



**UNITED STATES
NUCLEAR REGULATORY COMMISSION**

REGION IV
1600 EAST LAMAR BOULEVARD
ARLINGTON, TEXAS 76011-4511

November 22, 2019

Mr. Fadi Diya, Senior Vice President
and Chief Nuclear Officer
Ameren Missouri
Callaway Plant
8315 County Road 459
Steedman, MO 65077

SUBJECT: CALLAWAY PLANT – DESIGN BASIS ASSURANCE INSPECTION
(PROGRAMS) INSPECTION REPORT 05000483/2019011

Dear Mr. Diya:

On November 7, 2019, the U.S. Nuclear Regulatory Commission (NRC) completed an inspection at Callaway Plant, and discussed the results of this inspection with you and other members of your staff. The results of this inspection are documented in the enclosed report.

One finding of very low safety significance (Green) is documented in this report. This finding involved a violation of NRC requirements. We are treating this violation as a non-cited violation (NCV) consistent with Section 2.3.2 of the Enforcement Policy.

If you contest the violation or significance or severity of the violation documented in this inspection report, you should provide a response within 30 days of the date of this inspection report, with the basis for your denial, to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001; with copies to the Regional Administrator, Region IV; the Director, Office of Enforcement; and the NRC Resident Inspector at Callaway Plant.

This letter, its enclosure, and your response (if any) will be made available for public inspection and copying at <http://www.nrc.gov/reading-rm/adams.html> and at the NRC Public Document Room in accordance with 10 CFR 2.390, "Public Inspections, Exemptions, Requests for Withholding."

Sincerely,

/RA/

Vincent G. Gaddy, Chief
Engineering Branch 1
Division of Reactor Safety

Docket No. 05000483
License No. NPF-30

Enclosure:
As stated

cc w/ encl: Distribution via LISTSERV®

CALLAWAY PLANT – DESIGN BASIS ASSURANCE INSPECTION (PROGRAMS)
 INSPECTION REPORT 05000483/2019011 – November 22, 2019

DISTRIBUTION:

SMorris, RA
 MShaffer, DRA
 AVegel, DRP
 TInverso, DRP
 RLantz, DRS
 GMiller, DRS
 DCylkowski, RC
 JQuichocho, RIV/OEDO
 VDricks, ORA
 JWeil, OCA
 JKlos, NRR
 AMoreno, RIV/OCA
 BMaier, RSLO
 RAzua, IPAT
 NO'Keefe, DRP
 JMelfi, DRP
 NBrown, DRP
 DBradley, DRP
 SJanicki, DRP
 DYancey, DRP
 PJayroe, IPAT
 BCorrell, IPAT
 MHerrera, DRMA
 R4Enforcement

ADAMS ACCESSION NUMBER: ML19326C811

<input checked="" type="checkbox"/> SUNSI Review		<input checked="" type="checkbox"/> Non-Sensitive <input type="checkbox"/> Sensitive		<input checked="" type="checkbox"/> Publicly Available <input type="checkbox"/> Non-Publicly Available	
OFFICE	SRI/EB1	RI/EB1	RI/EB1	C/PBB	C/EB1
NAME	GGeorge	DReinert	CStott	NO'Keefe	VGaddy
DATE	11/19/2019	11/21/2019	11/19/2019	11/20/2019	11/22/2019

OFFICIAL RECORD COPY

U.S. NUCLEAR REGULATORY COMMISSION
Inspection Report

Docket Number: 05000483

License Number: NPF-30

Report Number: 05000483/2019011

Enterprise Identifier: I-2019-011-0011

Licensee: Ameren Missouri

Facility: Callaway Plant

Location: Steedman, MO

Inspection Dates: October 21, 2019, to November 7, 2019

Inspectors: G. George, Senior Reactor Inspector
D. Reinert, Reactor Inspector
C. Stott, Reactor Inspector

Approved By: Vincent G. Gaddy, Chief
Engineering Branch 1
Division of Reactor Safety

Enclosure

SUMMARY

The U.S. Nuclear Regulatory Commission (NRC) continued monitoring the licensee's performance by conducting a design basis assurance inspection (programs) inspection at Callaway Plant in accordance with the Reactor Oversight Process. The Reactor Oversight Process is the NRC's program for overseeing the safe operation of commercial nuclear power reactors. Refer to <https://www.nrc.gov/reactors/operating/oversight.html> for more information.

List of Findings and Violations

Failure to Environmentally Qualify Electrical Components in Containment to Most Severe Chemical Environment			
Cornerstone	Significance	Cross-Cutting Aspect	Report Section
Mitigating Systems	Green NCV 05000483/2019011-01 Closed	None (NPP)	71111.21N
The inspectors identified a Green finding and associated non-cited violation of 10 CFR 50.49(e)(3) when the licensee failed to environmentally qualify all 10 CFR 50.49 electrical equipment for the most severe chemical effects expected in containment.			

Additional Tracking Items

None.

INSPECTION SCOPES

Inspections were conducted using the appropriate portions of the inspection procedures (IPs) in effect at the beginning of the inspection unless otherwise noted. Currently approved IPs with their attached revision histories are located on the public website at <http://www.nrc.gov/reading-rm/doc-collections/insp-manual/inspection-procedure/index.html>. Samples were declared complete when the IP requirements most appropriate to the inspection activity were met consistent with Inspection Manual Chapter (IMC) 2515, "Light-Water Reactor Inspection Program - Operations Phase." The inspectors reviewed selected procedures and records, observed activities, and interviewed personnel to assess licensee performance and compliance with Commission rules and regulations, license conditions, site procedures, and standards.

REACTOR SAFETY

71111.21N - Design Bases Assurance Inspection (Programs)

Select Sample Components to Review - Risk Significant/Low Design (Inside/Outside Containment) (IP Section 02.01) (8 Samples)

- (1) Steam Generator Main Steam Isolation Valve B, ABHV0017
- (2) Auxiliary Building Residual Heat Removal Pump B Room Cooler, SGL10B
- (3) Containment Recirculation Sump A to Residual Heat Removal Pump A Isolation Valve, EJHV8811A
- (4) Auxiliary Relay Rack B Panel, RP 209
- (5) Component Cooling Water Heat Exchanger to Reactor Coolant Pump Header Flow Transmitter, EGFT0128
- (6) Chemical Volume and Control System Seal Water Injection Flow Transmitter, BGFT0215A
- (7) Air Supply Solenoid for Refueling Water Storage Tank to Fuel Pool Isolation Valve, BNHY8800A
- (8) Main Steam Loop 3 Steam Supply to Auxiliary Feedwater Pump Turbine Position Switch, ABZS0049

Select Sample Components to Review - Primary Containment (Inside Containment) (IP Section 02.01) (2 Samples)

- (1) Reactor Coolant System Pressurizer Safety Relief Valve Position Switch, BBZS8010A
- (2) Containment Fan Cooler Unit B and Inlet Air Temp Element, SGN01B and GNTE0063

INSPECTION RESULTS

Failure to Environmentally Qualify Electrical Components in Containment to Most Severe Chemical Environment			
Cornerstone	Significance	Cross-Cutting Aspect	Report Section
Mitigating Systems	Green NCV 05000483/2019011-01 Closed	None (NPP)	71111.21N

The inspectors identified a Green finding and associated non-cited violation of 10 CFR 50.49(e)(3) when the licensee failed to environmentally qualify all 10 CFR 50.49 electrical equipment for the most severe chemical effects expected in containment.

Description: The containment spray system functions to reduce pressure and temperature inside containment following a postulated loss of coolant accident or main steam line break and to remove radioactive fission products from the containment atmosphere. The containment spray system has two modes of operation. During the initial injection mode, the containment spray system draws borated water from the refueling water storage tank (RWST) and sprays it inside containment. After the RWST is depleted and the sprayed water has collected at the bottom of containment, the containment spray system transitions to its recirculation mode, drawing suction from containment sump and spraying the recirculated solution to continue scrubbing radioactive fission products.

In order to enhance the absorption of fission products following a loss of coolant accident, the original design of the containment spray system injection mode included a spray additive system. The spray additive system mixed the borated water from the RWST with a sodium hydroxide solution. The sodium hydroxide additive would raise the pH of the spray droplets to high levels during the injection mode (e.g., 9.3 to 11.0). The long-term equilibrium recirculation sump solution pH would remain greater than 8.5, which would ensure the absorbed radionuclides remain in solution and also minimize the potential for chloride-induced stress corrosion cracking of any sprayed metallic components.

Industry studies performed subsequent to original plant design and construction demonstrated that fission product removal during the injection mode could be effectively performed by borated water spray alone, without using a sodium hydroxide additive. Long-term radionuclide retention in the containment recirculation sump and minimization of stress-corrosion cracking could be assured so long as the recirculation sump pH was greater than 7.0. In 1994 the licensee received a license amendment to replace the spray additive system with a passive system consisting of stainless steel baskets containing trisodium phosphate (TSP) powder. With the new pH control methodology, the borated water sprayed during the injection mode collects at the containment sump and is neutralized by mixing with the TSP. The licensee calculated that the long term equilibrium recirculation sump solution pH would be in the range of 8.0 to 9.0.

During the inspection, the inspectors noted that the environmental qualification evaluations for all electrical components in containment only considered chemical sprays having a pH in the range of 8.5 to 11.0. After the plant modification that eliminated the spray additive system, the initial pH of the borated water spray during the injection mode could be as low as 4.0.

10 CFR 50.49(e)(3) and NUREG-0588, "Interim Staff Position on Environmental Qualification of Safety-Related Electrical Equipment," Revision 1, Section 1.3, require that the electric equipment qualification program must be based on the composition of chemicals at least severe as that resulting from the most limiting mode of plant operation (e.g., containment spray, emergency core cooling, or recirculation from containment sump). Contrary to these standards, the licensee never qualified the electrical equipment located inside containment qualification for the full range of chemical system conditions the equipment is expected to see during both the injection and recirculation containment spray modes. Specifically, the licensee had never evaluated the chemical compatibility of the containment spray injection mode acidic borated water spray with any of the materials inside containment comprising the electrical equipment required to be environmentally qualified.

Corrective Actions: The licensee entered this issue into their corrective action program and performed an operability determination. The licensee performed vendor manual and literature searches to evaluate the compatibilities of known exposed materials with boric acid solutions. The licensee also gathered the initial acidic spray evaluations from two other nuclear utilities and reasonably determined that the components exposed to the borated water spray would remain capable of performing their safety function. The licensee plans to perform the required analysis or testing to demonstrate that all equipment that must conform to 10 CFR 50.49(e)(3) is qualified for the entire range of all containment spray conditions.

Corrective Action References: Condition Report 201906878

Performance Assessment:

Performance Deficiency: The failure to include the most severe composition of chemicals resulting from the most limiting mode of plant operation for components in the equipment qualification program in accordance with 10 CFR 50.49 (e)(3) was a performance deficiency.

Screening: The inspectors determined the performance deficiency was more than minor because if left uncorrected, it would have the potential to lead to a more significant safety concern. Specifically, this was a programmatic deficiency where the qualification basis for all equipment located inside containment does not account for the gap between the full range of expected environmental conditions (pH 4.0-11.0).

Significance: The inspectors assessed the significance of the finding using Appendix A, "The Significance Determination Process (SDP) for Findings At-Power." The finding screens as having very low safety significance (Green) because it did not result in the loss of operability or functionality of mitigating systems. Specifically, the licensee reasonably determined the affected equipment will remain capable of performing its safety function based on evaluations of the same equipment and conditions at other nuclear power plants and from industry information addressing boric acid interaction with the affected materials.

Cross-Cutting Aspect: Not Present Performance. No cross-cutting aspect was assigned to this finding because the inspectors determined the finding did not reflect present licensee performance.

Enforcement:

Violation: Title 10 *Code of Federal Regulations* 50.49(e)(3) requires that the electric equipment qualification program must include and be based on the following: (3) *Chemical effects*. The composition of chemicals used must be at least as severe as that resulting from the most limiting mode of plant operation (e.g., containment spray, emergency core cooling, or recirculation from containment sump).

Contrary to the above, from 1994 to October 24, 2019, the licensee's electric equipment qualification program failed to include and be based on the chemical effects of the most severe composition of chemicals resulting from the most limiting mode of plant operation. Specifically, the most severe chemical composition expected inside containment could result from the containment spray injection mode. However, the qualification of electric equipment inside containment was based on the chemical composition of the containment spray recirculation mode, which was less severe due to the borated water from the injection mode being neutralized by the trisodium phosphate located inside of containment.

Enforcement Action: This violation is being treated as a non-cited violation, consistent with Section 2.3.2 of the Enforcement Policy.

EXIT MEETINGS AND DEBRIEFS

The inspectors verified no proprietary information was retained or documented in this report.

- On November 7, 2019, the inspectors presented the design basis assurance (programs) inspection results to Mr. F. Diya, Senior Vice President and Chief Nuclear Officer, and other members of the licensee staff.

DOCUMENTS REVIEWED

Inspection Procedure	Type	Designation	Description or Title	Revision or Date
71111.21N	Calculations	CN-CRA-04-39	Callaway Main Steam Tunnel MSLB Equipment Thermal Lag Calculation with GOTHIC	0
		J-27G03-HVC8800A	Stress Analysis of Instrument Lines System: As-built tube run for SFR 2-YY-016D	0
		J-G03-AO	Stress Analysis of Instrument Lines System: Westinghouse Control Valves and Accessories - Auxiliary Building	0
		J-G03-AS	Stress Analysis of Instrument Lines: Westinghouse Control Valves and Accessories - Auxiliary Building	0
		NAI-2052-001	Callaway Energy Center Auxiliary Building GOTHIC Model	0
		ZZ-443	SBLOCA Temperature and Pressure Analysis with Reduced Heat Sinks	1
		ZZ-524	Main Steam Tunnel Temperature Response to a Main Steam Line Break Outside Containment	0
		ZZ-525	LOCA and MSLB Containment Pressure and Temperature Response	2
	Corrective Action Documents	Condition Reports	201302563, 201506803, 201600527, 201600100, 201806334, 201901444	
	Corrective Action Documents Resulting from Inspection	Condition Reports	201906793, 201906810, 201906847, 201906878, 201906960, 201906963, 201907049, 201907111, 201907119, 201907147, 201907157, 201907166, 201907169, 201906847	
	Drawings	1D99954	Motor Operated Gate Valve - Model 14002GM84FEHOEO	5
		E-093-00045	Auxiliary Relay Rack Arrangement	13
		E-23-AB17(Q)	Steam Warmup to Auxiliary Feedwater Pump Turbine	8
		E-23AB17(Q)	Schematic Diagram Steam Warmup to Auxiliary Feedwater Pump Turbine	8
		E-23AB28(Q)	Main Steam Isolation Valves Control	11
		E-23EJ06A(Q)	Sump to No. 1 Residual Heat Removal Pump	15
		E-2R8900	Raceway Notes, Symbols, and Details	107
		J-07G03	Hanger Design	0
		J-27D22(Q)	Instrument Mounting Detail D.P. Transmitter	10
		J-27G03(Q), Sh.	Installation Details Westinghouse Control Valve Accessories	4

Inspection Procedure	Type	Designation	Description or Title	Revision or Date
		1		
		J-601A-00096	Control Valve 1" Model 38-20761-6A1 ANSI Class 1500 Sch. 80 Socket Weld Ends No. 9 Reverse Actuator 6A1 Side Mounted Handwheel	14
		M-22AB02(Q)	Piping and Instrumentation Diagram Main Steam Piping	18
		M-22EJ01(Q)	Piping and Instrumentation Diagram Residual Heat Removal System	62
		M-22GL02(Q)	Piping and Instrumentation Diagram Auxiliary Building HVAC	27
		M-628-00086	Solenoid Valve 1-4 Assembly Drawing	0
		M-628-00087	Solenoid Valve 5+6 Assembly Drawing	0
		M-628-00094	System Medium Operated Actuator for Quick Closing Valve Layout Diagram	1
	Engineering Changes	CMP 92-1053	Replace current spray additive system with a recirculating fluid pH control system utilizing trisodium phosphate-dodecahydrate (TSP-C)	06/28/1994
		MP 08-0054	Pressurizer Pressure Transmitter Replacement	000.1
		MP 18-0070	Atmospheric Steam Dump (ASD) Transducer Thermo-Wrap Modification Request	3
	Engineering Evaluations	CR 201901444-006	Rosemount Transmitter Qualified Life Calculations	04/09/2019
		RFR 07461A	ASCO SOV/Namco Switch Sealing	04/06/1990
		RFR 07461B	Evaluation of Thermal Insulator for Namco Quick Disconnects used in Area 5	04/27/1990
	Miscellaneous	10466-E-062-0003-05	Prototype Test Doc. BIW Cable Sys. Inc.	02/22/1983
		E-025-00006	Qualification Type Test Report for Limitorque Valve Actuators with Type LR Motor	1
		E-025-00006G01	Limitorque Valve Operator Generic Qualification Evaluation	3
		E-025-00006P01	Limitorque Motor Operator Plant Qualification Evaluation	5
		E-025-00008	Qualification Type Test Report Multi-Point Terminal Strips	1
		E-025-00008G01	Limitorque Terminal Block Generic Qualification Evaluation	2
		E-025-00008P01	Buchanan, Marathon, GE, Curtis Terminal Block Plant Qualification Evaluation	4
		E-025-00014	Tests of Raychem Flamtrol	0

Inspection Procedure	Type	Designation	Description or Title	Revision or Date
		E-025-00014G01	Raychem Cable Generic Qualification Evaluation	1
		E-025-00014P01	Raychem Cable Plant Qualification Evaluation	3
		E-035-00153	BIW Cable Systems, Inc.	0
		E-1032-00010	Qualification Test Report for NAMCO Series EA180 Limit Switches	0
		E-1032-00010G01	Namco Controls Limit Switch	1
		E-1032-00010P01	Namco Controls Limit Switch	5
		E-1032-00018G01	Namco Controls Limit Switch	1
		E-1032-00018G01	Namco Controls Limit Switch	1
		E-1032-00018P01	Namco Controls Limit Switch/ECSA/SEALANT	7
		E-21012	Bill of Materials, Auxiliary Relay Rack	21
		E-21013AAG01	Raychem (Tyco Electronics-Energy) Splice	0
		E-21013AAP01	Raychem (Tyco Electronics-Energy) Splice	5
		E-21013C	Test Report for EGS GRAY Boot Connectors Models GB-1, GB-2, &GB-3	1
		E-21013CG01	EGS Connectors Generic Qualification Evaluation	2
		E-21013CP01	EGS Corp. Connectors Plant Qualification Evaluation	6
		E-21013XG01	Raychem Corporation Splice Generic Qualification Evaluation	2
		E-21013XG01	Raychem Corporation Splice	2
		E-21013XP01	Raychem Splice	7
		E-21013XP01	Raychem Splice Plant Qualification Evaluation	7
		EDR-5336	Nuclear Products Requalification Testing	5
		EDR-5336	Nuclear Products Requalification Testing	5
		EQ CN 90-17	Downgrade MSIV, MFIV, and Various Area 5 J-601A NAMCO Limit Switches and the SG Chemical Addition Valves to Category C	07/06/1990
		EQCN 02-01	Revise the Qualified Lives of the Rosemount 1153 Series B Transmitters Located in the Auxiliary Building	01/08/2002

Inspection Procedure	Type	Designation	Description or Title	Revision or Date
		FSAR CN 88-58	Update FSAR to Incorporate Results of Reviews of MSLBs Outside Containment with Superheated Steam Releases, IN 84-90	11/28/1988
		FSAR CN 89-21	Change the Environmental Classification of the MSIV & MFIV 10% Exercise Limit Switches	05/04/1989
		FSAR CN 90-36	Change LOCA Category for all Area 5 NAMCO Limit Switches and Associated Terminal Boxes to C. Change MSLB Category for These Components to C	06/15/1990
		J-301-00064	Qualifications Report for Pressure Transmitters Rosemount Model 1153 Series B Rosemount Report 108025	J
		J-301-00065-02	Type Test Report for Pressure Transmitters, Rosemount Model 1153 Series B, Rosemount Report 108026	A
		J-301-00065G01	Rosemount Pressure Transmitters	2
		J-301-00065P01	Rosemount Transmitter	2
		J-301-00067	Model 1153 Series B Alphaline Pressure Transmitter for Nuclear Service	23
		J-301-0085-01	Qualification Report For Pressure Transmitters Rosemount Model 1153 Series D Rosemount Report D8300040	A
		M-237-00191	ASCO Qualification Test Report AQR-6768	1
		M-237-00191G01	Automatic Switch Company, Solenoid Valve	4
		M-237-00191P01	Automatic Switch Company, Solenoid Valve	9
		M-612-00062	IM Air Handling Units (Room Coolers) Carrier Corporation	23
		M-612-00087	Room Coolers - Class 1E Medium AC Motors (Outside Containment)	2
		M-612-00087G01	Carrier/Westinghouse Motor Generic Qualification Evaluation	1
		M-612-00087P01	Carrier/Westinghouse Area Room Coolers Plant Qualification Evaluation	1
		M-612-00119	Westinghouse Replacement Motor Design Data and Seismic Evaluation for DSGL09A&B, DSGL10B, DSGL13A and DSGF02A&B	0
		M-619.3-00007G01	Joy Manufacturing Co. Motor Generic Qualification Evaluation	5/7/2005
		M-619.3-00007P01	Joy Manufacturing Co. Motor Plant Qualification Evaluation	7/27/2015

Inspection Procedure	Type	Designation	Description or Title	Revision or Date
		M-619.3-0007-06	Joy Qualification Test Report	3/8/83
		M-628-00077	IM for MSIV Actuator CCI Manufactured APS-700	4
		M-630-00097	Nuclear Environmental & Seismic Qualification Test Report for Control Components, Inc. Solenoid Valves	0
		M-630-00097G01	Control Components, Inc. Solenoid Valve Generic Qualification Evaluation	2
		M-630-00097P01	Controlled Components, Inc. (CCI) Solenoid Valve Plant Qualification Evaluation	6
		M-724-00409	Westinghouse Instruction Book for Motor Operated Gate Valves, Manually Operated Gate Valves & Swing Check Valves for SNUPPS Project	1
		MPM-ZZ-QA001	Limitorque Actuator Inspection and Lubrication	49
		QR-065-351021043-01	Qualification Report for Current to Pressure Transducer Thermo Scientific P/N: STD6131-2	2
		S-1027-00013G01	Patel/EGS Connectors Generic Qualification Evaluation	05/16/2005
		S-1027-00013P01	Patel/EGS Connectors Plant Qualification Evaluation	10/15/2014
		S-1027-00023G01	EGS Corp. Sealant Generic Qualification Evaluation	0
	Procedures	APA-ZZ-00304	Control of Callaway Equipment List	44
		APA-ZZ-00420	Traceability and Accountability of Safety Related and Special Scope Material and Equipment After Issue	16
		EA189 90051	Namco Controls Maintenance Instructions for Type EA180 Switch	B
		EA189-90006	Namco Controls Installation Instructions for EA180 Nuclear Switch - Silicone Gaskets	01/23/1980
		EADS02-E	Namco Controls Product Data Bulletin for Limit Switches/Receptacle Assembly for Nuclear Environments	12/01/2002
		EDP-ZZ-04054	Conduct of Equipment Seismic Qualification Activities	7
		EDP-ZZ-04054	Product of Equipment Seismic Qualification Activities	7
		ITL-BG-215A	RCP's Seal Injection Flow	8
		MPM-AB-QV001	Mainsteam Isolation Valve Actuator Overhaul	32
		MPM-ZZ-QV021	FWIV and MSIV Solenoid Valve Overhaul	1

Inspection Procedure	Type	Designation	Description or Title	Revision or Date
		MTM-ZZ-QA008	Limitorque SB-1 MOV Inspection and Overhaul	8
		WDP-ZZ-00010	Identification, Control, Storage, and Disposition of Shelf Life Items	19
		WSP-ZZ-00002	Storeroom Storage and Control	30
	Self-Assessments	201309684-07	Self-Assessment Topic: Environmental Qualification Program	08/26/2014
		FSA-201900029-006	Environmental Qualification (EQ) Program Pre-Inspection Self Assessment	03/28/2019
	Work Orders	Work Orders	140506855.500, 14506428.500, 18004612.600, E489594, W471043	