LESSONS LEARNED FROM THE U.S. NUCLEAR REGULATORY COMMISSION RESPONSE TO THE FEBRUARY 2017 LASALLE COUNTY STATION UNIT 2 HIGH PRESSURE CORE SPRAY INJECTION VALVE FAILURE

August 16, 2018

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EXECUTIVE SUMMARY

By a memorandum dated October 3, 2017 (Agencywide Documents Access and Management System (ADAMS) accession number ML17269A253), the Deputy Executive Director for Reactor and Preparedness Programs (DEDR) directed the Office of Nuclear Reactor Regulation (NRR) and Region III to review the U.S. Nuclear Regulatory Commission's (NRC's) response to the February 2017 high pressure core spray (HPCS) injection valve failure at LaSalle County Station (LaSalle), Unit 2. Specifically, the special inspection team (SIT) and the related follow-up activities for Unit 1 were to be considered. Note that the NRC is currently reviewing generic aspects of continued use of large Anchor-Darling valves, including industry response to operating experience at LaSalle (subject of this lesson learned review), and other operating power reactor facilities. Those ongoing reviews are outside the scope of this focused review.

The DEDR directed that the review focus on three areas: consideration of valve operability, internal communication on the issues and NRC response, and communication with the licensee on the issues and NRC response.

NRR and Region III established a Lessons Learned Team (LLT) composed of staff and managers not directly involved in the NRC's response to the LaSalle Unit 2 HPCS injection valve failure. The primary data collection method of the LLT was structured interviews that focused on events and communications associated with the valve failure occurring from approximately February through June 2017.

The LLT interviewed Region III and NRR staff and managers, as well as Exelon (the licensee) corporate and site representatives, who had direct involvement in the LaSalle valve failure issue and ensuing operability evaluations. High-level results of the lessons learned effort are as follows:

- Given the same facts, Region III and NRR did not come to agreement on the operability for the LaSalle Unit 1 HPCS injection valve. The LLT found that the decision makers, that is the Region III and NRR executives who oversaw and led the staff's response to this issue, could have been more proactive, collaborative and timely in deciding which organization was the ultimate decision maker for assessing and determining the operability of the LaSalle Unit 1 HPCS injection valve, and deciding the appropriate regulatory response associated with that decision. This contributed to the Agency not making a timely regulatory decision regarding whether LaSalle Unit 1 should shutdown to inspect, then repair or replace the valve.
- Inspection Manual Chapter 0326, "Operability Determinations & Functionality Assessments for Conditions Adverse to Quality or Safety" (November 20, 2017) (ML16302A480) should be enhanced to (1) clarify the appropriate use of operating experience and (2) require the timely resolution of operability determination and licensing basis disagreements. Consideration should be given to expanding the use of probabilistic risk analysis (PRA) in an operability evaluation. Guidance should be developed to consider risk insights in the depth of review and assessment for degraded equipment (i.e., a graded approach).
- Discussions between Region III, NRR, and licensee representatives were generally professional and open. However, differences in assessments of the valve operability were not resolved in a timely manner, and a common understanding of the regulatory options,

including the possibility of an NRC order, was not reached. In addition, individuals involved in the special inspection noted that some negative perceptions between and among the parties were not openly acknowledged or discussed at the time of the inspection. Written documentation of assessment bases and common messaging to the licensee (coordinated between Region III and NRR) of the concerns and the regulatory options under consideration could have improved the effectiveness of both internal and external interactions and communications.

Despite the very challenging circumstances created by the complex technical issues that continued to evolve over this period, the LLT observed unwavering commitment to safety and security from everyone involved. The purpose of this report is to share feedback and make recommendations in the spirit of learning and growing as an organization.

BACKGROUND

In February, 2017, licensed operators shutdown LaSalle Unit 2 to begin a scheduled refueling outage. During the outage, the High Pressure Core Spray (HPCS) system passed its surveillance leak rate test, during which HPCS injection valve 2E22-F004 was successfully cycled open and closed multiple times. Subsequently, on February 11, 2017, while the plant staff was attempting to fill and vent the HPCS system, valve 2E22-F004 failed to open because the valve discs had separated from the valve stem. The licensee repaired the valve, and successfully completed post maintenance testing prior to restarting Unit 2 in March, 2017.

On April 12, 2017, the licensee submitted Licensee Event Report (LER) 50-374/ 2017-003-00, "High Pressure Core Spray System Inoperable due to Injection Valve Stem-Disc Separation" (ML17102B424). NRC Region III completed its Management Directive (MD) 8.3, "NRC Incident Investigation Program" (ML13175A294) to determine the appropriate regulatory response to the valve failure. Region III concluded that four deterministic criteria were met, and the estimated conditional core damage probability was 2.5E-5, which is in the overlap region for a Special Inspection Team (SIT) to Augmented Inspection Team response. Region III decided that an SIT was warranted, and issued the SIT Charter on April 21, 2017.

The SIT inspectors began their onsite inspection on April 24, 2017, completed their inspection activities on June 9, 2017, and issued the inspection results on August 31, 2017 in NRC inspection report "05000373/2017009; 05000374/2017009 LaSalle County Station, Units 1 and 2; Special Inspection Team Report and Exercise of Discretion" (ML17243A098). The SIT determined that the licensee had utilized an inadequate weak-link analysis for valve 2E22-F004 which resulted in the use of valve actuator torque settings that exceeded the valve's wedge pin shear strength and stem collar's press-fit design. This resulted in failure of the wedge pin, loosening of the stem collar, and degradation of the valve stem and disc threads over years of operation, ultimately causing stem-disc separation. Region III inspectors and managers, and the licensee had extensive discussions about the operability status of other similar valves in LaSalle Unit 1 and 2. Region III concluded that for all similar valves, with the exception of Unit 1 HPCS injection valve 1E22-F004, the licensee had established a "reasonable expectation" of operability, as defined in section 03.09 of Inspection Manual Chapter (IMC) 0326, "Operability Determinations & Functionality Assessments

for Conditions Adverse to Quality or Safety" (December 3, 2015) (ML15328A099)[1]. Despite multiple discussions regarding the operability evaluations performed to support continued operability of valve 1E22-F004, including the licensee's June 2, 2017 commitment to inspect the valve in the event of an unplanned outage or at the next refueling outage (scheduled for February 2018), Region III and the licensee continued to disagree on the operability of valve 1E22-F004. The licensee shutdown Unit 1 on June 22, 2017, to inspect and repair valve 1E22-F004. The SIT report noted that the licensee and Region III had discussed the operability status of valve 1E22-F004 throughout the inspection period, but did not document a conclusion with respect to operability of the valve.

REVIEW OF NRC RESPONSE

The NRC response described below was based on interviews of staff and managers from Region III, NRR, and the licensee involved in response to the LaSalle Unit 2 valve 2E22-F004 failure, and subsequent operability evaluations for the Unit 1 valve 1E22-F004. A list of the participants and their positions is included in Attachment 1.

1. CONSIDERATION OF VALVE OPERABILITY

The October 3, 2017 memorandum from the DEDR requested this review to "briefly document how the NRC and the licensee considered operability for other related valves at LaSalle after the failure of the Unit 2 valve. Document how perspectives were integrated (including both NRR and Region III) and how disagreements were resolved." This is described under Item 1.a below. The memorandum also requested the review to "consider lessons learned and any recommended actions to improve clarity of operability guidance (including level of assurance) for the NRC and licensees." This is described under Item 1.b below.

1. a. NRC and Licensee Operability Bases for Other Related Valves; Integration of Perspectives; Resolution of Disagreements

Consideration of Operability for Other Related Valves

Region III agreed with the licensee that, for all similar site valves, with the exception of Unit 1 HPCS injection valve 1E22-F004, the licensee had established a reasonable expectation of operability. This was based on the other similar valves being smaller, with lower actuator torque settings, such that there were no expectations that stem, collar, or wedge pin failures would have occurred.

[1] On November 20, 2017, IMC 0326, "Operability Determinations & Functionality Assessments for Conditions Adverse to Quality or Safety," was revised to clarify Appendix C, sections C.12 and C.13 with a focus on methodologies acceptable to the NRC when evaluating operational leakage and timing of relief requests, and to add a new section on heat exchanger tube leakage. Change Notice 17-026 (Nov. 20, 2017) (ML17324A837). Comparing the definition of "reasonable expectation" in section 03.09 of IMC 0326 dated Dec. 3, 2015 with the definition in section 03.14 of IMC 0326 dated Nov. 20, 2017 shows that the definition was not materially changed.

For the Unit 1 HPCS injection valve:

The licensee concluded that there was sufficient information to support a reasonable expectation of operability for valve 1E22-F004. The licensee based their operability decision on multiple factors in aggregate, including the younger age and resultant fewer lifetime open and closed operating cycles of the Unit 1 valve. The Unit 1 valve had been replaced in 1987, after pre-operational testing and approximately 4-5 years of normal operational testing and maintenance. The Unit 2 valve was the original valve and had experienced pre-operational testing cycles in addition to the normal operational testing and maintenance. The licensee concluded that the Unit 1 valve's comparatively fewer lifetime open and close cycles, as well as other factors, provided a reasonable expectation that the Unit 1 valve was operable and would remain operable through the remainder of the current operating cycle, which would end at the scheduled refueling outage in February, 2018. The licensee also committed in a June 2, 2017 letter addressing "Commitments for Resolution of Anchor Darling Double Disc Gate Valve Part 21 Issues" (ML17156A799), to replace the Part 21 applicable parts of the Unit 1 HPCS injection valve during the February, 2018 refueling outage, or earlier if Unit 1 were shut down for any reason prior to that refueling outage.[2] Key to this operability determination was the licensee's interpretation of the licensing basis of the HPCS injection valve. The licensee initially maintained the position that under accident conditions, the HPCS injection valve is only required to open once to allow high pressure injection to the reactor vessel. The licensee later updated its position in LER 50-374/ 2017-003-01 (ML17236A160); concluding that four cycles were required for operability.

Region III concluded that the licensee had failed to demonstrate a reasonable expectation of operability for valve 1E22-F004. This conclusion was based on the similarity of the Unit 1 and 2 valves (same design and manufacturer, similar operation and maintenance history), the unknown difference in the number of previous open and closed cycles the valves had experienced, as well as the uncertainty inherent in the manufacturing and installation of the two valves. Region III considered the relatively small difference in valve cycles in Unit 1 to be a minor consideration for continued operability. Region III determined the Unit 1 valve was highly likely to be degraded (wedge pin sheared, some degree of collar movement and stem/wedge thread damage), and based on the similarity to the Unit 2 valve and inability of diagnostic traces to predict impending failure, concluded a presumption of operability was no longer valid, and the licensee had failed to demonstrate a reasonable expectation of operability through its operability evaluation efforts. Region III considered the use of historic industry valve failure operating experience to be an inappropriate input for this operability determination, due largely to the uncertainty of applicability of the data because of emerging new information on the design inadequacies of these large Anchor-Darling valves. Also key to Region III's assessment of valve operability was their interpretation of LaSalle's licensing basis for the HPCS injection valve as requiring multiple (as many as 30) open and close cycles of the HPCS injection valve.

NRR concluded that there was not sufficient information to ascertain that there was a loss of reasonable expectation of operability for the Unit 1 HPCS injection valve. NRR considered

[2] In a June 20, 2017 letter, the licensee updated their commitment and on June 22, 2017, shut down LaSalle Unit 1 to replace the Unit 1 HPCS injection valve internals. Although subsequent analysis confirmed wedge pin failure and threaded connection degradation, the licensee concluded that the Unit 1 HPCS injection valve was operable at the time of shutdown.

historic, nation-wide operating experience in the nuclear industry, which showed a very low number of failures of this type of valve, as its primary reason for not supporting Region III's assessment of operability. NRR accepted the licensee's position that the favorably lower number of historic open and closed cycles of the Unit 1 valve compared to the number of cycles for the Unit 2 valve supported an expectation of operability of the Unit 1 valve.

Integration of Perspectives and Resolution of Disagreements

With respect to how perspectives were integrated and how disagreements were resolved between Region III and the licensee, Region III shared its concerns directly with the licensee during the course of the special inspection. In part due to new information, and in response to concerns articulated by the SIT, the licensee revised its operability evaluation several times. However, these revised evaluations were ultimately not sufficient to change Region III's conclusion that the licensee had not demonstrated a reasonable expectation of operability of valve 1E22-F004.

Efforts to resolve the differing perspectives between Region III and NRR were primarily conducted verbally, through periodic SIT debriefs and discussions on the status of NRR's application of its LIC-504, "Integrated Risk-Informed Decision-Making Process for Emergent Issues" process. NRR entered the LIC-504 process to assess the potential generic implications of identified Anchor/Darling valve degradation and recommend agency actions. However, these discussions were unsuccessful in achieving alignment between Region III and NRR on the operability assessment for valve 1E22-F004. Region III and NRR management discussed their respective views with the DEDR in June, 2017.

1. b. <u>Lessons Learned and Recommended Actions to Improve Clarity of Operability Guidance</u>

The LLT determined that three key pieces of information were considered differently by the licensee, Region III, and NRR, resulting in differing operability conclusions. These included: 1) licensee and Region III differences in the interpretation of the licensing basis of the HPCS injection valve, 2) licensee, Region III and NRR assessment of the significance of the difference in the number of historic cycles of the Unit 1 and Unit 2 HPCS injection valves, and 3) Region III and NRR view of the applicability of industry statistical valve failure rates as applicable operating experience.

The LLT offers the following recommendations to improve operability assessments and staff reviews of operability assessments:

<u>Recommendation 1a</u>. ***Add guidance in IMC 0326 on the appropriate use of operating experience and consider expanding the use of risk insights when assessing degraded equipment.***

Use of operating experience is allowed in an operability determination as described in IMC 0326 dated November 20, 2017 (e.g., section 3.11 "Nonconforming Condition" (providing the definition), section 4.01 "Review Activities" (describing activities during which potential degraded or nonconforming conditions of SSCs might be discovered), section 4.04 "Scope of Operability Determinations" (noting that the operability decision may be based on experience with operating events), Appendix B section B.04 "Reduced Reliability as a Degraded or Nonconforming

Condition" (stating that in service, reliability is based on operating experience), but detailed guidance or examples of how operating experience may be relevant to an operability determination is not provided. As described above, in the LaSalle case, Region III and NRR considered industry-wide statistical Anchor-Darling valve failure rates differently, contributing to delays on the operability assessment.

Appendix C, Section C.06 "Use of Probabilistic Risk Assessment in Operability Decisions" of IMC 0326 says "the use of PRA or probabilities of occurrence of accidents or external events is not consistent with the assumption that the event occurs, and is not acceptable for making operability decisions." Section C.06 notes that "PRA may provide valid and useful supporting information on the timeliness of a prompt operability decision and a corrective action." However, PRA in Section C.06 refers only to initiating event frequencies of external and internal events resulting in the design basis accident that would necessitate use of the specific system, structure or component (SSC) in question (in this case the HPCS injection valve). The LLT concluded that given the increased emphasis on the use of risk in all of our regulatory activities, it would be appropriate to consider the application of risk tools and insights to assess degraded SSCs when performing or assessing operability determinations. For example, risk insights may prove helpful in evaluating the level of assurance necessary to support continued expectation of operability for degraded SSCs.

Recommendation 1b. ***Add guidance in IMC 0326 for timely resolution of operability determination and licensing basis disagreements***

Per section 04.08 "Operator Awareness and Responsibilities" of IMC 0326, the operating shift crew is responsible for overall control of facility operation, and must be aware of the operability and functionality of plant SSCs and the status of degraded or nonconforming conditions that may affect plant operation. The licensee has the responsibility to ensure operability of its SSCs, and to comply with Technical Specifications when an SSC is determined to not be operable. Region III and NRR agreed that the primary oversight responsibility for the verification of adequacy of a licensee's operability determination lies with the Regional office; however, the ultimate decision maker was less clear. Region III had completed their analysis of the licensee's operability determination and concluded in early May, 2017, that the licensee had not established a reasonable expectation of operability, and therefore it should declare the Unit 1 HPCS valve to be inoperable and implement the appropriate Technical Specification actions. This was shared verbally with the licensee; the licensee disagreed, in part due to a difference in interpretation of the licensing basis, and continued attempting to justify its operability decision to Region III. Region III management delayed documenting its conclusions primarily due to NRR's disagreement with that conclusion, and NRR's stated lack of support of an order that would require the licensee to shutdown Unit 1. Consequently, the concern of a potentially inoperable HPCS system in Unit 1 was not fully addressed until the voluntary shutdown of Unit 1 to inspect and repair the valve on June 22, 2017. The SIT report, issued six months after the Unit 2 valve failure and six weeks after the Unit 1 shutdown, discussed the SIT efforts to assess Unit 1 HPCS valve operability, but did not definitively state a conclusion of that assessment. The team recommends consideration of the following guidance enhancements to facilitate timely agency decision making, provide guidance on how to resolve disagreements and to clarify authorities (i.e., final decision maker):

Recommendation 1bi. ***Revise IMC 0326 to add process guidance and timeliness goals for NRC action, including formal communication with the licensee, for response to disagreement with a licensee's operability determination, and interpretation of the licensing basis. The timeframe could be established consistent with existing Agency processes, such as guidance for granting Notice Of Enforcement Discretion and exigent or emergency license amendments.***

Recommendation 1bii. ***Revise IMC 0326 to reference Management Directive (MD) 9.29, "Organization and Functions, Regional Offices" and MD 9.27, "Organization and Functions, Office of Nuclear Reactor Regulation" for specific roles, responsibilities and authorities of the Regions and NRR with respect to the assessment of a licensee's operability determination and clearly identity the organization and positional decision-making authority.***

Recommendation 1biii. ***Revise IMC 0326 to reference COM-106, "Control of Task Interface Agreements" and MD 10.159, "NRC Differing Professional Opinion Program" as processes by which internal differences between regions and headquarters may be resolved.***

2. NRC COMMUNICATIONS (INTERNAL AND EXTERNAL)

The DEDR requested the development of a timeline of key internal communications and to "consider lessons learned and any recommended actions needed to improve communications and interactions consistent with our NRC Values and Principles of Good Regulation." The DEDR requested similar information related to communication with the licensee.

2. a. Time line of key events and internal and external communications

A timeline of key events, meetings, and communications is included in Table 1 of this report. This table was developed based on input from cognizant staff review of their calendars, meeting summaries, etc. Additional context for this timeline is provided below:

The Unit 2 HPCS injection valve failed on February 11, 2017. The Senior Resident Inspector (SRI) reviewed the condition report describing the failure, noted that the valve was not required to be operable at the time, and flagged the issue for later inspection. The licensee repaired the valve, completed the Unit 2 refueling outage, and restarted Unit 2 on March 9, 2017. In early April, Region III inspectors noted a potential past operability concern for the failed Unit 2 valve, and discussed their concerns with the SRI. The SRI discussed the concern with the licensee, and the licensee responded by submitting Licensee Event Report (LER) 2017-003-00 on April 12, 2017, for the valve failure. Note that during interviews the licensee stated that they did not agree that there was a past operability concern with the Unit 2 valve failure, but submitted the LER based on the SRI prompting, and with an understanding the LER could be retracted after further evaluation. Region III initiated a review of the valve failure in accordance with MD 8.3 which concluded that a SIT response was appropriate.

The SIT began its onsite inspection on April 24, 2017. During LLT interviews, licensee personnel shared that they did not understand the urgency for an SIT and had requested a delay in the inspection while they completed their valve failure analysis. Region III acknowledged the request, but stated it was important to begin the inspection as early as possible. Shortly after the inspection began, Region III determined that the team would benefit from the inclusion of an NRR valve expert, and NRR provided one. During the inspection, the team conducted periodic licensee debriefs, and daily team debriefs with Region III and NRR staff and managers to keep all involved stakeholders informed of the team's progress.

In early May, Region III management began regular conversations with the licensee to discuss the evolving results of the SIT inspection. These interactions were intended to maintain openness and transparency between the NRC and the licensee, including discussion of the full range of regulatory options the NRC was considering. During these interactions, Region III kept the licensee informed in real-time of its current assessment regarding the operability of the Unit 1 HPCS injection valve, and also informed the licensee of NRR's initiation of the LIC-504 process. The inspection continued through May and early June as the licensee obtained and provided new or revised information for its operability determination for the Unit 1 HPCS injection valve. Throughout this period, communications from Region III caused the licensee to believe that the NRC was repeatedly revisiting decisions concerning the need for a shutdown order, and concerning the need to execute LIC-504. Through interviews, the LLT learned that licensee management was not familiar with the LIC-504 process, and that following discussions with Region III, the licensee incorrectly equated entry into the LIC-504 process with a likely shutdown order outcome.

During the period of May through June, 2017, Region III and NRR conducted multiple phone calls, teleconferences, video calls, and face-to-face meetings to discuss the operability of the Unit 1 HPCS injection valve. As discussed in Section 1 above, Region III and NRR did not reach agreement on the assessment of operability of the valve, and NRR did not support an order to require the licensee to shutdown LaSalle Unit 1.

The extended duration of the inspection, combined with Region III's conclusion that the licensee, despite multiple attempts, failed to establish a reasonable expectation of operability, and the licensee's belief that the NRC was pursuing an order to shutdown LaSalle Unit 1, created a stressful and trying communications environment for both the licensee and the NRC.

On June 9, 2017, the SIT conducted an interim exit with the licensee with an apparent violation for the Unit 2 HPCS injection valve failure and an unresolved item pertaining to the operability of the Unit 1 HPCS injection valve.

On June 16, 2017, NRR and Region III senior management met with the DEDR to discuss their differing views regarding the LaSalle Unit 1 HPCS injection valve operability. The outcome of the meeting was direction from the DEDR to continue efforts on parallel paths: NRR would continue the LIC-504 generic issue review, Region III would continue efforts to support an order in case it was later determined to be appropriate, and DEDR would call the licensees' Chief Nuclear Officer to inform him of the Agency's continuing concerns and next steps.

On June 17, 2017, a licensee senior executive called the Director of NRR. The executive expressed frustration with not understanding the NRC regulatory position regarding operability of

the Unit 1 HPCS injection valve, as well as the licensees' priority of maintaining a positive perception of the licensee as a safe and conservative nuclear operator.

On June 19, 2017, the licensee informed Region III that it would shut down Unit 1 to inspect valve 1E22-F004 and repair it if it was degraded. On June 22, 2017, licensed operators performed a normal shutdown of LaSalle Unit 1. While shutdown, the licensee inspected valve 1E22-F004 and confirmed the degraded condition of the valve (wedge pin sheared and damage to stem and wedge threads). The licensee also concluded that the valve would have met its design function and had remained operable. The licensee repaired the valve and declared it operable prior to restarting Unit 1.

In late September, 2017, licensee executives discussed with the DEDR the NRC actions leading to the licensees' decision to shut down LaSalle Unit 1. During that conversation, the licensee executives expressed frustration with NRC communications with licensee staff and management over the last several months. From the licensees' point of view, the NRC had repeatedly changed its position regarding the operability of the Unit 1 HPCS injection valve, including pursuing (or not pursuing) a shutdown order. The nature of the communications left licensee executives unsure of the Agency's position and the basis for that position. The licensee executives opined that they believed the NRC used the possibility of a shutdown order as a means to convince the licensee to voluntarily shutdown LaSalle Unit 1.

2. b. Lessons Learned and Recommended Actions

The tasking memorandum requested consideration of lessons learned and any recommended actions to improve communications and interactions consistent with our Principles of Good Regulation and the NRC Organizational Values, as described in Attachment 2. The LLT reviewed both internal and external communications and, based on our observations, offers recommendations to enhance our communications consistent with our Principles and Values.

Internal Communications

With respect to interactions internal to the agency, discussions between Region III and NRR were generally professional and open. Both staff and managers shared that occasionally the discussions were stressful because of the strongly held views and continued misalignment between the two organizations. Based on our interviews, the LLT also noted some negative perceptions. Such perceptions may have been barriers to Region III and NRR reaching agreement on the operability of the Unit 1 valve, but we do not believe they were primary contributors. We include them in this report for completeness and awareness. One such perception was that NRC senior managers (Regional and Headquarters) may not have made a decision on the operability of the Unit 1 HPCS injection valve because the licensee was threatening to go to Congress. Based on its interviews with the licensee, Region III and NRR senior managers, the LLT found no evidence that the licensee pressured NRC mangers or that NRC managers succumbed to the alleged pressure. Another such perception was that the Region and NRR had "different safety culture values," implying that Regional personnel have a "stronger" safety culture than Headquarters personnel. A contrasting perception was that Regional personnel exceeded the reasonable expectation standard when pursuing this issue with a licensee. The LLT found no evidence of different safety culture values

among Region III or NRR staff and managers and also found that Region III was justified, based on the known facts, in its concerns with the licensee's operability determination.

In our view, the regulatory decision was significantly delayed primarily due to the continuing disagreement between Region III and NRR with respect to the acceptability of the licensees' operability evaluation. One contributing factor was that the application of two NRC guidance documents, IMC 0326 and LIC-504, led Region III and NRR to different answers. In its application of IMC 0326, Region III concluded that the Unit 1 HPCS injection valve was inoperable. Thus the licensee should follow its Technical Specifications which in turn should have resulted in a shutdown of Unit 1 to inspect the HPCS injection valve. In contrast, in its application of LIC-504, NRR concluded that the risk was low enough that a shutdown order was not necessary. The two different "answers" added to the confusion and contributed to the delay. A second contributing factor was lack of clarity with respect to which of the two organizations was the ultimate decision maker. NRR management repeatedly stressed in the LLT interviews that Region III had the lead for the review of the LaSalle operability evaluations. However, NRR did not agree with the Region III assessment. Both Region III and NRR managers told the LLT that they were frustrated by their inability to achieve a common position on the operability of the Unit 1 valve and the appropriate regulatory response.

Based on its review as documented herein, as well as careful consideration of the value the agency places on diversity of views and the expression of differing views and positions, which can impact decision-making, the LLT concluded that the NRC staff and managers who worked on this complex technical and regulatory issue adhered to the NRC's Principles of Good Regulation and the NRC's Organizational Values. However, the team found that the decision makers, that is the Region III and NRR executives who oversaw and led the staff's response to this issue, could have been more proactive, collaborative and timely in deciding which organization was the ultimate decision maker for assessing and determining the operability of the LaSalle Unit 1 HPCS injection valve, and deciding the appropriate regulatory response associated with that decision. Ultimately, any NRC decisions were rendered moot by the licensee's decision to voluntarily shut down LaSalle Unit 1 to inspect the HPCS injection valve. Consistent with our Principles and Values, it would be appropriate to address the organizational issues to enhance the processes that stymied timely decision-making in this case. Recommendations 1a and 1b discussed earlier in this report will address these contributing factors and enhance our application of the Principles of Good Regulation, in particular efficiency and reliability, as well as Organizational Values, in particular excellence and service.

External Communications

With respect to external communications, the licensee shared a number of negative perceptions regarding interactions with the agency. They felt the SI charter was too broad and did not clearly state the purpose of the inspection. They did not understand why an SI was initiated two months after the event, after the condition had been corrected and the facility was operating at full power. The licensee expressed the view that the SIT lacked the necessary expertise. The SIT used an NRR valve subject matter expert; however, the expert joined the team after the SIT was initiated, and the licensee did not agree that the NRR valve expert had the necessary level of knowledge. The licensee shared that there were instances where they felt the SIT communications with them were not professional. The licensee felt there was a lack of clear criteria that needed to be

satisfied for the SIT to agree with the operability evaluation, and believed that they were being held to an absolute assurance standard instead of the reasonable expectation standard articulated in IMC 0326. The LIC-504 process and criteria for and likelihood of an NRC order were misunderstood or unknown by the licensee. Most significantly, the licensees' managers indicated during interviews with the LLT that they believed Region III had a pre-determined outcome of Unit 1 valve inoperability, and that the Region had used the possibility of a shutdown order to persuade the licensee to voluntarily shutdown LaSalle Unit 1.

Region III had its share of negative perceptions regarding interactions with the licensee. There was a belief that the licensee was slow to identify and react to the safety significance of the initiating event. Region III felt they had to "prompt" the licensee to issue the LER and to conduct the initial operability evaluation. Region III believed they gave the licensee multiple opportunities to update and enhance their operability determination, with the sincere desire to achieve common understanding and agreement. Finally, Region III stated that they shared with the licensee that a shutdown order was under consideration in response to the licensee's specific request for this information and with the intent of being open and transparent about the regulatory options under consideration.

The LLT commends both the licensee and Region III for sharing in such a candid manner these differing perceptions. We recognized the very challenging environment in which both parties were operating and found that both parties were working with a full commitment to public health and safety. In such a challenging environment, communications take on a greater importance. To that end, and consistent with the Principles of Good Regulation and the NRC Organizational Values, the following recommendations are offered for consideration to further improve external communications.

> *Recommendation 2a*: Add communication and expected internal coordination protocols to IMC 0326 and LIC-504. Common messaging to a licensee of NRC concerns and the regulatory options under consideration (including criteria for each option) will enhance particularly "openness" and "clarity" of communications.
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> *Recommendation 2b*: Conduct training for regional staff and managers as well as licensee regulatory assurance managers on the objectives, entry criteria, and potential outcomes of LIC-504. Licensee training could be conducted during periodic regional utility group meetings. A better understanding of the LIC-504 process will improve "clarity" of communications.
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> *Recommendation 2c:* When faced with high-visibility, high-priority and potentially challenging interactions with a licensee, establish "touch points" between NRC and licensee managers to ensure timely, candid feedback is openly acknowledged, discussed, and acted upon, consistent with our values of "excellence" and "service." Consider adding this communication guidance to IMC 0612, and those inspection procedures associated with inspections that typically garner the highest public interest, such as supplemental procedures IP 9500x, and special inspection IP 93812 and augmented inspection IP 93800.

Table 1: Timeline of Key Events, Meetings and Communications

Date	Event / Meeting / Communication
2/11/2017	LaSalle Unit 2 High Pressure Core Spray (HPCS) injection valve fails during outage testing
4/12/2017	Licensee submits LER 50-374/2017-003-00, "High Pressure Core Spray System Inoperable due to Injection Valve Stem-Disc Separation"
4/14/2017	NRC completes evaluation under Management Directive 8.3 "NRC Incident Investigation Program" and concludes Special Inspection (SI) is appropriate
4/21/2017	Region III finalizes LaSalle SI charter and informs the licensee
4/24/2017	• SI begins at LaSalle • SI team (SIT) begins daily debriefs for Region III and licensee management (continues through 5/12/17)
4/25/2017	SIT engagement prompts licensee to initiate formal operability evaluation
4/26/2017	Region III issues press release announcing the start of the SI
4/28/2017	Licensee contractor, Kalsi Engineering, completes Unit 2 HPCS injection valve diagnostic traces analysis concluding previous testing could not have identified the impending Unit 2 HPCS injection valve failure
5/1/2017	Licensee completes initial operability evaluation (Revision 0) of other similar Anchor-Darling valves for both units and concludes all are operable
5/3/2017	First LIC-504 meeting to discuss entry conditions - Office of Nuclear Reactor Regulation (NRR), Division of Engineering (DE) considers need to enter LIC-504, "Integrated Risk-Informed Decision-Making Process for Emergent Issues" process
5/4/2017	• SIT completes review of initial operability evaluation and agrees with all determinations except Unit 1 HPCS injection valve, (the SIT had outstanding questions for 3 other valves, which were answered and considered resolved by the SIT) and discusses operability determination issues with Regional and licensee management • Regional management informs licensee of the potential initiation of the LIC-504 process, including consideration of an order
5/9/2017	• Kalsi Engineering completes an analysis of the Unit 1 HPCS injection valve diagnostic trace abnormalities and concludes they are different than the Unit 2 HPCS injection valve trace abnormalities • SIT does not agree that the diagnostic traces can be relied upon to detect valve degradation
5/10/2017	• Licensee revises the operability evaluation (Revision 1) to include the Unit 1 HPCS injection valve history and updated vendor analysis; valve still considered operable

Date	Event / Meeting / Communication
5/11/2017	• NRR/DE formally initiates LIC-504 process to track the generic issue related to the Part 21 reports submitted by Tennessee Valley Authority and Flowserve • Regional management informs licensee that the NRC has entered the LIC-504 process
5/12/2017	• SIT reviews Revision 1 to the licensee's operability evaluation and continues to conclude that the determination lacks reasonable expectation of operability for the Unit 1 HPCS valve • SIT discusses issues with Regional and licensee management • SIT scope is essentially complete, the only outstanding issue is operability of Unit 1 HPCS injection valve
5/15/2017	Regional management and NRR are not aligned on the operability determination; NRR recommends understanding the generic issue and how it would apply to LaSalle specifically
5/17/2017	• Regional management travels to the site to discuss concerns with Site Vice President and Plant Manager. • Regional management indicates order "off the table" while new, relevant valve information is evaluated
5/21/2017	Licensee revises the operability evaluation (Revision 2) to include operating experience by Duke and wedge pin analysis performed by Kalsi Engineering; valve still considered operable
5/23/2017	SIT reviews Revision 2 to the licensee's operability evaluation and continues to conclude that the determination lacks reasonable expectation of operability for the Unit 1 HPCS valve
5/25/2017	SIT briefs Region III senior management. Region III concludes that if the licensee could show "positive margin" with respect to the wedge pin analysis, that would demonstrate reasonable expectation of operability
5/26/2017	Licensee's evaluation shows positive margin. Region III management communicates with licensee to indicate an order is no longer being considered and requests licensee commitment letter
5/30/2017	Licensee vendor (MPR) completes the Unit 2 HPCS injection valve failure analysis; confirms the wedge pin collar design flaw; concludes the Unit 1 HPCS injection valve is susceptible to this failure
6/1/2017	• SIT postpones SI exit (initially scheduled for June 1) to consider failure analysis report • NRC meets to continue LIC-504 discussion, including new developments; Region III shares that SIT lacks sufficient evidence to conclude inoperability of the injection valve and thus no longer considering an order

Date	Event / Meeting / Communication
6/2/2017	• Exelon submits letter to Region III committing to additional defense-in-depth actions for the Unit 1 HPCS injection valve • Licensee for Columbia shares new information related to HPCS injection valve • Region III management discusses Columbia issue with Exelon and communicates renewed concerns related to the operability of the LaSalle Unit 1 HPCS injection valve
6/5/2017	SIT refines its recommendations regarding the operability determination for the Unit 1 HPCS injection valve concluding licensee has not demonstrated reasonable expectation of operability
6/7/2017	• SIT onsite, including Regional Branch Chief, to discuss SIT assessment of the MPR failure analysis report with licensee • Region III management continues to convey concerns to the licensee and that an order may be appropriate
6/8/2017	• Licensee revises the operability evaluation (Revision 3) to include the Columbia operating experience and the MPR failure analysis report; licensee continues to conclude the Unit 1 HPCS injection valve is operable • LIC-504 meeting to discuss recent Columbia operating experience • During routine licensee quarterly “drop-in” with Region III management, Region III management convey continued concerns with the licensee’s operability determination
6/9/2017	SIT conducts interim exit with the licensee with an apparent violation for the Unit 2 HPCS injection valve failure and an unresolved item pertaining to the operability of the Unit 1 HPCS injection valve
6/12/2017	SIT debriefs Region III Regional Administrator
6/13/2017	Region III management recommends to NRR management issuance of an order to licensee; NRR not in agreement
6/14/2017	NRC meeting to continue discussion of LIC-504 process to address generic implications arising from LaSalle SI
6/16/2017	• NRR and Regional senior management meet with Deputy Executive Director for Reactor and Preparedness Programs (DEDR) to discuss differing views • DEDR directs multiple parallel paths: DEDR to call Exelon’s Chief Nuclear Officer, NRR to continue the LIC-504 generic issue process, and Region III to draft an order
6/17/2017	Exelon Senior Executive calls NRR Office Director; expresses frustration with not understanding the NRC regulatory position regarding operability of the Unit 1 HPCS injection valve but also expressed Exelon’s priority of maintaining a positive perception by the NRC and the public of Exelon as a safe and conservative nuclear operator

Date	Event / Meeting / Communication
6/19/2017	Exelon executive contacts Region III management to inform them of their plan to shut down LaSalle Unit 1 on 6/22/2017 to replace Unit 1 HPCS injection valve internals
6/20/2017	Exelon sends letter to Region III notifying its intent to shutdown Unit 1 on June 22, 2017
6/22/2017	Licensee shuts down LaSalle Unit 1; sends replaced injection valve to external lab for evaluation; lab confirms wedge pin failure and threaded connection degradation; licensee concludes the Unit 1 HPCS injection valve was operable at the time of shutdown
7/21/2017	SIT formally exits with the licensee
8/14/2017	NRR issues recommendation regarding agency action to address Anchor-Darling valve degradation issues in accordance with LIC-504
8/31/2017	NRC issues SIT report

Attachment 1: List of Interview Participants

Region 3

Office	***Name***	***Title***
DRS	Benjamin, Jamie	Senior Inspection Team Leader
DRS	Dunlop, Andrew	Senior Inspector
DFS	Heck, Jared	Legal Counsel
DRS	Jeffers, Mark	Branch Chief
DRP	Kozak, Laura	Branch Chief
DRP	Lara, Julio	Deputy Division Director, Reactor Projects
DRP	Louden, Patrick	Division Director, Reactor Projects
RIII	O'Brien, Ken	Division Director, Reactor Safety
RIII	Pederson, Cindy	Regional Administrator
DRP	Phillips, Charles	Project Engineer
RIII	Roberts, Darrell	Deputy Regional Administrator
DRS	Rodriguez, Reinaldo "Lionel"	Resident Inspector
DRP	Ruiz, Robert	Senior Resident Inspector
DRS	Shuabi, Mohammed	Deputy Director, Reactor Safety
EICS	Skokowski, Richard	Enforcement Officer
DRS	Stoedter, Karla	Branch Chief

Headquarters

Office	**Name**	**Title**
OEDO	Johnson, Mike	Deputy Executive Director for Reactor and Preparedness Programs

Office	Name	Title
NRR	Alley, Dave	Branch Chief
NRR	Benney, Brian	Senior Project Manager
NRR	Chernoff, Harold	Branch Chief
NRR	Circle, Jeff	Senior Reliability and Risk Analyst
RES	Coyne, Kevin	Branch Chief
NRR	Dean, Bill	Office Director (retired)
NRR	Farnan, Mike	Mechanical Engineer
NRR	Garmoe, Alex	Senior Project Manager
NRR	Gavrilas, Mirela	Division Director, Safety Systems
NRR	Giitter, Joe	Division Director, Risk Assessment
NRR	Helton, Shana	Deputy Director, Division of Engineering
NRR	Hickey, Jim	Senior Tech Advisor
NRR	Holian, Brian	Acting Director of Nuclear Reactor Regulation
NRR	King, Mike	Deputy Director, Inspection and Regional Support
NRR	Lubinski, John	Deputy Office Director, Nuclear Security and Incident Response
NRR	Martinez, Nancy	Physical Scientist
NRR	Miller, Chris	Division Director, Inspection and Regional Support
NRR	McDermott, Brian	Acting Office Director, Nuclear Security and Incident Response
NRR	Stuchell, Sheldon	Branch Chief
NRR	Thompson, John	Senior Reactor Engineer
NRR	Tilton, Caroline	Reactor Systems Engineer
NRR	Vaidya, Bhalchandra	Project Manager
NRR	Weerakkody, Sunil	Branch Chief

NRR	Wilkins, Lynnea	Project Manager
NRR	Wrona, David	Branch Chief

Licensee

Name	Title
Enright, Daniel	Senior Vice President, Midwest Operations
Fewell, Brad	Senior Vice President of Regulatory Affairs
Ford, Guy	Regulatory Assurance Manager
Gullott, Dave	Licensing Manager
Kaegi, Glen	Director, Licensing
Trafton, Bill	Site Vice President
Vinyard, Harold	Plant Manager

Attachment 2: Principles of Good Regulation and NRC Organizational Values

Principles of Good Regulation

As a responsible regulator with a very important safety and security mission, our values guide us in maintaining certain principles in the way we carry out our regulatory activities. These principles focus us on ensuring safety and security while appropriately balancing the interests of the NRC's stakeholders, including the public and licensees. The following table briefly describes these principles.

Independence:	Nothing but the highest possible standards of ethical performance and professionalism should influence regulation. However, independence does not imply isolation. All available facts and opinions must be sought openly from licensees and other interested members of the public. The many and possibly conflicting public interests involved must be considered. Final decisions must be based on objective, unbiased assessments of all information, and must be documented with reasons explicitly stated.
Openness:	Nuclear regulation is the public's business, and it must be transacted publicly and candidly. The public must be informed about and have the opportunity to participate in the regulatory processes as required by law. Open channels of communication must be maintained with Congress, other government agencies, licensees, and the public, as well as with the international nuclear community.
Efficiency:	The American taxpayer, the rate-paying consumer, and licensees are all entitled to the best possible management and administration of regulatory activities. The highest technical and managerial competence is required, and must be a constant agency goal. NRC must establish means to evaluate and continually upgrade its regulatory capabilities. Regulatory activities should be consistent with the degree of risk reduction they achieve. Where several effective alternatives are available, the option which minimizes the use of resources should be adopted. Regulatory decisions should be made without undue delay.
Clarity:	Regulations should be coherent, logical, and practical. There should be a clear nexus between regulations and agency goals and objectives whether explicitly or implicitly stated. Agency positions should be readily understood and easily applied.
Reliability:	Regulations should be based on the best available knowledge from research and operational experience. Systems interactions, technological uncertainties, and the diversity of licensees and regulatory activities must all be taken into account so that risks are maintained at an acceptably low level. Once established, regulation should be perceived to be reliable and not unjustifiably in a state of transition. Regulatory actions should always be fully consistent with written regulations and should be promptly, fairly, and

	decisively administered so as to lend stability to the nuclear operational and planning processes.

NRC Organizational Values

In conducting all our work, we at the NRC adhere to the following organizational values. These values guide every action we take — from decisions on safety, security, and environmental issues; to how we perform administrative tasks; to how we interact with our fellow employees and other stakeholders.

Integrity

…in our working relationships, practices and decisions
…trustworthy, reliable, ethical, unbiased

Service

…to the public, and others who are affected by our work
…responsive, accountable, proactive

Openness

…in communications and decision-making
…transparent, forthright

Commitment

…to public health and safety, security and the environment
…dedicated, diligent, vigilant

Cooperation

…in the planning, management, and performance of agency work
…helpful, sharing, team-oriented, engaged

Excellence

…in our individual and collective actions
…high quality, continuously improving, self-aware

Respect

…for individuals' diversity, roles, beliefs, viewpoints, and work-life balance
…professional, courteous, objective, compassionate