April 06, 2017

ULNRC-06331

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

10 CFR 50.90
NRC Regulatory Guide 1.106

Ladies and Gentlemen:

DOCKET NUMBER 50-483
CALLAWAY PLANT UNIT 1
UNION ELECTRIC CO.
RENEWED FACILITY OPERATING LICENSE NPF-30
PROPOSED REVISION OF CALLAWAY'S FSAR-DESCRIBED COMPLIANCE WITH REGULATORY GUIDE 1.106 REGARDING MOV THERMAL OVERLOAD PROTECTION (LDCN 16-0001)

Pursuant to 10 CFR 50.90, "Application for amendment of license or construction permit," Ameren Missouri (Union Electric Company) herewith transmits an application for amendment to Renewed Facility Operating License NPF-30 for the Callaway Plant.

The proposed amendment would revise the FSAR description of Callaway's compliance with NRC Regulatory Guide (RG) 1.106, Revision 1, "Thermal Overload Protection for Electric Motors on Motor-Operated Valves." Specifically, FSAR Standard Plant Appendix 3A, "Conformance to NRC Regulatory Guides," and FSAR Standard Plant Section 8.3.1.1.2.e, "480-V Motor Control Center Overcurrent Relaying," would be revised to incorporate a clear description of how Callaway complies with RG 1.106 in regard to the control and/or bypassing of thermal overload protection (TOP) devices for motor-operated valves (MOVs) during routine/maintenance testing of such valves.

The proposed change would allow MOV TOP devices to remain bypassed during routine valve stroke surveillances (such that the TOP bypass jumpers are not removed during such testing), which is not in strict compliance with RG 1.106.

Ameren Missouri has determined that the proposed change requires prior NRC approval per 10 CFR 50.59(c)(2)(ii). It was concluded that the proposed change (i.e., from requiring the TOP devices to be enabled during surveillance valve stroke testing to keeping the TOP devices bypassed during such testing) is considered to be a change that results in more than a minimal increase in the likelihood of occurrence of a malfunction, on the basis of an estimated, slight (but acceptable) increase in the risk of motor damage if the thermal overload protection is not enabled during surveillance tests. Per NEI 96-

07 Revision 1, this 10 CFR 50.59 criterion allows minimal increases; however, licensees must still meet applicable regulatory requirements and other acceptance criteria to which they are committed (such as contained in Regulatory Guides). It was therefore determined that the proposed change requires NRC approval.

The Enclosure to this letter provides an Evaluation of the proposed FSAR changes. Attachment 1 to the Enclosure provides the proposed FSAR changes, in support of this amendment request.

It has been determined that this amendment application does not involve a significant hazard consideration as determined per 10 CFR 50.92, "Issuance of Amendment." In addition, pursuant to 10 CFR 51.22, "Criterion for Categorical Exclusion; Identification of Licensing and Regulatory Actions Eligible for Categorical Exclusion or Otherwise not Requiring Environmental Review," Section (b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of this amendment. It should also be noted that this submittal does not contain new commitments.

The Callaway Onsite Review Committee has reviewed and approved the proposed changes and has approved the submittal of this amendment application.

Ameren Missouri requests approval of the requested license amendment prior to 04/06/2018. Ameren Missouri further requests that the license amendment be made effective upon NRC issuance, to be implemented within 90 days from the date of issuance.

In accordance with 10 CFR 50.91 "Notice for Public Comment; State Consultation," Section (b)(1), a copy of this amendment application is being provided to the designated Missouri State official. If there are any questions on this amendment application, please contact me at 573-310-7025 or Mr. Tom Elwood at 314-225-1905.

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

Sincerely,

Executed on: April 6, 2017

PIN 6381

Roger Wink
Manager, Regulatory Affairs

Enclosure: Evaluation of the Proposed Change

Attachments to the Enclosure:

1. Proposed FSAR Changes

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EVALUATION OF THE PROPOSED CHANGE

EVALUATION OF THE PROPOSED CHANGE

1. SUMMARY DESCRIPTION

The proposed amendment would revise Final Safety Analysis Report (FSAR) Appendix 3A and Section 8.3.1.1.2.e to provide a clear description of how Callaway complies with Regulatory Guide (RG) 1.106 in regard to the control and/or bypassing of thermal overload protection (TOP) devices for motor-operated valves (MOVs) during routine/maintenance testing of such valves. Text would be added to the Callaway FSAR to indicate that Regulatory Position C.1 of RG 1.106 is followed to the extent that TOP devices are continuously bypassed except during maintenance testing/activities. The added text would make it clear that (as an exception to the Regulatory Guide) MOV TOP devices remain bypassed during valve stroke surveillance testing such that TOP bypass jumpers are not removed during such testing. [Note: Text will also be added to clarify that for the auxiliary feedwater control valves (ALHV0005, ALHV0007, ALHV0009, ALHV0011), Regulatory Position C.2 of RG 1.106 is followed. This part of the overall FSAR change, however, does not require NRC approval.]

2. DETAILED DESCRIPTION

2.1 Proposed Changes

Changes to be made to the Callaway FSAR are described below. Changes to two FSAR sections are requested to incorporate a clear description of how Callaway complies with Regulatory Guide (RG) 1.106 in regard to the control and/or bypassing of thermal overload protection (TOP) devices for motor-operated valves (MOVs) during routine testing/maintenance activities of such valves.

I. In Appendix 3A of the Callaway FSAR, Callaway's compliance with RG 1.106 is described. The current statement that RG 1.106 does not apply to the Auxiliary Feedwater (AFW) control valves is being removed. (This statement was inserted under FSAR Change Notice 08-012 and is now being removed since it was the subject of an NRC violation.) New wording is being added to this section of Appendix 3A to state that for these AFW control valves, Regulatory Position C.2 of RG 1.106 is followed. This requires the setpoints for the TOP devices associated with these valves to be established and controlled in accordance with the Position, including periodic testing of the TOP devices themselves. This change will restore compliance with Regulatory Guide 1.106 for these valves. As noted in Section 1, this change does not require NRC approval. It is described in this submittal for information only.

II. RG 1.106 requires TOP devices to be continuously bypassed except during periodic or maintenance testing. It is Callaway's intent, however, to maintain the TOPs bypassed during surveillance stroke tests of MOVs (such that the jumpers used to bypass the TOPs would be removed only during maintenance testing/activities). Text would thus be added to FSAR Appendix 3A and Section 8.3.1.1.2.e to indicate that Regulatory Position C.1 of RG 1.106 is followed to the extent that TOP devices are continuously bypassed except during maintenance testing/activities. The added text would make it clear that MOV TOP devices remain bypassed during valve stroke surveillances (such that the TOP bypass jumpers are not removed during such testing).

In summary, the proposed change would revise the FSAR description of Callaway's compliance with NRC Regulatory Guide (RG) 1.106, Revision 1, "Thermal Overload Protection for Electric Motors on Motor-Operated Valves." Specifically, the FSAR will be revised to clarify how Callaway complies with RG 1.106 in regard to the control and/or bypassing of thermal overload protection (TOP) devices for motor-operated valves (MOVs) during routine testing/maintenance activities of such valves. The change would allow Thermal Overload Protection (TOP) devices to remain bypassed during routine valve stroke surveillance testing (such that the TOP bypass jumpers are not removed during such testing), which is not in strict compliance with RG 1.106.

2.2 Background

During the 2014 Component Design Bases Inspection (CDBI) at Callaway, discrepancies were identified between Callaway's FSAR and compliance with NRC Regulatory Guide (RG) 1.106, Revision 1, "Thermal Overload Protection for Electric Motors on Motor-Operated Valves." Callaway received a Severity Level IV, non-cited violation (NCV) of 10 CFR Part 50.59, "Changes, Tests and Experiments," due to implementing an FSAR change that exempted the auxiliary feedwater control valves (ALHV0005, ALHV0007, ALHV0009, and ALHV0011) from the scope of RG 1.106 requirements on the basis that each of the valves has a direct-current (DC) valve operator and has its overload protection integral to the valve operator (i.e., not with the motor starter). It was determined that resolution of the issues identified in connection with the NCV required a follow-up revision of the FSAR to be processed, via License Document Change Notice (LDCN) 16-0001.

There are two changes to be made per LDCN 16-0001, as described above in Section 2.1. Both changes are needed to incorporate (into the FSAR) a clear description of how Callaway complies with Regulatory Guide (RG) 1.106 in regard to the control and/or bypassing of thermal overload protection (TOP) devices for motor-operated valves (MOVs) during routine testing/maintenance activities of such valves.

3. TECHNICAL EVALUATION

Regulatory Guide (RG) 1.106, "Thermal Overload Protection For Electric Motors On Motor-Operated Valves," describes methods acceptable to the NRC staff with regard to the application of thermal overload protection devices that are integral with the motor starter for electric motors on motor-operated valves. The methods prescribed in the RG are intended to ensure that the thermal overload protection devices will not needlessly prevent the motor from performing its safety-related function.

In order to ensure that safety-related motor-operated valves whose motors are equipped with thermal overload protection devices integral with the motor starter will perform their function, one of the two regulatory positions should be implemented per RG 1.106:

I. Provided that the completion of the safety function is not jeopardized or that other safety systems are not degraded, (a) the thermal overload protection devices should be continuously bypassed and temporarily placed in force only when the valve motors are undergoing periodic or maintenance testing or (b) those thermal overload protection devices that are normally in force during plant operation should be bypassed under accident conditions.

II. The trip setpoint of the thermal overload protection devices should be established with all uncertainties resolved in favor of completing the safety-related action. With respect to those uncertainties, consideration should be given to (a) variations in the ambient temperature at the installed location of the overload protection devices and the valve motors, (b) inaccuracies in motor heating data and the overload protection device trip characteristics and the matching of these two items, and (c) setpoint drift. In order to ensure continued functional reliability and the accuracy of the trip point, the thermal overload protection device should be periodically tested.

The Callaway Plant was not designed with circuit provisions for bypassing TOP devices in and out of MOV starter circuits. Thus, bypassing TOPs requires the use of jumpers.

The proposed change (described in Section 2.1) would allow bypassing of TOPs during surveillance stroke tests of MOVs when the risk of motor damage to the valve is low. The proposed change does not take exception to the RG 1.106 recommendation for having the TOP devices in place during valve maintenance, when the risk for motor damage is likely greater. There is a concern with literally complying with the RG, as further explained below.

Ameren Missouri's position is that it is prudent to remove the thermal overload bypass jumpers during corrective or preventative maintenance activities in order to minimize motor damage as a result of an overload condition. For corrective or preventative maintenance where there is a concern of valve motor damage, the thermal overload bypass jumper is removed at Callaway. However, for Technical Specification required surveillance tests, there is no concern that motor damage is likely.

Technical Specification required testing of an MOV is not intrusive and does not put the valve at a higher risk of valve stall than normal operation of the valve. Control Room handswitches or actuation circuitry are used to reposition the valve for normal operation and for surveillance tests. Valves are repositioned as needed for normal operation, such as for swapping trains and for maintenance personal protection. There are no requirements for removing thermal overload bypass jumpers for normal operation or for maintenance workman's protection needs.

As noted previously, the bypassing of MOV TOPs at Callaway requires the use of jumpers (such that for each valve, a jumper must be installed to bypass the TOP and then removed to place the TOP back in force). There is an inherent risk of removing and re-installing thermal overload jumpers in that they may not be re-installed properly. Removing thermal overload bypass jumpers for surveillance stroke tests, during which motor damage is of low probability, may carry more risk with respect to ensuring that the valves can carry out their safety function of stroking as required during an accident.

If thermal overload jumpers are removed for surveillance stroke tests, a subsequent stroke test may be required to ensure that the jumper is landed appropriately and does not inhibit valve movement, consistent with the practice of requiring testing after a wiring modification. It is not possible to remove the jumper for this stroke test. This would be part of the periodic testing. So, all periodic tests cannot be done with the jumper removed.

Large populations of MOVs are tested each quarter. There are approximately 670 valve stroke tests each operating cycle. Testing frequency is generally either quarterly or every 18 months. Terminations (machine screws and wire lugs) are not meant to be removed repeatedly. This many incidents of bypassing and re-instating thermal overload protection for MOVs could lead to stripped screws, damaged terminal boards and broken lugs as a result of the repeated loosening and tightening of connections. Due to a broken connection, the bypass jumper may not be in the circuit, as desired, to ensure that the thermal overload relay does not inadvertently trip when repositioning the valve to fulfill the safety function. This would add risk to the plant operation.

Proper maintenance, periodic diagnostic testing, and proper operator sizing and setup and electrical design ensure that the valve motors are not challenged or damaged by motor stalls. During normal plant operation, voltages are higher and operating valve motor torque margins are increased, reducing the possibility of motor stall occurrences. Operation of the thermal overload is mainly intended for abnormal conditions. Currently at Callaway, if these abnormal conditions were to occur, the overload relay would trip and not automatically reset. When the jumpers are removed, the valve control circuit would become de-energized and the condition identified. Corrective actions would take place to resolve the abnormal condition. This has not been seen to occur at Callaway because of the proper maintenance and design. If the motor stalls during surveillance stroke tests, it will fail the surveillance. Most of the valves are stroke tested each quarter. The abnormal condition would be identified.

4. REGULATORY EVALUATION

4.1 Applicable Regulatory Requirements/Criteria

10 CFR 50.59 establishes the conditions under which licensees may make changes to the facility or procedures and conduct tests or experiments without prior NRC approval. Proposed changes, tests and experiments that satisfy the definitions and one or more of the criteria in the rule must be reviewed and approved by the NRC before licensee implementation.

Any change that adversely affects an FSAR-described design function and/or the method in which the design function is performed or controlled requires evaluation under 10 CFR 50.59. The proposed change involves keeping the thermal overload protection (TOP) devices for motor-operated valves (MOVs) bypassed during surveillance testing. Although the risk associated with this approach is considered to be acceptably low for surveillance testing, it is not in strict compliance with NRC Regulatory Guide (RG) 1.106 and is considered adverse in light of the intent of the Regulatory Guide to protect MOVs during testing.

NRC Regulatory Guide (RG) 1.106, Revision 1, requires the removal of MOV thermal overload relay bypass jumpers during both maintenance and periodic tests. The regulatory guide's position is that having the thermal overload protection enabled during periodic tests of an MOV is pertinent to preventing valve motor damage. The concern is that the motor may be damaged if the thermal overload protection is not in force.

At Callaway, bypassing TOP devices for the associated MOVs requires the installation of bypass jumpers, placing the TOP devices back in force following testing requires removing the bypass jumpers. Ameren Missouri is proposing to not remove the bypass jumper during required surveillance testing because of the potential for a malfunction as a result of a broken bypass jumper or circuit caused by the repeated removal and installation of the jumper. There is a large amount of operating and maintenance experience where stripped screws and broken lugs occur when terminations are repeatedly removed and re-installed.

There is a basis to conclude that the risk of not having the TOP in effect during surveillance testing is low compared to the risk that may be associated with removing and reinstalling the jumper for surveillance testing. Nevertheless, the regulatory guide's position is that the thermal overload protection for safety-related MOVs is to be enabled to provide protection during maintenance and periodic tests. Thus, keeping the bypass jumpers in place during surveillance MOV stroke testing can be seen as an increase in the likelihood of a malfunction of a safety-related MOV. Because of this determination, the proposed change requires the submittal of a license amendment as required by 10CFR50.59(c)(2)(ii).

4.2 NO SIGNIFICANT HAZARDS CONSIDERATION DETERMINATION

This section addresses the standards of 10 CFR 50.92 as well as the applicable regulatory requirements and acceptance criteria.

The proposed amendment would revise Final Safety Analysis Report (FSAR) Appendix 3A and Section 8.3.1.1.2.e to provide a clear description of how Callaway complies with Regulatory Guide (RG) 1.106 in regard to the control and/or bypassing of thermal overload protection (TOP) devices for motor-operated valves (MOVs) during routine testing/maintenance activities of such valves. Text would be added to the Callaway FSAR to indicate that Regulatory Position C.1 of RG 1.106 is followed to the extent that TOP devices are continuously bypassed except during maintenance testing/activities. The added text would make it clear that (as an exception to the Regulatory Guide) MOV TOP devices remain bypassed during surveillance testing such that TOP bypass jumpers are not removed during such testing. Furthermore, text would also be added (to the Callaway Plant FSAR) to clarify that for the auxiliary feedwater control valves (ALHV0005, ALHV0007, ALHV0009, ALHV0011), Regulatory Position C.2 of RG 1.106 is followed.

Ameren Missouri has evaluated whether or not a significant hazards consideration is involved with the proposed changes for Callaway Plant based on the three standards set forth in 10 CFR 50.92(c), "Issuance of Amendment," as discussed below:

1. Does the proposed amendment involve a significant increase in the probability or consequences of an accident previously evaluated?

Response: No.

Keeping the thermal overload protection (TOP) devices bypassed during surveillance testing does not introduce the possibility of a change in the frequency of an accident because failure of a single safety-related motor-operated valve (MOV) is not, by itself, an initiator of any previously evaluated design basis accident. Valves are active components that either position to "open" or "close" as required to fulfill safety functions. As such, safety-related MOVs are subject to single active failures, but such failures are not accident initiators. (For safety-related systems, redundancy in the design ensures that failure of a valve to open or to close on demand, as applicable, will not prevent fulfillment of the safety function(s). However, the associated safety functions are for accident mitigation/response, and while an MOV failure can affect such functions (without loss of the overall function), a single MOV failure cannot by itself initiate any accident previously evaluated in the FSAR.)

Furthermore, the change does not result in an increase in the consequences of an accident previously evaluated in the FSAR. The proposed change would permit MOV TOP devices to remain bypassed during surveillance stroke testing but not during valve maintenance. In regard to the bypassing of TOP devices during testing, the potential for valve damage is of greater concern during valve maintenance activities (when work has been done on the affected valve(s)) than it is for surveillance stroke tests. It may be assumed that the low probability of valve damage resulting from – or occurring during - surveillance valve stroke tests (with the TOP devices bypassed) does not change the single-failure assumptions already considered in the plant's design and accident analyses. As previously noted, redundancy in the design of safety-related systems ensures that failure of a valve to open or close on demand, as applicable, will not prevent fulfillment of the safety function(s). Accordingly, it may be concluded that the provisions for bypassing TOP devices during MOV surveillance testing does not require any changes to assumptions regarding MOV availability, single-failure protection, or the associated systems' capabilities for performing accident mitigation functions. With no changes to such assumptions, the proposed change does not result in more than a minimal increase in the consequences of an accident previously evaluated in the FSAR.

Therefore, the proposed change does not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. Does the proposed amendment create the possibility of a new or different kind of accident from any accident previously evaluated?

Response: No.

NRC Regulatory Guide (RG) 1.106, Revision 1, requires the removal of MOV thermal overload relay bypass jumpers during both maintenance and periodic tests. The regulatory guide's position is that having the thermal overload protection enabled during periodic tests of an MOV is desired to prevent valve motor damage. The concern is that the motor may be damaged if the thermal overload protection is not in force.

Keeping the thermal overload protection (TOP) devices bypassed during surveillance testing does not introduce the possibility of an accident of a different type than any previously evaluated in the FSAR. Although there could be a slight increase in the probability of valve damage due to the proposed change, any such failure would not be of a different kind or nature than what may already be experienced by an MOV. Thus, no new failure modes or initiators of a different type of accident are introduced. The single active failure of a motor-operated valve is already considered in the accident analysis assumptions described in the FSAR, and the failure of a single MOV is not by itself an accident initiator.

Therefore, the proposed change does not create the possibility of a new or different kind of accident from any previously evaluated.

3. Does the proposed amendment involve a significant reduction in a margin of safety?

Response: No.

No, this change does not affect design basis limits for a fission product barrier. No changes to the accident analyses, including any associated assumptions, are required or being made for the proposed change. Because of redundancy incorporated into the plant design (for single-failure protection), the failure of a single motor-operated valve will not result in the loss of any overall safety function.

Therefore, the proposed change does not involve a significant reduction in a margin of safety. Based on the above, Ameren Missouri concludes that the proposed amendment presents no significant hazards consideration under the standards set forth in 10 CFR 50.92(c), and, accordingly, a finding of "no significant hazards consideration" is justified.

4.3 Conclusions

In conclusion, based on the considerations discussed above, (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

5. ENVIRONMENTAL CONSIDERATION

Ameren Missouri has evaluated the proposed amendment and has determined that the proposed amendment does not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluent that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed amendment meets the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the proposed amendment.

6. REFERENCES

1. NRC Regulatory Guide 1.106, Revision 1, "Thermal Overload Protection For Electric Motors On Motor-Operated Valves," March 1977.

2. NRC Inspection Report 2014007 (ADAMS Accession No. ML14213A301)

LDCN 16-0001

FSAR Markups

FSAR – SP Sections

Appendix 3A	Conformance to NRC Regulatory Guides
Section 8.3.1.1.2	Class 1E AC System

Westinghouse setpoint studies performed with the original steam generators provide an allowance from the nominal trip setpoint to the technical specification allowable value (AV) to account for drift when measured at the rack during periodic testing, rack calibration accuracy, and rack comparator setting accuracy. The difference between the nominal trip setpoint (NTS) and the safety analysis limit includes the following items: a) the inaccuracy of the instrument (sensor temperature and pressure effects, sensor reference accuracy, sensor drift), b) process measurement accuracy, c) uncertainties in the sensor calibration, d) the potential transient overshoot determined in the accident analyses (this primary element accuracy may include compensation for the dynamic effect), e) environmental effects on equipment accuracy caused by postulated or limiting postulated events (only for those systems required to mitigate consequences of an accident), f) rack temperature error, g) rack and sensor M&TE errors, and h) the rack error terms discussed above (between the NTS and AV). Designers choose setpoints such that the accuracy of the instrument is adequate to meet the assumptions of the safety analysis.

Westinghouse setpoint studies performed for the replacement steam generators (RSGs) provide an allowance from the nominal trip setpoint to the technical specification allowable value to account only for rack calibration accuracy. The difference between the nominal trip setpoints for reactor trips and ESF actuations started by SG water level low-low, SG water level high-high, and low steamline pressure and their safety analysis limits includes the same error terms discussed above. The “Nominal Trip Setpoints and Allowable Values” section in the Background Bases for Technical Specifications 3.3.1 and 3.3.2 discuss some differences between the pre-RSG and post-RSG setpoint methodologies, but the major difference is the tightening of the band between the NTS and the AV for the above RTS and ESFAS functions. Designers choose setpoints, such that the accuracy of the instrument is adequate to meet the assumptions of the safety analysis.

The range of instruments is chosen, based on the span necessary for the instrument's function. Narrow range instruments will be used where necessary. Instruments will be selected, based on expected environmental and accident conditions. The need for qualification testing will be evaluated and justified on a case basis.

Administrative procedures coupled with the present cabinet alarms and/or locks provide sufficient control over the setpoint adjustment mechanism, so that no integral setpoint securing device is required. Integral setpoint locking devices will not be supplied.

The assumptions used in selecting the setpoint values in Regulatory Position C.1, and the minimum margin with respect to the safety analysis limit and calibration uncertainty will be documented by Westinghouse. Drift rates and their relationship to testing intervals will not be documented by Westinghouse.

REGULATORY GUIDE 1.106 REVISION 1 DATED 3/77

Thermal Overload Protection for Electric Motors on Motor-Operated Valves

DISCUSSION:

~~The recommendations of this regulatory guide are met. Refer to Section 8.3.1.1.2. This regulatory guide does not apply to the auxiliary feedwater control valves (ALHV0005, -7, -9, and -11) each of which has its thermal overload protection device(s) located in the valve assembly.~~

INSERT

REGULATORY GUIDE 1.107 REVISION 1 DATED 2/77

Qualifications for Cement Grouting for Prestressing Tendons in Containment Structures

DISCUSSION:

The recommendations of this regulatory guide are not applicable to the SNUPPS application, since a prestressing system using ungrouted tendons is used.

REGULATORY GUIDE 1.108 REVISION 1 DATED 8/77

Periodic Testing of Diesel Generator Units Used As Onsite Electric Power Systems at Nuclear Power Plants

DISCUSSION:

The recommendations of this regulatory guide were met with regard to the periodic testing of standby diesel generators at Callaway Plant following initial licensing of the facility. However, since the issuance of Revision 3 of Regulatory Guide 1.9 and adoption of the Improved (NUREG-1431 based) Technical Specifications at Callaway Plant per License Amendment 133 (in 1999), periodic testing of the standby diesel generators has been based on the requirements and/or recommendations of those documents in lieu of Regulatory Guide 1.108. Further, Regulatory Guide 1.108 was withdrawn by the NRC in 1993 (58 FR 41813, 8/5/93) in light of the guidance provided in Regulatory 1.9, Revision 3 wich largely incorporated and superseded the guidance of Regulatory Guide 1.108.

REGULATORY GUIDE 1.109

Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I.

DISCUSSION:

Refer to Appendix 3A of the Site Addendum.

REGULATORY GUIDE 1.110 REVISION 0 DATED 3/76

Cost-Benefit Analysis for Radwaste Systems for Light-Water-Cooled Nuclear Power Reactors

The voltage control systems function to ensure that the voltage at NB01 and NB02 is sufficient to reset the safety related degraded voltage relays and loss of voltage relays before time limits are exceeded. With this, the preferred offsite power sources are retained to power the safety related electrical distribution system. The voltage control systems also function to ensure that overvoltages are not present in the safety related electrical distribution system when fed from the preferred power sources.

8.3.1.1.2 Class 1E AC System

The Class 1E ac system is that portion of the onsite power system inside the broken-line enclosures shown in Figure 8.3-1.

The Class 1E ac system distributes power at 4.16 kV, 480 V, 208/120 V, and 120 V ac to all safety-related loads. Also, the Class 1E ac system supplies certain selected loads which are not safety related but are important to the plant operation. Figure 8.3-2 lists the major safety-related and isolated nonsafety-related loads supplied from the Class 1E ac system.

In addition to the above power distribution, the Class 1E ac system contains standby power sources which provide the power required for safe shutdown in the event of a loss of the preferred power sources.

The following describes various features of the Class 1E systems:

POWER SUPPLY FEEDERS - Each 4.16-kV load group is supplied by two preferred power supply feeders and one diesel generator (standby) supply feeder. Each 4.16-kV bus supplies motor loads and 4.0-kV/480-V load center transformers with their associated 480-V busses.

BUS ARRANGEMENTS - The Class 1E ac system is divided into two redundant load groups per unit (load groups 1 and 2). For each unit, either one of the load groups is capable of providing power to safely reach cold shutdown for that unit. Each ac load group consists of a 4.16-kV bus, 480-V load centers, 480-V motor control centers, and lower voltage ac supplies.

LOADS SUPPLIED FROM EACH BUS - Refer to Figure 8.3-2 for a listing of Class 1E system loads and their respective busses.

MANUAL AND AUTOMATIC INTERCONNECTIONS BETWEEN BUSSES, BUSSES AND LOADS, AND BUSSES AND SUPPLIES - No provisions exist for automatically connecting one Class 1E load group to another redundant Class 1E load group or for automatically transferring loads between load groups. The incoming preferred power supply associated with a load group can supply the 4.16-kV Class 1E bus of the other load group by manual operation of the requisite 4.16-kV circuit breakers when required.

Interlocks are provided that would prevent an operator error that would parallel the standby power sources of redundant load groups.

For a further discussion of interlocks, refer to Section 8.3.1.1.3.

INTERCONNECTIONS BETWEEN SAFETY-RELATED AND NONSAFETY-RELATED BUSSES - No interconnections are provided between the safety-and nonsafety-related busses. The startup transformer supplies power through the same winding to a 13.8-kV bus and a 13.8/4.16-kV ESF transformer.

REDUNDANT BUS SEPARATION - The Class 1E switchgear, load centers, and motor control centers for the redundant load groups are located in separate rooms of the control building and auxiliary building in such a way as to ensure physical separation. Refer to Section 8.3.1.4.1 and Section 8.3.1.1.7 for the criteria governing redundant bus separation.

CLASS 1E EQUIPMENT CAPACITIES -

a. 4.16-kV Switchgear

Bus	2000A continuous rating
Incoming breakers	2000A continuous, 350 MVA interrupting
Feeder breakers	1200A continuous, 350

b. 480-V Unit Load Centers

Transformers	1000 kVA, 3 phase, 60-Hz, 4000/480 V
Bus	1600A continuous
Incoming breakers (See Note)	
(GE AKR)	1600A continuous, 50,000A rms symmetrical interrupting
(Square D)	1600A continuous, 65,000A rms symmetrical interrupting

Feeder breakers (See Note)

(GE AKR)	800A continuous, 30,000A rms symmetrical interrupting (with instantaneous trip) 25,000A rms symmetrical interrupting (without instantaneous trip)
(Square D)	800A continuous, 42,000A rms symmetrical interrupting

Note: The GE AKR breakers used in the 480V Unit Load Centers are being replaced with Square D breakers with higher interrupting rating. The breaker replacement is being phased in over several years. During the interim period both breaker types will be in-use in the 480V Unit Load Centers.

c. 480-V Motor Control Centers

Horizontal bus	600A continuous, 25,000A rms symmetrical
Vertical bus	300A continuous, 25,000A rms symmetrical
Breakers (molded case)	25,000A rms symmetrical, minimum interrupting (singly for thermal-magnetic breakers and in combination with a starter for magnetic only breakers)

AUTOMATIC LOADING AND LOAD SHEDDING - The automatic loading sequence of the Class 1E busses is indicated in Figure 8.3-2.

If preferred power is available to the 4.16-kV Class 1E bus following a LOCA, the Class 1E loads will be started in programmed time increments by the load sequencer. The sequencer provides an interlock signal to the capacitor banks and ESF transformer load tap changers to assure proper system operation and coordination. The emergency standby diesel generator will be automatically started but not connected to the bus. However, in the event that preferred power is lost following a LOCA, the load sequencer will function to shed selected loads and automatically start the associated standby diesel generator (connection of the standby diesel generator to the 4.16-kV Class 1E bus is performed by the diesel generator control circuitry). Load sequencers will then function to start the required Class 1E loads in programmed time increments.

A failure modes and effects analysis and a reliability study have been performed on the load shedder emergency load sequencers (LSELS). These studies have shown that no failure within a single LSELS can result in the failure of both sources of offsite power, that there are no credible sneak circuits or common mode failures in the LSELS that could render both the onsite and offsite power sources unavailable, and that sequencing of loads on the offsite power system does not compromise the reliability of the offsite power source.

There are no permissive devices (e.g., lube oil pressure) incorporated into the final actuation control circuitry for large horsepower, safety-related motors.

Refer to Section 8.3.1.1.3 for additional information on load shedding and sequencing.

CLASS 1E EQUIPMENT IDENTIFICATION - Refer to Section 8.3.1.3 for details regarding the physical identification of Class 1E equipment.

INSTRUMENTATION AND CONTROL SYSTEMS FOR THE APPLICABLE POWER SYSTEMS WITH THE ASSIGNED POWER SUPPLY IDENTIFIED - The dc control supplies for switchgear breaker operation are separate and independent so that Class 1E dc load group 1 supplies Class 1E load group 1 switchgear. The battery chargers for dc load group 1 are fed from the same load group switchgear. Class 1E dc load group 2 supplies Class 1E load group 2 switchgear. For further information on the dc power system, refer to Section 8.3.2.

Each 4.16-kV switchgear bus and 480-V load center bus is equipped with an undervoltage relay for annunciation in the control room. The voltage of each bus is monitored by instruments in the control room.

ELECTRIC CIRCUIT PROTECTION SYSTEMS - Protective relay schemes or direct-acting trip devices on primary and backup circuit breakers are provided throughout the onsite power system in order to:

a. Isolate faulted equipment and/or circuits from unfaulted equipment and/or circuits

b. Prevent damage to equipment

c. Protect personnel

d. Minimize system disturbances

The short circuit protective system is analyzed to ensure that the various adjustable devices are applied within their ratings and set to be coordinated with each other to attain selectivity in their operation. The combination of devices and settings applied affords the selectivity necessary to isolate a faulted area quickly with a minimum of disturbance to the rest of the system.

Major types of protection applications that are used consist of the following:

a. Overcurrent Relaying

Each bus supply breaker (except the standby diesel breaker) is equipped with three inverse-time overcurrent relays and one inverse-time ground fault relay for bus faults and to provide backup for feeder circuit relays. Bus supply breakers from the standby emergency diesel generator are equipped with three inverse-time overcurrent relays only. Ground protection is provided on each generator neutral.

Each 4.16-kV motor circuit breaker has three overcurrent relays, each with one long-time and two instantaneous elements for overload, locked rotor, and short circuit protection. Each 4.16-kV motor circuit breaker is also equipped with an instantaneous ground current relay.

The current for Class 1E motors is monitored by computer in the control room and at the Class 1E switchgear.

Each 4.16-kV supply circuit breaker to a load center transformer has three overcurrent relays with long-time and instantaneous elements. An instantaneous overcurrent ground current relay provides sensitive ground fault protection.

b. Undervoltage Relaying

Each 4.16-kV Class 1E bus is equipped with undervoltage relays for diesel generator start initiation and undervoltage annunciation.

Each 480-V Class 1E load center bus is equipped with undervoltage relays for undervoltage annunciation.

c. Differential Relaying

The main, unit auxiliary, startup, station service, and ESF transformers are equipped with differential relays. These relays provide high-speed disconnection to prevent severe damage in the event of transformer internal faults.

Motors rated above 3,500 horsepower are equipped with differential protection.

The main generator and the standby emergency generator are provided with differential protection.

d. 480-V Load Center Overcurrent Relaying

DELETE

DELETE

INSERT

Each 480-V load center circuit breaker is equipped with a solid state device which has an adjustable phase and ground overcurrent trip.

e. 480-V Motor Control Center Overcurrent Relaying

Molded case circuit breakers provide time overcurrent and/or instantaneous short circuit protection for all connected loads. The molded case circuit breakers for motor circuits are equipped with instantaneous trip only. Motor overload protection is provided by ambient compensated thermal trip units in the motor controller. The molded case breakers for nonmotor feeder circuits provide thermal time overcurrent protection as well as instantaneous short circuit protection.

INSERT:
As noted
above, all

~~All~~ starters for motor-operated valves are equipped with thermal overload relays. The thermal overload relay trip contacts located in 480-V motor control centers, for I Class 1E valves, are bypassed with jumpers except when the valve motors are undergoing ~~periodic or~~ maintenance testing.

The starters and the feeder circuit breakers located in the motor control center are coordinated with the motor control center incoming supply breakers so that, upon ground fault, the protective device nearest the fault trips first. Where coordination is not possible using the protective devices normally furnished in a standard motor control center module, solid-state ground fault protectors are added to the affected modules on an individual basis.

TESTING OF THE AC SYSTEMS DURING POWER OPERATION - All Class 1E circuit breakers and motor controllers are testable during reactor operation, except for the electric equipment associated with those Class 1E loads identified in Chapter 7.0. During periodic Class 1E system tests, subsystems of the engineered safety features actuation system, such as safety injection, containment spray, and containment isolation, are actuated, thereby causing appropriate circuit breaker or contactor operation. The 4.16-kV and 480-V circuit breakers and control circuits can also be tested independently while individual equipment is shut down. The circuit breakers can be placed in the test position and exercised without operation of the associated equipment.

SHARING OF SYSTEMS AND EQUIPMENT BETWEEN UNITS - There is no sharing of Class 1E systems or equipment between units.

8.3.1.1.3 Standby Power Supply

The standby power supply for each safety-related load group consists of one diesel generator complete with its accessories and fuel storage and transfer systems. It is capable of supplying essential loads necessary to reliably and safely shut down and isolate the reactor. Each diesel generator is rated at 6,201 kW for continuous operation. Additional ratings are 6,635 kW for 2,000 hours, 6,821 kW for 7 days, and 7,441 kW for

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Appendix 3A Insert

With respect to the control of thermal overload protection devices for electric motors on safety-related motor-operated valves (MOVs), the recommendations of this regulatory guide are met, with the following clarification(s) and exception:

a. Regulatory Position C.2 is followed for the auxiliary feedwater control valves (ALHV0005, ALHV0007, ALHV0009, and ALHV0011). For the auxiliary feedwater control valves, the thermal overload relay contacts are located in the valve limit switch compartments (at the valves). Since the thermal overload relay setpoints for these valves were established and are maintained and tested in accordance with Regulatory Position C.2 of Regulatory Guide 1.106, the thermal overload protection devices are not continuously bypassed.

b. For all other MOVs, Regulatory Position C.1 is followed such that thermal overload protection devices are continuously bypassed except during maintenance testing/activities. For periodic valve stroke surveillances, the jumpers installed for bypassing the thermal overload protection devices are not required to be removed. Refer to Section 8.3.1.1.2.

Section 8.3.1.1.2 Insert

For routine periodic surveillance valve stroke tests, and in order to maintain circuit integrity, thermal overload relay contact jumpers are typically not removed during such tests.