DD-05-05

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION

J. E. Dyer, Director

In the Matter of	)	Docket No. STN 50-454
	)	
Exelon Generation Company, LLC	)	License No. NPF-37
	)	
	)	
(Byron Station, Unit 1)	)	
	)	

DIRECTOR'S DECISION UNDER 10 CFR 2.206

I. Introduction

By electronic mail dated March 2, 2005, to Mr. Luis A. Reyes, Executive Director for Operations at the U.S. Nuclear Regulatory Commission, Mr. Barry Quigley (the petitioner) filed a petition pursuant to Title 10 of the *Code of Federal Regulations*, Section 2.206 (Agencywide Document Access and Management System (ADAMS Accession No. ML050680255). The petitioner requested that the U.S. Nuclear Regulatory Commission (NRC) take enforcement action against Exelon Nuclear's (Exelon's or the licensee's) Byron Station for failure to comply with 10 CFR Part 50, Appendix B, Criterion XVI. Specifically, the petitioner stated that the 1C cold leg loop stop isolation valve (LSIV) (1RC8002C) has been broken for at least 6 years and has not been repaired. The basis for the request is that LSIV 1RC8002C can be difficult to close, to the point that the protective features of the motor actuated. The petitioner stated that the failure mechanism was metal-to-metal contact between the valve disc and a misaligned valve guide which introduced debris into the reactor coolant system.

On March 3, 2005, the Office of Nuclear Reactor Regulation (NRR) Petition Review Board (PRB) first met to discuss the petition. On March 4, 2005, the petitioner provided

additional clarifying information during a conference call with the PRB. The conference call was recorded; a transcript is publicly available in ADAMS Accession No. ML050870619. Subsequent information was provided by the licensee in ADAMS Accession Nos. ML051670196, ML051670192, ML051660544, ML051660534, ML051660541, ML051660527, and ML051660529. In addition, a public meeting was held in the NRC Region III offices on March 21, 2005; a summary of the meeting is available in ADAMS Accession No. ML050820530. Following an internal PRB meeting on March 22, 2005, NRC sent the petitioner an acknowledgment letter, dated April 5, 2005 (ADAMS Accession No. ML050870616). Although the NRC concluded that there was no immediate safety concern, and, therefore, it did not have a basis for taking immediate action, it decided that the issue should be reviewed for potential enforcement action under the 10 CFR 2.206 petition process. In support of the ongoing review, the licensee responded on May 27, 2005 (ADAMS Accession No. ML051590148) to the NRC's Request for Additional Information dated May 4, 2005 (ADAMS Accession No. ML050970118).

All referenced documents are available in ADAMS for inspection at the NRC's Public Document Room (PDR) at One White Flint North, 11555 Rockville Pike (first floor), Rockville, Maryland. Publicly available records will be accessible from the ADAMS Public Electronic Reading Room on the NRC Web site at <http://www.nrc.gov>. Persons who do not have access to ADAMS or who have problems in accessing the documents in ADAMS should contact the NRC PDR reference staff by telephone at 1-800-397-4209 or 301-415-4737, or by e-mail to pdr@nrc.gov.

The NRC sent a copy of the proposed Director's Decision to the petitioner and to the licensee on July 29 and August 1, 2005, respectively (ML051940352 and ML051940179). The petitioner responded on August 14, 2005 (ML052500244). The licensee responded on August 12, 2005 (ML052500241). The licensee's comments clarified the description of certain

plant components. A more detailed response to the petitioner's comments is available in ADAMS (ML052860285) and is included as a separate enclosure to the letter of issuance for this Director's Decision. After considering the comments received, the staff revised selected portions of the Director's Decision.

II. Discussion

The LSIVs facilitate repair and maintenance activities on the steam generators during plant outages. Although the bodies of the LSIVs are part of the primary system pressure boundary, valve operation does not perform a safety function. However, the malfunction of the valves could create a potential safety concern. Valve degradation could result in the introduction of loose parts into the reactor coolant system (RCS). For example, a valve guide could slip out of the groove in the valve body due to a pin or valve retaining block failure, a valve guide could break (which has happened within the industry), or the blocks might have been improperly installed at the bottom of the valve guides. In addition, it was not clear that the licensee fully considered how a loose part might affect the analyses of Updated Final Safety Analysis Report (UFSAR) design basis accidents.

One aspect of the NRC staff review focused on whether 1RC8002C was degraded to a point where a loose part (e.g., a piece of valve guide) could migrate to the reactor vessel. The licensee's and the staff’s analyses of the motor-operated valve's torque switch settings for 1RC8002C indicated that the thrust forces were unlikely to cause the valve guides to yield or break. During the most recent Byron Station, Unit 1, refueling outage, the licensee was able to fully close 1RC8002C, indicating that the valve guide had not slipped onto the valve seat. The staff determined that the valve guide cannot exit the valve in one piece because of the length of the valve guide and its geometric relation to the valve disc when the valve is open. Plants where valve guides broke and migrated into the RCS or slipped onto the valve seat did not have the same retaining blocks as Byron Station, Unit 1. Therefore, a key issue was whether the

valve blocks were still in position in 1RC8002C. The licensee's installation package included quality control points during the welding process for the valve blocks. Also, the licensee said during the public meeting on March 21, 2005, that the valve blocks had been visually inspected by remote means during installation. The welding process should make the valve blocks able to withstand significant force in their installed position. Although not absolutely certain that the valve blocks remained installed in the valve, the licensee did not locate any valve blocks during the 10-year inservice inspection of the reactor vessel at Byron Station, Unit 1. Therefore, the NRC staff considered that reasonable assurance existed to support the licensee's conclusion that the valve blocks remained in place in LSIV 1RC8002C. In that absolute assurance did not exist for the presence of the valve blocks, the licensee evaluated the capability of the valve guides to maintain their structural integrity if the valve blocks did not prevent the guides from slipping into the path of the valve disc when the valve was closing. The licensee determined that the torque switch setting of the motor actuator for LSIV 1RC8002C was not set sufficiently high to break the valve guides. When intact, the valve guides are too long to enter the RCS flow stream. Therefore, the staff considered that the licensee had provided reasonable assurance that the valve blocks remained in place. As a result, NRC staff finds that the Byron Station, Unit 1, RCS cold leg LSIV 1RC8002C is unlikely to be degraded to the point that the valve guide, or a piece of the valve guide, can loosen and migrate to the reactor vessel during normal plant operation.

Nevertheless, the staff considered the potential for the release of loose parts into the RCS at Byron Station, Unit 1 and what effect they may have on plant operation. A large loose part would be expected to be carried by the RCS flow into the bottom of the reactor vessel or be lodged somewhere else in the primary system. Under normal operating and shutdown activities, the part would remain there. The staff has concluded that the only event that could produce sufficiently high RCS flow and turbulence to move the part with sufficient velocity to do

damage within the RCS boundary is a large break loss-of-coolant accident (LBLOCA). However, in the case of an LBLOCA, any damage done by the loose part would be small compared to the damage resulting from the LBLOCA itself. During the most recent refueling outage (B1R13), there were no loose parts that were associated with the LSIVs identified during the 10-year inservice inspection of the reactor vessel. Further, the staff considers it unlikely that a large loose part present in the RCS, coincident with a loss of coolant accident of sufficient size to cause the loose part to become an aggravating factor would occur.

With regard to small loose parts, the NRC staff postulated the following situations: (1) a loose part obstructing the chemical and volume control system (CVCS) letdown line from the RCS, (2) a loose part obstructing the pressurizer sprayline/nozzle, and (3) loose parts entering the reactor core. In its May 27, 2005, submittal, the licensee addressed the first two situations by referring to Section 5.4 of the Byron Station UFSAR. Section 5.4 discusses compliance with Reactor Systems Branch (RSB) Branch Technical Position RSB 5-1, "Design Requirements of the Residual Heat Removal System," attached to Section 5.4.7 of the NRC Standard Review Plan (NUREG-0800). RSB 5-1, which specifies shutdown requirements for light water reactors, requires in part that the reactor can be taken from normal operating conditions to cold shutdown using only safety-grade systems. Section 5.4 of the Byron Station UFSAR shows that the Byron Station has the capability to transition from normal operating conditions to a cold shutdown under a natural circulation scenario without pressurizer spray and with limited functional capability (e.g., a loss of RCS letdown). NRC reported its acceptance of this analysis in Supplement 2 to NUREG-0786, "Safety Evaluation Report Related to the Operation of Byron Station, Units 1 and 2." In the response to the draft Director's Decision, the petitioner commented that because of concerns with the capability of the pressurizer relief tank (PRT), the proposed process for cooling down in the event of obstructions in the normally used systems is invalidated. The PRT is a non-safety vessel that condenses and cools any steam

that might be discharged from the pressurizer power operated relief valves. If, while the plant is being shut down, the pressure in the PRT becomes too high (which is the petitioner's concern), the pressure discs would rupture (as designed), thus directing the tank discharge to the containment drains and the containment sump. While not a preferred shutdown method, the reactor could be safely shut down with no increase in radiation exposure to the public.

Both the CVCS letdown line and the pressurizer sprayline/nozzle are downstream of the 1RC8002C valve at Byron. In the event that small loose parts continued past the lines, it could conceivably be carried by the RCS flow through the reactor downcomer and into the lower plenum. From the lower plenum, loose parts could turn with the flow and impact the bottom of the core. Before entering the core, the loose parts would have to pass through debris filters which would remove some of them. Each fuel assembly at Byron has a 17x17 array of fuel rods, which translates to approximately 50,000 flow channels in the core. It would take a large number of small parts, passing through the debris filters, to plug a significant portion of the flow channels in the core. In the event that some small loose parts do enter the core and form plugs, RCS flow would be restricted and/or redirected in the area of the plugs. However, the flow streams would reunite downstream of the plugged flow channel volume.

It is also possible that small loose parts could cause fuel fretting resulting in some fuel leakage. Nevertheless, any leakage in excess of that considered during plant design and licensing would require a plant shutdown in accordance with the plant's technical specifications.

In its May 27, 2005, submittal, the licensee (1) discussed the detection and alerting system that would enable plant personnel to identify the presence of loose parts and (2) the procedures for identifying and responding to a loose part. The licensee's loose parts monitoring system (LPMS), which is designed to comply with Regulatory Guide 1.133, "Loose Part Detection Program for the Primary System of Light-Water-Cooled Reactors," is to function to

automatically detect metal-to-metal type impacts that may be indicative of a loose part in the RCS. Operator response to the LPMS alarms is governed by Byron Station procedures. Based on a review of the information provided, the NRC staff concludes that, when utilized, the licensee's loose parts monitoring system would provide a tool to detect, alarm, and help locate and identify large loose parts.

In the March 21, 2005, public meeting, Exelon discussed its long-term plans for addressing the 1RC8002C performance issues. First, Exelon noted that a rigging structure needed to perform the valve repair was constructed during the most recent Byron Station, Unit 1, refueling outage. Second, Exelon stated that it would prepare a contingency repair plan for 1RC8002C for the next Byron Station, Unit 1, refueling outage. Third, Exelon stated that it was evaluating enhanced valve diagnostic activities for the next Byron Station, Unit 1, refueling outage. The licensee also noted that, with the help of the vendor it was preparing a formal decision tree with specific criteria to determine the need for repair of 1RC8002C. In their May 27, 2005, letter, Exelon stated that it was developing a long-term plan to identify any additional diagnostic testing or inspection to be performed to assess LSIV performance during future outages. The commitment to develop a plan was entered into the Action Tracking Module of the Passport data base as a Regulatory Commitment. The plan was completed on October 14, 2005. In addition, the staff notes that due to difficulties previously encountered

with 1RC80002C closure, the licensee entered this condition into its Corrective Action Program in March 2002.

Details relating to NRC staff's consideration and conclusions may be found at ADAMS Accession No. ML051890369.

III. Conclusion

In its letter of April 5, 2005, the NRC informed the petitioner that although there was no immediate safety concern and therefore, no basis for taking immediate enforcement action, the NRC had accepted the petition for review.

In determining whether any safety concerns exist regarding operation of Byron Station, Unit 1, in light of the past performance of 1RC8002C, NRC staff considered the previous information provided by the licensee. With regard to the failure of 1RC8002C and the generation of loose parts from it, the staff concludes that the licensee has adequately justified the structural integrity of the valve guides in 1RC8002C. The NRC staff concludes that there is reasonable assurance that the valve blocks remained in the valves thus preventing intact valve guides from sliding out of their grooves and into the RCS flow stream. Further, based on its estimate of the stress generated in the valve guides if the guides were misoriented and struck by the valve disc, it is unlikely that the valve guides would be deformed or that their structural integrity would be compromised. Evidence that there has been no physical degradation of 1RC8002C in the past is that during the most recent refueling outage (B1R13), there were no loose parts that were associated with the LSIVs identified during the 10-year inservice inspection of the reactor vessel.

The NRC staff also considered the effect of loose parts, should they occur, on operation and shut down of the reactor. It was concluded that large parts would become a factor in the event of an LBLOCA, and then only a small factor in comparison to the consequences of the LBLOCA. Based on the evaluation for the potential of 1RC8002C valve degradation discussed

earlier, the staff also concluded that large loose parts from the Byron Station, Unit 1, cold leg LSIVs have an acceptably low potential of occurrence.

Further, in the event that there are small loose parts in the RCS which could compromise systems used for normal shutdowns, through its compliance with Branch Technical Position RSB 5-1, Byron, Unit 1, can be taken from normal operating conditions to cold shutdown using only safety-grade systems with no increase in radiation exposure to the public. With regard to the effect of small loose parts from the 1RC8002C valve that might be carried into the reactor core, the staff concluded that the expected number of such parts would not affect safe operation of the plant.

Accordingly, the NRC staff concludes that there is reasonable assurance that safe operation of Byron Station, Unit 1 is not endangered by 1RC8002C valve performance.

The NRC staff has determined that the petitioner's request for enforcement action concerning a failure to comply with 10 CFR Part 50, Appendix B, Criterion XVI is denied. Appendix B requires licensees to have a quality assurance program that includes structures, systems, and components that prevent or mitigate the consequences of postulated accidents that could cause undue risk to the health and safety of the public. Although the valve body is a part of the primary system pressure boundary, the valve operation does not perform a safety function and is not credited in any of the design basis accidents. The NRC staff has concluded that there is reasonable assurance that the internal components of valve 1RC8002C have not degraded to the point of contributing loose parts to the RCS. Exelon has properly entered the 1RC8002C valve performance deficiencies into its corrective action program. Exelon has assessed the valve performance and developed corrective actions with respect to valve 1RC8002C performance. Development of long-term corrective actions, included in the Action Tracking Module of the Passport database as Regulatory Commitments at the Byron Station site, was completed on October 14, 2005. The licensee intends to monitor valve 1RC8002C

performance and has a plan to respond to potential malfunctions. Thus, the performance deficiencies of the 1RC8002C valve and any failure to timely identify and correct those deficiencies do not constitute a violation of Appendix B, Criterion XVI.

The petitioner is concerned that the licensee has put excessive emphasis on dose reduction which is compromising safety. NRC licensees are responsible for assuring that maintenance activities for structures, systems, and components are conducted in a manner sufficient to provide assurance that they are capable of performing their intended functions. Licensees are also required to develop a radiation protection program to achieve occupational doses and doses to members of the public that are as low as reasonably achievable (ALARA). However, nothing in the ALARA requirement may be construed as precluding actions that may be necessary to protect health and safety. In this case, the licensee's deferral of maintenance repairs because of ALARA considerations has not compromised the public health and safety. There is a low probability of valve degradation resulting in the migration of loose parts to the RCS. The licensee has indicated that the retrieval of loose parts will be addressed on a case-by-case basis, depending on the size and location of the loose part. The licensee will follow the guidance provided in the Byron Station procedures for investigating, evaluating, and recovering unexpected foreign material. In the event that loose parts are present in the RCS that affect operation of the plant, the plant can be safely shut down.

As provided in 10 CFR 2.206(c), a copy of this Director’s Decision will be filed with the Secretary of the Commission for the Commission to review. As provided for by this regulation, the decision will constitute the final action of the Commission, 25 days after the date of the decision unless the Commission, on its own motion, institutes a review of the decision within that time.

Dated at Rockville, Maryland, this 8th day of November 2005.

FOR THE NUCLEAR REGULATORY COMMISSION

/RA/

J. E. Dyer, Director
Office of Nuclear Reactor Regulation