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

April 12, 2016

MEMORANDUM TO: Travis L. Tate, Chief
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Division of Operating Reactor Licensing

FROM: Alexander N. Chereskin, Project Manager
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Division of Operating Reactor Licensing

RLHyman for,

SUBJECT: SUMMARY OF MEETING WITH EXELON GENERATION COMPANY, LLC, TO DISCUSS THE FLAW INDICATION IN THE CALVERT CLIFFS UNIT NO. 1 PRESSURIZER SAFETY VALVE DISSIMILAR METAL WELD

On February 24, 2016, a teleconference was held to exchange information between Exelon Generation Company, LLC (the licensee), and the U.S. Nuclear Regulatory Commission (NRC) regarding the weld indication in the Calvert Cliffs Nuclear Power Plant (Calvert Cliffs) Unit No. 1 pressurizer safety relief nozzle to safe end dissimilar metal (DM) weld. During Calvert Cliffs Unit No. 1 refueling outage (RFO)-23 the licensee performed examinations on the DM weld 4-SR-1006-1 which revealed a change from the previously discovered indication on the same weld. The purpose of the examinations were to meet American Society of Mechanical Engineers (ASME) Code Case N-770-1 and Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.55a(g)(6)(ii)(F). Due to the discovery of the indication, the licensee is required by 10 CFR 50.55a(g)(6)(ii)(F)(6) to submit a report to the NRC. This report will summarize the licensee's "...evaluation, along with inputs, methodologies, assumptions, and causes of the new flaw or flaw growth...."

The licensee indicated that the examination included all 27 DM welds at Calvert Cliffs Unit No. 1 that are within the scope of ASME Code Case N-770-1. The licensee stated that the examination used a fully encoded phase array ultrasonic testing (UT) examination that meets all industry guidance for examinations of DM welds with the potential for pressurized water stress corrosion cracking (PWSCC). The licensee reported that full examination coverage of the weld was achieved. In addition, once the licensee identified that the weld had an indication of an 81.6 percent percent through wall flaw, another vendor was brought in to examine the weld. The vendor confirmed the existence of the flaw. The NRC staff asked the licensee if they had concluded examination work and made a final determination that there is a flaw. The licensee confirmed that examination work has been completed and have a consensus that there is an inner diameter (ID) connected flaw. The licensee also noted that there is no plan to gather more data, but they will further review historical data. The licensee also stated that they will conduct a full structural weld overlay (FSWOL) repair of the affected weld starting sometime during the weekend (2/26/16 – 2/28/16).

The licensee stated that the affected weld was mitigated by a mechanical stress improvement process (MSIP®) application in 2006. The licensee also noted that post MSIP® examinations in 2006 and ISI examinations in 2010 identified the indications in the same location. At that time, the licensee reported the flaw as 8 percent through-wall. Immediately following the MSIP® application, the licensee's UT examination confirmed the presence of the flaw still at 8 percent through-wall depth. The staff also asked the licensee the level of confidence that the current indications line up with those found in 2006 and 2010. The licensee responded that the indications line up very well with the previous indications, and that they are very confident of the results.

The licensee conducted an analysis following the 2006 examination that confirmed an axial PWSCC flaw of 8 percent depth that was contained within the compressive hoop stress zone of the post MSIP® stress profile at operating conditions. Results from the current (2016) examination show that the axial flaw is widest at the ID, narrower in the center third of the flaw, and wider at the top third of the flaw. This may be due to compression in the middle of the flaw. The NRC staff asked the licensee if the post MSIP® stress profile is accurate given a repair on the outer diameter (OD) of the nozzle. The licensee stated that the stress profile is accurate because it factors in the OD repair. In addition, the licensee stated that the stress profile is based on a flaw growth line along the butter weld where the flaw is located after MSIP® was performed. The staff asked the licensee if good stress distributions were assumed to remain due to the results of the licensee measurements of the OD of the pipe. The licensee confirmed that this was the case. The OD measurements to evaluate if the MSIP® stress profile had relaxed were conducted in 2010, but had not yet been repeated in 2016.

The licensee reviewed the fabrication and examination history of weld 4-SR-1006-1 to confirm fabrication repairs, construction examination and inservice examination results. In addition, inservice examinations from 2006 (pre- and post-MSIP®), 2010, and 2016 were reviewed in order to determine if the observed flaw had been present, but not identified, in previous years. Post-MSIP® stress profiles were reviewed in 2006 and 2010 to confirm the compressive stress region and effectiveness of the MSIP® application. In addition, the licensee performed physical measurements in 2010 to confirm MSIP® parameters were met. Based on the review of past data and examinations, the licensee determined that the MSIP® process was applied correctly, and that the stress profile was met. The NRC staff queried the licensee on the material used in the nozzle. The licensee stated that there was stainless steel (SS) cladding on the low alloy steel nozzle, and alloy 82/182 on the butter portion that ties into the SS cladding. In addition, the staff asked the licensee how the aspect ratio of the flaw extent seen in the past examination compares to 2016. The licensee stated that the aspect ratios are comparable. The staff also asked if the examinations were done clockwise and counter-clockwise. The licensee stated that the examinations were done both ways, although the flaw was better seen from the counter-clockwise direction.

Based on the discussion above, the licensee developed three potential causes for the change in the axial flaw through-wall extent:

1) The MSIP® application was ineffective allowing the existing axial flaw to grow,
2) A new indication developed in the weld, or
3) Prior NDE did not detect a pre-existing flaw larger than 30% through-wall prior to MSIP® (either ~80% through-wall or some value between ~30% and 80%)

The NRC staff challenged the licensee as to why the first two potential causes may be ruled out. The staff did recognize that the licensee intends to complete a more thorough review in a root cause analysis as part of their Corrective Action Program requirements. The licensee indicated that they plan to submit a formal report to the NRC under 10 CFR 50.55a(g)(6)(ii)(F)(6) prior to leaving Mode 5 or Mode 6. In addition, the licensee plans to start the FSWOL on the affected weld the weekend of February 26, 2016.

The NRC staff asked the licensee whether or not all MSIP® welds were inspected during this outage. The licensee stated that all 7 MSIP® welds on Calvert Cliffs Unit 1 were inspected, and the data was reviewed and is with site engineering. The licensee also stated that they are examining all 27 DM welds (20 of which are not MSIP® but are chemically mitigated) during the outage. These examinations are all encoded phase array examinations. The licensee also noted that two of the other DM welds with MSIP® that were examined had flaws prior to applying MSIP® in 2006. The welds are on a 12 inch hot leg surge line and a 2 inch hot leg drain. These welds were examined in 2016 and it was found the flaws have not changed.

The NRC staff asked the licensee if they had performed a flaw analysis and looked at the potential for flaw growth, assuming different starting flaw sizes. The staff also questioned as to why a leak has not already started. The licensee stated they are looking into this. In addition, the licensee stated that the flaw line from 2006 follows the same path as the current flaw and that the stress plots are the same shape. This effort is ongoing in conjunction with an operability analysis.

The NRC staff inquired to see if the licensee was looking at past data to determine if the data will support the licensee's conclusion. The licensee indicated that they continue to look at historical data. In addition, the staff asked if the licensee found other potential concerns from the data reviewed so far. The licensee noted that there was some information that showed there could be deeper features that were not observed following MSIP® due to compressive stresses. The staff also asked if the licensee is planning to detail what was observed in the 2006 and 2010 examinations. The licensee confirmed they are attempting to do this.

The NRC staff also asked the licensee if they had repeated the same examination done in 2010, for the weld in 2016 to evaluate any differences in the data. The licensee stated that they had not performed the same examination, but are confident that the 2016 examination produced valid data.

Attached to this meeting summary is a list of participants. In addition, the licensee's report submitted to the NRC on February 25, 2016, is available in Agencywide Documents Access and Management System (ADAMS) under Accession No. ML16057A002. The draft version of this report, transmitted to the NRC via e-mail dated February 24, 2016, to facilitate discussion during the teleconference, is available in ADAMS under Accession No. ML16076A352.

Docket No. 50-317

Attachment: As stated

MEETING PARTICIPANTS, FEBRUARY 24, 2016

**U.S. Nuclear Regulatory Commission**

| | |
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Enclosure

Attached to this meeting summary is a list of participants. In addition, the licensee's report submitted to the NRC on February 25, 2016, is available in Agencywide Documents Access and Management System (ADAMS) under Accession No. ML16057A002. The draft version of this report, transmitted to the NRC via e-mail dated February 24, 2016, to facilitate discussion during the teleconference, is available in ADAMS under Accession No. ML16076A352.

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| DATE | 03/16/16 | 03/16/16 | 04/12/16 |

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