



UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION III
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September 27, 2013

MEMORANDUM TO: Eric J. Leeds, Director
Office of Nuclear Reactor Regulation

Victor McCree, Regional Administrator
Region II

FROM: Richard A. Skokowski, Chief /RA/
Plant Support Branch, Region III
Browns Ferry 95003 Inspection Assistant Team Leader

SUBJECT: INSPECTION PROCEDURE 95003: EVALUATION OF NRC
ASSESSMENT AND INSPECTION PROCESSES AT
BROWNS FERRY UNIT 1

On August 22, 2013, the NRC issued Supplemental 95003 Inspection Report 5000259/2013011, 05000260/2013011, and 05000296/2013011. This inspection report documented the results of the supplemental inspection completed at Browns Ferry Nuclear Plant (BFN), Units 1, 2, and 3, and was completed in accordance with Inspection Procedure (IP) 95003, "Supplemental Inspection for Repetitive Degraded Cornerstones, Multiple Degraded Cornerstones, Multiple Yellow Inputs, or One Red Input." As prescribed in Sections 02.11 and 03.11 of IP 95003, the enclosed evaluation was conducted to determine whether the NRC assessment and inspection processes appropriately characterized licensee performance based on previous information and whether sufficient warning was provided to identify a significant reduction in safety. This evaluation included an assessment of the approach and methodology used in completing the 95003 inspection at BFN. Insights from the 95003 team members, as well as from various members of the Agency involved with Browns Ferry over the last several years, was sought out for input into this evaluation.

In summary, the evaluation determined that: (1) based on a review of previous information, the Agency appropriately characterized Brown Ferry's performance; (2) the Agency was provided sufficient warning to identify a significant reduction in safety; and (3) the methodology and approach used in completing the Browns Ferry 95003 was thorough and efficient.

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This evaluation also contains additional insights related to the NRC inspection and assessment process gained during the course of completing the IP 95003 supplemental inspection at BFN. In addition, the enclosed document contains the evaluation including a timeline of significant events and recommendations and suggestions resulting from the evaluation. As appropriate, the recommendations will be submitted to the Office of Nuclear Reactor Regulations via feedback process.

Please contact Rick Skokowski at (630)-829-9757 should you have any questions regarding this evaluation.

Enclosure:

As stated

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Evaluation Purpose

This evaluation was conducted in conjunction with the Browns Ferry Nuclear Plant (BFN) Inspection Procedure (IP) 95003 supplemental inspection. The purpose was to determine whether the NRC inspection and assessment processes appropriately characterized licensee performance based on previous inspection information and performance indicators, and whether sufficient warning was provided to identify a significant reduction in safety. This evaluation included an assessment of the approach and methodology used in completing the IP 95003 supplemental inspection. Also included in this evaluation are additional insights related to the NRC inspection and assessment process gained during the course of completing the IP 95003 supplemental inspection at BFN.

Summary of Results

In summary, the evaluation determined that: (1) based on a review of previous information the NRC appropriately characterized Brown Ferry's performance; (2) the NRC was provided sufficient warning to identify a significant reduction in safety; and (3) the methodology and approach used in completing the BFN IP 95003 supplemental inspection was thorough and efficient.

Background

On October 23, 2010, in support of the BFN Unit 1 refueling outage U1R8, operators started the "B" residual heat removal (RHR) pump to provide shutdown cooling to the reactor. After 110 seconds of observing no flow to the reactor, the operators stopped the pump and promptly placed the redundant RHR pump in service to provide shutdown cooling. The Tennessee Valley Authority (TVA), the licensee for BFN, subsequently found that the disc in the Unit 1 outboard low pressure coolant injection (LPCI) Valve, 1-FCV-74-66, had separated from the stem/disc skirt assembly and lodged in the valve seat preventing flow to the reactor from the "B" RHR train.

The NRC concluded that the finding was of high safety significance (RED) because the failure to maintain adequate design and perform adequate maintenance on LPCI Valve 1-FCV-74-66 led to the RHR loop II being unable to fulfill its intended safety function. In addition to the detailed risk evaluation performed by the NRC, as prescribed in NRC Inspection Manual Chapter (IMC) 0609, "Significance Determination Process," the NRC performed risk sensitivity evaluations that took into account potential operator actions to use alternate core cooling injection sources following the LPCI Valve 1-FCV-74-66 failure to pass system flow. In particular, the NRC recognized that alternative sources of core cooling flow paths may be available even with the failure of LPCI Valve 1-FCV-74-66; however, because of the fire mitigation strategy implemented at BFN, there were certain fire scenario that relied on the use of only one available train of RHR as the sole capable core cooling injection source. The results of these risk sensitivity evaluations supported that the finding was appropriately characterized as RED. Moreover, based on the fire mitigation strategy utilized at BFN that relies on the use of one available train of RHR as the sole capable injection source during certain fires scenarios, deficiencies such as this valve failure will continue to have high risk impact until the licensee's approach to these events is modified. BFN has initiated actions to address the fire mitigation issues with their submittal to utilize the approach described in the National Fire Protection Association Code 805, "Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants."

Evaluation Methodology

In order to understand the aspects of BFN's performance a historical review of major regulatory and performance events was necessary. A timeline of these events was developed and is provided as Attachment 1 to this evaluation. This assessment is based on review of BFN inspection documentation and program bases documentation, and interviews with several members of the NRC involved with BFN leading up to and following the time that BFN Unit 1 transitioned to Column 4 of the NRC Action Matrix. Additionally, throughout the performance of the BFN IP 95003 supplemental Inspections, the team noted best practices and lessons learned regarding the methodology and approach used to complete the inspections.

Detail Assessment

1. Did the NRC assessment and inspection processes appropriately characterize licensee performance based on available information?

Based on a review of inspection reports, exit meeting notes, available Plant Performance Summaries (PPSs), and discussions with several NRC inspectors and managers associated with BFN, the characterization of the licensee's performance was consistent with that observed by the 95003 inspection team. At no time was the operation of the BFN Station unsafe, contributing to this assurance was the robust plant design, normally good operator performance in response to events, and layers of equipment redundancy. However, long-standing, low safety level, widespread human performance and Corrective Action Program (CAP) problems have and continued to adversely affect station performance.

The significance determination completed to assess the Red finding utilized the Fire Protection Appendix of IMC 0609, "Significance Determination Process," and accurately characterized the significance of the Finding associated with the LPCI valve failure. The major factor in the appropriate characterization of the significance of the finding was the NRC's review of external event and fires in conjunction with an awareness of BFN reliance on a single train and single pieces of equipment for certain fire scenarios. This approach, in combination with prior fire risk evaluation efforts completed by inspectors for issues at BFN, provided the NRC the technical insights that allowed the NRC to recognize the appropriate safety significance of the LPCI valve failure.

Although BFN's fire protection scheme was accepted as part of its licensing bases, there was additional risk incurred with respect to defense in depth. This additional risk would incur also at other plants that rely on single trains or single pieces of equipment to mitigate significant fires or other significant external events. Although the reactor oversight process (ROP) prompts developing inspection insights and assessing findings with respect to fires and external events, the probabilistic risk analysis for fires and other external events tend to lack sufficient detail to readily identify these components with increased risk and to allow the NRC to complete the Significance Determination Process (SDP) as they did for Browns Ferry.

Recommendation

Review fire and other external events for components, systems, and operator actions with increased risk worth's resulting from mitigation strategies with single point vulnerabilities similar to that found at BFN. Assess the reviews from a probabilistic perspective so the information can be used in the SDP and inspection efforts.

2. Did the NCR's inspection and assessment activities provide sufficient warning to identify a significant reduction in safety?

Based on a review of inspection reports, exit meeting notes and available Plant Performance Summaries, and discussions with several NRC inspectors and managers associated with BFN, there was sufficient warning documented and discussed with the licensee that identified a potential for a significant reduction in safety to occur. Moreover, prior to the identification of the RED Finding, a concerted effort was made by the cognizant Region II DRP Branch to document, in accordance with the NRC's process, the repetitive nature of the long-standing, low level safety, widespread human performance and CAP issues.

The review of the middle-of-cycle and end-of-cycle PSSs that were available for the last five years were reviewed and it was determined that the information provided accurately reflected the longstanding equipment problems, as well as the human performance and CAP issues. In addition, the PSSs also captured that INPO had similar views regarding BFN's performance. Moreover, the information provided in the PSSs was used to drive the inspection focus within the boundaries of the inspection program. For example, based on the insights contained in the PSSs, five PI&R inspections were completed in a 6-year period.

Obtaining historical PSSs was difficult as only half of the PPSs since 2007 were available. Although NRR has stored the most recent years PPSs on their SharePoint site, there is no procedural requirement to save copies of the PPSs as NRC records.

Once BFN Unit 1 reached Column 4, Region II monitored station operations for the continued ability to safely operate as documented in the May 9, 2012, White Paper regarding the Browns Ferry Regulatory Decision Bases. This White Paper also established reasonable thresholds for what the Region would have considered degradation leading to unsafe operations.

Regarding, the repetitive nature of the long-standing, low level safety, widespread human performance and CAP issues, the NRC was documenting and communicating concerns regarding station performance in accordance with the ROP. Possible enhancements for the inspection and assessment process were identified in the course of completing this evaluation and these enhancements are provided in Section 4.1.1.

Recommendation

Revise IMC 0305, "Operating Reactor Assessment Program," to require saving the PSSs as NRC Records.

3. Lessons learned and best practices gained during the completion of the BFN IP 95003 supplemental inspection

3.1 Lessons Learned

3.1.1 Network Access

The computer issues associated with network connections were significant despite the efforts to foresee and address the problems. The team received very good support from both Region II and Headquarters Information Technology (IT) staff in getting the

necessary equipment. However, despite the team's request to have the computers wireless WIFI accessible, IT was steadfast in only issuing air cards. The team was concerned, based on the known poor cell phone capabilities at the site, that the air cards would not provide acceptable access for the 23-person team. The networking of the team members was something the team relied upon heavily during the preparation for the inspection with a significant amount of information on the team SharePoint site. Furthermore, there was an anticipated need to share a great deal of electronic information between team members.

With the team's arrival to the site, it was determined that the air cards were incapable of connecting to the NRC network. Numerous hours by the team leader and administrative assistant were spent in attempts to make the air cards functional. Efforts included several hours communicating with the NRC IT staff, making configuration changes, installing signal boosters, and the licensee even coordinated with the wireless provider to obtain a portable local cell tower. The solution was to finally configure the computers to allow wireless WIFI access.

Recommendation

Since most of the power plants are located in areas where cell access is poor at best, activate the wireless WIFI function in all issued laptops with the necessary "work from anywhere" application, and provide the associated training to the users. The use of the air cards should be considered as backup method.

3.1.2 Qualified Safety Culture Assessors

Due to the very limited number of qualified safety culture assessors (SCAs) in the NRC, it was difficult to obtain the desired number of assessors for the team. As a result, most of the assessors selected to be on the team were still in the qualification process, and most of them have very little site experience. Nonetheless, the exceptional effort provided by the team of assessors and the guidance provided by the SCA leads and senior support allowed this aspect of the inspection to be a success despite the need for additional qualified SCAs in the NRC.

Recommendation

Increase the number of qualified individuals as safety culture assessors; consider adding a position in each region as a designated safety culture lead. Although there is a current effort in the regions to encourage individuals to qualify as safety culture assessors, it is on a voluntary basis.

3.2 Best Practices

3.2.1 Inspection Preparation

Due to the extremely large volume of information for the inspection team to review and the significant degree of overlap in the areas to be inspected, a great deal of emphasis was placed on inspection preparation. This included a week of just-in-time training that provided the NRC's perspective of the licensee and the history of issues to be inspected, and the expectations of how the team should interact to ensure an effective and thorough inspection. In addition, due to the large number of root cause analyses to be reviewed, the team was provided root cause refresher training with a focus on the

Brown's Ferry process. The preparation also included an onsite orientation week, during which the licensee explained their recovery process, and their perspectives of the significant issues related to the inspection. During the site orientation badging and site tours were completed as well as establishing the point of contact for each inspection area. A timeline of the preparation and inspection activities is provided as Attachment 2 to this evaluation.

3.2.2 Emphasis on Observations of In-Plant Activities

Based on the licensee's history of being able to develop processes that were on par with the rest of the industry, but having difficulties implementing these processes and sustaining improvement, the team focused observations on in-plant activities. To allow this to happen, the team completed a majority of the document reviews during the preparation weeks. Also, all observations, whether positive, negative or neutral, were collected and tracked in a database to allow the development of trends. In addition, due to the concerns regarding safety culture, coordination between the technical inspectors and the safety culture assessors was vital to the success of the inspection, so, the two groups worked together in the field and during interviews as well as in the team discussion to ensure both the technical aspects and the safety culture aspects were captured.

3.2.3 Licensee's Readiness for Inspection

During the licensee's preparation for the IP 95003 supplemental inspection Region II made a significant effort to communicate with the licensee regarding the upcoming inspection. A great deal of emphasis was placed on ensuring that, prior to the NRC sending the inspection team to the site, the NRC had a reasonable level of confidence that the licensee's actions were implemented and showing signs of substantial and sustained improvement. This emphasis resulted in the licensee monitoring their performance in the areas identified by their diagnostic review and having trending information indicating improvement. In addition to using the licensee's metrics as an indication of improved performance, Region II completed two portions of the IP 95003 supplemental inspection shortly after BFN Unit 1 was placed in Column 4. The purpose of these inspections was to provide the NRC with a "snapshot" of licensee's performance and a means to assess BFN improvement over time. Moreover, similar expectations were included in the development of the Confirmatory Action Letter for the items the 95003 inspection team identified that would require addition effort by the licensee before the NRC would consider assessing the move out of Column 4.

Recommendation

Include the best practices as guidance in the Inspection Procedures 95003 and 95002.

4. Additional Insights

4.1 Missed opportunity to identify the issue associated with the Red Finding

Based on the technical analysis completed by the licensee as part of their root cause evaluation for the RED Finding, it was determined that the disc/stem separation of the LPCI valve occurred prior to November 2008. In November 2008, during a refueling outage, the licensee was unable to adequately vent the LPCI line associated with the RED Finding. The need to vent this and other similar systems was required by the

BNF Technical Specifications. The importance of venting these types of systems was described in Generic Letter 08-01, "Managing Gas Accumulation in Emergency Core Cooling [ECCS], Decay Heat Removal, and Containment Spray Systems." Specifically, the purpose of venting was to ensure that the ECCS was filled and vented so that system starts do not lead to piping and support damage in the event of a water hammer. The licensee's attempts to troubleshoot the failure to vent in this case were unsuccessful. Also, during the same refueling outage, the licensee had identified blockage in a similar vent line that their troubleshooting was unsuccessful in clearing. Based on this, and, in conjunction with the station's experience with several past vent line issues, the licensee assumed that this vent line was plugged. The licensee made the decision to use an alternative testing method to verify that the lines were filled. The results of this alternate test indicated that the line was filled, and the licensee allowed plant restart without further investigation. The inspectors assessed the licensee's decision at that time and found no issues with it.

Although the purpose of the venting was to verify that the system was water filled, the failure to vent could have also been an indication that the valve disc was stuck in the seat. This potential cause of the failure to vent was not recognized by several management layers in the licensee's organization, including the Plant Operations Review Committee (PORC) pre-startup review. Moreover, even though the inspectors looked into the venting problem with the LPCI valve and discussed the issue with their Branch management, they too focused on the importance of verifying that the lines were water filled and the acceptability of the alternative method of testing used. This focus was based on the known safety concerns and an acceptance of the assumption that the vent line was plugged, similar to the prior cases, without adequately challenging what other conditions could provide similar indications. Although disc stem separation is uncommon, the NRC could have demonstrated a more thorough questioning attitude to ensure the aspects were understood for the non-conforming condition associated with a significant piece of safety-related equipment.

Recommendation

Have Region II perform an in-ward looking assessment of this issue, and then provide training to the inspection staff NRC-wide, possible at an inspector counterpart meeting. The training should emphasize the importance of a thorough and challenging questioning attitude and the importance of trust but verify philosophy. Utilize this example, as well as the Davis-Besse reactor head example, and possibly the Columbia shuttle event, as illustrations of a thorough and challenging attitude especially with respect to understanding the causes and impacts of indications associated with risk-significant equipment.

Revise IP 71111.15 "Operability Determinations and Functionality Assessments," to include guidance with respect to understanding the causes and impacts of indications associated with risk-significant equipment, using this example to convey the concept.

4.2 Inspection and Assessment Program Enhancements

Throughout the performance of the IP 95003 supplemental inspection at BFN and this evaluation several possible enhancements for the inspection and assessment programs were identified. These enhancements focus on using the insights gained from our existing programs and processes to aid the NRC in making better informed decisions and make additional options available to the Agency for creating substantial and sustained improvement in licensee's performance before they reach Column 4 of the NRC action matrix. It is recognized that the recommendations provided would need to be assessed with respect to the NRC policies and statutes, as well as coordination with other stakeholders, to ensure that these recommendations are consistent with the Agency's underlining authority.

4.2.1 The use of the cross-cutting issues in creating substantial and sustained improvement in licensee's performance

Based on the review of inspection findings and associated cross-cutting aspect assignments, along with the substantive cross-cutting issues as communicated in the middle-of-cycle and end-of-cycle letters, the NRC used the process in accordance with the program. Moreover, the NRC's actions taken in response to longstanding substantive cross-cutting issues (SCCIs) used the full extent of the options available by the program. Nonetheless, these efforts and actions were ineffective in creating substantial and sustained improvement in the licensee's performance. No substantial and sustained improvement in the licensee's performance was evident until after the licensee was placed in Column 4 of the action matrix.

During the review, it was also noted that the Region provided numerous minor violations to the licensee during inspection exit meetings. As a result of the review, some of the issues classified as minor violations were determined to be very close to the established minor/more than minor threshold contained in IMC 0612, "Power Reactor Inspection Reports," and could have been classified as more than minor. None of these issues were considered to be more than Green. Based on discussion with the inspectors and other members of Region II, a great deal of effort, especially in the Division of Reactor Projects, is placed on ensuring that the process is consistently and rigorously followed. In most cases, the emphasis is placed on having actual consequences associated with the finding to place the issue into the more than minor category. This may not be totally consistent with the intent of the inspection program, but may be driven by disconnects between the more than minor questions provided in IMC 0612 Appendix B, "Issue Screening," and the examples provided in IMC 0612 Appendix E, "Examples of Minor Issues."

The concern is with how these very low safety significant issues were classified and not in the simple documenting of Green findings, which, by itself would not offer any measureable impact on safety. The concern is that this approach limits the number of cross-cutting issues documented; therefore, limiting the number of potential substantive cross-cutting issues opened. This concern was evident by the long-standing widespread low-level issues at Browns Ferry. Specifically, during the period from the end of cycle 2010 through the end of cycle 2012, BFN had seven cross-cutting aspects with three examples for at least one assessment period. These were in addition to the two SCCIs already recognized. Although, the NRC's SCCI process was not effective in creating substantial and sustained improvement at BFN with the two identified SCCIs, had some

or all of the other seven aspects resulted in SCCIs, our impact may have been more effective. And even if it had not significantly influenced BFN to improve, the NRC documents would have more accurately reflected the poor performance existing at BFN.

Several similar observations related to cross-cutting issues were provided in the assessment following the Palo Verde IP 95003 supplemental inspection.

Recommendations

Provide additional guidance to IMC 0305, "Operating Reactor Assessment Program," regarding long-standing SCCIs, that if a SCCI exists for three assessment letters recommend that RA with NRR director and above meet with the licensee's Board of Directors to discuss the licensee's performance issues.

Provide additional guidance to IMC 0305 regarding aspects to consider prior to closing an SCCI, such as cyclic performance or other existing SCCIs especially in the area of PI&R, to ensure the NRC has confidence that the licensee's actions were effective.

For human performance and/or PI&R SCCIs, provide additional guidance for both annual sample and biennial inspections in IP PI&R to observe maintenance and other field activities to gather observations on human performance, and in-field performance of identifying and entering issues into the CAP.

For PI&R SSCIs, recommend, that during biennial PI&R inspections, that the corrective actions for all NCVs and findings issued since the last biennial inspection be reviewed and documented because, as described in IMC 2515, Appendix A, confidence in a licensee's CAP is one basis for closing NCVs when they are entered into the CAP.

For human performance SCCIs, provide additional guidance to the SDP to have a Senior Reactor Analyst (SRA) run a sensitivity analysis using a lower human performance success rate to provide management insights that would be valuable in making risk-informed SDP decisions. Similarly, for PI&R SCCIs provide additional guidance to SDP to have an SRA run sensitivity analysis using lower than average equipment reliability rates.

Re-evaluate the minor/more than minor threshold to determine if more focus should be placed on leaning toward the more than minor side for close issues. Include a review of the examples in IMC 0612, Appendix E, to ensure consistency with the more than minor question provided in IMC 0612, Appendix B.

4.2.2 The use of the biennial Problem Identification and Resolution inspections, and annual samples for providing insights into equipment issues and human performance issue

Between August 2007 and March 2012, the NRC completed five PI&R inspections at the BFN Site. Region II's decision to do more than the baseline number of PI&R inspections was a proactive decision. This decision was based on the poor performance of BFN's CAP.

A review of the biennial inspections and the annual PI&R samples completed in 2007 through the end of 2010 indicated that Region II was actively identifying and pursuing the issues at BFN. Moreover, the use of the PI&R inspections and samples were

completed in accordance with the program and the documentation in the applicable inspection report explicitly stated the NRC's concerns with BFN's performance. The PI&R inspection reports and samples reviewed contained numerous valuable findings and observations and several of the same comments were made from one report to the next. This is demonstrated by the following excerpts taken during this period from BFN PI&R inspection reports:

- “The inspectors concluded that the licensee had been slow to effect significant improvement in equipment reliability based on the number of equipment problems and timeliness of corrective actions.” (PI&R report dated October 9, 2007, Summary of Findings);
- The licensee states the cause as “inadequate management supervisor oversight and failure to reinforce standards and expectations.” (PI&R report issued December 22, 2008, in a discussion regarding the licensee’s common cause analysis related to a substantive cross-cutting issue in problem identification and resolution).

Both of these problems continued for several years past the Red finding, and the issue with management reinforcing standards and expectations was included in the Confirmatory Action Letter (ML13232A105) addressing post-IP 95003 supplemental inspection Column 4 closure issues.

During the review of the PI&R reports and annual samples, most of the observations and minor violations described in the reports were characterized consistent with the inspection guidance regarding the minor/more than minor classification. However, there were a few instances where issues could have been classified as Green findings instead of a minor violation or an observation. Although, none of the issues would have been Greater than Green, as discussed in the answer to Question 5, this approach limited the number of cross-cutting issues documented; therefore, the approach limited the number of substantive cross-cutting issues opened. This concern was evident by the long-standing, widespread, low-level issues at Browns Ferry.

Based on a review of the control documents, including IMC 2515, “Light-Water Reactor Inspection Program – Operational Phase,” IMC 0305, “Operating Reactor Assessment Program,” IMC 0308, “Reactor Oversight Process (ROP) Basis Document,” and Inspection Procedure 71152, “Problem Identification and Resolution,” the efforts taken to address BFN performance was in accordance with the process. However, the PI&R inspection efforts and SCCIs were ineffective in improving the licensee’s performance.

The NRC relies heavily on the licensee having a robust CAP. For example:

- IMC 0308, “Reactor Oversight Process (ROP) Basis Document,” Section 05.05.a.3. states, “Defining and implementing an effective problem identification and resolution program is a key element underlying licensee performance in each cornerstone area. A fundamental goal of the NRC’s reactor inspection and assessment process is to establish confidence that each licensee is detecting and correcting problems in a manner that limits risk to members of the public. The NRC expects licensees to be technically and organizationally self-sufficient in this regard. Ineffective problem identification and resolutions programs, including poor conduct of root cause analysis of self-identified issues, has been a common theme among problem plants in the past.”

- IP 71152, "Problem Identification and Resolution," specifies that Inspection Objective 01.01 is "To provide for early warning of potential performance issues that could result in the crossing threshold in the ROP Action Matrix described in IMC 0305, "Operating Reactor Assessment Program."
- IMC 2515 Appendix A, "Risk-Informed Baseline Inspection Program," Section 4.c: states, "The primary means by which licensees maintain an appropriate level of safety is through an effective problem identification and resolution program to correct deficiencies involving human performance, equipment problems, and programs and procedures. The NRC's confidence in a licensee's CAP for finding and fixing problems is one basis for closing Severity Level IV violations when a licensee enters them into its CAP."

Although the NRC's expectations of the licensee's CAP and how we utilized the concept of a robust CAP in the development of our processes are well established, our process lacks guidance in several areas. Specifically:

- How to address licensee's that have a long-standing poor performing CAP?
- What to do with the early warning signs of poor performance before a licensee crosses the threshold out of Column 1, the only effective guidance comes once the licensee reaches Column 4?
- What should be done with the review of NCVs, if the licensee's CAP is poor?

Regarding minor violations and the CAP, IMC 2515, Section 08-01, states: "inspection findings which are determined to be minor do not need to be nor shall be tracked or trended by either inspectors or regional managers. Instead, minor findings are to be reported to the licensee for action in accordance with the licensee's corrective action program. Licensees are expected to track and trend minor findings and issues as stated in their program. When implementing inspection procedure 71152, "Problem Identification and Resolution," inspectors may include minor findings and issues as part of their semiannual trend review. This review will determine whether the licensee has adequately identified and corrected an adverse trend, if any, resulting from all identified deficiencies, including minor findings, during the period of review." However, IP 71152 does not mention reviewing corrective actions for minor violations, moreover, since there is no tracking of minor violations it is difficult to know what to inspect. In addition, the guidance of documenting the specific NCVs and/or minor violations related corrective action verified during a PI&R inspection is non-existent, and therefore not auditable.

Recommendations

For human performance and or PI&R SCCIs, provide additional guidance for both annual sample and biennial inspections in IP 71152 to observe maintenance and other field activities to gather observations on human performance, and in-field performance of identifying and reporting issues into the CAP.

For PI&R SSCIs, recommend, that during biennial PI&R inspections, the corrective actions for all NCVs and findings issued since the last inspection be reviewed and

specifically documented in the inspection scope sections of the inspection report. The basis for this recommendation is that, as described in IMC 2515, Appendix A, confidence in a licensee's CAP is one basis for closing NCVs when entered into the CAP, and if there is a SCCI associated with a licensee's CAP there is some lack of confidence in their program.

Consider requiring the licensee's to complete periodic third party safety culture assessments with NRC review of the results and licensee's actions to supplement the inspections insights of the PI&R inspections and the cross-cutting process.

Provide guidance in IMC 0612 associated with PI&R reports to explicitly document in the inspection scope section all the specific NCVs and minor violations reviewed for verification of the corrective actions.

4.2.3 Inspection Procedure 95001 and 95002 supplemental inspections effectiveness

The IP 95001 and 95002 supplemental inspections reports reviewed were completed in accordance with the governing procedures and the inspection process. The insights documented were valuable. Moreover, both IP 95002 supplemental inspections acknowledged the licensee root causes had significant ties to safety culture, specifically in the areas of decision making, resources, work practices, work control, human performance and the CAP. Nonetheless, our process did not create a driving force for either substantial or sustainable improvement in the licensee's performance.

The inspections, as prescribed by the inspection program, required verification that the root cause analyses were adequate, that the corrective actions appeared sound, and that effectiveness reviews were planned by the licensee. The verification of the implementation of the corrective actions and the effectiveness of those actions were not required by the inspection program. In the case of BFN, the causes were heavily weighted towards safety culture issues and a weak CAP as evidenced by the related substantive cross-cutting issue, which indicated that a reliance on the planned corrective actions was not sufficient. Moreover, the inspection process places a great deal of emphasis on being performance-based, especially with respect to classifying and assessing the significance of findings. Therefore, it may be more effective if a similar approach was used in assessing the licensee's performance during supplemental inspections instead of only assessing the licensee's corrective action plans.

Recommendations

Revise the IP 95002 supplemental inspection procedure to provide additional aspects including:

- The completion of a localized diagnostic inspection of the area or concern in addition to the review of the root cause.
- Require the licensee to demonstrate improved performance by either their internal metrics or an effectiveness review prior to initiating the inspection.
- Provide additional guidance to require the inspectors to inspect issues related to open substantive cross-cutting issues as they relate to the IP 95002 supplemental inspection findings.

4.2.4 Inspection program perspective regarding programmatic issues

The Browns Ferry engineering programs, specifically the Generic Letter 89-10 and the Inservice Testing (IST) programs, had problems directly related to the LPCI valve failure. Moreover, during the licensee's diagnostic review in preparation for inspection and the inspections team's findings additional problems were found in the Inservice Inspection (ISI) and maintenance rule programs. Although performance issues tied to these programs are inspected, the programs themselves are not inspected, and these programs, particularly the maintenance rule program aspect of ensuring the proper preventative maintenance is being performed is vital to equipment reliability.

Recommendation

Adjust the inspection program to include periodic reviews of the significant engineering programs on a rotating basis. This should include such programs as the maintenance rule, motor-operated valve (MOV), IST and commercial grade dedication programs. The inspections program could be changed so that the reviews are incorporated into the Component Design Bases Inspections or by creating a new inspection procedure to accomplish these reviews.

Based on the issues associated with BFN related to the IP 95003 supplemental inspection recommend the following inspection procedure revision:

- Revise IP 71111.22, "Surveillance Testing," to include verifying the classification of "Active Components" during inspection of the IST program valves or pumps, to ensure the correct test requirements are applied.
- Revise IP 71152, "Problem Identification and Resolution," and IP 71111.21, "Component Design Bases Inspection," to include guidance regarding consideration of NRC Operating experience smart samples as part of the inspection scope.

4.2.5 The staffing of the NRC Resident Inspection Team for the work load at three unit sites

The resident inspector staff was maintained in accordance with the N philosophy since 2003 and no significant lapses in assigned coverage were noted. Nonetheless, based on observation of site activities and the number of inspection issues, including, outages, LERs findings/violations and minor violations, the aspects of a three unit site pose significant challenges to the resident inspector staff. In addition, the oversight aspect of the Senior Resident Inspector (SRI) at a three unit site significantly reduces the inspection time afforded the SRI.

A similar observation was documented in the assessment following the Palo Verde IP 95003 supplemental inspection.

Recommendation

Permanently change the resident inspector staffing requirements for three unit sites to N + 1, and maintain the SRI as a team leader.

4.2.6 The NRC's approach to consider INPO's actions that were expected to influence Browns Ferry to strive for excellence effective

Browns Ferry had a long history as a poor performer under INPO's assessment program, including being placed under Policy Note 14, since October 2008. Although the licensee directed resources to address the issues identified by INPO, the programs put in place and the efforts taken by TVA were ineffective to create substantial and sustained improvement. Therefore, the NRC's approach to consider that INPO's actions would influence Browns Ferry to strive for excellence was also ineffective.

Recommendation

For long-standing poor performance as recognized by INPO, consider additional interactions between the NRC and INPO to develop efforts to promote licensee improvement.

4.2.7 Lessons learned regarding how the NRC handled the BFN Unit 1 restart between 2002 and 2007

Based on discussions with various members of the NRC and the licensee regarding the restart of BFN Unit 1, the following insights were noted:

- The impact of redirecting funds and resources during the recovery of Unit 1 not only affected Unit 1 because the licensee was trying to be as cost efficient as possible, it also redirected resources from Units 2 and 3.
- Although the documentation and decision making approach used by the NRC for allowing the 2007 BFN Unit 1 to restart was not reviewed in detail, the interviews and the numerous fire protection related deficiencies identified since the restart, indicated that improvements could be made in how the NRC addresses similar licensing issues.

Recommendations

Add guidance to the inspection program to consider the impact on the governance, operations, maintenance and engineering activities and other resources at other units during a restart and or recovery. Include guidance to focus on the plant going through recovery/restart as well as on the other plants in the licensee's fleet being impacted by the redirected resources. Consider the possibility of combining efforts with INPO during such situations.

Complete a more in-depth review of the Browns Ferry Unit 1 restart effort with respect to fire protection to obtain lessons learned to be used in future situations.

4.2.8 Effectiveness Review of Evaluation of NRC Assessment and Inspection Processes Associated with IP 95003 Supplemental Inspections

As noted within the assessment above, several of the issues discussed and associated recommendations had related recommendations provided during the report for the last IP 95003 supplemental inspection (Palo Verde dated February 1, 2008).

Recommendations

- In approximately two years, complete an effectiveness review for the actions taken to address the issues provided in this report.
- Add a requirement to the IP 95003 supplemental inspection procedure or to IMC 0305, "Operating Reactor Assessment Program," to complete an effectiveness review of the actions taken to address the issues provided in the associated reports.

Attachment 1: Timeline of Relevant Browns Ferry's Events and Performance

Attachment 2: BFN IP 95003 Supplemental Inspection Activity Schedule

Timeline of Relevant Browns Ferry's Events and Performance

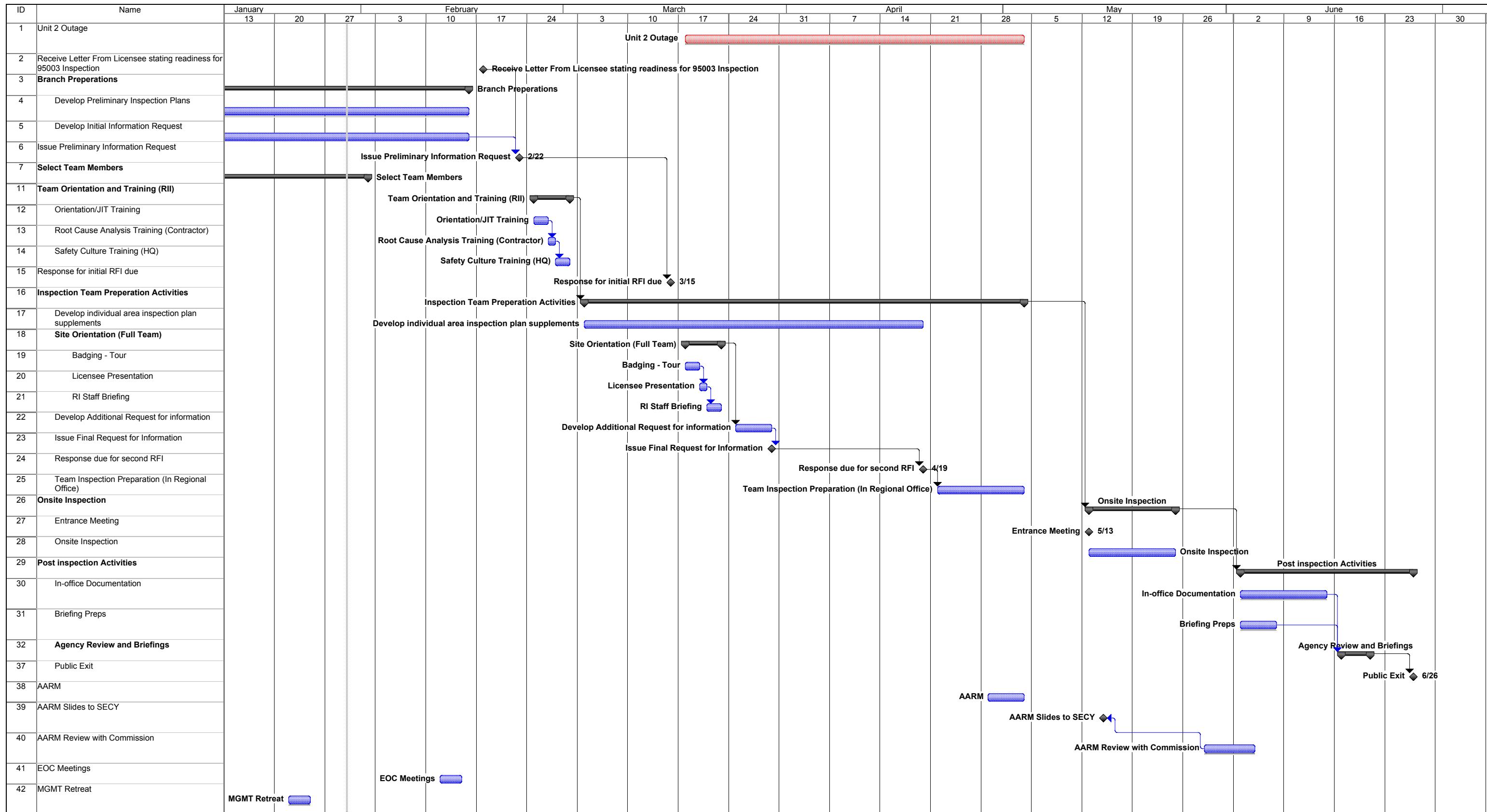
- March 22, 1975 - Browns Ferry Nuclear Plant (BFN) Unit 1 fire.
- March 1985 - BFN Unit 1 was shutdown, along with Units 2 and 3, to correct a variety of issues.
- May 1991 - Unit 2 restart.
- November 1995 - Unit 3 restart.
- May 2002 - restoration efforts began for Unit 1.
- May 22, 2007 - Unit 1 was brought critical for the first time since March 3, 1985.
- Middle-of-Cycle Letter 2007 - "The NRC is aware that you [BFN] have initiated a broad range of corrective actions to address persistent plant equipment reliability issues at BFN. As such, we plan to conduct the biennial Problem Identification and Resolution Inspection (PI&R) originally scheduled for 2009 in 2008 in order to assess the effectiveness of your corrective actions."
- 4th Quarter 2007 - Unit 1 transitioned to Column 3 due to Unplanned Scrams per 7000 Critical Hours Performance Indicator (PI) exceeding the Yellow threshold.
- End-of-Cycle Letter 2007 - The NRC opened a substantive cross-cutting issue in PI&R area with the theme of "appropriate and timely corrective actions," (P.1(d)). The NRC used the previously rescheduled PI&R inspection as means to assess licensee's performance.
- 1st Quarter 2008 - Unit 1 transitioned from Column 3 to Column 2 for Unplanned Scrams per 7000 Critical Hours Performance Indicator as critical hours increased.
- 2nd Quarter 2008 - Unit 1 transitioned from Column 2 to Column 1 for Unplanned Scrams per 7000 Critical Hours Performance Indicator as critical hours increased.
- October 21, 2008 - BFN was notified that INPO had placed Browns Ferry under Policy Note 14.
- December 2008 - NRC completed Inspection Procedure (IP) 95002 supplemental inspection for the Unit 1 Yellow PI associated with Unplanned Scrams. Excerpt from the report: "The licensee concluded that an unhealthy safety culture with respect to the decision making, work control, human performance and problem identification and resolution areas was the common cause for the scrams."
- End-of-Cycle Letter 2008 - Although BFN met the numeric criteria to exit the substantive cross-cutting issue (SCCI) in Problem Identification and Resolution area with the theme of "appropriate and timely corrective actions," (P.1(d)), the NRC was unable to determine the effectiveness of the BFN's corrective actions. Therefore, the NRC left the SCCI open, and an additional biennial PI&R was scheduled to assess the effectiveness of BFN's corrective actions.

- July 2009 - The NRC completed the PI&R Inspection to assess the effectiveness of the licensee's actions associated with the SCCI in Problem Identification and Resolution with the theme of "appropriate and timely corrective actions," (P.1(d)).
- Middle-of-Cycle Letter 2009 - The NRC closed the SCCI theme associated with "appropriate and timely corrective actions," (P.1(d)), based on the numeric criteria and the additional PI&R inspection completed July 2009.
- October 2009 - The NRC completed the fire protection inspection identifying several violations including a Yellow Finding associated with the failure to meet cable separation needed for Appendix R safe shutdown capability, and a White Finding associated with inadequate safe shutdown instructions.
- End-of-Cycle Letter 2009 - The NRC opened a SCCI in the PI&R area with the theme of "thorough evaluation of identified problems" (P.1(c)). The NRC utilized PI&R annual samples as the means to assess licensee's performance.
- 4th Quarter 2009 - All three Units transitioned to Column 3 of the Action Matrix for a Yellow Finding associated with the failure to meet cable separation needed for Appendix R safe shutdown capability, and a White Finding associated with inadequate safe shutdown instructions. (The Final Significance Determination was completed in April 2010, and column change was retroactive to the 4th Quarter of 2009).
- December 2009 - The NRC issues a Confirmatory Order to the TVA regarding safety conscious work environment related to discrimination against an individual for raising safety concerns during the Unit 1 recovery efforts.
- Middle-of-Cycle Letter 2010 - The NRC left open the SCCI in PI&R with the theme of "thorough evaluation of identified problems" (P.1(c)) because a corrective action plan had not been developed and scheduled.
- October 2010 - LPCI Valve 1-FCV-74-66 failure discovered.
- October 2010 - The NRC completed IP 95002 supplemental inspection for the Yellow Finding associated with the failure to meet cable separation needed for Appendix R safe shutdown capability, and the White Finding associated with inadequate safe shutdown instructions.
- 4th Quarter 2010 - Unit 1 transitioned to Column 4 due to Red Finding associated with the LPCI Valve disc stem separation. (The Final Significance Determination was completed in May 2011, and column change was retroactive to the 4th Quarter of 2010).
- 4th Quarter 2010 - Units 2 and 3 transitioned to Column 1.
- End-of-Cycle Letter 2010 - The NRC continued to leave open the SCCI in Problem Identification and Resolution with the theme of "thorough evaluation of identified problems" (P.1(c)). A new SCCI in Problem Identification and Resolution with the theme of "appropriate and timely corrective actions" (P.1(d)) was opened. For both open SCCIs, associated with PI&R the NRC utilized PI&R annual samples as the means to assess licensee's performance. A third SCCI for human performance, with the theme of "human performance & error prevention," (H.4 (b)) met the numeric criteria. However, a SCCI was

not opened because the NRC determined that BFN completed a common cause root cause for the related four findings, the scope and content of the corrective actions were reasonable and sufficient time had not passed for BFN to implement the corrective action.

- Middle-of-Cycle Letter 2011 - The SC defense in Problem Identification and Resolution with the themes of “thorough evaluation of identified problems” (P.1(c)) and “appropriate and timely corrective actions,” (P.1(d)) remained open, and the NRC requested that the licensee address these issues in their safety culture assessment being completed for the upcoming IP 95003 supplemental inspection. The NRC verified that corrective actions for (H.4(b)) were effective.
- End-of-Cycle Letter 2011-The SC defense in Problem Identification and Resolution with the themes of “thorough evaluation of identified problems” (P.1(c)) and “appropriate and timely corrective actions,” (P.1(d)) remained open because corrective actions have yet to be proven effective.
- 2nd Quarter 2012 - Units 2 and 3 transitioned to Column 2 (Unit 1 was already in Column 4) due to a White Finding for all three units associated with the failure to implement post modification training for affected safe shutdown instructions. An IP 95001 supplemental inspection was required to review the root cause and corrective actions for this finding.
- Middle-of-Cycle Letter 2012 - Unit 3 exceeded the White threshold for the Unplanned Scram PI threshold, requiring a separate IP 95001 supplemental inspection. The SC defense in Problem Identification and Resolution with the themes of “thorough evaluation of identified problems” (P.1(c)) and “appropriate and timely corrective actions,” (P.1(d)) remained open because corrective actions have yet to be proven effective. The NRC opened an SC defense for Human Performance with a theme of “Complete Documentation and Component Labeling,” (H.2(c)).
- October 2012 - The NRC completed the IP 95001 supplemental inspection for the failure to implement post-modification training for affected safe shutdown instructions.
- 2nd Quarter 2013 - 3 Performance Indicators (PI) crossed the Green/White due to a re-base-lining of the licensing risk calculations. Specifically:
 - Unit 1: Mitigating Systems Performance Index, Emergency Alternating Current (AC) Power System (Mitigating System Cornerstone),
 - Unit 1: Mitigating Systems Performance Index, High Pressure Injection System (Mitigating System Cornerstone),
 - Unit 2: Mitigating Systems Performance Index, Emergency AC Power System, (Mitigating System Cornerstone)

In addition, the PI for Unplanned Scrams per 7000 Critical Hours (Initiating Events Cornerstone) on Unit 3 also exceeded the Green/White Threshold. As a result, since the WHITE PI for Unit 2 was in the same cornerstone as the existing WHITE finding, in accordance with the ROP, it transitioned to the Degraded Cornerstone Column (Column 3) of the ROP action matrix. Unit 3 remained in Regulatory Response Column (Column 2) since the WHITE PI was in a different cornerstone as the existing WHITE finding.



Project: 95003 Prep Scheduling NEW
Date: Wed 1/30/13

Task
Split

Progress
Milestone

Summary
Project Summary

External Tasks
External Milestone

Deadline

