Attachment 1

NRC Audit Questions and Responses

As noted in the cover letter to this LAR supplement, on September 26 and 27, 2018, the NRC conducted a regulatory audit at the Callaway Plant in order to further develop an understanding of the technical basis for the LAR. A letter providing a summary of the audit, including documentation of the questions and responses discussed during the audit, was issued by the NRC on January 4, 2019. In light of the supporting information provided by the audit for Ameren Missouri's LAR, the documented audit questions and responses are provided in the enclosed pages of this attachment.

Item 1

NRC staff needs to determine that the GOTHIC model documents the air flow patterns necessary to support the LAR's related design modifications.

NRC staff question:

Do the air flow patterns utilizing the new fans/ducts provide appropriate and complete air flow to the back of the Motor Control Centers?

Callaway Response:

The air flow patterns from the revised GOTHIC model with the new fans and ducts in service indicate that the supplemental cooling system will provide appropriate and complete air flow to the back of the Motor Control Centers. The graph of the revised air flow patterns was provided to the NRC staff during the audit process.

Item 2

The licensee's LAR proposes to change TS 5.5.11, "Ventilation Filter Test Program (VFTP)," by lowering the required control room HVAC heater wattage from 15 +/- 2 kW to 5 +/- 1 kW. NRC staff needs to understand the basis for change from the original 15-kW heater and the consequences, if any, on the charcoal filters.

NRC staff question:

1. Please provide a copy of the original calculation to support this proposed change.

Callaway Response:

The original calculation was provided during the audit and reviewed by NRC staff.

The calculation documents that there is a range for the heat load provided by the heaters in order to meet the "humidity level" and the temperature limit downstream of the heating coil ("off coil" temperature).

The heat generated by the charcoal heater(s) is within a maximum and minimum limit. The maximum limit ensures the "off coil" temperature limit is not exceeded (for charcoal protection). At the same time, the minimum heat level had to be evaluated to ensure that a humidity level of no more than 70% would be maintained for the charcoal, even at the minimum heater output level. This analyzed temperature range, from the lower to the upper limit, allows the charcoal to remain capable of performing its function without any adverse consequences on the charcoal filters.

NRC staff question:

2. The LAR states that 414 V is the minimum allowable voltage at the bus. Assuming that a 2-3% voltage drop from the bus to the terminals of the heater produces a heat output of less than the 3.16-kW value identified in the calculation, please provide a discussion related to the adequacy of the proposed heater size and TS range, based on limiting voltage at the heater terminals.

Callaway Response:

The voltage range for operation of the Control Room Pressurization Filtration Unit Heater is 460 Vac +/-10% at the unit heater terminals. This range is not at the motor control center bus.

The degraded voltage safety limit load-flow analysis provided during the audit documents that the voltage is specified to be 427 Vac with the NB bus at 3720 Vac. This then provides a 13-Vac margin from the 414-Vac limit for this heater, and protection is further provided by the degraded voltage relays.

NRC staff question:

3. Please provide a discussion on the adequacy of the proposed heater size when the 4160-V bus is operating at 3740 V and 58.8 Hz.

Callaway Response:

The low steady-state limit of 3740 Vac at the Emergency Diesel Generators (EDGs) is bounded by the 3720-V safety limit at the NB buses, as documented by the degraded voltage load-flow cases reviewed by the NRC staff during the audit. Load flow diagrams were also provided to support this discussion during the audit to the NRC staff.

Additionally, the EDG frequency variations do not impact the heater capacity.

NRC staff question:

4. Please discuss how the proposed filtration configuration with the reduced heater size will be tested to validate the adequacy of proposed design.

Callaway Response:

The proposed filtration configuration with reduced heater size will be tested to:

1) validate the adequacy of the proposed design by demonstrating that the heaters will dissipate 5 ± 1 kW when tested in accordance with American National Standards Institute (ANSI) N510-1975, "Testing of Nuclear Air Cleaning Systems," and corrected to design nameplate voltage settings.

2) operate from the Control Room for a minimum time of 15 continuous minutes with flow through the HEPA filters and charcoal beds, with the heater circuits in the filter train energized.

The related procedures for post-maintenance testing were identified to the NRC staff during the audit.

Item 3

Typically, the cables in the cable trays have a conductor temperature of 90°C. The NRC staff needs to understand the LAR's assumptions related to the following electrical conditions.

NRC staff question:

1. What temperature (for conductors and other electrical equipment) was used to evaluate heat input into the rooms?

The major contributors to heat load are transformers and cables where the heat generated is calculated as I^2R with I, current, and R, the resistance. Here, R increases as temperature increases.

Cables are designed to operate at 90°C. With room temperatures approaching 100°F or more, the cables themselves may be operating at or above their design temperature of 90°C. Hence the "R" value of cables should be computed at an appropriate conductor temperature.

With the onset of an event, such as a loss-of-coolant accident (LOCA), the pressures in the Reactor Coolant System (RCS) may be low and pumps may operate at runout conditions. Hence, the motors associated with the pumps may be operating above nominal rating, resulting in higher current.

Please provide details on how the large loads were considered at the onset of an event and for the first few initial hours.

Callaway response:

The cable temperature to calculate heat output from the cables was 90°C. There is an assumption that all cables in the tray are loaded at their full ampacity current rating to achieve 90°C in the tray. However, only a small amount of the cables are energized, and the cables are not at their full ampacity. Evaluations of similar type cable trays demonstrated that the trays exhibited a 15°C temperature rise over the ambient. Thus, the 90°C assumption for cable resistance in order to maximize heat output is conservative. The heat load calculation and ampacity evaluations were reviewed by the NRC staff during the audit.

The electrical loads are based on the worst loading for the driven load (i.e. maximum flow, maximum loading, runout, etc.) For instance, ECCS injection pumps feeding the RCS large-break loss-of-coolant break were assumed to be operating at the worst case flow, giving the maximum brake horsepower loading point for the pump motors. Other pumps and fans were assumed to operate at their maximum design load operating point for their system requirements. No change or deviation was made from the maximum operating requirements assumed in the plant electric load analysis.

NRC staff question

2. The corresponding loads on the transformers need to be confirmed. The current in each transformer should account for max load plus losses.

In addition, please provide details on the calculation that was developed to evaluate tray fill and any diversity factor used for heat loss calculations.

Callaway response:

The transformer losses are based on the maximum loads for the large-break LOCA. Both transformer no-load and load losses were included in the calculation.

The calculation that was developed to evaluate tray fill includes the heat loss for the "G" and "B" type cable trays used, as well as actual cable currents for all energized cables in the tray. The "U" type cable trays are mixed-service trays that have 125-Vdc, 120-Vac and 480-Vac cables. The cable trays have a high diversity where only a small percentage of the cables are energized. Typically, the largest percentage of these cables are control cables for motor control center loads. These typically have load currents of less than one amp, often only a few milliamps to power indication lights or small relays. Even during a LOCA, the number of continuous motor control center loads is small. The largest number of motor control center loads is for motor-operated valves, the motors for which operate less than a minute. Thus, conservative assumptions are used in the heat load calculation which was reviewed by the NRC staff during the audit.

Item 4

Callaway's Final Safety Analysis Report (FSAR), Rev. OL-22, Chapter 1, "Introduction and General Description of the Plant," (ADAMS Accession No. ML17048A157) Section 1.2.1.8, "Meteorology," states:

> The climate of the Callaway site is temperate continental with cold snowy winters and warm, humid summers. Based on climatological data from nearby weather stations, the normal annual average temperature is 55°F at Columbia, Missouri. Extreme temperatures for the area are 116°F for Fulton, Missouri, and -26°F for Fulton, Missouri.

Callaway's TS, Callaway, Unit 1, Current Facility Operating License NPF-30, Tech Specs, Revised 09/26/2017, (ADAMS Accession No. ML053110040), Surveillance Requirement (SR) 3.8.6.3 states: Verify average electrolyte temperature of representative cells is ≥ 60°F (at a frequency of at least once per 92 days).

FSAR, Rev. OL-22, Chapter 9, Section 9.4.1.2.3, "System Operation," states: "...The ambient temperature in the battery rooms, under any mode of operation, will be between 60°F and 90°F..."

The batteries have minimum and maximum operating temperature limits. The battery will give the best results when working in a room temperature between 60°F and 80°F, but will function when operating in temperatures outside the allowable band. High temperatures increase the performance, but decrease the life of the cells; low temperatures reduce the performance.

The NRC staff needs clarification on the values associated with the minimum vital battery room temperatures during an Extended Loss of Alternating Current [AC] Power (ELAP) Event calculation and to understand the consequences of extreme winter temperatures and battery room temperatures that were evaluated during minimum heat load conditions.

The NRC staff's concern is related to a planned or unplanned 30-day train outage which may be in the middle of winter when the outside temperature is -26°F.

Please consider the following scenario and related questions;

<u>NRC staff question:</u>

1. The plant is online, then the Emergency Core Cooling System (ECCS) is not operating and heat load in the areas of concern may be minimal – please provide a discussion on any corrective actions that may be needed to maintain battery operability.

Callaway Response:

Implementation of TS 3.7.20 allows plant operation with a single operable Class 1E AC unit. This represents a reduction in overall cooling capacity. The proposed TS ensures that there is adequate cooling to the Class 1E electrical equipment through implementation of the Required Actions for proposed Condition A (when one Class 1E AC unit is inoperable) by utilizing the supplemental cooling system to be installed in the plant. Therefore, implementation of TS 3.7.20 and use of the associated supplemental cooling system will not adversely impact normal or post-accident minimum battery room temperatures.

Although implementation of the supplemental cooling modification and TS 3.7.20 would not adversely impact minimum battery room temperatures, a discussion of minimum Control Building temperatures in normal and accident conditions is provided below.

Normal Operating Conditions

During preparation for cold weather operations, plant operations procedures for cold weather direct implementation of the plant heating system by verifying that the plant heating system and control building unit heaters are available.

The Control Building unit heaters (EGK02A/B, EGK03A/B, EGK05A/B) energize at a room temperature of 63°F and are located in the upper and lower cable spreading rooms and the ESF switchgear rooms.

The plant heating system provides hot water to the Control Building supply air unit (SGK02) heating coil. Heated air is delivered to all levels of the Control Building. The temperature of the heated air is controlled as a function of outside air temperature, as described in FSAR Section 9.4.1.2.3.

These systems provide all of the heating required to maintain the TS-required battery temperatures during normal plant operation regardless of whether or not the TS 3.7.20 mitigating actions have been established.

Procedures to provide temporary heaters are not needed. Historically, operation of the installed unit heaters has not been required. Adequate room temperatures have historically been maintained by operation of the SGK02 supply air unit.

NRC staff question

2. If an accident occurs 24 hours or 7 days after declaring a Class 1E electrical equipment A/C train inoperable (i.e., after entering Condition A of TS 3.7.20), the expected load shedding reduces heat input into the rooms. Please provide a discussion related to the operability of the batteries after a few days into the event. The accident could also occur at any time during the 30-day train outage.

Callaway Response:

Under accident conditions the unit heaters and Control Building supply air units used during normal operating conditions are not credited to maintain acceptable Control Building temperatures.

A Station Blackout (SBO) or Extended Loss of All AC Power (ELAP) event represents the limiting scenario for minimum battery room temperatures due to the minimal equipment heat loads present. The minimum control building heat loads during an SBO/ELAP event conservatively bound the minimum heat loads present during any postulated Design Basis Accident (DBA), including a Loss of Offsite Power (LOOP) or events that extend beyond assumed offsite power restoration at 7 days.

The calculation which documents an evaluation of minimum battery room temperatures during an ELAP event, assuming limiting atmospheric conditions (-26°F) and minimal equipment heat loads, was reviewed by the NRC staff during the audit. In the calculation, battery room temperatures are assumed to start at the minimum allowable battery temperature of 60°F and are then shown to not drop below 60°F over the course of the event. Battery room temperatures are shown to steadily increase over the course of the 12-hour analysis and would continue to increase until an equilibrium temperature point is reached during the course of a longer 30-day event.

NRC staff question:

3. Assuming a station blackout event occurs following an extended Loss of Offsite Power (LOOP) event anytime during the proposed 30-day Completion Time (CT) for Required Action A.3, please provide a discussion related to battery operability for the required coping duration.

Callaway Response:

Loss of offsite power is a licensing-basis event described in FSAR Section 15.2. Station Blackout is a separate event described in FSAR Section 8.3A. There is no licensing-basis requirement to postulate the plant being in one licensing-basis event during or immediately following another licensing-basis event.

However, as documented above, a Station Blackout (SBO) or Extended Loss of All AC Power (ELAP) event represents the limiting scenario for minimum battery room temperatures due to the minimal equipment heat loads present. The minimum control building heat loads during an SBO/ELAP event conservatively bound the minimum heat loads present during any postulated Design Basis Accident (DBA), including a Loss of Offsite Power (LOOP) or events that extend beyond assumed offsite power restoration at 7 days.

NRC staff question:

4. Please provide a discussion on the low-end design temperature related to operability of the safety related batteries.

Callaway Response:

As noted above, the limiting event for minimum battery room temperatures is an SBO/ELAP. The SBO/ELAP bounds all DBAs, including events that are evaluated for time periods beyond 7 days out to 30 days. The SBO/ELAP minimum temperature analysis shows that battery room temperatures, postulated to start at the minimum allowable temperature of 60°F, never drop below 60°F and continue to increase over the course of the event (until an equilibrium temperature is eventually reached). As a result, the batteries would be available to perform their specified safety functions during the course of a postulated DBA occurring during limiting Callaway cold weather conditions.

NRC staff question:

5. How will this be controlled during the proposed CT?

Callaway Response:

Since the batteries would be available to perform their specified safety functions during the course of a postulated DBA occurring during limiting Callaway cold weather conditions, no additional controls are required during the proposed CT.

NRC staff question:

6. Do the battery room temperatures drop below 60°F?

Callaway Response:

The SBO/ELAP minimum temperature analysis shows that battery room temperatures never drop below 60°F and continue to increase over the course of the event (until an equilibrium temperature is eventually reached). As a result, the batteries would be available to perform their specified safety functions during the course of a postulated DBA occurring during limiting Callaway cold weather conditions.

Item 5

Maximum hydrogen (H2) discharge occurs during battery charging/discharging cycles. At the onset of an event, the batteries supply maximum DC loads such that they would be close to their maximum load capability within the first few minutes and then would require recharge when power is restored.

The licensee's license amendment request (LAR) did not present data related to the calculated H2 discharge for such a postulated scenario.

NRC staff question:

1. The licensee needs to confirm that an H2 discharge calculation was utilized for this amendment.

Callaway Response:

An H2 discharge calculation was utilized for this amendment and was provided to the NRC staff during the audit. The battery manufacturer memorandum documented in the H2 discharge calculation provides the basis for hydrogen generation rates used in the GOTHIC analysis.

NRC staff question:

2. It is not clear to the NRC staff how the LAR's GOTHIC calculation considered H2 generation during battery charging. The licensee needs to present how H2 is distributed within the rooms when the HVAC is in recycle mode only.

Callaway response:

The GOTHIC analysis, which was reviewed by the NRC staff during the audit, utilizes hydrogen generation rates provided by the battery vendor as a function of room temperature and the concurrently applied maximum charging voltage of 2.33 V/cell. The maximum charging voltage that is applied to the batteries represents the worst-case charging conditions with a malfunctioning charger (that continues to provide charging current even when batteries are fully charged).

The GOTHIC analysis incorporates maximum hydrogen generation rates with the supplemental fan system in service, and outside air only being provided by the Control Room pressurization system.

For periods of complete Control Building isolation (tornado hazard), the analysis of record determined that the battery rooms can be completely isolated for 2.62 days with no ventilation while charging before reaching regulatory limits (2% hydrogen by volume). That analysis bounds the addition of the supplemental fan system, as it assumes no ventilation is available.

Item 6

During the NRC staff walkdown the following questions where developed.

NRC staff question:

1. Several Class 1E electrical equipment rooms have wall-mounted temperature sensors. Do these read out in the Control Room or display out on the plant computer?

Callaway Response:

The wall mounted temperature sensors in the rooms provide input to Control Room annunciators 19F and 22F, as well as plant computer alarms GKT0091-94, GKT0130, and GKT0137. The plant computer alarms do not display the temperature; rather, they only read out in HI or NOT-HI. The alarm setpoints are currently 85°F for the ESF switchgear rooms on the 2000' level and 88°F for the switchboard rooms on the 2016' level. The alarm setpoints for all the rooms will be lowered to 83°F as part of modification MP 16-0024.

NRC staff question:

2. Are these also alarm points?

Callaway Response:

The wall-mounted temperature sensors in the rooms provide input to Control Room annunciators and plant computer alarms. The computer points do not display the temperature; rather, they only read out as HI or NOT-HI.

NRC staff question:

3. If these temperature indications are non-safety related powered to the plant computer, how does the plant computer indicate loss of power?

Callaway Response:

The power source for the indicators is non-safety. If the plant computer loses power, then the individual display stations will display "Time Not Updating." Depending on the failure mode, a Control Room annunciator (69F) may also be in alarm.

NRC staff question:

4. Are there procedures in place to monitor the battery room temperatures since there is no wall-mounted temperature controller?

Callaway Response:

An attachment will be added to the normal operating procedure for the Control Building ventilation system to record room temperatures in the first hour after the supplemental cooling system is started and every 4 hours thereafter. A calibrated hand-held temperature indicator will be utilized if local indication is not available.

NRC staff question:

5. How will monitoring be performed for the proposed TS actions to monitor, locally, every 4 hours or shift?

Callaway Response:

An attachment will be added to the normal operating procedure for the Control Building ventilation system to record room temperatures in the first hour after the supplemental cooling system is started and every 4 hours thereafter. A calibrated hand-held temperature indicator will be utilized if local indication is not available.

Item 7

The diesel generator (DG) frequency, as specified in TS SR 3.8.1.11, item c. 4, may be as low as 58.8 Hz. The supporting calculation for the LAR needs to use air flow rates to calculate room temperatures for the DG.

NRC staff question:

1. Does the GOTHIC analysis for the LAR use ECCS pump runout conditions or some other condition?

Callaway Response:

The Class 1E electrical equipment room electrical heat load used in the GOTHIC analysis is based on the Callaway Plant electrical load calculation that was reviewed by the NRC staff during the audit. This load is based on a large break LOCA, which maximizes load currents since pump flows at the maximum design condition are assumed.

NRC staff question:

2. Please identify which large pumps (greater than 50 hp) are assumed to have flow control or orifices.

Callaway Response:

The large pumps which have flow control or orifices are provided in Table 1 below.

Table 1 - Flow Control Status for SR Pumps Greater Than 50 Horsepower

Component Number	Description	Nameplate Horsepower	Load Brake Horsepower	Flow Control or Flow Orifice
ESF Train A				
DPEC01A	Fuel Pool Cooling Pump A"	150	124	Flow element
DPAL01A	Auxiliary Feed Water Pump A	800	660	Flow orifices, flow control
DPBG05A	Centrifugal Charging Pump A	600	680	Flow elements, flow control, throttle valves
DPEF01A	Essential Service Water Pump A	1750	1500	Flow elements, throttle valves, flow orifices
DPEG01A	Component Cooling Water Pump A	700	640	Flow elements, throttle valves
DPEG01C	Component Cooling Water Pump C	700	640	Flow elements, throttle valves
DPEJ01A	Residual Heat Removal Pump A	500	545	Flow control, flow orifices
DPEM01A	Safety Injection Pump A	450	460	Flow elements, throttles valves
DPEN01A	Containment Spray Pump A	500	495	Flow elements

Component Number	Description	Nameplate Horsepower	Load Brake Horsepower	Flow Control or Flow Device
ESF Train B				
DPEC01B	"B" Fuel Pool Cooling Pump B	150	124	Flow element
DPAL01B	Auxiliary Feed Water Pump B	800	660	Flow orifices, flow control
DPBG05B	Centrifugal Charging Pump B	600	680	Flow elements, flow control, throttle valves
DPEF01B	Essential Service Water Pump B	1750	1500	Flow elements, throttle valves, flow orifices
DPEG01B	Component Cooling Water Pump B	700	640	Flow elements, throttle valves
DPEG01D	Component Cooling Water Pump D	700	640	Flow elements, throttle valves
DPEJ01B	Residual Heat Removal Pump B	500	545	Flow control, flow orifices
DPEM01B	Safety Injection Pump B	450	460	Flow elements, throttles valves
DPEN01B	Containment Spray Pump B	500	495	Flow elements

NRC staff question:

3. Please provide details on changes in flow rates and any impact on room heat-up calculations if the DG frequency is at 58.8 Hz.

Callaway Response:

The impact of steady state diesel frequency and voltage variations on pump and fan flowrates is recognized as an industry-wide issue and is being analyzed at Callaway through implementation of NRC approved WCAP-17308-NP Rev. 0. The WCAP implementation project will culminate with a License Amendment Request to update the TS 3.8.1 allowable frequency and voltage bands. In the interim, Callaway has compensatory measures in place to ensure that steady state DG frequency is maintained between 60.0 Hz and 61.2 Hz.

The GOTHIC model incorporates a 10% margin in credited fan performance for the SGK05A/B units and 5% margin for the Supplemental Cooling system fans. Based on preliminary WCAP-17308 analysis, this margin will be more than adequate to accommodate the EDG frequency and voltage bands that will be established as part of the WCAP-17308-P implementation and TS 3.8.1 revision project.

Item 8

The proposed TS Bases per the LAR, Attachment 5, (ADAMS Accession No. ML18068A691) states that mitigating actions are to be taken with the starting of recirculating fans to limit Class 1E electrical equipment room heat-up to < 90°F. Room temperature monitoring is proposed in the TS required actions.

It is not clear to the NRC's technical review staff how the elements of a surveillance requirement to support proper area temperatures would be accounted for in this amendment.

1. Address whether the following elements should be part of the LCO related to the requested amendment;

NRC staff question:

a. room temperature < 90°F

Callaway Response:

The 90°F temperature limit serves as an initial condition in the room temperature analysis when a single train of Class 1E air conditioning is cooling both trains of Class 1E electrical equipment rooms. When both trains of Class 1E air conditioning are available, it is not necessary to impose an initial condition temperature limit to demonstrate acceptable room temperatures over the 30-day mission time for the Class 1E electrical equipment. Further, room temperature limits and monitoring requirements are not included as an LCO or SR in the Improved Standard Technical Specifications.

Room temperature limits and monitoring requirements that are applicable when not in a Required Action have been relocated to FSAR Specification 16.7.4, "Area Temperature Monitoring." Based on this, it would not be appropriate to impose the < 90°F room temperature limit in the LCO when both trains of Class 1E electrical equipment are operable.

<u>NRC staff question:</u>

b. the 10 room numbers for cooling

<u>Callaway Response:</u>

The 10 room numbers are listed in the proposed Technical Specification Bases [provided as Attachment 3 to this LAR supplement]. This will provide the detailed information regarding which specific rooms are covered, while maintaining a concise Technical Specification.

<u>NRC staff question:</u>

c. the mitigating actions.

<u>Callaway Response:</u>

The mitigating actions are not applicable or needed when both trains of Class 1E Air Conditioning are operable (as they are only needed when a Class 1E Electrical Equipment Air Conditioning train has been declared inoperable). Therefore, it would not be appropriate to list or require the mitigating actions in the LCO.

With respect to the proposed Conditions and Required Actions, Required Action A.1 of proposed Technical Specification 3.7.20 was developed using Required Action B.1 of Technical Specification 3.7.10, "Control Room Emergency Ventilation System (CREVS)," as the model. As was previously discussed in this item, imposing the 90°F temperature limit of Required Action A.2 as a Surveillance Requirement or LCO limit would have no basis in the analyses for the condition of having both trains of Class 1E Electrical Equipment Air Conditioning operable.

Item 9

The LAR's proposed Completion Time for Condition A of the proposed TS should primarily be selected based on the maintenance component for the duration selected.

It is not clear to the NRC technical review staff what were the additional factors and considerations that accounted for the LAR's proposed Completion Time of 30 days.

<u>NRC staff question:</u>

1. Justify why the proposed 30-day TS Completion Time is needed for normal maintenance of the chiller/HVAC system related to this proposed TS change.

<u>Callaway Response:</u>

If the type of compressor (or other component) used in the existing system at Callaway would have to be changed to a new manufacturer due to obsolescence, for example, and if the additional piping and support rework time is considered as part of the replacement, there is the potential that the maintenance window could move out to several weeks.

The 30-day Completion Time is consistent with what is allowed on the Control Room air conditioning system in Technical Specification 3.7.11, "Control Room Air Conditioning System (CRACS)". Additionally, based on a qualitative review of risk significance, it should be noted that with Condition A of proposed TS 3.7.20 in effect (including its associated mitigating actions), there is no loss of safety function. Both Class 1E electrical equipment trains would remain within their FSAR-described licensing basis room temperatures. That is, both trains of electrical safety equipment would remain capable of performing at the level credited in the plant's safety analyses and meeting the mission times credited therein.

With Condition A in effect, there is a reduction in redundancy at the support system level, and this is why plant operation is only allowed to continue for a limited period of time (based on the allowed Completion Time and shutdown time specified per the proposed Required Actions). Based on the precedent of the WCNOC license amendment and the similarity to what is allowed in Technical Specification 3.7.11 for a single train of Control Room air conditioning inoperable, 30 days is appropriate.

Item 10

The proposed LAR design modifications omitted technical equipment and specification details.

NRC staff question:

1. Please provide missing information such as equipment safety class, Class 1E power supply, seismic classification and component testing for the design modifications that support this amendment.

Callaway Response:

Components of the supplemental cooling system are classified as safety related, which correlates with the classification of the original Class 1E Electrical Equipment Air Conditioning System (SGK05). As the supplemental fan system is safety related, Class 1E power sources are utilized for the equipment, and components are considered Seismic Category I (designed and built to withstand design-basis earthquake stresses).

Supplemental fan system components will be subjected to safety related testing at the supplier's shop to verify compliance to specification requirements. After installation, post-modification testing will be performed to validate that the system is operating properly and that the supplemental fans are supplying the minimum airflow required by the GOTHIC analysis.

Control (isolation) dampers, fire dampers, HVAC duct and flexible connections, control panel, and control systems are all classified as safety related, Seismic Category I.

Steel doors that have passive grilles installed are classified as non-safety related, Seismic Category II/I. The steel doors on 2016' have 5 square feet of area removed to provide an opening for supplemental cooling system airflow, and the grille is added to provide structure/stiffness to the door with the material removed. All door components are passive and cannot fail in a method that would adversely impact supplemental cooling system airflow. If a door were to fail, it would be in a manner that provides additional flow area for the supplemental fan system, which would only increase cooling provided to the train with an out-of-service SGK05 unit.

Item 11 - Deleted by NRC staff – not used.

Item 12

The LAR describes the need to shut down a complete train of Engineered Safety Feature (ESF) equipment after 7 days, with one HVAC train unavailable prior to an event. This may complicate plant safety, considering significant equipment in one train (with inoperable HVAC) may not be available for an extended period.

NRC staff question:

1. It is not clear to the NRC staff how the detailed combinations of events and plant conditions were considered for heat load calculations related to the amendment.

Callaway Response:

This item is being addressed in Ameren Missouri's response to the NRC's Request for Additional Information (RAI) that was transmitted on January 9, 2019. The response to the RAI is due to be submitted on or by February 8, 2019.

Item 13 - Deleted by NRC staff – not used.

Item 14 - Deleted by NRC staff – not used.

Item 15

NRC staff question:

1. Are there any wall-mounted Control Building area heaters?
2. If so, are these heaters part of the GOTHIC heat load calculations?
3. How are these area room heaters controlled?

Callaway Responses:
There are wall-mounted area heaters in the Control Building. The assumption in the GOTHIC model is that the heaters are off. The normal operating procedure for the Control Building ventilation systems will be revised to implement the TS 3.7.20 mitigating actions. Procedural controls will be put in place to ensure that all wall-mounted heaters on the 2000' and 2016 elevations of the Control Building are de-energized when the fan recirculation system (i.e., supplemental cooling system) is in service.

Item 16 - Deleted by NRC staff – not used.

Item 17 - Deleted by NRC staff – not used.

Item 18

NRC staff question:

Please describe the safety classification of the existing Class 1E electrical HVAC trains and reference any FSAR Sections and Tables.

Callaway Response:

Components of the original Class 1E Electrical Equipment Air Conditioning System (SGK05) are classified as safety related. As the original Class 1E Electrical Equipment Air Conditioning System is safety related, Class 1E power sources are utilized for the equipment, and components are considered Seismic Category I (designed and built to withstand design basis earthquake stresses).

The Class 1E Electrical Equipment Air Conditioning system is described as part of the overall Control Building HVAC system in section 9.4 of the Callaway FSAR (Standard Plant).

Item 19 - Deleted by NRC staff – not used.

Item 20

In the licensee's LAR-proposed TS Bases for SR 3.7.20.2, it states that this SR verifies that the heat removal capability of the A/C units is adequate to remove the heat load assumed in the control room during design basis accidents.

NRC staff question:

Please clarify if the intent was to state that this SR verifies that the heat removal capability of the A/C units is adequate to remove the heat load assumed in the Class 1E electrical equipment areas during design basis accidents.

Callaway Response:

SR 3.7.20.2 is intended to verify that the heat removal capability of the A/C units is adequate to remove the heat load assumed in the Class 1E electrical equipment areas and NOT in the control room. This correction is included in Attachment 3 of this submittal (LAR supplement), which identifies changes being made to the TS Bases originally proposed for TS 3.7.20 in the LAR.

Item 21

NRC staff question:

It is not clear to the technical staff if:

1. A new Technical Requirements Manual (TRM) associated with the recirculation subsystem will be created, including its associated SRs.

2. Additionally, will FSAR Chapter 16.7.13, "Class 1E Electrical Equipment Air Conditioning (A/C)," be revised or deleted, as appropriate to support this amendment?

Callaway Response:

Callaway will revise FSAR Chapter 16 Technical Requirement 16.7.13 to address functionality and testing requirements for the supplemental cooling system. Thus, the existing FSAR Technical Requirement 16.7.13 that addresses requirements for the Class 1E Electrical Equipment A/C trains (which are to be addressed in new/proposed TS 3.7.20) will be replaced with the new FSAR Technical Requirement 16.7.13 that addresses requirements for the supplemental cooling trains.

The new/revised FSAR Technical Requirement that will be issued following installation of the supplemental cooling system will also provide guidance for the mitigating actions required by proposed Technical Specification 3.7.20, Required Action A.1, since the supplemental cooling system is intended to be used for fulfilling those mitigating actions. In addition, the new/revised FSAR Chapter 16 Technical Requirement will include the following surveillance requirements:

- Proposed Callaway SR 16.7.13.1.a states: Verify each Class 1E Electrical Equipment A/C Supplemental Cooling system train is available at least once per 30 days.

- Proposed Callaway SR 16.7.13.1.b states: Verify each Class 1E Electrical Equipment A/C Supplemental Cooling system train actuates and provides recirculation air flow at least once per 18 months.

Testing of the dampers will be included as part of the surveillance requirement to verify that each train actuates and provides recirculation flow. The damper actuation is inherent to the system design since the fan start logic is tied to the damper open limit switch for the respective fan. In order to start the fan, the damper must change from the closed to open position.

Proposed FSAR Chapter 16 Technical Requirement 16.7.13 is presented in Attachment 4 to this submittal (LAR supplement).

Item 22

The licensee's LAR dated March 9, 2018, includes information regarding potential cross-train impacts related to fire protection and hydrogen gas build-up.

NRC staff question:

Please provide or summarize evaluations that address maintaining train independence, redundancy and separation when opening a communication pathway between the Operable and inoperable redundant Class 1E electrical equipment trains for any applicable hazard or condition such as flooding or any requirements to maintain negative pressure in the affected areas for HVAC/radiological control issues. This question considers whether the proposed operator action creates a condition that adversely impacts plant system independence, redundancy or separation relative to NUREG-1764, "Guidance for the Review of Changes to Human Actions", Rev. 1, Section 4, "Level II Review Guidance," ADAMS Accession No. ML072640413.

Callaway Response:

With fire protection and hydrogen gas accumulation discussed in the LAR, other considerations have been given to flooding, radiological control (Control Room habitability), and separation distance between trains. The original plant design has normally open communication pathways between the equipment trains via ductwork that provides fire protection separation using fire dampers. The supplemental fan system utilizes this same design criterion, so no new cross-train hazards or concerns are created.

All new penetrations are placed above the post-flood water levels for rooms, so it can be concluded that those penetrations have no adverse impact. The only partial exceptions are the two floor penetrations in the Lower Cable Spreading Room. The floor drain capacity in the Lower Cable Spreading Room, however, is sufficient to remove the design-basis flood with the water at floor level. The design-basis flood thus does not result in accumulation of water above the floor of the Lower Cable Spreading

Room. Based on this, interim flood barriers will be used during construction (i.e., implementation of the plant modification for installing the supplemental cooling system) to divert floor-level flood water to the floor drain, and the final installed configuration will accomplish the same.

Regarding radiological control provided by HVAC systems, all new, added penetrations are within the Control Building boundary, and no penetrations are added from the outside environment to the Control Building or from the Control Building to the Control Room. With regards to Control Room habitability, the configurations will have no impact on boundaries between:

- The Control Building and the outside environment,
- The Control Room and the Control Building,
- The Control Room and the outside environment.

Therefore, the proposed modification does not adversely affect the Control Building pressure boundary or Control Building pressure boundary functions.

Item 23

NRC staff question:

Describe the administrative controls that alert Control Room operators during normal operations of the need to start the Class 1E room recirculation fan system (i.e., supplemental cooling system) within one hour of a Class 1E Electrical Equipment AC train being declared inoperable and to initiate mitigating actions.

Callaway Response:

Procedures are in place to provide administrative controls that alert the operators of the need to start the supplemental cooling recirculation fan system under the following conditions.

1. If a Class 1E Electrical Equipment A/C Unit has a loss of control voltage or a handswitch is placed in Pull-To-Lock, an audible alarm and annunciator will be actuated on the respective train's Engineered Safety Feature (ESF) Status Panel in the Control Room.

2. If a Class 1E Electrical Equipment A/C Unit malfunctions without losing control voltage, then high temperatures in the equipment rooms will be detected by either discovery of a hot room by Callaway personnel, or annunciator 19F or 22F will alarm in the Control Room.

Item 24

NRC staff question:

Will the associated dampers automatically align when the Class 1E recirculation fan system is started, or will the operator align dampers and start recirculation fans as separate actions?

Callaway Response:

A single operator action (one switch) will align the four dampers associated with the recirculation fan system and then start the recirculation fans.

Item 25

NRC staff question:

Please describe the operator actions required to place the recirculation fans/dampers into service.

Callaway Response:

There will be procedural guidance for the operator to close the breakers for the three associated recirculation fans and place the handswitch in the start position. The detailed procedural steps were reviewed by the NRC staff during the audit and are provided in Item 26 below.

Item 26

NRC staff question:

1. Describe the specific operator actions required to place the new Class 1E recirculation fan system in service during normal operating conditions. Describe the administrative controls associated with manually placing the recirculation fans in service during normal operating conditions. Identify operator actions that will be proceduralized, or are already in procedures, or describe other applicable administrative controls.

Callaway Response:

If SGK05B is out of service, the operator will be directed to the NG01A switchgear.
At NG01ADF1:

1. Close the following breakers for the associated fans:
    a. NG01AGF3 for CGK06A
    b. NG01AGF4 for CGK05A
    c. NG01AFF3 for CGK07A
2. Place GKHS0196 in the START Position.
3. Verify the following lights for associated dampers indicate RED (OPEN):
    a. CGK05A DISCH DMPR GKHZ0185
    b. CGK06A SUCT DMPR GKHZ0186
    c. CGK07A DISCH DMPR GKHZ0189
4. Verify the following light for associated damper indicates GREEN (CLOSED):
    a. CGK07A OUT ISO DMPR GKHZ0191
5. Verify the RED (RUNNING) indicating lights for the following fans:
    a. NG01AGF3 for CGK06A
    b. NG01AGF4 for CGK05A
    c. NG01AFF3 for CGK07A

Verify air flow from fans in the ESF switchgear rooms and DC equipment rooms.

If SGK05A is out of service, the operator will be directed to the NG02A switchgear.

At NG02AEF1:

1. Close the following breakers for the associated fans:
   a. NG02AFF1 for CGK06B
   b. NG02AER3 for CGK05B
   c. NG02ABF3 for CGK07B
2. Place GKHS0197 in the START Position
3. Verify the following lights for associated dampers indicate RED (OPEN):
   a. CGK05B DISCH DMPR GKHZ0187
   b. CGK06B SUCT DMPR GKHZ0188
   c. CGK07B DISCH DMPR GKHZ0190
4. Verify the following light for associated damper indicates GREEN (CLOSED):
   a. CGK07B OUT ISO DMPR GKHZ0192
5. Verify the RED (RUNNING) indicating lights for the following fans:
   a. NG02AFF1 for CGK06B
   b. NG02AER3 for CGK05B
   c. NG02ABF3 for CGK07B

Verify air flow from fans in the ESF switchgear rooms and DC equipment rooms.

These actions, to start the applicable train fans, will be listed as contingency actions identified in the normal operating procedure for the Control Building HVAC System and will replace the current contingency actions for an inoperable Class 1E Electrical Equipment A/C unit.

Item 27

NRC staff question:

1. Describe the training (and frequency of training) that will be provided regarding identifying the need to place the Class 1E recirculation fan system in service under normal operating conditions, as well as the training that will be provided regarding the specific actions required to place the Class 1E recirculation fan system in service under normal operating conditions.

Callaway Response:

Training was given on the modification (for installing the Class 1E recirculation fan system) during Operations training cycle 18-3 (in 2018). The training related to the Class 1E recirculation fan system has been identified as a common knowledge item for the licensed operators and is to be taught in initial training and continuing training on a 54-month frequency. For the Operations Technicians (OTs), the Job Task Analysis (JTA) is to be taught in initial OT training. A course enhancement was initiated to update the initial training programs with the finalized modification. The requirements of proposed TS 3.7.20 were included in this training.

Item 28

The licensee's LAR dated March 9, 2018, describes a maximum post-accident room temperature limit of 104°F. A normal operating temperature of ≤ 90°F is maintained to ensure that post-accident room temperatures will not exceed the 104°F limit. However, the LAR does not appear to include analyses or other technical justification confirming the ability of one train of Class 1E A/C to cool both trains of Class 1E equipment under the heat loading of normal operation to the ≤ 90°F TS temperature limit. (The heat load during normal conditions is greater than the heat load during accident conditions since no load shedding is performed during normal conditions.) Also, the planned design modifications described in Section 3.3 do not indicate that ≤ 90°F can be maintained for both trains of Class 1E equipment using only one train of Class 1E A/C.

The LAR, Attachment 2, Section 3.1, "Normal and Design Basis Accident Environmental Conditions," (ADAMS Accession No. ML18068A688) states in part:

> "The normal operating temperature of the Class 1E electrical equipment rooms, as specified in the FSAR, remains below the 90°F maximum. Normally, the temperatures in the Class 1 E electrical equipment rooms are maintained between 68°F and 75°F, and during normal equipment operation (with both SGK05A or SGK05B units in service) the room temperatures are assured to remain below 90°F. A single functional Class 1 E electrical equipment A/C train providing area cooling for both electrical equipment trains concurrent with accident condition (LOCA) heat loading will maintain the equipment room temperatures less than the 104°F maximum for accident/faulted environmental conditions."

NRC staff question:

1. Please provide the historical data since it does not appear that operation of the new recirculation fan system can support both Class 1E trains < 90°F, under normal operating conditions, with only one Class 1E AC train operable. (This may indicate that the proposed design modification cannot support the new proposed TS 3.7.20 Required Action A.2 of the LAR.)

Callaway Response:

During the design of the supplemental cooling system, Callaway retrieved three years of temperature data for the Class 1E electrical equipment rooms. A listing of peak temperatures encountered during train outages of the Class 1E air conditioning system during the three year period was provided to the NRC staff during the audit. These peak temperatures were encountered while using the current compensatory actions of opening the doors of the Class 1E electrical equipment rooms to provide a pathway for buoyancy-driven natural circulation airflow between the two sets of rooms. The historical data that was provided showed a peak temperature of 87.5 °F.

Use of the supplemental cooling system with the forced air recirculation that it provides will certainly be more effective than the current compensatory actions of opening doors to the Class 1E electric equipment rooms to support buoyancy-driven air circulation, in the event that a Class 1E A/C unit is declared inoperable during normal operating conditions.

Based on the above, there is ample historical operating data to provide a reasonable expectation that room temperatures will be maintained below 90°F while TS 3.7.20 mitigating actions are in place during normal operations.

Item 29

Attachment 2 of the LAR, Section 3.3, "Credited Manual Operator Actions," (ADAMS Accession No. ML18068A688) discusses crediting operator manual actions associated with the new Class 1E recirculation fan system. This subsection only addresses accident/event initiation and states that operators are trained on revisions to the Emergency Operating Procedures.

NRC staff question:

Describe the training (and frequency of training) that will be provided regarding identifying the need to place the Class 1E recirculation fan system (i.e., supplemental cooling system) in service under accident/event conditions as well as the training that will be provided regarding the specific actions required to place the Class 1E recirculation fan system in service under accident/event conditions.

Callaway Response:

A Training Request (TRRQ) will be processed, and the Operations Training Department will perform a Job Task Analysis on the actions required following implementation of the modification for installing the supplemental cooling system. At that time, the correct disciplines, priority, setting, and frequency of this training will be determined.

Item 30

NRC staff question:

1. Describe the validation that has been performed to demonstrate that the manual operator action credited in the GOTHIC calculation to restart the recirculation fans within 30 minutes of accident/event initiation is feasible and reliable.

Callaway Response:

The table on page 31 provides an example of the validation that was performed to start the "A" train of the supplement cooling system. The timed verifications were performed using an Operator Response Time Verification Form to document the times for an operator to perform the steps required to place the supplemental cooling train in service.

Human factor considerations for procedures steps that implement mitigating actions by an operator were reviewed by the NRC staff during the audit. The human factor considerations included accessibility of handswitches and supplemental cooling equipment, including lighting and area ventilation.

For the operator that is dispatched to the switchgear to start the fans, there are no obstructions in this pathway. Lighting is adequate throughout the entire path to the Control Building level where the switchgear is located. The operator will not be required to enter a radiological control area or any other hazardous atmosphere in order to access the rooms containing the switchgear.

The rooms where the breakers, handswitches, and indication lights are located are well ventilated and well lit. The panel for the "A" Train switchgear is labeled with red placards to identify it as an "A" Train electrical component. The panel for the "B" Train switchgear is labeled with yellow placards to identify it as a "B" Train electrical component. All fan breakers and damper position indications are on one side of the associated cabinet to help prevent operator error.

The manual operator actions are feasible in the allotted amount of time and are reliable since the operator will have numerous indications of whether the fans start (light indication, fan noise, and air flow). The handswitches and lights to be installed on the switchgear cabinets are of a type that is familiar to the operators and will not require an excessive amount of training. Training to be presented for this modification will make the operator aware of the new plant equipment.

Validation of the operator actions was performed by simulation to ensure the actions could be completed within the assumed time of 30 minutes. The verification runs were administered using actual Operations personnel. The times recorded for the runs were approximately 15 minutes, from the event start time to the time when the supplemental fans were started. A detailed discussion of the procedure steps, including the human factors considerations, was conducted with the NRC staff during the audit. In addition, the associated response time verification forms were provided to the NRC staff during the audit.

The manual operator actions described above are for the scenario in the E-0 procedure where there is a safety injection (SI) required. The following describes how the same operator actions would be taken in response to a scenario involving no SI. (This additional information regarding use of a different EOP to address non-SI scenarios is one of the LAR changes recognized in Attachment 2 of this LAR supplement.)

For the case where no safety injection is required, the operator would transition to ES-0.1, "Reactor Trip Response." In continuous action step 2 ("check status of AC buses") of the draft revision of ES-0.1, an action is being added to the step to ensure the supplemental cooling system is for the Class 1E A/C train that had been out of service prior to event. The assumed time to complete the restart of the supplemental cooling system would be bound by the case described above (with an SI) since Attachment A of procedure E-0 would not be required to be implemented (8-minute duration) as it is when an SI is occurring. Therefore, the time required to restart the supplemental cooling fans would be less than 15 minutes in the case where an SI was not required when performing emergency procedure E-0.

Operator Actions	Time Start	Time Complete
Crew performs procedure E-0, Immediate Actions, following an event and hands off E-0, Attachment A to the Reactor Operator (RO) to perform Automatic Equipment Actuation.	0	2 min
RO performs steps A1 – A13 of E-0, Attachment A	2 min	10 min
RO directs Operations Technician (OT) to "A" ESF Switchgear Room to start fans in A Train for ESF Switchgear Room Supplemental Cooling. (One minute allowed for RO to turn over field actions needed to an OT)	10 min	11 min
OT Proceeds to NG01A and checks fans are powered but not running at panels NG01ABF4, NG01ACF4, and NG01AGF4.* (Breaker closed and Green light ON.)	11 min	12 min 50 sec
OT locates and starts Supplemental Fans by taking handswitch GKHS0196, SGK05A FAN SYS CTRL SW, to "Start" on Panel NG01ADF1.	13 min	13 min 10 sec
OT observes the lights that represent dampers OPEN on panel NG01ADF1 change to Red.	13 min 10 sec	13 min 15 sec
OT observes fans start by observing that the indication lights change to indicate the fan is on at panels NG01ABF4, NG01ACF4, and NG01AGF4.*	13 min 20 sec	15 min

Comments
This is a simulation of the time it will take an Operations Technician to perform actions to get Supplemental Fans restarted in the AC and DC Switchgear Rooms.
Pictures of the proposed changes to NG01A were used to simulate the breakers and the indication that the Operator will see when the modification is installed.
The time from event initiation to initial dispatching of the Operator will be 10 minutes, based on Operator interviews and observation of operating crews in the simulator.

*Note: The panel breaker identification numbers have been changed since this simulation was performed.

NRC Staff Question:

2. How was this validation demonstration activity documented?

Callaway Response:

The timed verifications were documented using Callaway Form CA2647, "Operator Response Time Verification Form." This verification document is filed in the Callaway Document Room under the appropriate file code.

Item 31

NRC staff question:

1. Describe the validation that has been performed which demonstrates that the required load shed described in the Section 3.3 subsection regarding credited operator manual actions can be reliably completed within the 30-minute credited time frame in addition to all actions required to place the recirculation fans in service within the same 30-minute time frame.

Callaway Response:

The required load shed described in Section 3.3 of Attachment 1 of the LAR is an automatic load shed. No validation is required since it is an automatic action.

NRC staff question:

2. How was this validation demonstration activity documented?

Callaway Response:

No validation demonstration activity is required to be documented.

Item 32

NRC staff question:

1. Is the 30-minute action time discussed in the Section 3.3 subsection regarding credited operator manual actions being controlled, or should it be controlled as a time critical operator action?

Callaway Response:

The 30-minute action time will be controlled in accordance with the Callaway procedure designated for Significant Operator Response Timing.

NRC staff question:

2. What is the time margin available to place the Class 1E recirculation fan system in service under accident/event conditions?

Callaway Response:

Based on the operator response timing discussed in Item 30, there is approximately 15 minutes of time margin available.

Item 33

NRC staff question:

1. Describe all mitigating actions (referred to on page 40 of 45 of Attachment 2 to the LAR, Section 4.2, "Precendent," ADAMS Accession No. ML18068A688) involving operator actions being relied on by Callaway to fulfill the requirements of Required Actions A.1 and A.2 under proposed TS 3.7.20 when utilizing the supplemental cooling system to fulfill the required actions.

Callaway response:

TS 3.7.20 (proposed)

Condition A and Required Actions A.1 and A.2 of proposed TS 3.7.20 are as follows:

Condition A – One Class 1E electrical equipment A/C train inoperable.

Action A.1 – Initiate action to implement mitigating actions – Immediately

AND

Action A.2 – Verify room area temperatures ≤ 90°F – within 1 hour AND once per 4 hours thereafter.

Mitigating Actions

If one Class 1E electrical equipment A/C train is declared inoperable, the following will occur:

1. The operations procedure for the Control Building HVAC System contains a section titled "Contingency Actions For An Inoperable 1E A/C Unit (SGK05A/B)." This procedural guidance will be used to implement the immediate Actions.

2. The procedure will have a NOTE at the beginning of the section to remind operators that the mitigating actions are required to be initiated immediately and that the room temperatures are required to be verified within 1 hour. This can be done by monitoring indication on the plant computer.

3. A place for recording the room temperatures will be included in the procedure to ensure the room temperatures stay less than 90°F and are checked within 1 hour initially and then every 4 hours.

4. The Control Room will then CHECK/ENSURE that the opposite train Class 1E A/C unit is running by going to control panel RP068 (Control Room back panel). This panel is accessed easily by a Control Room operator. The handswitches are labeled with RED above handswitches for "A" Train and YELLOW above handswitches for "B" Train, in a well lit and well ventilated area. The operator will verify the appropriate Class 1E A/C unit is running by observing the indicating lights associated with the handswitch.

5. An Operations Technician, using the procedure, will then be sent down to NG01A or NG02A to start the appropriate fans. These panels are located in the Control Building.

    a. Operator uses stairs or elevator to traverse to Control Building elevation where the switchgear panels are located. There are no obstructions in this pathway, and lighting is adequate throughout the entire pathway. Since the Operator is not leaving the Control Building, he/she will not enter a radiological control area or any other hazardous atmosphere.

    b. The Operator will encounter a key-carded missile door to open in order to enter either of the Class 1E Switchgear Rooms. The Operator will enter the "A" Class 1E Switchgear Room to access panel NG01A, or enter the "B" Class 1E Switchgear Room to access panel NG02A. These rooms are well ventilated and well lit. NG01A is labeled with red placards to identify it as an "A" Train electrical component. NG02A is labeled with yellow placards to identify it as "B" Train electrical component. All fan breakers and damper position indications are on one side of the associated cabinet to help prevent operator error.

    c. If energizing the "A" train supplemental fans at NG01A:

        i. Operator closes the following breakers and verifies the GREEN light is ON and RED light is OFF:

            1. NG01AGF3 for Fan CGK06A
            2. NG01AGF4 for Fan CGK05A
            3. NG01AFF3 for Fan CGK07A

        ii. At NG01ADF1 Panel on NG01A, Operator verifies the following dampers are closed by the indication of GREEN light is ON and RED light is OFF:

            1. CGK05A DISCH DMPR GKHZ0185
            2. CGK06A SUCT DMPR GKHZ0186
            3. CGK07A DISCH DMPR GKHZ0189

        iii. At NG01ADF1 Panel on NG01A, Operator verifies the following damper is open by the indication of GREEN light is OFF and RED light is ON:

            1. CGK07A OUT ISO DMPR GKHZ0191

iv. At NG01ADF1 Panel Handswitch GKHS0196 for SGK05A, Supplemental Fan Sys Ctrl Sw, is taken to START:

1. Operator verifies three dampers are OPEN by RED light ON and GREEN light OFF for the following dampers as seen on panel NG01ADF1:
    a. CGK05A DISCH DMPR GKHZ0185
    b. CGK06A SUCT DMPR GKHZ0186
    c. CGK07A DISCH DMPR GKHZ0189
2. Operator verifies the GREEN light is ON and RED light is OFF for the following damper as seen on panel NG01ADF1:
    a. CGK07A OUT ISO DMPR GKHZ0191
3. Operator verifies all supplemental fans start by verifying the RED light is ON and the GREEN light is OFF on the following panels:
    a. NG01AGF3 for Fan CGK06A
    b. NG01AGF4 for Fan CGK05A
    c. NG01AFF3 for Fan CGK07A
4. Operator hears fans start in the Class 1E Switchgear room and feels air flowing through the room, validating air is moving in the room to provide adequate ventilation.
5. Operator then proceeds up two flights of stairs to the Class 1E Switchboards area of the Control Building and feels air flowing through the rooms and hears recirculation fan running.

d. If energizing the "B" train supplemental fans at NG02A:

   i. Operator closes the following breakers and verifies the GREEN light is ON and the RED light is OFF:
      1. NG02AFF1 for Fan CGK06B
      2. NG02AER3 for Fan CGK05B
      3. NG02ABF3 for Fan CGK07B
   ii. At NG02AEF1 Panel on NG02A, Operator verifies the following dampers are closed by indication of GREEN light is ON and RED light is OFF:
      1. CGK05B DISCH DMPR GKHZ0187
      2. CGK06B SUCT DMPR GKHZ0188
      3. CGK07B DISCH DMPR GKHZ0190
   iii. At NG02AEF1 Panel on NG02A, Operator verifies the following dampers is open by indication of GREEN light is OFF and RED light is ON:
      1. CGK07B OUT ISO DMPR GKHZ0192
   iv. At NG02AEF1 Panel Handswitch GKHS0197 for SGK05B, Supplemental Fan Sys Ctrl Sw, is taken to START:
      1. Operator verifies the following dampers are OPEN by indication of RED light is ON and GREEN light is OFF for the following dampers as seen on panel NG02AEF1:
         a. CGK05B DISCH DMPR GKHZ0187
         b. CGK06B SUCT DMPR GKHZ0188
         c. CGK07B DISCH DMPR GKHZ0190
      2. Operator verifies the following damper is CLOSED by indication of RED light is OFF and GREEN light is ON for the following damper as seen on panel NG02AEF1:
         a. CGK07B OUT ISO DMPR GKHZ0192
      3. Operator verifies all supplemental fans start by verifying the RED light is ON and the GREEN light is OFF on the following panels:
         a. NG02AFF1 for Fan CGK06B
         b. NG02AER3 for Fan CGK05B
         c. NG02ABF3 for Fan CGK07B
      4. Operator hears fans start in the Class 1E switchgear room and feels air flowing through the room, validating air is moving in the room to provide adequate ventilation.
      5. Operator then proceeds up two flights of stairs to the Class 1E switchgear area of Control Building and feels air flowing through the rooms and hears recirculation fan running.

6. The actions are feasible in the allotted amount of time (checking area temperature and starting fans) and reliable since the operator will have numerous indications of whether the fans start (light indication, fan noise, air flow) to supply supplemental cooling to the Class 1E AC and DC Switchgear rooms. Breakers, fans, and dampers installed would be reliably expected to operate as designed.

7. Validation of the actions was done by simulation since none of this equipment was installed at the time of the NRC audit. The handswitches and lights to be installed on the NG01A and NG02 cabinets are familiar to the operators and will not require an excessive amount of training. Training of this modification would make the operator aware of new plant equipment.

<u>NRC staff question:</u>

2. Provide the human factors evaluations that justify the feasibility and reliability of the mitigating operator actions, and describe the validation that was performed to verify the feasibility and reliability of these actions.

<u>Callaway response:</u>

Human factor considerations for procedures steps that implement mitigating actions by an operator were reviewed by the NRC staff during the audit. The human factor considerations included accessibility of handswitches and supplemental cooling equipment, as well as lighting and area ventilation.

For the operator that is dispatched to the switchgear to start the fans, there are no obstructions in this pathway. Lighting is adequate throughout the entire path to the Control Building areas where the switchgear is located. The operator will not be required to enter a radiological control area or any other hazardous atmosphere in order to access the rooms containing the switchgear.

The rooms where the breakers, handswitches, and indication lights are located are well ventilated and well lit. The panel for the "A" Train switchgear is labeled with red placards to identify it as an "A" Train electrical component. The panel for the "B" Train switchgear is labeled with yellow placards to identify it as a "B" Train electrical component. All fan breakers and damper position indications are on one side of the associated cabinet to help prevent operator error.

The mitigating actions are feasible in the allotted amount of time and are reliable since the operator will have numerous indications of whether the fans start (light indication, fan noise, and air flow). The handswitches and lights to be installed on the switchgear cabinets are of a type that is familiar to the operators and will not require an excessive amount of training. Training to be presented for this modification will make the operator aware of the new plant equipment.

Item 34

Callaway proposes to utilize the Surveillance Frequency Control Program for the SR 3.7.20.1 and SR 3.7.20.2 frequencies, as shown in the LAR, Attachment 3, (ADAMS Accession No. ML18068A689).

NRC staff question:

Please provide an initial SR frequency and basis for each SR below, in regard to the Class 1E electrical equipment A/C trains.

1. Verify each train actuates on an actually/simulated actuation signal.
2. Verify each train has the capability to remove the assumed heat load

Callaway Response:

The initial surveillance frequency (interval) proposed for SRs 3.7.20.1 and 3.7.20.2 was identified in Attachment 1 of the LAR (pages 34 and 35 of 45) as "18 months on a staggered test bases." This was considered in order to make the Frequency, especially for SR 3.7.20.1, consistent with the frequency established for Engineered Safety Features Actuation System (ESFAS) testing required to satisfy a large number of SRs in the Technical Specifications. Upon further consideration of the test frequency for SRs 3.7.20.1 and 3.7.20.2, however, it has been determined that the "staggered test basis" is not appropriate for these SRs.

In regard to SR 3.7.20.1, it has been determined that the actuation signals to be tested under this SR should only include the control room ventilation isolation system signal (CRVIS). Actuation signals from the LOCA and shutdown sequencers have been and are currently surveillance tested in accordance with SR 3.8.1.12 (under TS 3.8.1, "AC Sources – Operating"), and it is desired to keep the LOCA and shutdown sequencer testing defined by SR 3.8.1.12 under the scope of that SR. (SR 3.8.1.12 is one of the many SRs in the scope of ESFAS testing performed every 18 months on a staggered test basis at the Callaway plant.) This approach is consistent with how the scope of testing performed for SR 3.7.10.3 (under TS 3.7.10, "Control Room Emergency Ventilation System (CREVS)") is defined relative to the scope of SR 3.8.1.12, as described in the Bases for SR 3.7.10.3, given the similarity of that SR to proposed SR 3.7.20.1.

Based on the above, it has been determined that the initial test frequency for SR 3.7.20.1 (for testing the CRVIS actuation circuitry associated with the Class 1E Electrical Equipment A/C trains) should be 18 months in lieu of the initially proposed surveillance frequency/interval of 18 months on a staggered test basis.

In regard to SR 3.7.20.2, the purpose and scope of testing for this SR is very different from SR 3.7.20.1, as it has no connection with logic/actuation testing (and thus no potential impact or association with ESFAS testing). Each of the Class 1E Electrical Equipment A/C units can be independently tested to satisfy the requirements of this performance-type test, and there are no restrictions, conditions or ties to other equipment or functions that necessitate tying this test to a test interval of 18 months "on a staggered test basis." It has thus been determined that an initial surveillance frequency/interval of 18 months is appropriate for this SR.

This change to the initial surveillance frequency/interval from "18 months on a staggered test basis" to "18 months" for SRs 3.7.20.1 and 3.7.20.2, as specified under the plant's Surveillance Frequency Control Program (SFCP), is one of the LAR changes identified and described in Attachment 2 of this submittal.

Item 35 - Deleted by NRC staff – not used.

Item 36

The LAR, as provided, does not document room-to-room delta pressures, nor room H2 generation/concentrations.

NRC staff question:

1. Please provide this data that supports room pressures and room H2 concentrations.

Callaway Response:

The wall pressures between rooms are calculated in the GOTHIC analysis and are at a maximum of 4.5 lb/sq ft. The block walls in the Control Building are structurally qualified via analysis for 6.25 lb/sq ft applied air pressure, and the GOTHIC analysis results showed that applied wall pressures between rooms are well below this analyzed limit.

The maximum differential pressures between rooms is shown in tabular form below for the "A" train. This information is from the GOTHIC analysis.

(Maximum PSFD Between Rooms)																
0.38	3.27	0.93	0.78	2.35	2.35	2.17	1.00	4.42	1.22	1.22	0.78	2.07	1.16	0.65	1.92	1.18
3301	3404	3404	3404	3405	3405	3405	3410	3411	3406	3407	3407	3407	3408	3408	3412	3413
3302	3401	3405	3410	3401	3406	3411	3411	3412	3407	3401	3408	3413	3401	3414	3413	3414

The maximum differential pressures between rooms is shown in tabular form below for the "B train. This information is from the GOTHIC analysis.

(Maximum PSFD Between Rooms)																
0.34	1.53	1.09	0.84	1.05	1.05	2.20	1.27	2.65	2.43	2.43	0.98	2.03	3.37	0.61	4.34	0.93
3301	3404	3404	3404	3405	3405	3405	3410	3411	3406	3407	3407	3407	3408	3408	3412	3413
3302	3401	3405	3410	3401	3406	3411	3411	3412	3407	3401	3408	3413	3401	3414	3413	3414

As discussed in the response to Item 5, the hydrogen concentration is also analyzed for bounding scenarios. The table from the GOTHIC analysis for peak hydrogen concentrations is reproduced below. Case 1 assumes SGK05A is in operation post-LOCA with a Loss of Offsite Power (LOOP) and SGK05B out of service (OOS). Case 2 assumes SGK05B is in operation post-LOCA with a LOOP and SGK05A OOS.

Maximum Hydrogen Concentration

Case	Room	Max Conc. (%)	Time (Day) [hr]	Case	Room	Max Conc. (%)	Time (Day) [hr]
1	3301 ESF SWGR Rm. 1	0.0197	13.83 [332]	2	3301 ESF SWGR Rm. 1	0.0204	5.17 [124]
1	3407 Batt. Rm. 1	0.0224	13.79 [331]	2	3407 Batt. Rm. 1	0.0221	5.21 [125]
1	3408 SWBD Rm. 1	0.0217	13.79 [331]	2	3408 SWBD Rm. 1	0.0220	5.21 [125]
1	3413 Batt. Rm. 3	0.0214	13.79 [331]	2	3413 Batt. Rm. 3	0.0221	5.17 [124]
1	3414 SWBD Rm. 3	0.0211	13.79 [331]	2	3414 SWBD Rm. 3	0.0220	5.17 [124]
1	3302 ESF SWGR Rm. 2	0.0190	13.83 [332]	2	3302 ESF SWGR Rm. 2	0.0204	5.17 [124]
1	3404 SWBD Rm. 4	0.0215	13.79 [331]	2	3404 SWBD Rm. 4	0.0223	5.17 [124]
1	3405 Batt. Rm. 4	0.0215	13.79 [331]	2	3405 Batt. Rm. 4	0.0229	5.17 [124]
1	3410 SWBD Rm. 2	0.0215	13.79 [331]	2	3410 SWBD Rm. 2	0.0218	5.17 [124]
1	3411 Batt. Rm. 2	0.0215	13.79 [331]	2	3411 Batt. Rm. 2	0.0219	5.17 [124]
1	3401 Corridor 1	0.0151	28.04 [673]	2	3401 Corridor 1	0.0155	7.08 [170]
1	3406 Corridor 2	0.0158	9.79 [235]	2	3406 Corridor 2	0.0156	4.29 [103]
1	3412 Corridor 2	0.0158	9.67 [232]	2	3412 Corridor 2	0.0156	4.29 [103]

Item 37

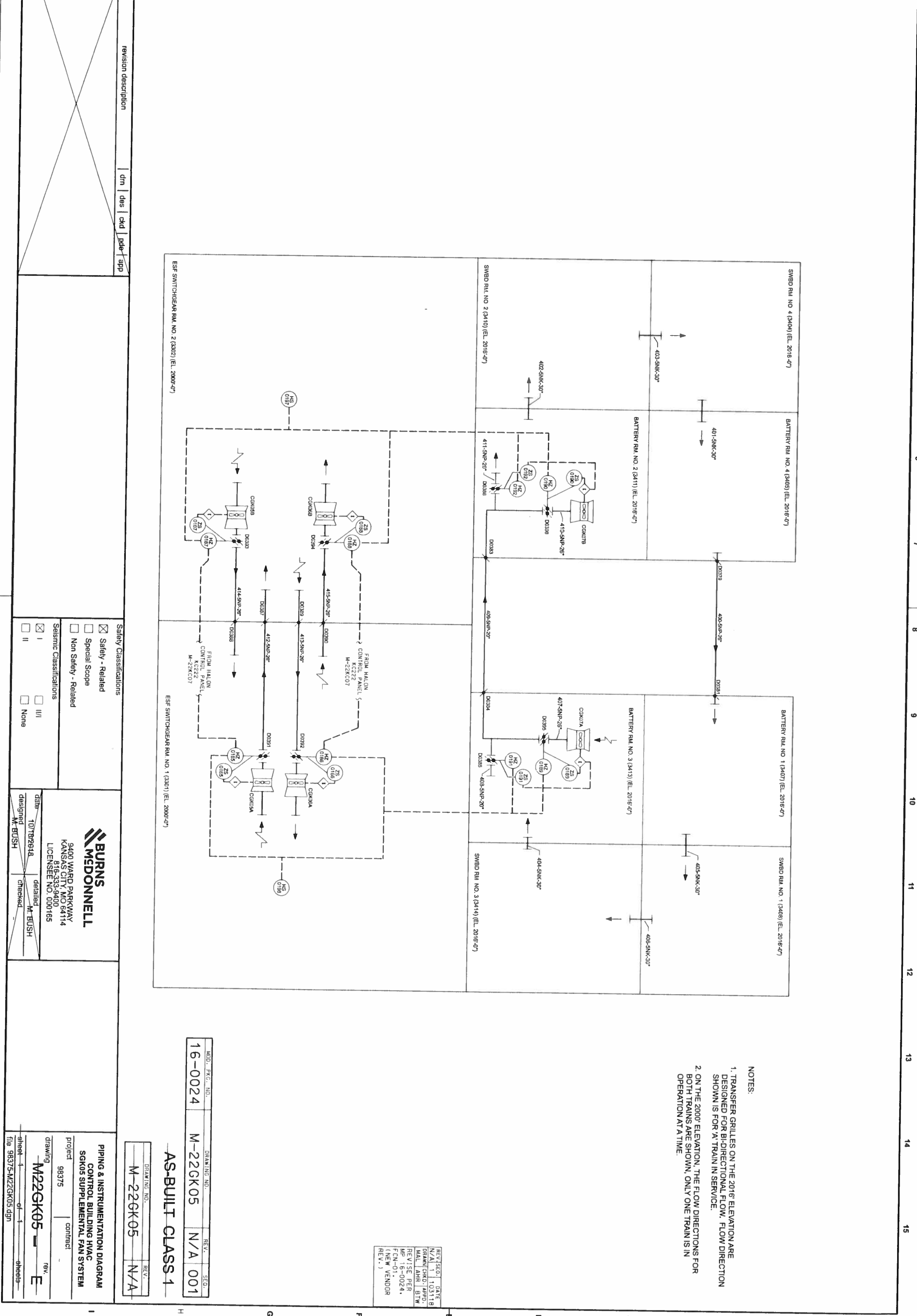
NRC staff question:

Please provide a copy, via supplemental letter, of the Piping and Instrumentation Diagram (P&ID) for the Control Building HVAC system.

Callaway Response:

The P&ID showing the supplemental cooling system is provided on the next page of this document.

Note: A revision to the P&ID (M-22GK05) is pending to properly reflect that the supplemental cooling system will trip upon fire detection in the Class 1E electrical equipment rooms on the 2016' level of the Control Building, as already discussed in the "Fire Protection Evaluation" section of the LAR (Ameren Missouri letter ULNRC-06401).


COPYRIGHT © 2017 BURNS & McDONNELL ENGINEERING COMPANY, INC.
NOTES:
1. TRANSFER GRILLES ON THE 2016' ELEVATION ARE DESIGNED FOR BI-DIRECTIONAL FLOW. FLOW DIRECTION SHOWN IS FOR 'A' TRAIN IN SERVICE.
2. ON THE 2000' ELEVATION, THE FLOW DIRECTIONS FOR BOTH TRAINS ARE SHOWN, ONLY ONE TRAIN IS IN OPERATION AT A TIME.
ESF SWITCHGEAR RM. NO. 2 (3302) (EL. 2000'-0")
ESF SWITCHGEAR RM. NO. 1 (3301) (EL. 2000'-0")
SWBD RM. NO. 4 (3404) (EL. 2016'-0")
BATTERY RM. NO. 4 (3405) (EL. 2016'-0")
SWBD RM. NO. 2 (3410) (EL. 2016'-0")
BATTERY RM. NO. 2 (3411) (EL. 2016'-0")
BATTERY RM. NO. 1 (3407) (EL. 2016'-0")
BATTERY RM. NO. 3 (3413) (EL. 2016'-0")
SWBD RM. NO. 1 (3408) (EL. 2016'-0")
SWBD RM. NO. 3 (3414) (EL. 2016'-0")
Safety Classifications
Safety - Related
Special Scope
Non Safety - Related
Seismic Classifications
I
II
III
None
BURNS & McDONNELL
9400 WARD PARKWAY
KANSAS CITY, MO 64114
816-333-9400
LICENSEE NO. 000165
PIPING & INSTRUMENTATION DIAGRAM
CONTROL BUILDING HVAC
SGK05 SUPPLEMENTAL FAN SYSTEM
project 98375
drawing M22GK05
rev. E
file 98375-M22GK05.dgn
AS-BUILT CLASS 1
16-0024
M-22GK05
N/A
001

Item 38

NRC staff question:

Provide in the LAR supplement those LAR-related documents needing revision since submittal of the initial LAR, including those changes made as a result of the change made to modification MP 16-0024 following submittal of the LAR.

Callaway Response:

The revised documents are included as attachments to this LAR supplement. Attachment 2 of this LAR supplement is specifically provided to identify and describe changes made to the LAR since initial submittal.

Item 39

Attachment 2 to the LAR, Section 3.3, "Planned Modifications," ADAMS Accession No. ML18068A688, page 24 states, "…wall and door penetrations equipped with fire dampers…"

NRC staff question:

Describe the technical basis for the acceptability of the grills in the fire doors (without fire dampers).

Callaway Response:

The walls and doors internal to the fire areas where the grills in the fire doors are located are not rated fire barriers. Therefore, a fire damper is not required for these specific doors. Fire modeling has been performed to show that the grills, when installed, have no adverse impact on the fire modeling assumptions or results for associated fire areas.

Item 40

NRC staff question:

For the proposed amendment, are there any new flooding concerns with the modified fire door related to the new grills?

Callaway Response:

There are no new flooding concerns created due to the use of grilles in the doors. For each affected door, the grill is inserted in the lower half of the door but does not impact the bottom 6" of the door (which remains solid).

The flood height in each of the interior rooms located on either side of a door grill is 0'-0". In other words, the drain system is more than sufficient to accommodate the water flow from postulated pipe breaks associated with these rooms.

Therefore, since there is no postulated flood level above the nominal surface of the floor in these rooms, the water will not rise in these rooms and cannot create a flooding situation in adjacent rooms through the door grilles.

Item 41

While reviewing the LAR's proposed Class 1E recirculation system Piping and Instrumentation Diagram, the NRC staff identified some questions.

NRC staff question:

1. Arrows appear to incorrectly indicate A versus B train operation. (Note: The arrows as provided show only A train is in service, but B trains fans are showing flow arrows.)

Callaway Response:

M-22GK05 drawing notes were added in response to this question. As indicated by the notes, the transfer grilles on the 2016' elevation are designed for bi-directional flow. Flow direction shown on the drawing is for A train in service. On the 2000' elevation, the flow directions for both trains are shown. However, only one train would be in operation at a time.

NRC staff question:

2. An area on the P&IDs, between ESF SG 1 and 2, indicates open space where it should indicate that a wall exists.

Callaway Response:

The drawing has been revised to reflect that a wall exists between ESF SG Rooms 1 and 2.

NRC staff question:

3. Please describe why there are 36" vs 30" openings between battery rooms.

Callaway Response:

The 26" openings represent 24" x 24" fire dampers; the 30" openings represent 24" x 30" transfer grilles without fire dampers. Some design changes have been made that allowed consistent sizes to be used between all battery rooms. Traditional Bechtel HVAC nomenclature converts rectangular duct dimensions to the equivalent round size for line numbers.

NRC staff question:

4. Please document if a fan blade missile analysis for the new proposed fans was developed to support the LAR.

Callaway Response:

The fans are being procured under a design specification developed for this project. The specification requires the fan housing to be capable of containing any internally-generated missiles. The fan supplier has qualified the fan housing as part of the seismic qualification calculation.

Item 42

NRC staff reviewed the GOTHIC calculation during the audit and found the following items.

1) No approval signatures or dates.
2) The GOTHIC calculation data stated that room 3101 has a maximum temperature of 120°F. This appears to be an editorial error on that page of the calculation. Please confirm.
3) For Attachment 2 to LAR, Section 3.2.3, "Results," Table 4, "Maximum Room Temperature Summary," (ADAMS Accession No. ML18068A688), and the listed GOTHIC calculations, room temperatures are not consistent by a value of 0.01. Please discuss.
4) Room delta pressures provided in the calculation show color blocking of green, red, blue. There is no legend associated with these colors.

NRC staff question:

1. Please provide the revised, final, signed calculation for audit review.

Callaway Response:

Revision 1 of the calculation documented under MP 16-0024 includes a signature page with signatures and dates. The revision was provided to and reviewed by the NRC staff during the audit.

NRC staff question

2. Describe why this temperature (for room 1301) is acceptable.

Callaway Response:

Per FSAR Table 3.11(B)-2, CB Room 3101, "Pipe space tank area El. 1974," is assumed to reach a maximum DBA temperature of 120°F. This room is conservatively assumed to be at the maximum FSAR temperature of 120°F for the duration of the event.

NRC staff question

3. Provide a correction to the LAR table, as appropriate.

Callaway Response:

Attachment 2 to the LAR, Section 3.2.3, "Results," Table 4, "Maximum Room Temperature Summary," will be revised to correct the discrepancy.

NRC staff question

4. Describe the color legend for this section of the calculation.

Callaway Response:

Color coding identifies maximum and minimum pressures. Revision 1 of the calculation included an explanation of the color coding. This information was reviewed by the NRC staff during the audit.

Item 43

Fire doors are modified with new fans.

NRC staff question:

1. Describe if the fires door are part of the fan structure.

Callaway Response:

Fire doors are not part of the fan structure. On the 2000' elevation, an existing double-leaf fire door is being converted to a single-leaf door. The area from the other door leaf is being converted into a stationary wall section designed as a 3-hour fire barrier with HVAC penetrations. This new wall section consists of safety-related steel framing to support the fire dampers and ventilation duct, and is enclosed in Durasteel (or equivalent) fire barrier to establish its fire rating.

Item 44

Attachment 2 to the LAR, Section 3.3, "Planned Modifications," subsection "Fire Protection Evaluation," ADAMS Accession No. ML18068A688, on page 29 references the Halon fire system, but during the NRC staff walkdown it was noted that the Halon is removed from certain elevations of the Control Building.

NRC staff question:

1. Please update LAR with correct information and P&ID drawing since the drawing references a Halon control panel.

Callaway Response:

In the Halon protected areas within fire areas C-9 and C-10. (i.e., the two ESF switchgear rooms), the fans shut off and the air isolation dampers close in response to a Halon system actuation signal. The fans and air isolation dampers for the DC switchgear and battery rooms also shut down in response to a Halon system actuation signal. The fan motors are sized such that they do not meet ignition sources criteria, so no new ignition sources are being added.

The P&ID drawing does not require revision for this concern since all the fans and dampers associated with the modification shut down or close in response to a Halon system actuation.

Item 45

Open grating is added to 6 fire doors as part of the LAR.

NRC staff question:

Does this affect the normal air flow balance (path of least resistance) when the proposed TS 3.7.20 Required Actions are not in effect?

Callaway Response:

This modification does not impact the normal system air flow balance. The existing Class 1E Electrical Equipment Air Conditioning System operates at neutral balance; it is designed to return and supply equal quantities of air from each individual room.

NRC staff question:

1. Describe why this is acceptable, and is this air flow balance accounted for in the GOTHIC analysis?

Callaway Response:

Several normally-open penetrations already exist between rooms but are not large enough to provide sufficient cooling capacity when used with the supplemental fan system; therefore, additional free area with the transfer grilles is being installed.

The GOTHIC analysis models all open penetrations between rooms as well as the HVAC supply and return flowrates.