UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION IV
1600 E. LAMAR BLVD.
ARLINGTON, TX 76011-4511

March 31, 2016

MEMORANDUM TO: Alexander R. Klein, Chief
Fire Protection Branch
Division of Risk Assessment
Office of Nuclear Reactor Regulation

FROM: Gregory E. Werner, Chief ***/RA/***
Engineering Branch 2
Division of Reactor Safety
Region IV

SUBJECT: REQUEST TO REVIEW AND UPDATE GUIDANCE IN NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) 805 FREQUENTLY ASKED QUESTION (FAQ) 07-0040

The purpose of this memorandum is to request that NRR work with the NFPA 805 Task Force in accordance with the NFPA 805 Frequently Asked Questions Program to review and update the guidance in FAQ 07-0040, "Non-Power Operations Clarifications," Revision 4, in response to an issue of concern associated with the non-power operations assessment that was recently identified at the Callaway Plant.

During a discussion between the regional inspectors and members of your staff, the participants concluded that this issue was not considered during the staff's review of Callaway's NFPA 805 license amendment request and it possibly exists at other NFPA 805 plants. Since this issue was not anticipated when the current revision of Nuclear Energy Institute (NEI) 04-02 was endorsed, the participants agreed that the best way to resolve this issue is for NRR to work with the NFPA 805 Task Force to review and update the guidance in FAQ 07-0040 for all NFPA 805 plants rather than address this issue through potential enforcement actions on a plant by plant basis.

The enclosure to this memorandum includes a discussion of the issue of concern, a discussion of the current guidance in FAQ 07-0040, and recommended improvements to be considered for FAQ 07-0040.

Please contact Dr. Steven Alferink of my staff if you require any additional information.

CONTACT: Dr. Steven Alferink, RIV/DRS
(817) 200-1548

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☒ SUNSI Review By: SMA		ADAMS ☒ Yes ☐No	☒ Publicly Available ☐Non-Publicly Available		☒Non-Sensitive ☐Sensitive		Keyword: RGN-002
OFFICE	RI:EB2	C:EB2					
NAME	SAlferink	GWerner					
SIGNATURE	/RA/	/RA/					
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Issue of Concern at the Callaway Plant

On August 29, 2011, the Callaway Plant (the licensee) submitted a license amendment request to transition their fire protection program to a risk-informed, performance-based program based on National Fire Protection Association (NFPA) 805. On January 13, 2014, the staff approved the request and issued a revised license.

Paragraph 1.3.1 of NFPA 805 requires licensees to provide reasonable assurance that a fire during any operational mode and plant configuration will not prevent the plant from achieving and maintaining the fuel in a safe and stable condition.

Paragraph 1.5.1 of NFPA 805 lists five nuclear safety performance criteria. These criteria provide requirements to demonstrate that fire protection features are capable of providing reasonable assurance that the plant is not placed in an unrecoverable condition in the event of a fire. For the decay heat removal nuclear safety performance criterion, the standard requires that decay heat removal shall be capable of removing sufficient heat from the reactor core or spent fuel such that fuel is maintained in a safe and stable condition.

Paragraph 1.6.56 of NFPA 805 provides the following definition of safe and stable conditions:

> For fuel in the reactor vessel, head on and tensioned, safe and stable conditions are defined as the ability to maintain Keff <0.99, with a reactor coolant temperature at or below the requirements for hot shutdown for a boiling water reactor and hot standby for a pressurized water reactor. For all other configurations, safe and stable conditions are defined as maintaining Keff <0.99 and fuel coolant temperature below boiling.

The licensee described how they satisfied the nuclear safety performance criteria in Calculation KC-26, “Nuclear Safety Capability Assessment,” Revision 1. This Nuclear Safety Capability Assessment applied to both power and non-power operations. For non-power operations, the licensee evaluated the spent fuel pool decay heat removal key safety function and determined that the spent fuel pool decay heat removal key safety function did not require a detailed review since adequate time was available, and procedural guidance was provided, for operators to respond to and mitigate a loss of spent fuel pool decay heat removal, even under full hot core offload conditions.

The licensee implemented the process outlined in Frequently Asked Question (FAQ) 07-0040, “Non-Power Operations Clarifications,” Revision 4, for the non-power operations assessment. This frequently asked question stated that licensees should conservatively assume the entire contents of a fire area are lost and document the loss of success paths. This frequently asked question also stated that licensees should specifically identify those areas (pinch points) that cause the loss of all success paths for a key safety function.

The inspectors noted that the licensee did not perform these actions for the spent fuel pool decay heat removal key safety function because this key safety function was screened from further consideration. If the licensee had evaluated the spent fuel pool decay heat removal key safety function using the process outlined in this frequently asked question, then the licensee would have assumed that both trains of spent fuel pool cooling are lost during a fire in the fuel

handling building because both trains are located within the same fire area and were unprotected.

In the event that a fire in the fuel handling building disabled both trains of spent fuel pool cooling, operators were expected to enter Procedure OTO-EC-00002, “Spent Fuel Pool High Temperature,” Revision 9, due to the increasing temperature of the spent fuel pool. This procedure provided directions for operators to restore one or both trains of spent fuel pool cooling. Since both trains of spent fuel pool cooling were assumed lost due to the fire, the operators would be unable to restore spent fuel pool cooling using this procedure.

After a period of time, the spent fuel pool would begin boiling and the level would begin lowering. At this time, operators were expected to enter Procedure OTO-EC-00001, “Loss of SPF/Refuel Pool Level,” Revision 13. Procedure OTO-EC-00001 directed the operators to open two normally locked essential service water valves to restore and maintain spent fuel pool level.

The licensee’s procedures allowed the spent fuel pool to reach boiling conditions prior to restoring and maintaining level. Since NFPA 805 defined safe and stable conditions, in part, as fuel coolant temperature below boiling, the procedures did not maintain the fuel in a safe and stable condition. The inspectors were concerned that the licensee screened the potential loss of spent fuel pool cooling from further consideration for any fire event based on adequate procedural guidance and time when the procedures would not maintain the fuel in a safe and stable condition.

During a discussion between the regional inspectors and headquarters staff members, the participants concluded that this issue was not considered during the staff’s review of Callaway’s NFPA 805 license amendment request and it possibly exists at other NFPA 805 plants.

Current FAQ 07-0040 Guidance

Frequently Asked Question (FAQ) 07-0040 notes that many studies have been performed to characterize the risk associated with non-power operations. These studies used core damage frequency as a risk metric, and it is generally accepted that most outage configurations have a relatively low risk and that only a few outage configurations have a risk near or greater than at-power operations.

As described above, the issue of concern at Callaway involves an outage configuration where there is no fuel in the vessel. In this configuration, the concept of risk becomes qualitative in nature since the traditional methods for calculating core damage frequency were developed assuming the fuel is in the vessel. Intuitively, however, this configuration corresponds to the period of highest intrinsic risk for the spent fuel pool as the entire core, in addition to the spent fuel, is located in the spent fuel pool. Since the guidance in FAQ 07-0040 was risk-informed based on quantitative estimates of risk with fuel in the vessel, it is not apparent how this particular configuration should be addressed.

For the outage configurations where the fuel is in the vessel, FAQ 07-0040 provides a strategy for control and protection of equipment that is a combination of normal fire protection program defense-in-depth actions and additional risk-informed steps based on the availability of systems and equipment needed to support key safety functions during higher risk evolutions. The goal

of this strategy is to ensure that contingency plans are established when the plant is in a higher risk evolution and there is the possibility of losing a key safety function due to fire. Normal risk management controls and fire protection program defense-in-depth actions are relied upon during periods of low risk.

Frequently Asked Question 07-0040 describes a process to demonstrate that the nuclear safety performance criteria are met during non-power operations. This process involves the following four steps:

1. Review existing outage management processes (Section F.1)

2. Identify components and cables to be included in the review (Section F.2)

3. Perform fire area assessments (identify pinch points) (Section F.3)

4. Manage the risk associated with fire-induced vulnerabilities during an outage (Section F.4)

There are two aspects of the current FAQ 07-0040 guidance that relate to the issue of concern at Callaway. First, FAQ 07-0040 does not provide guidance for screening key safety functions from further review. As noted above, the inspectors were concerned that the licensee screened the potential loss of spent fuel pool cooling from further consideration for any fire event based on adequate procedural guidance and time when the procedures would not maintain the fuel in a safe and stable condition.

Second, FAQ 07-0040 states that the definition of a higher risk evolution should consider the following: time to boil, reactor coolant system and fuel pool inventory, and decay heat removal capability. The licensee defined higher risk evolutions in Procedure EDP-ZZ-01129, “Callaway Energy Center Risk Assessment,” Revision 45. The licensee’s definition lists two configurations that qualify as a higher risk evolution under NFPA 805. Both of these configurations specifically state that fuel is in the reactor vessel. Therefore, using the licensee’s definition, a full core offload into the spent fuel pool is not considered a higher risk evolution.

<u>Proposed Improvements to Consider for FAQ 07-0040</u>

Based on the discussion above, Region IV requests that Nuclear Reactor Regulation (NRR) work with the NFPA 805 Task Force to review and update the guidance in FAQ 07-0040 related to two areas. First, Region IV requests that additional guidance be provided for licensees to consider before screening key safety functions from further consideration. The region recommends that key safety functions should be retained for consideration unless it can be demonstrated that the fuel remains in a safe and stable condition, as defined in NFPA 805, as fuel coolant temperature below boiling if the key safety function is lost.

Second, Region IV requests that the current guidance for higher risk evolutions be reviewed and updated or clarified as necessary. The region recommends that FAQ 07-0040 acknowledge that the period of highest intrinsic risk for the spent fuel pool occurs during a full core offload and that this configuration should be treated as a higher risk evolution when managing the risk associated with fire-induced vulnerabilities during an outage.

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Electronic distribution by RIV:
Regional Administrator (Marc.Dapas@nrc.gov)
Deputy Regional Administrator (Kriss.Kennedy@nrc.gov)
DRP Director (Troy.Pruett@nrc.gov)
DRP Deputy Director (Ryan.Lantz@nrc.gov)
DRS Director (Anton.Vegel@nrc.gov)
DRS Deputy Director (Jeff.Clark@nrc.gov)
Senior Resident Inspector (Thomas.Hartman@nrc.gov)
Resident Inspector (Michael.Langelier@nrc.gov)
Branch Chief, DRP/B (Nick.Taylor@nrc.gov)
Senior Project Engineer, DRP/B (David.Proulx@nrc.gov)
Project Engineer, DRP/B (Shawn.Money@nrc.gov)
CWY Administrative Assistant (Dawn.Yancey@nrc.gov)
Public Affairs Officer (Victor.Dricks@nrc.gov)
Project Manager (John.Klos@nrc.gov)
Team Leader, DRS/IPAT (Thomas.Hipschman@nrc.gov)
RITS Coordinator (Marisa.Herrera@nrc.gov)
ACES (R4Enforcement.Resource@nrc.gov)
Acting Regional Counsel (Emily.Monteith@nrc.gov)
Technical Support Assistant (Loretta.Williams@nrc.gov)
Senior Congressional Affairs Officer (Jenny.Weil@nrc.gov)
RIV Congressional Affairs Officer (Angel.Moreno@nrc.gov)
RIV/ETA: OEDO (Theresa.Clark@nrc.gov)