forum,* June 26, 1997, New Orleans, LA.

"Restructuring The Electric Utility Industry: Theory vs. Reality," presented at the American Bar Association Restructuring Conference, Raleigh, NC, Dec. 5, 1996.

"Alternative Rate Making for the Natural Gas Industry: State Issues," presented at the Tenth Annual NARUC Biennial Regulatory Information Conference, Columbus, Ohio, Sept. 12, 1996.

"Stranded Assets Recovery Issues," presented at the Western Electric Power Institute: Financial Forum, Tucson, Arizona, March 8, 1996.

"Performance Based Regulation for The Natural Gas Industry," panelist on Southern Gas Association's Televised Regulatory Forum, Dallas, Texas, Jan. 18, 1996.

"Industry Structure Should Meet Stakeholder Objectives," *Electric Light and Power,* Jan., 1996.

"Quantifying the Value of Stranded Investment: A Dynamic Modeling Approach," *Proceedings: Implementing Transmission Access and Power Transactions Conference,* Denver, Colorado, Dec. 14, 1995.

Comments to FERC in the matter of Notice of Proposed Rulemaking on Open Access, Docket No. 95-9-000, 1995.

"Comparing New York State Electric and Gas Corporation's Non-Utility Generator Payments to Current Avoided Cost Rates," report submitted in support of affidavit filed before FERC in Docket No. EL 95-28-000.

"A Solution To The Transmission Pricing and Stranded Investment Problems" *Public Utilities Fortnightly,* January 1995.

"Gas Integrated Resource Planning: The Niagara Mohawk Experience," for Martin Marietta Energy Systems, Inc., under contract to the United States Department of Energy, ORNL/SUB/93-03369.

"Future Regulation In the Water Industry - Can We Solve the Problems Before They Happen?" *Water,* Vol. 29, No. 2, pp. 14-17, Summer 1988.

Testimony

- Rebuttal testimony for Progress Energy Carolinas, related to the economic and rate implications from an electric utility's loss of large load customers, North Carolina Utility Commission Docket No. E-2, Sub 1023, March 4, 2013.

- Presented testimony before the Mississippi Public Service Commission on behalf of Entergy Mississippi, Inc., related to proposals to modify that State's existing confidentiality rules and procedures, Docket No. 2010-ADD-259, August, 2010.

- Presented testimony before the North Carolina Public Utility Commission on behalf of interveners in opposition to rates and regulatory policies proposed by Bald Head island ferry service operator, testimony dealt with various cost and regulatory policy issues including excess capacity, rate base, affiliate transactions, and other issues, Docket No. A-41, Sub 7, October, 2010.

- Presented testimony before the Mississippi Public Service Commission on behalf of Entergy Mississippi, Inc., in support of the formula rate plan annual evaluation, Docket No. 2002-UN-526, March, 2009.

- Presented testimony before the Mississippi Public Service Commission on behalf of Entergy Mississippi, Inc., in support of an energy efficiency pilot program and cost recovery mechanism, Docket No. 2009-UN-064, February, 2009.

- Presented testimony before the Mississippi Public Service Commission on behalf of Entergy Mississippi, Inc.., in a proceeding to review statewide energy generation needs, Docket 2008-AD-270, August 2008.

- Presented testimony on behalf of Public Service of North

Carolina related to the establishment of a formulary type rate setting mechanism for this natural gas LDC, August, 2008, Docket No. G-5, Sub 495.

- Presented testimony on behalf of Entergy Mississippi in an investigation of that utility's fuel charges and its fuel cost recovery, July, 2008, Docket No. 2008-AD-270.

- Presented testimony on behalf of Entergy Mississippi on its IRP or electric resource plan and demand side initiatives, June, 2008, Docket No. 2008-Ad-158.

- Provided testimony for Georgia Power in its 2007 Integrated Resource Plan reviewing the plan filed by the Company and discussing how its demand-side proposals were reasonable, (TRC, RIM, PTC), Docket number 24505-U, May, 2007.

- Presented two testimonies before the South Carolina Public Service Commission on behalf of South Carolina Electric and Gas, Duke Energy and Progress Energy Carolinas in the investigation of adoption of energy efficiency and generation standards related to the Energy Policy Act of 2005, Dockets No. 2005-385-E and No. 2005-386-E, April, 2007.

- Presented testimony before the North Carolina Public Utilities Commission on behalf of Duke Energy and Progress Energy Carolinas in the investigation of adoption of energy efficiency and generation standards related to the Energy Policy Act of 2005, Docket No. E-100, Sub 108 November, 2006.

- Presented testimony before the North Carolina Public Utilities Commission on behalf of Duke Energy in the investigation of Duke Energy's 2006 Integrated Resource Plan, Docket No. E-100, Sub 103, June, 2006.

- Provided testimony for Georgia Power in its 2005 Fuel Adjustment Hearing on the issue of the appropriate pricing methodology for the dispatch and sale of electricity in the Southern Company system, Docket number 19142-U, April, 2005.

- Presented testimony on behalf of South Carolina Electric and Gas Company before the South Carolina Public Utility Commission for South Carolina Pipeline Company related to the inclusion of a generating plant in rate base and to the recovery of RTO (GridSouth) related costs, Docket No. 2004-178-E, October, 2004.

- Presented testimony on behalf of Entergy Mississippi before the Mississippi civil court dealing with maintaining the confidentiality of special use contracts, August, 2004.

- Presented rebuttal testimony before the South Carolina Public Utility Commission for South Carolina Pipeline Company related to the reasons for continuing a program that allows flexible, competitive based pricing for large, interruptible customers that have alternative fuels, Docket No. 2004-6-G, May 29, 2004.

- Presented testimony before the Georgia Public Service Commission on the appropriate range for a return on equity earnings band (a form of performance based regulation) to set in a Savannah Electric & Power Company rate case, Docket No. 14618-U, April, 2002.

- Presented testimony before the Georgia Public Service Commission on behalf of Scana Energy Marketing related to affiliate relationships and the appropriate affiliate rules between Atlanta Gas Light Company's regulated and unregulated affiliates. Docket No. 146060-U, August 24, 2001.

- Presented testimony before the North Carolina Public Utilities Commission on behalf of SCANA Corporation regarding issues related to market power the appropriate affiliate relationship protections necessary in its merger with Public Service Company of North Carolina, Docket No. G-5, Sub 400; G-3, Sub 0.

- Presented testimony before the South Carolina Public Service Commission on behalf of South Carolina Pipeline Corporation regarding issues related to its annual review of gas costs as reflected in its purchase gas adjustment charge, Docket No. 1999-007-G, September, 1999.

- Presented testimony to the South Carolina Public Utility Commission for South Carolina Pipeline Corp. related to acquisition adjustments and regulatory policies related to performance based regulation, Docket No. 90-588-G, June, 1998.

- Testified before the Mississippi Public Service Commission on issues related to the establishment of retail electric competition, including ISO establishment, regional power exchanges, legislation, taxes and regulatory policies, April 16, 17, 1997.

- Support of Transition Proposals filed by Virginia Power Corporation, March, 1997.

- Entergy Arkansas testimony in support of Transition to Competition Filing, 1997.

- Entergy Louisiana testimony in support of Transition to Competition Filing, 1997.

- Support of Performance Based Regulation for GTE South Inc., Docket No. P-19, Sub 277, before the North Carolina Utility Commission, filed Nov. 22, 1995.

- Stranded Cost Regulatory Policy and Recovery Testimony before the South Carolina Public Service Commission, the Commission approved the request Dr. Wright was advocating, Docket No. 95-1000-E, October 27, 1995.

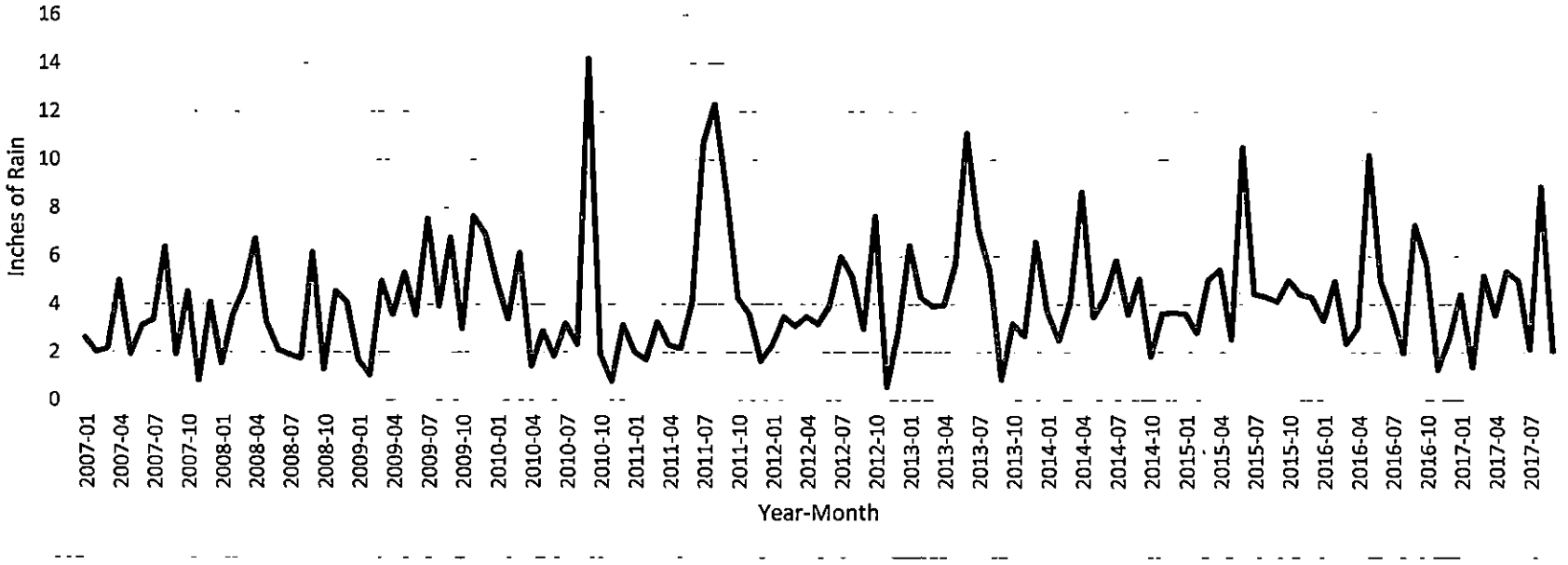
Education

Dr. Wright received a Ph.D. in Economics from North Carolina State University, focusing on regulatory and environmental economics, and is a member of the honor society. He received an MBA in finance from Georgia State University in 1978, graduating with honors. He received a Master of Economics from North Carolina State University in 1991 and was a member of the honor society. He received a B.S. in Chemistry from Valdosta State College in Valdosta, Georgia, graduating Magna Cum Laud.

In addition, he has completed the Michigan State University Regulatory Course, several other NARUC courses on regulation, been an instructor on regulatory issues at several NARUC courses, completed management courses at Corning Glass and financial seminars at Bank Boston and Merrill Lynch dealing with regulation.

Public Staff Rosenberger
Cross Exhibit 1
1 of 4

Historical Monthly Rainfall at Williamsburg Va.
2007-2017



Data received from National Oceanic and Atmospheric Administration (NOAA); Howard Diamond-Climate Science Program Manager at NOAA's Air Resources Laboratory.