UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

August 2, 2013

Mr. Adam C. Heflin
Senior Vice President
and Chief Nuclear Officer
Union Electric Company
P.O. Box 620
Fulton, MO 65251

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION FOR THE REVIEW OF THE CALLAWAY PLANT, UNIT 1, LICENSE RENEWAL APPLICATION, SET 26 (TAC NO. ME7708)

Dear Mr. Heflin:

By letter dated December 15, 2011, Union Electric Company (Ameren Missouri) (the applicant) submitted an application pursuant to Title 10 of the *Code of Federal Regulations* Part 54 (10 CFR Part 54) for renewal of operating license No. NPF-30 for the Callaway Plant, Unit 1 (Callaway). The staff of the U.S. Nuclear Regulatory Commission (NRC or the staff) is reviewing this application in accordance with the guidance in NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants." During its review, the staff has identified areas where additional information is needed to complete the review. The staff's requests for additional information are included in the enclosure. Further requests for additional information may be issued in the future.

Items in the enclosure were discussed with Sarah G. Kovaleski, of your staff, and a mutually agreeable date for the response is within 30 days from the date of this letter. If you have any questions, please contact me by telephone at 301-415-2946 or by e-mail at Samuel.CuadradoDeJesus@nrc.gov.

Sincerely,

Samuel Cuadrado de Jesús, Project Manager
Projects Branch 1
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket No. 50-483

Enclosure:
As stated

cc: Listserv

August 2, 2013

Mr. Adam C. Heflin
Senior Vice President
and Chief Nuclear Officer
Union Electric Company
P.O. Box 620 Fulton, MO 65251

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION FOR THE REVIEW OF THE CALLAWAY PLANT, UNIT 1, LICENSE RENEWAL APPLICATION, SET 26 (TAC NO. ME7708)

Dear Mr. Heflin:

By letter dated December 15, 2011, Union Electric Company (Ameren Missouri) (the applicant) submitted an application pursuant to Title 10 of the *Code of Federal Regulations* Part 54 (10 CFR Part 54) for renewal of Operating License No. NPF-30 for the Callaway Plant, Unit 1 (Callaway). The staff of the U.S. Nuclear Regulatory Commission (NRC or the staff) is reviewing this application in accordance with the guidance in NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants." During its review, the staff has identified areas where additional information is needed to complete the review. The staff's requests for additional information are included in the enclosure. Further requests for additional information may be issued in the future.

Items in the enclosure were discussed with Sarah G. Kovaleski, of your staff, and a mutually agreeable date for the response is within 30 days from the date of this letter. If you have any questions, please contact me by telephone at 301-415-2946 or by e-mail at Samuel.CuadradoDeJesus@nrc.gov.

Sincerely,

/RA/
Samuel Cuadrado de Jesús, Project Manager
Projects Branch 1
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket No. 50-483

Enclosure:
As stated
cc: Listserv

DISTRIBUTION:
See next page

ADAMS Accession No.: ML13192A025

OFFICE	LA:DLR/RPB2	PM:DLR/RPB1	BC:DLR/RPB1	PM:DLR/RPB1
NAME	YEdmonds	SCuadrado	YDiaz-Sanabria	SCuadrado
DATE	7/30/13	8/1/13	8/1/13	8/2/13

OFFICIAL RECORD COPY

Letter to Adam C. Heflin from S. Cuadrado de Jesus dated August 2, 2013

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION FOR THE REVIEW OF THE CALLAWAY PLANT, UNIT 1, LICENSE RENEWAL APPLICATION, SET 26 (TAC NO. ME7708)

DISTRIBUTION:

HARD COPY:
DLR R/F

E-MAIL:
PUBLIC
RidsNrrDlrResource
RidsNrrDraAfpb Resource
RidsNrrDraApla Resource
RidsNrrDeEmcb Resource
RidsNrrDeEeeb Resource
RidsNrrDssSrxb Resource
RidsNrrDssSbpb Resource
RidsNrrDssScvb Resource
RidsOgcMailCenter Resource

SCuadrado
FLyon
THartman
CFells
DMorey
BMizuno (OGC)
DCylkowski (OGC)
LSubin (OGC)
GPick (RIV)

CALLAWAY PLANT, UNIT 1

LICENSE RENEWAL APPLICATION

REQUEST FOR ADDITIONAL INFORMATION, SET 26

RAI B2.1.3-1c

Background:

By letter dated April 26, 2013, the applicant responded to RAI B2.1.3-1b, and stated in part that detensioning of stud No. 18 during each refueling outage (RFO) confirms its intended function will be maintained. The applicant also stated that normal reactor pressure vessel (RPV) head stud tensioning and detensioning operations performed during each RFO are a form of "proof test" of the adequacy of the threaded connection to support in-service RPV head stud loads. The applicant further stated that the minimum RPV head stud load experienced by RPV head stud No. 18 during detensioning is a 113 percent proof test of the maximum in-service primary plus secondary RPV head stud loading during heatup.

The applicant stated that the 1987 evaluation which calculated the RPV head stud minimum thread engagement (6.31 inches) was based on a conservative methodology. The applicant also stated that an evaluation performed in 2013 demonstrates that the minimum RPV head stud engagement required to resist all primary loads is 4.77 inches. The applicant further stated that the stuck stud No. 18 nominally has in excess of 35 percent more thread engagement than is required to meet American Society of Mechanical Engineers (ASME) Code limits, and that the margin is sufficiently large that the comments related to plastic deformation in the 1989 evaluations do not apply to RPV stud No. 18.

The applicant stated that although the condition of the threads on the inside of the RPV head stud hole No. 18 cannot be observed through direct visual examination, the 2013 evaluation performed a bounding estimate based on the amount of force used during efforts to remove stud No. 18 and concluded that the effective damage could be no more than 20 percent of a single thread, which would result in less than 0.025 inches of lost effective thread engagement. The applicant also stated that stud No. 18 is protected from boric acid corrosion by encapsulation during refueling to prevent exposure to the boric acid in the refueling pool. The applicant further stated that most wear occurs when an RPV head stud is threaded in and out of the RPV head stud hole, since stud No. 18 is stuck, it is not removed or installed, therefore essentially there is no wear (loss of material).

In addition, the applicant stated that the existing RPV head stud handling procedures and practices do not damage threads. The applicant stated that with the exception of minor maintenance on RPV head stud No. 18 (burr removal in 1996) and RPV head stud No. 20 (chasing lead threads), no threads have been damaged in over 20 years. The applicant also stated that it has not destructively removed an RPV head stud since 1989, when five stuck studs were removed due to their interference with the fuel transfer path and to restore functionality to RPV head stud No. 2. The applicant further stated that at that time the risks associated with destructive removal, which included possible introduction of foreign material,

worker safety, dose exposure, possibility of additional damage during the repair process, technical challenges associated with the RPV head stud removal tooling, and failure to restore the normal fuel transfer path, were acceptable in order to repair the RPV.

Finally, the applicant stated that given the above considerations, it is considered appropriate to monitor and manage the continued use of RPV head stud No. 18 rather than pursue its removal.

Issue:

The staff finds that the applicant's response still did not fully address how the condition of the threads for the RPV head stud and stud hole No.18 would be monitored during the period of extended operation. In its response the applicant stated that normal RPV head stud tensioning and detensioning operations performed during each RFO is a form of "proof test" of the adequacy of the threaded connection to support in-service RPV head stud loads for the subsequent cycle. The staff does not agree that successful tensioning and detensioning provides adequate assurance that the threads will withstand all in-service loads in the subsequent operating cycle. Specifically, the tensioning and detensioning is usually performed at ambient temperatures. In addition, during tensioning and detensioning, some of the stresses may be distributed or shared by the adjacent studs and flange ligaments, while during in-service transients the adjacent areas may not be able to share as much of the stresses.

Furthermore, the staff noted that the applicant is essentially assuming zero corrosion at the location of the stuck stud, because the stuck stud is encapsulated during RFOs. The staff noted that leakage past the encapsulation may occur along with leakage past the inner o-ring, and therefore loss of material at this location is an aging effect which requires management during the period of extended operation.

Request:

Explain how the current aging management program (AMP) will monitor the condition of the threads on the stud and vessel flange hole threads, so that there is reasonable assurance that the known degradation and any postulated degradation along with the number of unengaged threads will not exceed the acceptance criteria during the period of extended operation.

RAI B2.1.3-2c

Background:

By letter dated April 26, 2013, the applicant responded to RAI B2.1.3-2b, and stated that during the 1989 and 1992 repairs, a tool especially designed for inspection of RPV stud holes was used which produced a high quality video of the stud hole threads by using a laser to illuminate and map the profile of the threads. The applicant stated that the laser inspection tool was used before and after the repairs. The applicant also stated that since 1992, due to improved RPV head stud handling procedures, only one minor indication was found on RPV stud hole No. 20 threads. The applicant further stated that the laser inspection device has not been used since 1992.

In addition the applicant stated that the 1989 evaluation was intended to apply to the remainder of the "RPV design life" and includes a discussion on the pattern of the degraded RPV head at that time, however the thread damage existing at that time was used only to support the

discussions estimating the effective thread engagement in hole locations 2, 4, 5, 7, and 9. The applicant also stated that thread damage to RPV stud hole Nos. 13, 25, 39, 53 and 54, subsequent to the 1989 evaluations do not invalidate past evaluations as long as the minimum thread engagement criteria are met. The applicant further stated that the thread degradation evaluation criteria developed in the 1989 report was analyzed such that each RPV stud engagement region fully meets applicable ASME Code rules, provided that the thread degradation evaluation criteria are met for each vessel stud hole. The applicant stated that using this evaluation, the RPV flange as a whole would fully meet ASME Code rules even if the effective thread engagement of all 54 RPV head stud locations were at a minimum. The applicant stated that there is no interaction mechanism between adjacent RPV stud hole locations, provided that each one meets the acceptance criteria established in the 1989 evaluation.

The applicant also stated that Recommendation 2 from the 1989 evaluation which stated that "studs used in vessel flange holes with degraded threads should be free from damage," was based on the assumption that the vessel threads would engage with RPV head stud threads that were each fully intact. The applicant stated that use of RPV head stud No. 18 after removing a small burr was not in conflict with the recommendation that "studs used in vessel flange holes with degraded threads should be free of damage." The applicant further stated that the recommendations of the 1989 evaluations are considered to be optional since the language used was "should" rather than "must" or "shall."

The applicant stated that the 1987 evaluation calculated a 6.31 inch minimum vessel/stud thread engagement length based on a conservative calculation methodology. However a 2013 evaluation demonstrates that the minimum vessel/stud engagement required to resist all primary loads is 4.77 inches. The applicant also stated that the stuck RPV head stud No. 18 has in excess of 35 percent more thread engagement than is required to meet ASME Code limits. The applicant further stated that this margin is sufficiently large that the comments related to localized plastic deformation do not apply to stuck stud No. 18.

Issue:

During its review, the staff noted that the evaluations (1987 and 1989), essentially used similar language such as "should" rather than "must" or "shall." This is because at the time these evaluations were performed the applicant had other options, such as the option to repair the RPV stud hole locations with stud hole inserts. However, in perusing the continued use of the 1987 and 1989 evaluations to justify the use of the RPV closure bolting in its current condition (i.e., with multiple locations with less than full thread engagement), the use of the recommendations should not be considered as "optional" by the applicant. In addition, since these evaluations are only valid if the acceptance criteria are still being met, the staff still seeks assurance that for locations Nos. 2, 4, 5, 7, 9, 13, 18, 25, 39, 53, and 54 the minimum thread engagement criteria will continue to be met during the term of the renewed license, with sufficient margin such that there is an extremely low probability of abnormal leakage, rapidly propagating failure, and gross rupture.

The staff noted that the applicant in its response stated that the 1989 evaluation was intended to apply to the remainder of the RPV design life. The staff reviewed the license renewal application (LRA) and did not note that the 1989 evaluation was identified as time-limited aging analyses (TLAA), the applicant's response did not provide additional information for the staff to determine whether this evaluation should have been identified as a TLAA in the LRA.

Request:

a) Explain what is meant by the term "remainder of the RPV design life," as discussed above. In addition, clarify whether the 1987 and/or 1989 evaluations should be identified as a TLAA in accordance with 10 CFR 54.3. If the evaluations are identified as TLAAs, revise the LRA accordingly and provide TLAA disposition in accordance with 10 CFR 54.21(c)(1). If not, provide the justifications why these evaluations are not considered as TLAAs.

b) Explain how the current AMP will monitor the condition of the threads such that there is adequate assurance that the acceptance criteria will continue to be met at repaired RPV stud hole location Nos. 2, 4, 5, 7, 9, 13, 25, 39, 53, and 54 during the period of extended operation.