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10 CFR 50
10 CFR 51
10 CFR 54

RS-15-256

October 8, 2015

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

LaSalle County Station, Units 1 and 2
Facility Operating License Nos. NPF-11 and NPF-18
NRC Docket Nos. 50-373 and 50-374

Subject: Response to NRC Request for Additional Information, Set 11, dated September 14, 2015 related to the LaSalle County Station, Units 1 and 2, License Renewal Application (TAC Nos. MF5347 and MF5346)

References:

1. Letter from Michael P. Gallagher, Exelon Generation Company LLC (Exelon), to NRC Document Control Desk, dated December 9, 2014, "Application for Renewed Operating Licenses"

2. Letter from Jeffrey S. Mitchell, US NRC to Michael P. Gallagher, Exelon, dated September 14, 2015, "Requests for Additional Information for the Review of the LaSalle County Station, Units 1 and 2 License Renewal Application – Set 11 (TAC Nos. MF5347 and MF5346)"

In Reference 1, Exelon Generation Company, LLC (Exelon) submitted the License Renewal Application (LRA) for the LaSalle County Station (LSCS), Units 1 and 2. In Reference 2, the NRC requested additional information to support staff review of the LRA.

Enclosure A contains the response to these requests for additional information.

Enclosure B contains updates to sections of the LRA affected by the response.

There are no new or revised regulatory commitments contained in this letter.

If you have any questions, please contact Mr. John Hufnagel, Licensing Lead, LaSalle License Renewal Project, at 610-765-5829.

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

Executed on 10-08-2015

Respectfully,

Michael P. Gallagher
Vice President - License Renewal Projects
Exelon Generation Company, LLC

Enclosures: A: Response to Set 11 Requests for Additional Information
B: LSCS License Renewal Application Updates

cc: Regional Administrator – NRC Region III
NRC Project Manager (Safety Review), NRR-DLR
NRC Project Manager (Environmental Review), NRR-DLR
NRC Project Manager, NRR-DORL- LaSalle County Station
NRC Senior Resident Inspector, LaSalle County Station
Illinois Emergency Management Agency - Division of Nuclear Safety

Enclosure A

**Response to Set 11 Request for Additional Information
Related to various sections of the LaSalle County Station (LSCS)
License Renewal Application (LRA)**

RAI 4.2.7-1a

RAI 4.2.7-1a

Background:

By letter dated August 6, 2015, the applicant responded to RAI 4.2.7-1 that requested sufficient information on the parameters used in the reactor vessel reflood thermal shock analysis (LRA Section 4.2.7). In its response, the applicant indicated that the maximum initial flaw depth postulated in the analysis is 5.2 percent of the reactor vessel wall thickness per ASME Code Section XI, Table IWB-3510-1.

Issue:

License Renewal Application (LRA) Table 4.2.7-2 and associated discussion in LRA Section 4.2.7 describe applied stress intensity factor values (KI-applied) at 52 percent of the reactor vessel wall thickness during the recirculation line break transient. The LRA also compares these KI-applied values with the adjusted fracture toughness values (KIc/1.414) of the LSCS limiting reactor vessel material during the transient. It is not clear to the staff why LRA Table 4.2.7-2 and associated discussion in Section 4.2.7 refer to the location at 52 percent of the reactor wall thickness for the fracture toughness comparison rather than 5.2 percent of the wall thickness that corresponds to the postulated initial flaw depth.

In addition, the staff noted that LRA Section 4.2.7 does not provide the KI-applied value and the allowable fracture toughness value (KIc/1.414) that were evaluated in the applicant's analysis for N6 low pressure coolant injection nozzles.

Request:

1. Clarify why LRA Table 4.2.7-2 and associated discussion in Section 4.2.7 assume a flaw depth of 52 percent of the wall thickness which is different from the postulated initial flaw depth per ASME Code Section XI, Table IWB-3510-1.

2. Provide the KI-applied value and the allowable fracture toughness value (KIc/1.414) that were evaluated in the applicant's analysis for N6 low pressure coolant injection nozzles.

Exelon Response:

1. The correct flaw depth is 0.052T, which is 5.2 percent of the wall thickness, T. LRA Table 4.2.7-2 and the discussion in LRA Section 4.2.7 have typographical errors that have been corrected, as shown in Enclosure B.

2. At a flaw depth of 0.052T, $K_{I\text{-}applied}$ is approximately 35 ksi$\sqrt{}$inch. This is significantly less than the allowable fracture toughness value (K_{Ic} /1.414) of 141 ksi$\sqrt{}$inch. Therefore, adequate margin against non-ductile fracture has been demonstrated for the Unit 1 and Unit 2 N6 LPCI nozzles. These values are added to LRA Section 4.2.7, as shown in Enclosure B.

Enclosure B

LSCS License Renewal Application Updates
Resulting from the Response to the following RAI:

RAI 4.2.7-1a

Note: To facilitate understanding, portions of the LRA have been repeated in this Enclosure, with revisions indicated. Previously submitted information is shown in normal font. Changes are highlighted with ***bolded italics*** for inserted text and ~~strikethroughs~~ for deleted text.

As a result of the response to RAI 4.2.7-1a provided in Enclosure A of this letter, the Recirculation Line Break Analysis subsection of LRA Section 4.2.7 and Table 4.2.7-2, on LRA pages 4-53 and 4-54, are revised as shown below in ***bolded italics*** to correct three typographical errors:

4.2.7 REACTOR PRESSURE VESSEL REFLOOD THERMAL SHOCK ANALYSIS

Recirculation Line Break Analysis

In Reference 4.8.10, the Recirculation line break LOCA was evaluated. A summary of this analysis at selected times during the transient is presented in Table 4.2.7-2, but with updated material properties at 54 EFPY. Note that K_{Ic} is determined using crack tip temperature at the maximum allowable crack depth of 0.052T and ART is based on the limiting inside surface (0T) fluence.

Table 4.2.7-2
Crack Stability Analysis for Beltline Shells During Recirculation Line Break

Time During Transient (s)	**0**	**25**	**84**	**480**	**1200**	**3000**
Temperature at 0.052T	550	450	450	160	120	80
Limiting 0T 54 EFPY ART (ºF)	168	168	168	168	168	168
T-ART (ºF)	382	282	282	-8	-48	-88
K_{Ic}/1.414 (ksi√in)	141	141	141	**36**	**29**	26
$K_{I\text{-}applied}$ at ~~0.52T~~***0.052T*** (ksi√in)	33	47	20	**56**	**47**	24
Margin	4.3	3.0	7.1	**0.6**	**0.6**	1.1

Table ~~4.7-2~~ ***4.2.7-2*** shows that at times 0, 25, 84, and 3,000 seconds after the start of the transient, the applied stress intensity factor, $K_{I\text{-}applied}$ at ~~0.52T~~***0.052T***, is less than the available toughness, K_{Ic}/1.414, calculated as a function of crack tip temperature and the bounding 0T fluence level. However, at 480 seconds and 1,200 seconds after the start of the transient, the applied stress intensity factor exceeds the available toughness value by 40 percent, which would indicate the initiation and propagation of a crack during that time period. However, since fluence actually attenuates as a function of distance from the inside surface, further analysis may be performed to take into account the reduced fluence as a function of crack depth. If crack initiation still occurs, the cracking must be shown to arrest prior to reaching 0.75T in order to meet the acceptance criteria.

As a result of the response to RAI 4.2.7-1a provided in Enclosure A of this letter, the Beltline Nozzles subsection of LRA Section 4.2.7 on LRA page 4-56 is revised as shown below:

Beltline Nozzles

The N6 Low Pressure Coolant Injection (LPCI) nozzles are selected as the limiting beltline nozzles since the Emergency Core Coolant System (ECCS) injects coolant through this nozzle following a LOCA. Consequently, there is a severe thermal transient at this location following the design basis LOCA.

The finite element analysis (FEA) results are documented in the LSCS Unit 1 and Unit 2 RPV stress analyses. The bounding temperature distribution in the LPCI Nozzle analyzed for both units is selected. A thermal stress distribution is developed from this temperature profile, which is then used to calculate a stress intensity factor.

Since there is negligible pressure in the RPV following the LOCA event and since the location of the highest thermal stresses is remote from welds, there is no K_I from internal pressure or weld residual stress. A flat plate K_I solution for a point load acting at an arbitrary location along the crack front is selected. The point load is replaced with $\sigma(x)dx$ then integrated over the crack depth in order to obtain the K_I caused by the thermal stress distribution. The same acceptance criteria as described for the beltline shells are applied for the nozzle.

The resulting $K_{I\text{-applied}}$ value ***is approximately 35 ksi√inch at a flaw depth of 0.052T. This*** is significantly less than the allowable fracture toughness value~~,~~ ***(***K_{Ic}/1.414***) of 141 ksi√inch~~,~~***. ~~t~~***T***herefore***,*** ~~demonstrating~~ adequate margin against non-ductile fracture ***has been demonstrated*** for the Unit 1 and Unit 2 ***N6 LPCI*** nozzles.