Enclosure 3

Reactor Oversight Process Task Force FAQ Log
March 23, 2017

Dated April 6, 2017

FAQ Log March 23, 2017 ROP Meeting

FAQ No.	PI	Topic	Status	Plant/Co.	Point of Contact
17-02	IE	Palo Verde Unit 3 Scram	Introduced on March 23	Palo Verde Nuclear Generating Station Unit 3	George Andrews (APS) Charles Peabody (NRC)
17-01	IE	Grand Gulf June 2016 Power Change	Introduced on January 12 Discussed on March 23	Grand Gulf Nuclear Station Unit 1	James Nadeau (Entergy) Matt Young (NRC)
16-04	MS	Maintenance on High Pressure Coolant Injection	Introduced on November 16 Discussed on January 12 and March 23	Browns Ferry Nuclear Plant Unit 2	Eric Bates (TVA) Jamie Paul (TVA) Z. Hollcraft (NRC)

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Plant: Browns Ferry Nuclear Plant Unit 2
Date of Event: March 19, 2016
Submittal Date: November 8, 2016
Licensee Contact: Eric Bates/Jamie Paul Tel/email: 256-614-7180/256-729-2636
NRC Contact: ___________________________ Tel/email: __________________

Performance Indicator:
MS05 Safety System Functional Failure (SSFF)

Site-Specific FAQ (Appendix D)? No

FAQ requested to become effective: When approved.

Question Section:

1. If a condition on a single train safety system that could have affected operability is created during maintenance while the equipment is out of service (OOS), such that the condition did not exist prior to the equipment being declared inoperable for maintenance, was discovered during post-maintenance testing (PMT) prior to surveillance (SR) testing, and accident conditions or operation cannot produce the observed degradation or equipment failure, should it count as a SSFF against the Reactor Oversight Process (ROP) Performance Indicator (PI)?

NEI 99-02 Guidance needing interpretation (include page and line citation):

1. Section 2.2, Safety System Function Failures: The guidance is silent regarding how to count a condition created while a system, structure, or component (SSC) was OOS for maintenance, which would have affected Operability, and was outside the scope of the planned maintenance. (page 30)

Event or circumstances requiring guidance interpretation:

Browns Ferry (BFN) entered Technical Specification (TS) Limiting Conditions for Operation (LCO) 3.5.1, Emergency Core Cooling Systems (ECCS) – Operating, Condition C on March 17, 2016. Condition C was entered due to High Pressure Coolant Injection (HPCI) inoperability for planned maintenance to repack the steam admission valve. The purpose of the HPCI system is to provide high pressure core cooling in the event of a Loss of Coolant Accident or in the event of a reactor isolation and failure of the Reactor Core Isolation Cooling (RCIC) system. Besides vessel injection, another safety function of the HPCI system is to maintain structural integrity regarding Primary and Secondary Containment pressure boundaries. On March 19, 2016, Operations personnel received a ground alarm during performance of valve diagnostic (MOVATS) testing on the Unit 2 HPCI Steam Admission Valve. The valve motor breaker was opened and the alarm cleared. The thermal overload relay was found tripped, resulted in the alarm, and was reset. Later on March 19, 2016, Operations attempted to stroke the valve from the Control Room for PMT using a hand switch and the valve failed to stroke due to a stuck contactor in the breaker.

Troubleshooting later revealed that the breaker thermal overloads had tripped and that a breaker contactor in the valve closing circuit had become hot enough to fuse its contacts together, which prevented the valve from opening. There was no vendor specific service life for these contacts. The cause of the equipment failure was determined to be due to excessive valve stroking during the earlier PMT on March 19, 2016. The cause was not reviewed by a vendor or an independent party. The corrective actions are to revise procedures to limit the number of strokes per hour for the applicable piece of equipment.

BFN received a NRC-identified Severity Level IV non-cited violation (NCV) of 10 CFR 50.72(b)(3)(v) and 10 CFR 50.73(a)(2)(v) for the licensee's failure to notify the NRC within 8 hours and submit a Licensee Event Report (LER) within 60 days of discovery of a condition that could have prevented the fulfillment of a safety function. Specifically, the licensee failed to notify the NRC that the HPCI system had been rendered inoperable due to an equipment failure. BFN submitted LER 50-260/2016-002-00, High Pressure Coolant Injection System Failure Due to Stuck Contactor, to the NRC in response to this NCV. BFN did not deny the violation but is advocating at the ROP TF that the condition should not count against the SSFF PI.

If licensee and NRC resident/region do not agree on the facts and circumstances explain: BFN's NRC Senior Resident Inspector's perspective is the valve motor breaker failure was not part of the HPCI planned maintenance; therefore, the failure should count as a SSFF due to it not being part of the planned maintenance.

Potentially relevant existing FAQ numbers: There are no relevant FAQ numbers.

Response Section:

Proposed Resolution of FAQ:

The SSFF PI should only count failures that occur or potentially existed while there was an expectation that the SSC was Operable. Conditions affecting operability created during a maintenance OOS period that did not exist while the SSC was considered Operable and were identified and corrected while still in a maintenance state do not count for purposes of the SSFF PI. This exemption applies even if the condition created required repairs outside of the scope of planned maintenance and those repairs were required in order to return the equipment back to Operable status.

Examples of conditions that would not count as a SSFF under this resolution would include:

- An electrician transposes connecting leads to terminals in the actuation panel for a single train safety system causing a failed PMT. The condition was created during the maintenance activity and corrected while still in a maintenance state within the LCO window.

- During MOVATS testing, while a single train system is OOS for unrelated maintenance, a valve technician overheats the contactors causing them to stick. Replacement of the contactor is not part of the original scope of the planned maintenance activity but is identified and completed prior to SR Operability testing.
- A nearby instrument required to maintain operability of a single train safety system is damaged while breaking a bolt loose for an unrelated maintenance activity on the same system. This condition was not part of the preplanned maintenance. Correcting this condition requires an additional 4 hours of LCO time.

This proposed change applies similar treatment from MSPI failure guidance on page F-29 of NEI 99-02 to SSFF criteria.

> "Failures identified during post maintenance tests (PMT) are not counted unless the cause of the failure was independent of the maintenance performed" … "System or component failures introduced during the scope of work are not indicative of the reliability of the equipment, since they would not have occurred had the maintenance activity not been performed."

This failure was not counted by BFN as a MSPI failure and similarly should not count as a SSFF.

If appropriate, provide proposed rewording of guidance for inclusion in next revision:

Add the following on Page 30, section 2.2, starting after the period on line 7:

> If the following elements are met for a condition affecting Operability of a SSC, then the condition does not count for purposes of the SSFF PI:
> - Created during a maintenance OOS period and it did not exist while the SSC was considered Operable,
> - Not possible and/or reproducible during accident conditions, and
> - Identified and corrected while still in a maintenance state.
>
> This exemption applies even if the condition:
> - Required repairs outside of the scope of planned maintenance, and
> - Repairs were required in order to return the equipment back to Operable status.

PRA update required to implement this FAQ? No
MSPI Basis Document update required to implement this FAQ? No

NRC Response:

The staff reviewed the guidance found in NUREG 1022 Revision 3 to determine if additional exclusions of reported SSFFs should be considered for inclusion in NEI 99-02. The following was found:

> *reports are not required when systems are declared inoperable as part of a planned evolution for maintenance or surveillance testing when done in accordance with an approved procedure and the plant's TS (unless a condition is discovered that would have resulted in the system being declared inoperable).*

Revision 0 of NUREG 1022 contained an example of this that further clarified the staff's intent:

> *For example, if the licensee removes part of a system from service to perform maintenance, and the Technical Specifications permit the resulting configuration, and the system or component is returned to service within the time limit specified in the Technical Specifications, the action need not be reported under this paragraph. However, if, while the train or component is out of service, the licensee identifies a condition that could have prevented the whole system from performing its intended function (e.g., the licensee finds a set of relays that is wired incorrectly), that condition must be reported.*

The intent of this example is to clarify that if the licensee discovers a condition during the maintenance that existed prior to the maintenance, it is reportable. However if the licensee creates a new condition during the maintenance that would have rendered the system inoperable, that is not reportable as long as it is repaired prior to restoration of operability in accordance with Technical Specifications. The licensee proposed change to NUREG 1022 includes the following key attribute:

- Created during a maintenance OOS period and it did not exist while the SSC was considered Operable,

This proposed NEI 99-02 criteria is already covered by NUREG 1022. As such, it is not required.

The staff does not concur with the recommended change to NEI 99-02. Since a SSFF report was made, barring meeting some separate criteria for excluding the SSFF PI found in the NEI 99-02 guidance, this SSFF should count towards the SSFF PI.

FAQ 17-01
Grand Gulf June 2016 Power Change (Draft Response)

Plant: Grand Gulf Nuclear Station Unit 1
Date of Event: June 17, 2016
Submittal Date: January 11, 2017
Licensee Contact: James Nadeau **Tel/email:** 1-601-437-2103 / jnadea1@entergy.com
NRC Contact: Matt Young **Tel/email:** 1-601-437-2387 / matt.young@nrc.gov

Performance Indicator: Unplanned Power Changes per 7,000 Critical Hours

Site-Specific FAQ (see Appendix D)? ~~Yes~~ or No

FAQ to become effective when approved or (other date) Approval

Question Section

NEI 99-02 Guidance needing interpretation (include page and line citation):

NEI 99-02, IE03 Unplanned Power Changes, Page 14, Examples, Lines 17 through 31:

17 Examples of occurrences that would be counted against this indicator include:
18 • Power reductions that exceed 20% of full power and are not part of a planned and
19 documented evolution or test. Such power changes may include those conducted in
20 response to equipment failures or personnel errors or those conducted to perform
21 maintenance.
22 • Runbacks and power oscillations greater than 20% of full power. A power oscillation
23 that results in an unplanned power decrease of greater than 20% followed by an
24 unplanned power increase of 20% should be counted as two separate PI events, unless the
25 power restoration is implemented using approved procedures. For example, an operator
26 mistakenly opens a breaker causing a recirculation flow decrease and a decrease in power
27 of greater than 20%. The operator, hearing an alarm, suspects it was caused by his action
28 and closes the breaker resulting in a power increase of greater than 20%. Both transients
29 would count since they were the result of two separate errors (or unplanned/non-
30 proceduralized action).
31 • Unplanned downpowers of greater than 20% of full power for ALARA11 reasons.

NEI 99-02, IE03 Unplanned Power Changes, Page 16, Lines 1 and 2:

1 Off-normal conditions that begin with one or more power reductions and end with an unplanned
2 reactor trip are counted in the unplanned reactor scram indicator only. However, if the cause of

Event or circumstances requiring guidance interpretation:

Event Discussion:

On June 17, 2016 the Grand Gulf Nuclear Station was performing routine Turbine Control Valve testing in accordance with an approved procedure. During this testing the operators depressed the rest button on a solenoid valve to test one turbine control valve closure. The solenoid did not perform as designed and ultimately a second control valve closed and remaining two control valves began oscillating (open/close) in an attempt to maintain turbine load/power. This oscillation induced a similar power swing in the core. Upon release of the solenoid test switch the oscillations dampened but did not terminate.

The operators next attempted to reopen the first valve in accordance with the test procedure slow-close method using the control oil bleed-off valve. This attempt did not open the valve and two valves remained closed. This increased the magnitude of the oscillations of the remaining two valves. The increased oscillation of the control valves induces a larger power oscillation in the core. Upon closure of the bleed-off valve the oscillations again dampened but did not terminate.

In an attempt to reduce and control the power oscillations within the core the operators inserted a number of control rods several steps. This dampened the magnitude of the power oscillations and frequency time between oscillations. This final action ultimately lead to a OPRM reactor trip.

Questions:
It is Entergy's position, based on the guidance provided in Lines 1 & 2 on Page 16 of NEI 99-02, that this was one event caused by the unexpected closure of a second control valve. This closure resulted from equipment failure of the solenoid valve, which ultimately was terminated by the insertion of rods and the receipt of an OPRM reactor trip. Operator actions to attempt to open the first closed valve using the test procedure, and reduce power changed the magnitude and frequency of the power oscillations but could not in of themselves cause the oscillations without the second control valve being shut. Therefore this should be counted as an unplanned SCRAM.

To aid the reviews in understanding the event the following attachment is provided:
- A Graph showing the power oscillations. The graph depicts magnitude of the y-axes and the time on the x-axes.

Question 1: How should this event be counted?

Should it be counted from start to finish as one event which resulted in an unplanned SCRAM?

Or

Should it be counted as two events one being Unplanned Power Change and one being an Unplanned SCRAM?

Question 2: If it counts as an Unplanned Power Change how should the event be counted?

Should it be counted as one event (turbine control valve testing) which introduced oscillation and was ultimately terminated in a reactor scram?

Or

Should each power oscillation greater than 20% full power, be counted?

Or

Should a group of oscillations greater than 20% full power influenced by a single cause be counted as a one power change event?

<u>Question 2 Supporting Questions</u>:

If each oscillation greater than 20% full power is to be counted, how do we count it?

Do we count each oscillation greater than 20% full power from the initial power, just prior to the start of the event?

For example: It the initial power was 60% then each oscillation greater than 80.0% or less than 40.0% would be counted

Or

Do we count each oscillation greater than 20% full power from peak to valley and valley to peak?

If licensee and NRC resident/region do not agree on the facts and circumstances, explain:
The collection of facts that caused the power oscillations and reactor SCRAM are understood and agreed upon by both Entergy and the Nuclear Regulatory Commission (NRC).

The NRC inspectors at the Grand Gulf Nuclear Station, however, do not agree with the licensee's determination that this event is only counted in the Unplanned Scrams per7000 Critical Hours performance indicator. The NRC inspectors' position that NEI 99-02, Revision 7, guidance would cause the licensee to count this series· of events in both the Unplanned Scram, per 7000 Critical Hours and Unplanned Power Changes per 7000 Critical Hours performance indicators:

The basis for this position is as follows:

The first set of oscillations greater than 20 percent power resulted from the second control valve closure and operator action to maintain the manual push buttons depressed on the solenoid valves. The control rooms' decision to hold the manual push button on the solenoid valve depressed resulted in approximately five minutes, of power oscillations of greater than 20 percent power. When the manual push button on the solenoid valve was depressed, the operators were unknowingly diverting electrohydraulic system flow, which challenged the control valves ability to stabilize steam flow when two stop valves were closed. Operators then decided to release the manual push buttons and the power oscillations reduced to approximately 10 percent. This response demonstrated that the second control valve closure and the pressure control system issue resulted in power oscillations that were limited to only 10 percent. The operator actions to maintain the manual push button depressed caused power oscillations that were greater than 20 percent power.

The second set of power oscillations of greater than 20 percent was caused by operator actions to troubleshoot the issue by attempting to reset and reopen a control valve using the slow closure method with a different solenoid valve. When the desired plant response was not achieved; operators backed out of the troubleshooting efforts, and the power oscillations returned to approximately 10 percent. The third set of increased power oscillations was caused by additional operator actions as attempts were made to troubleshoot the issue by resetting the control valve. These troubleshooting efforts resulted in additional power oscillations of greater than 20 percent. During the control valve reset, operators began to insert control rods with the intention to reduce power and stop the power oscillations. Operators believed that a power reduction to less than 50 percent power would stabilize the plant since two open control valves could pass the resultant steam produced.

Ultimately, operators inserted four control rods, which reduced power and increased the frequency of the power oscillations: Although the magnitude of the power oscillations decreased, the increased frequency of the power oscillations were now in the “counting domain" of the Oscillating Power Range Monitor system, and provided a valid input to the reactor protection system to cause an automatic reactor SCRAM.

Based on the above information and NEI 99-02, Revision 7, the inspectors' position is that the initial cause of the event (an unexpected control valve closure resulting in 10 percent power oscillations) was not the cause of the automatic reactor SCRAM. The reactor SCRAM was a result of operator action to insert control rods as an attempt to reduce power. Also, the cause of the greater than 20 percent power oscillations was a result of repeated operator decisions and actions to conduct troubleshooting activities during a 42 minute period. Therefore; this series of events should be counted in both the Unplanned Scrams per 7000 Critical Hours and Unplanned Power Changes per 7000 Critical Hours performance indicators.

Potentially relevant FAQs:

FAQ: 329

Date Entered: 12/12/2002

Cornerstone: Initiating Event

PI: IE03

Question:

NEI 99-02 states that unplanned power changes include runbacks and power oscillations greater than 20% of full power. Under what circumstances does a power oscillation that results in an unplanned power decrease of greater than 20% followed by an unplanned power increase of 20% count as one PI event versus two PI events? For example: During a maintenance activity an operator mistakenly opens the wrong breaker which supplies power to the recirculation pump controller. Recirculation flow decreases resulting in a power decrease of greater than 20% of full power. The operator, hearing an audible alarm, suspects the alarm may have been caused by the activity and closes the breaker resulting in a power increase of greater than 20% full power.

Response:

Both transients in the example should be counted. There were two errors: (1) opening the wrong breaker and (2) reclosing the breaker without establishing the correct plant conditions for restarting the pump. If the pump had been restored per approved procedures only the first transient would be counted.

Response Section

Proposed Resolution of FAQ:

This even should be counted as an unplanned SCRAM. The cause of the power oscillation and ultimately the reactor SCRAM were the same, the unanticipated closure of the second control valve. The conduct of turbine control valve testing in accordance with approved testing procedures combined with an unexpected equipment failure caused the SCRAM.

If appropriate, provide proposed rewording of guidance for inclusion in next revision:

No rewording of the guidance is required.

PRA update required to implement this FAQ?

No PRA updates are required.

MSPI Basis Document update required to implement this FAQ?

Not applicable.

NRC Response

Interpretation of Guidance and Process

This event did result in multiple unplanned power changes and one unplanned scrams, however due to its unique nature it does not easily fit the intent of NEI 99-02 when describing an unplanned power change. As such, the staff determined that the best approach to this event would be to use a site specific FAQ response dictated by NEI 99-02 Appendix D while trying to adhere to the logic of the Unplanned Power Changes per 7000 Critical Hours indicator guidance, while understanding that it cannot be applied literally. The staff decided to not attempt to update the PI guidance because this was a rare event and attempting to describe it could result in a complicated scenario that would confuse other simpler events that may require reporting.

The most applicable portion of NEI 99-02 to this event is the following:

A power oscillation that results in an unplanned power decrease of greater than 20% followed by an unplanned power increase of 20% should be counted as two separate PI events, unless the power restoration is implemented using approved procedures. For example, an operator mistakenly opens a breaker causing a recirculation flow decrease and a decrease in power of greater than 20%. The operator, hearing an alarm, suspects it was caused by his action and closes the breaker resulting in a power increase of greater than 20%. Both transients would count since they were the result of two separate errors (or unplanned/non-proceduralized action).

FAQ 329 referenced above also addresses this:

Both transients in the example should be counted. There were two errors: (1) opening the wrong breaker and (2) reclosing the breaker without establishing the correct plant conditions for restarting the pump. If the pump had been restored per approved procedures only the first transient would be counted.

The key factor in determining the number of transients that would count towards the PI is the number of separate errors that occurred. The staff decided to apply this concept to the Grand Gulf event rather than attempt to count each individual power change.

The staff did note the following section of NEI 99-02:

Off-normal conditions that begin with one or more power reductions and end with an unplanned reactor trip are counted in the unplanned reactor scram indicator only.

It is the staff's opinion that this guidance applies to a single, relatively short duration, transient that begins with a downpower, and ends with either a manual or automatic scram. An example would be lowering condenser vacuum where the crew lowers reactor power to try to halt the lowering vacuum, but the condition worsens until a scram occurs. In the Grand Gulf event, power oscillations occurred in both the upward and downward direction for approximately 50 minutes before the final operator action to insert rods to lower power which ended with the OPRM scram signal.

<u>Disposition</u>

The staff determined that three separate errors occurred during this transient that are indicative of plant performance and should be considered inputs into the unplanned power change PI.

The first error was the equipment issue that led to the initial oscillations. This issue can be summarized as a combination of both the failure of start-up fluid MSV 3 solenoid valve 1N32F514C/SJ13S243 due to excessive mechanical force along with the procedural inadequacies of 06-OP-1N32-V-0001 Attachment II.

The second error was the decision by operators, at time 02:27, after having stopped the procedure, to not proceed with the conservative path of inserting a manual scram or commencing a shutdown, but to try to continue the procedure. This resulted, as seen on the PDS trend plot in an increase in the magnitude of oscillations at that time.

The third error occurred at time 02:49, when the operators again attempted to utilize the surveillance procedure rather than take the more conservative path of a scram or shutdown.

The decision to begin to insert control rods to lower power would be the beginning of the final transient, which resulted in the OPRM scram, as such, this final portion of the event would count only towards the unplanned scram PI.

This response only applies to this specific event at Grand Gulf.

Root Cause Evaluation

Site / Unit:	Grand Gulf Nuclear Station / Unit 1		
Event Title:	Operators' Decisions Prior to an Automatic SCRAM		
Event Date:	June 17, 2016		
CR Number:	CR-GGN-2016-4834		
Report Date:	August 15, 2016	**Revision:**	0

	Type Name
Team Lead:	James Nadeau
Independent Reviewer:	Peg Lucky, RBS
Evaluators:	Wesley Johnson Greg Duffy, Industry Consultant Mel Leach, Industry Consultant
Responsible Manager:	Brad Wertz
CARB Chairperson:	James Nadeau

Problem Statement	*Reference Procedure Step 5.4*

At Grand Gulf Nuclear Station on June 17, 2016, gaps in Control Rom supervisors' performance resulted in the failure to take the appropriate conservative action and initiate a manual SCRAM. This resulted in Reactor power, pressure, and level oscillations over a 44 minute period.

Object: Control Room supervisors' performance
Deviation: Failure to take conservative action and initiate a manual SCRAM
Consequence: Reactor power, pressure, and level oscillations over a 44 minute period

Evaluation Summary	*Reference Procedure Step 5.15*

Event Summary:
On June 17, 2016, Grand Gulf Nuclear Station Unit 1 (GGNS) was in Mode 1 at approximately 65% power after a planned power reduction to complete a Control Rod sequence exchange, Steam Jet Air Ejector (SJAE) swap, Cooling Tower acid flush, and Main Turbine Stop and Control Valve Operability Surveillance (06-OP-1N32-V-0001).

During the performance of the Main Turbine Stop and Control Valve Operability Surveillance, the 'B' Turbine Stop Valve (TSV) was closed, as directed by the surveillance procedure. While the 'B' TSV was closed, the 'D' TSV unexpectedly closed at 02:12, resulting in a Division 2 Reactor Protection System (RPS) half SCRAM signal.

With the two TSVs ('B' and 'D') closed, the remaining two Turbine Control Valves ('A' and 'C' TCVs) were challenged to precisely control Turbine and Reactor pressure. Both turbine throttle and reactor pressure began to fluctuate because of the 'A' and 'C' TCV oscillations. Reactor pressure increased, but remained below the high pressure alarm and SCRAM setpoint (1064.7 psig). Reactor water level remained between the SCRAM low and high setpoints (+11.4" Narrow Range [NR] and +53.5" NR).

Initially, attempts were made to re-open the 'B' TSV. These attempts continued for the next 39 minutes until four control rods were directed to be inserted. Control rod insertion was completed at 02:54. The Reactor received an automatic SCRAM at 02:56 on a Neutron Monitoring System Oscillation Power Range Monitoring (OPRM) trip.

Plant Data System (PDS) computer trend data showed that Reactor power oscillated 10-20% peak-to-peak on the Average Power Range Monitoring System (APRM) during the periods of component manipulations that involved the Turbine Controls System (02:12 – 02:16; 02:30 – 02:32; 02:48 – 02:50). Reactor power oscillated approximately 10% peak to peak during other time periods during the transient. Reactor pressure oscillated 20 psig peak-to-peak.

Evaluation Summary	*Reference Procedure Step 5.15*

During the transient, the Operating Crew believed the reactor was safe and thought they were acting conservatively based on the following actions:

1. The CRS had set limits on Turbine Casing delta temperature and assigned operators to monitor power, pressure, and level for changes.
2. The At-The-Controls Operator (ACRO) questioned if Thermal Hydraulic Instability (THI) was occurring, and the crew confirmed that oscillations were not THI. The crew determined that the reactor parameter oscillations were caused by TCVs repositioning.
3. The Crew questioned thermal limits, and the Reactor Engineer (RE) ran three Thermal Limit cases throughout the transient. These cases confirmed thermal limits were not being challenged.
4. The Crew had developed a strategy to reset the ‘B’ TSV and to reduce power by inserting control rods if the ‘B’ TSV did not re-open.
5. A manual SCRAM was to be initiated if the control rod insertion did not stabilize the reactor parameter oscillations.
6. The Crew had questioned and confirmed they did not want to reduce core flow using the Reactor Recirculation System Flow Control Valves (FCVs) because that would place the reactor closer to operation in a region of potential instability.
7. The crew thought they understood the condition and could fix it based on actions taken from a previous event in 2015.

There were flaws in the Crew’s plan and logic.

1. Actions limits were not set for power, pressure and level.
2. The thermal limit cases run by the RE are valid for stable conditions. The cases are inconclusive for the oscillations observed because the snapshot may not be representative of the peaks.
3. The Crew did not fully understand the cause of the ‘D’ TSV closure. The reason for the unexpected ‘D’ TSV and plant conditions was not the same as the 2015 event.
4. Time limits were not set for recovering the ‘B’ TSV, or for the control rod insertion.

There were multiple instances where control room personnel failed to remain in role, as defined by EN-OP-120 “Operator Fundamentals Program” and EN-OP-115, “Conduct of Operations.” These lapses resulted in opportunities being missed to set appropriate benchmarks for actions to be taken based on plant parameters and provide the necessary oversight of the crew behaviors.

The crew did not exhibit a strong conservative bias in their assessment of the potential impact of the pressure control system oscillations on reactor power, pressure and level during the period of approximately 44 minutes prior to the scram. Upon review of the transient, GGNS Management identified that the crew should have inserted a manual SCRAM within the first few minutes of the transient instead of making continued attempts to reopen the closed turbine stop valve.

A gap analysis to SOER 94-1, 96-1 and SOER 10-2 was conducted and it was found that although training and process changes had been conducted, many of the behaviors exhibited in these SOERs were similar to this transient. The site’s existing strategy for ensuring the lessons learned from these SOERs are internalized by control room personnel includes: process guidance, initial and continuing training, management reinforcement for conservative decisions and similar reinforcement for managers to stay in their role.

Evaluation Summary	*Reference Procedure Step 5.15*

Based on the crew's response to the turbine control system transient, the following assessment can be made regarding the effectiveness of the existing site strategy for ensuring control room crews operate with a conservative bias:

- This Root Cause Team determined that the necessary guidance for making a conservative decision when a procedure is inadequate or a procedure does not exist has not been effectively implemented. Entergy Fleet direction for making conservative decisions is specified in EN-OP-115, Conduct of Operations; GGNS-specific direction for items to consider had not been developed.

- The communications during the transient were ineffective in that a formal Transient Brief with the entire crew was not conducted. The phone calls to the Duty Manager and Operations Manager – Shift did not contain sufficient details of the transient that might have enabled them to advise the SM to scram the unit. Also, the Duty Manager and OM-Shift did not request specific details of the transient during the phone calls.

- The OM-Support is trained like any other SRO. During the transient, the OM-Support fell back into an SRO role and did not maintain the "balcony view" of the crew's performance and decision making. Additionally, the STA was not requested to return to the Control Room to oversee the transient, nor did he decide to do so on his own.

- An off-normal event procedure for Reactor pressure control malfunctions with pre-determined action points did not exist at GGNS for this transient.

Causes and Corrective Actions:

<u>Root Cause(s)</u>:

[EMFM Cause] RC1: The Root Cause of the event is Station Management has not effectively implemented a comprehensive Conservative Decision Making (CDM) strategy which would include training, procedures, and reinforcement of CDM Fundamentals in order to assure that Shift Management will consistently make conservative decisions when faced with abnormal, but not SCRAM-imminent events. This Root Cause resulted in the crew focusing on re-opening the 'B' Stop Valve and Shift Management's failure to direct a manual SCRAM be inserted when plant conditions warranted. This cause produced the extended duration of the transient. **[FX07: (PII S2) Strategic Planning – Inadequate Assessment of Company Capabilities.]**
The CAPR for RC1 involves developing and implementing a comprehensive Conservative Decision Making strategy, based on benchmarking INPO recommended stations and best practices that accounts for generic transients so that conservative decisions are consistently made by all operating crews.

<u>Contributing Cause(s)</u>

[O&P Cause] CC1: The first Contributing Cause of the event is inadequate crew communication. The CRS failed to conduct a transient brief with the entire crew in accordance with EN-OP-200 – Plant Transient Response Rules. This inadequate communication contributed to the event by delaying transient termination. **[FO10: (PII O4) Organizational – Inadequate Communication Within an Organization]**
The key corrective actions include collaborating with Operations Training to focus on inter-crew communications during Simulator and Control Room events. The communications can include a crew-wide update and or transient brief.

Evaluation Summary	*Reference Procedure Step 5.15*

[O&P Cause] CC2: The second contributing cause of the event was ineffective implementation of Shift Management (SM, CRS, and STA) and oversight roles and responsibilities in the control room during this transient. This failure to effectively implement roles and responsibilities, as defined in EN-OP-115: Conduct of Operations and EN-OP-120: Operator Fundamentals Program, contributed to the event by delaying transient termination. The crew focused on the turbine controls versus reactor stability. **[FO03: (PII OP1): Organization-to-Program – Lack of Commitment to Program Implementation]**

The key corrective actions include developing an "Operations High Intensity Oversight Plan." This plan will bring in contractors that will observe, coach and trend standards lapses in the management of the control room staff on a 24/7 hour per day basis for a minimum of three months. The results of thi high intensity observation program will be regularly briefed with the Site Vice President, General Manager of Plant Operations, and Senior Operations Manager.

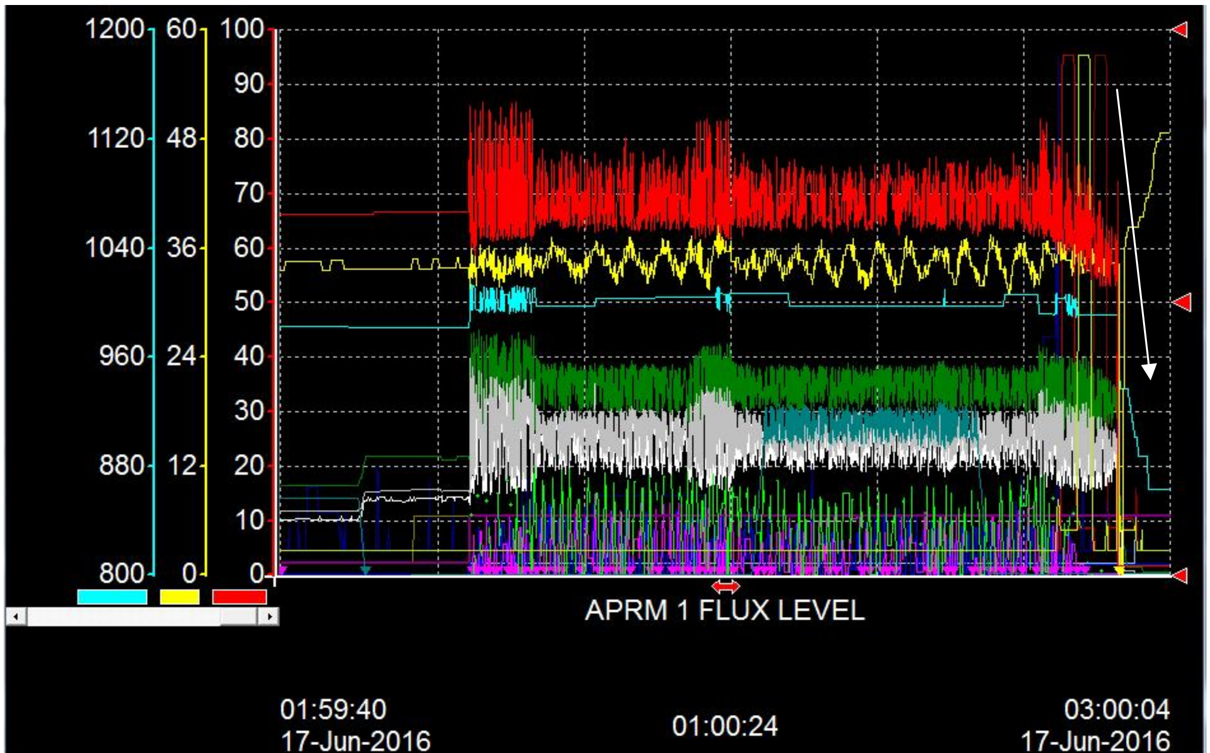
[O&P Cause] CC3: The third contributing cause of the event is the station did not create the necessary procedural guidance to address operational impacts of equipment issues related to the Turbine Controls System (System number N32). This contributed to the event because the operators were not sufficiently prepared for unanticipated issues where a conservative decision would be required, ultimately delaying the termination of the transient. **[FO08: (PII O2) Organizational – Inadequate Attention to Emerging Problems]**

The key corrective actions include a review of current ODMIs to determine if enhanced procedural direction is required until permanent equipment repairs are completed, and the development of a new Off-Normal Event Procedure (ONEP) for Reactor Pressure Control Malfunctions.

Event Description	*Reference Procedure Step 5.5*

The equipment malfunction that caused the SCRAM that occurred at 02:56 on June 17, 2016, is being evaluated under a Root Cause Evaluation captured in CR-GGN-2016-4766. A detailed timeline of events is included as Attachment 1.

Overall Transient View



✔	Point ID	Description	Value	Engr	Qual	Y Min	Y Max	Value Min	Value Max	Valu
✔	C51NA051	APRM 1 FLUX LEVEL	0.0000	%PWR	GOOD	0.0000*	100.0000*	1.7762	86.8976	68
✔	C34NA001	STEAM DOME PRESSURE	-0.7372	PSIG	LOW...	800.0000*	1200.0000*	862.7905	1019.6461	996
✔	C93CA001	REACTOR NARROW RANGE LEVEL - SPDS	31.1585	INCHES	GOOD	0.0000*	60.0000*	-15.0000	48.7561	34
✔	N30N023A.C88	HP CONTROL VALVE A POSITION	0.9888	%	GOOD	0.0000*	200.0000*	-0.4150	73.5596	48
✔	N30N023B.C88	HP CONTROL VALVE -B- POSITION	-0.2625	%	LOW...	0.0000*	200.0000*	-0.6287	64.1296	44
✔	N30N023C.C88	HP CONTROL VALVE -C- POSITION	1.2634	%	GOOD	0.0000*	200.0000*	0.6836	79.8157	51
✔	N30N023D.C88	HP CONTROL VALVE -D- POSITION	1.5381	%	GOOD	0.0000*	200.0000*	0.9583	90.1611	68
✔	N30N026A	BYPASS CONT VALVE 1 POSN	-0.7813	%	GOOD	0.0000*	200.0000*	-0.8203	39.9609	14
✔	N30N026B	BYPASS CONT VALVE 2 POSN	-0.7813	%	GOOD	0.0000*	200.0000*	-1.9141	29.4531	8
✔	N30N026C	BYPASS CONT VALVE 3 POSN	-0.6250	%	GOOD	0.0000*	200.0000*	-0.1953	27.0313	8
✔	N30N021A	MSV A POSN	CLOSED		GOOD	N/A	N/A	N/A	N/A	
✔	N30N021B	MSV B POSN	CLOSED		GOOD	N/A	N/A	N/A	N/A	
✔	N30N021C	MSV C POSN	CLOSED		GOOD	N/A	N/A	N/A	N/A	
✔	N30N021D	MSV D POSN	CLOSED		GOOD	N/A	N/A	N/A	N/A	

Operator Response

Overall response to the transient was determined to be unacceptable. The transient was caused by a concurrent closure of 'B' and 'D' HP Turbine Stop Valves (TSVs). The 'B' TSV was closed using instructions from the Turbine Stop and Control Valve Operability Surveillance (06-OP-1N32-V-0001, Attachment 2). The 'D' TSV closed for an unknown reason to the crew. Prior to the automatic scram, the operating crew chose to attempt to correct the equipment malfunction for an extended and unacceptable period of time.

Event Description	*Reference Procedure Step 5.5*

The crew delayed the actions to lower reactor power for 39 minutes while Reactor power, pressure, and level were fluctuating. Although benchmarks were set for turbine casing differential temperatures, they were not set appropriately for reactor parameters (power, pressure, or level).

The crew had verified that they were in the “OPRM Armed” region of the power/flow map, but outside of the areas where thermal hydraulic instability is known to occur (high Reactor power and low core flow). The crew became distracted with the turbine issues and did not realize how much time had passed during their efforts to respond to the turbine. They did not realize how long they were making attempts to reopen ‘B’ Stop Valve prior to directing control rods be inserted to reduce power.

The individual providing oversight during the planned power maneuver (Operations Manager – Support) similarly became focused on the need to correct the equipment problem and failed to remain in an oversight role to ensure the Shift Manager (SM) and Control Room Supervisor (CRS) were being conservative in their decision-making.

The SM and CRS both failed to remain in their oversight role. The CRS retained his “command and control” function, and provided clear direction for the Reactor Operators to follow. The CRS did not retain a broad sense of the transient, and became focused on re-opening the ‘B’ TSV. The SM did not retain his conservative bias, and failed to re-direct the CRS from making attempts to recover the ‘B’ TSV.

The Shift Technical Advisor/Field Support Supervisor (STA/FSS) was fulfilling his FSS role by providing in-field oversight to the team of Non-Licensed Operators (NLOs) performing the Turbine Stop and Control Valve Operability Surveillance. During the entire transient, the STA/FSS remained in his FSS role and provided oversight of the NLOs at the Turbine Front Standard. The STA/FSS was never directed to return to the Control Room to resume his STA role until the automatic SCRAM occurred.

As previously noted, initial response to the pressure control issue prior to the SCRAM did not indicate the expected bias for conservative action to insert a reactor SCRAM when plant conditions warranted it. The crew did not have clear off-normal procedural guidance for a malfunction of the Electro-hydraulic Control (EHC) system. The crew ruled out guidance in the procedure for thermal hydraulic instability (Reduction of Recirculation Flow Rate ONEP) because it was determined using the station’s “Power to Flow Map” that the reactor was operating in a region where THI was less likely to occur. Based on their indications, the control room crew determined that the Reactor power fluctuations being experienced were caused by the oscillation of the Control and Bypass Valves. The crew’s decision to insert control rods to lower power, while conservative, contributed to the OPRM scram.

During the transient, the SM contacted the Operations Manager – Shift in accordance with GGNS Management Standard 20, “Management Notifications.” This procedure provides a guidance to ensure appropriate management notifications are made as plant conditions warrant. The notification was made due to the unexpected transient occurring. The SM and Operations Manager – Shift did not have a standardized communication protocol to follow. The SM did not discuss the APRM oscillations, but did discuss the two closed TSVs and the Reactor pressure and level oscillations. The Operations Manager – Shift did not request a discussion related to the APRMs.

Event Description	*Reference Procedure Step 5.5*

The SM contacted the Site Duty Manager, also in accordance with GGNS Management Standard 20, due to the onset of the transient. There was no standardized protocol for either the SM or Site Duty Manager to follow for this notification.

The crew did not exhibit a strong conservative bias in their assessment of the potential impact of the pressure control system oscillations on reactor power, pressure and level during the period of approximately 44 minutes prior to the scram. Upon review of the transient, GGNS Management identified that the crew should have inserted a manual SCRAM instead of making continued attempts to reopen the closed turbine stop valve.

A gap analysis to SOER 94-1, 96-1 and SOER 10-2 was conducted and it was found that although training and process changes had been conducted, many of the behaviors exhibited in these SOERs were similar to this transient. The site's existing strategy for ensuring the lessons learned from these SOERs are internalized by control room personnel includes: process guidance, initial and continuing training, management reinforcement for conservative decisions and similar reinforcement for managers to stay in their role.

Based on the crew's response to the turbine control system transient, the following assessment can be made regarding the effectiveness of the existing site strategy for ensuring control room crews operate with a conservative bias:

- This Root Cause Team determined that the necessary guidance for making a conservative decision when a procedure is inadequate or a procedure does not exist has not been effectively implemented. Entergy Fleet direction for making conservative decisions is specified in EN-OP-115, Conduct of Operations; GGNS-specific direction for items to consider had not been developed.

- The communications during the transient were ineffective in that a formal Transient Brief with the entire crew was not conducted. The phone calls to the Duty Manager and Operations Manager – Shift did not contain sufficient details of transient that might have enabled them to advise the SM to scram the unit. Also, the Duty Manager and OM-Shift did not request specific details of the transient during the phone calls.

- The OM-Support is trained like any other SRO. During the transient, the OM-Support fell back into an SRO role and did not maintain the "balcony view" of the crew's performance and decision making. Additionally, the STA was not requested to return to the Control Room to oversee the transient, nor did he decide to do so on his own.

- An off normal event procedure for Reactor pressure control malfunctions with pre-determined action points did not exist at GGNS for this transient.

Shift Workload for the night of 06/16/2016 – 06/17/2016
For this particular night shift, the work load was high and extra personnel were brought in to adjust for the work load. The crew scheduled the necessary ROs and NLOs to support the evolutions planned that night. The workload was not excessive due to the extra operators.

Event Description	*Reference Procedure Step 5.5*

Additionally, an extra SRO was assigned to monitor reactivity manipulations (Reactivity SRO) and the OM-Support was present in the Control Room to provide the necessary oversight for the down power and sequence exchange. Once the down power and sequence exchange were completed, the Reactivity SRO left the Control Room to work on other administrative duties. The Reactivity SRO was summoned back to the Control Room just prior to the reactor SCRAM. The OM-Support remained in the Control Room for the duration of this transient.

Recent events involving operators were reviewed, and determined this particular Shift Management crew (SM, CRS, and STA/FSS) were not involved in the previous events. Those events have been classified as Apparent Cause Evaluations, and are discussed in the respective Condition Reports. This crew had recently been evaluated in the simulator by the corporate operations experts during the biennial Entergy Crew Performance Evaluation attaining scores in all categories above the “satisfactory” band.

Operator Training
ROs, STAs, and SROs are trained approximately every 7 weeks to maintain their operational proficiency. Each training week includes time in the classroom and in the simulator where the training conducted is a function of the Long Range Training Plan (LRTP), which is derived from tasks selected for continuing training. Classroom training consists of a review of systems and procedures. Training is also provided in key SOERs and other industry events, as determined by GGNS response and Operations Training Review Group (TRG) actions. Simulator training is where the crews exercise System Operating Instructions (SOIs, Alarm Response Instructions (ARIs), Off-Normal Event Procedures (ONEPs), and Emergency Procedures (EPs). Each crew is trained to assess the transient, determine a plan of action, and then execute the plan of action to mitigate the effects of equipment malfunctions, and off-normal or accident conditions. For example, the crew is presented a case where a component malfunctions. They assess the malfunction and follow the procedural guidance provided in SOIs, ARIs, ONEPs, and EPs, as appropriate. The shift management (CRS, SM, and STA) assesses the overall situation and plant status to decide on the conservative actions to perform. The CRS directs the crew to perform actions from the ARIs, ONEPs, and EPs as necessary. The CRS informs the crew via either crew brief or update of his intended actions. During the crew brief or update, the CRS should establish a “line in the sand” (benchmark) for the crew to secure a system or SCRAM the reactor. ROs may be assigned critical parameters to monitor. Critical parameters are comprised of three parts:

1. The parameter,
2. The frequency of an update,
3. And the action to take upon reaching a pre-determined value.

In addition, the ROs can, and are expected to, immediately take action when control of the plant or component cannot be maintained, including stopping the evolution, involving supervision, securing the component and initiating a manual SCRAM.

Scenarios that challenge the Operators to make conservative decisions, where there is no existing procedure guidance, have not been trained. However, Operators are challenged in scenarios to make the “prudent” choice instead of “allowable” choices, and constantly coached to maintain Reactor safety at all times.

The OM-Support is trained as part of the License Operator Requalification Program in order to maintain his SRO license. There is no specific training provided for serving in the oversight role.

Event Description	*Reference Procedure Step 5.5*

The operators do receive training on conservative decision making and staying in role. These are generally lectures which have incorporated lessons learned from SOER 94-1, SOER 96-1 and SOER 10-2. Reinforcement of these principles occur in both simulator and plant situations.

Plant Response
An assessment of the plant's integrated response to the initiating event and subsequent plant scram has been conducted. This assessment indicates that reactor pressure control system was affected and ultimately resulted in a trip of the OPRMs, causing a reactor scram.

Operators cannot directly read the information the OPRMs are monitoring. Following the insertion of control rods, the power oscillations were shifted to within the "range of interest" of the OPRM's period based detection algorithm (PBDA), and were of sufficient amplitude to cause clear peaks and valleys on the normalized cell signals. A neutron monitoring system trip was ultimately generated due to exceeding the PBDA amplitude trip setpoint with sufficient confirmation counts. The OPRM response is currently under reviews by Genral Elecgric Corporation.

The response to the closure of the 'B' and 'D' main stop valves, due to the failure of the reset solenoid valve 1N32F514C, resulted in pressure control and associated fluctuations in reactor level and APRM flux. These swings were the result of the need for the two remaining control valves (A and C) to operate at a non-linear point on their flow characteristic (CV) curve. This is discussed in the equipment failure evaluation written in response to CR-GGN-2016-4766.

OPRMs 1, 3, and 4 tripped within 0.015 seconds of each other.

Factors Influencing the Event
Equipment Issues
Grand Gulf has had long-standing issues with the Turbine Controls System. Condition Reports as far back as 2005 have reported issues with spurious Turbine Control Valve swings, issues while using the ATT, issues while manually testing ATT devices, spurious Pressure Demand changes, and lift faults on the Bypass Valves. These long-standing issues have desensitized the site to the challenges operators face when operating the unit. CR-GGN-2016-4998 describes a second automatic SCRAM, and that Root Cause Evaluation focuses on the long-standing issues related to the Turbine Controls System.

A review of the System Health Report back to Q1-2013 indicates the system has been classified as follows:

Quarter	Color	Grade
2013-Q1	WHITE	85.03
2013-Q2	WHITE	85.03
2013-Q3	WHITE	85.03
2013-Q4	RED	68.77
2014-Q1	YELLOW	79.69
2014-Q2	RED	68.71
2014-Q4	RED	66.73
2015-Q1	RED	68.71
2015-Q2	RED	70.76
2015-Q3	RED	72.74
2015-Q4	RED	72.74
2016-Q1	WHITE	85.67
2016-Q1	WHITE	85.67

The poor rating of the N32 System over the last 3+ years has led to the operators, engineers, and maintenance personnel mitigating the issues to bridge continued operations until the digital controls system is installed via SIPD 154 and SIPD 167. These two SIPDs have been tentatively scheduled for implementation in RF21 or RF22. The bridging strategy has consisted of refurbishing obsolete electronic components until the digital upgrade can be installed.

The operators have been conducting Turbine Stop and Control Valve Operability Surveillance from the front standard for years due to long standing equipment deficiencies with Automatic Turbine Tester (ATT). Although repairs were made in the recent RF 20 to make the ATT operational, recent performance with the ATT locking up, returned the test to the front standard.

Event Description	*Reference Procedure Step 5.5*

CR-GGN-2015-2061 documents receipt of a Division 2 Half SCRAM while performing Turbine Stop and Control Valve Operability Surveillance Attachment 2 Step 5.2.7.o (the same step as this event.) This was the last time the surveillance was performed until June 17, 2016 (reference WO 52600990-01 and PMID 50019925-01). The solenoid valves were replaced in RF 20.

Since January 1, 2016, the following Condition Reports have been written, and provide a basis for the station's decision to perform the Turbine Stop and Control Valve Operability Surveillance manually instead of with the ATT.

1) CR-GGN-2016-1129: Engineering documents issues encountered with the ATT Program and suggested WO 372439-09 be used to address these issues during RF20.
2) CR-GGN-2016-3558: ATT Safety Device Test EPI (04-1-03-N32-5) locked up at Step 7.2.4.c. Troubleshooting performed proved that JC13 C06 energized when provided 24 VDC from the output of JC11 F29, proving the relay works correctly. Suspect the cause of the condition is a failure of card JC11 F29. Testing returned to front standard after this CR.

Test Methodology
The Turbine Stop and Control Valve Operability Surveillance can be performed using the ATT or by manually depressing plungers on solenoid valves from the Turbine Front Standard on the Turbine Deck. The operators performed the Surveillance manually for this event.

The surveillance was run manually from the Front Standard. While there, the operators were in communication with the Main Control Room via one headset. The area for the surveillance is in a high temperature (> 115^{o}F) and high noise ($\geq$ 85 dB) environment.

Operator Experience Level and Training
The Shift Manager obtained his SRO license at GGNS in November, 2013. He spent approximately 6 months on shift as a CRS before spending approximately 12 months as a Work Control Center SRO. He had been 'C' Shift Manager for approximately 12 months prior to this event.

The CRS obtained his SRO license at GGNS in October 2012. He spent approximately 16 months on shift as a CRS before serving as 'C' Shift STA, with the Shift Manager described above, for the next 2 years. He transitioned back to CRS on 'C' Shift in May 2016 with the same Shift Manager.

Shift Technical Advisor and Field Support Supervisor (STA/FSS) are two listed positions that are typically filled by one individual. The STA/FSS spent approximately 16 months on shift as an NLO after completing NLO Initial Training. He spent the next 12 months in STA Initial Training. He was STA-qualified for approximately 1 month prior to this event. The STA/FSS is not required to hold an active SRO license. On the night of the event, the STA/FSS on shift did not have an SRO license, and was new in position.

The Shift Manager, CRS, and STA had officially stood watch as a team for 7 shifts prior to the event described in this CR.

Based on review of the Narrative Logs, four ROs were assigned to the control room on that night shift. One RO has been licensed at GGNS for over 10 years. The second RO has been licensed for approximately 2 years. The third RO had spent the previous fuel cycle off shift developing tagouts and is now assigned to control room shifts. The fourth RO was recently licensed, and had started standing shift in March 2016.

Event Description	*Reference Procedure Step 5.5*
The SROs and ROs receive training on conservative decision making and staying in role. These training sessions are generally designed as lectures which have incorporated lessons learned from SOER 94-1, SOER 96-1 and SOER 10-2. Reinforcement of these principles takes place in both simulator and plant situations. In addition the Shift Manager attended the INPO leadership development seminar for Shift Mangers, which is designed to similarly reinforce conservative decision making principles.	

Operating Experience	*Reference Procedure Step 5.6*

Internal Operating Experience:
Using the Paperless Condition Reporting System (PCRS) Database (and other databases), OE searches were performed for applicable CRs that were originated between (07/2012) and (07/2016). The search criteria included Category A and B CR's where the following keywords were in the condition description field: "Risk Assessment"; "Operator Fundamental"; "SCRAM"; and "Non-Conservative." The search yielded 150 CR's. All CRs were reviewed and 4 were found to be applicable to this evaluation. The applicable results of this search are as follows:

CR-PNP-2013-1564, Control Room Teamwork Shortfalls (INPO AFI)

Brief Summary: Lapses in operations personnel exercising command and control, providing needed oversight, and challenging one another's actions are contributing to shortfalls in control room teamwork.

Cause(s):

AC1: Team behaviors were being evaluated by senior managers to a standard inconsistent with industry excellence. The analysis concluded that the apparent cause is a failure to implement all elements of the new industry standard for key attributes of control room team work.

CC1: The simulator debrief process identified that the grading tool being used to evaluate crew fundamentals, and only permitted capturing a gap in a single fundamental area. This limitation prevented identifying performance shortfalls that belonged in more than one area.

CC2: The crews are not consistently self-critical of performance and gaps in performance went unchallenged by the evaluation team occasionally.

Pertinent Corrective Actions: Establish standard for crew simulator debrief self-criticality and formally establish expectation for its use. Create 'What it Looks Like' (WILL) sheet for control room teamwork behavior evaluation. Add WILL sheet results to critical parameter metric for crew and department trending. Implement Shift Manager cross-crew evaluations of teamwork and debrief effectiveness.

CR-GGN-2015-2991, Common Cause Evaluation for Operator Fundamentals

Brief Summary: Over the course of recent months an adverse trend in the Operations Department has emerged, indicating weaknesses in the application of operations fundamentals.

Cause(s):

AC1: Inadequate program monitoring or management; inconsistent reinforcement of operator fundamentals.

CC1: Operations Management did not use leading indicators.

CC2: Operators are overconfident and make assumptions rather than verify information.

Pertinent Corrective Actions: Implemented a shiftly Operator Fundamentals focus. Implemented 100% field oversight. Created a paired observation program standard.

Operating Experience	*Reference Procedure Step 5.6*

CR-GGN-2015-4299, Weakness in Operator Fundamentals (INPO AFI)

Brief Summary: CRS do not establish appropriate priorities when mitigating some simulated events. Consequently, actions were not taken in a timely manner.

Cause(s):

AC1: Inadequate program monitoring and management; inconsistent reinforcement of Operator Fundamentals.

CC1: Operations Management did not adequately reinforce the use of Operator Fundamentals.

CC2: Operators are overconfident, make assumptions, and fail to consult supervision to address questions.

Pertinent Corrective Actions: Performed WILL Sheets for Questioning Attitude, Control, and Procedure Use and Adherence. Continued actions from CR-GGN-2015-2991.

Operating Experience	*Reference Procedure Step 5.6*

External Operating Experience:
A search of Significant Operating Experience was performed. The search was performed for IERs L1, L2, SOERs, SERs, INs, GLs, NRC Bulletins. The search identified the following applicable significant OE:

IER L1-11-3, Operator Fundamentals

This INPO Event Report (IER) establishes actions to assess the effectiveness of operator fundamentals and operator training programs at each station. Analysis of the assessment results will be used to revise other guidance, as appropriate. Lessons learned from the assessments will be shared industry-wide to promote further learning. This IER also establishes actions to ensure operator fundamentals are well-ingrained and rigorously applied within Operations.

Causes and contributing factors included:

- Operator fundamentals were not clearly defined.
- An over-reliance on process and procedures promoted a compliance-based approach to operations and a "checklist mentality." The focus became how to do the task, without appropriate consideration for why the task was being done.
- In some cases, operator initial and continuing training insufficiently challenges or reinforces operator fundamentals. Specifically, some training and operations departments did not institutionalize the initial changes in training and operations. Some corrective actions were one-time events or were limited in scope and duration.
- Management and supervisor monitoring, feedback, reinforcement, and correction of operator fundamentals were insufficient or ineffective.
- Because the plants are operating more reliably, operators have fewer opportunities to experience significant plant transients and complex evolutions that foster the development and application of operator fundamentals.

Recommendations include:

- Conduct a self-assessment of the operations training program to understand fully their effectiveness in training on operator fundamentals.
- Perform a self-assessment of operator fundamentals to identify gaps that could cause events or reduce crew effectiveness when responding to a transient.
- Implement the following organization and leader behaviors and practices to establish and reinforce operator fundamentals:
    - Clearly define, communicate, and make readily available for operator reference the fundamentals.
    - Ensure initial and continuing training provides operators with a thorough understanding of plant design, engineering principles, and sciences to complement task requirements. Ensure methods such as open-ended questioning, discussions, walk downs, and dynamic learning activities are used to establish, refresh, reinforce, and test this knowledge.

Operating Experience	*Reference Procedure Step 5.6*

- Actively monitor and engage operators to improve the application of operator fundamentals through in-field coaching. Ensure active monitoring includes the following goals and attributes:
  - Make changing behaviors the primary objective, with capturing and trending data as a secondary objective.
  - Include thorough, probing inquiry as part of any observations to assess the level of operator attention on the task, thinking process, level of task understanding, and mind-set; in addition to the visible behaviors, such as having the procedure in hand and self-checking.
  - Promote, reinforce, and reward behaviors that support a culture of intellectual curiosity – understanding how the plant works and why it works that way.
  - Build in follow-up activities to ensure identified gaps are addressed in a timely manner and are shared across crews and departments to promote learning and improvement.
- Ensure individuals in the operations line of responsibility (shift manager, operations superintendent, operations manager, plant manager, and site vice president) actively monitor key operator fundamental activities at an appropriate frequency.
- Ensure operator performance is closely reviewed after significant plant transients and scrams to identify potential weaknesses in behaviors, knowledge, and practices.

- Establish and maintain training and programs that support control room teamwork. Training and program aspects should include the importance of staying in role, of challenging other team members who do not meet the intent of their roles or step out of their roles, and of working together to control and monitor the plant effectively.
  - Make crew composition assignments to ensure there is a good mix of new and experienced operators on each crew with complementary backgrounds and personalities.
  - Ensure members of a newly constituted crew train together before assuming control room duties, and evaluate personnel returning from off-shift assignments.
  - Ensure the shift manager leads, sets high standards, encourages the crew members to be critical of their performance, and develops timely and effective actions to continuously improve crew performance.
- To ensure sustainability of the above actions, use the corrective action process, performance indicators, and self-assessments to identify, track, and trend effective application of the fundamentals.

Operating Experience	*Reference Procedure Step 5.6*

SOER 10-2, Engaged Thinking Organizations

The underlying causes of these events involve all levels of the organizations and include inadequate recognition of risk, weaknesses in the application of significant operating experience, tolerance of equipment or personnel problems, and a significant drift in standards. Organizational and leadership shortfalls allowed these weaknesses to go unrecognized or uncorrected. This SOER provides recommendations to correct the situations that allowed these events to occur.

Supervisors did not fulfill their expected oversight roles by becoming engaged in conducting activities. For example, at ANO shift managers tended to facilitate problem-solving instead of delegating to support staff. Several activities at Nine Mile Point created distractions that supervisors did not manage well. At Vogtle, two auxiliary operators—both first-time performers of the task—did not fully understand the instrument air restoration procedure, yet supervisory personnel allowed them to proceed without appropriate help.

Repetitive and long-standing issues were tolerated, and the consequences of not addressing them were not recognized. These issues involved both equipment and personnel and created conditions that caused or worsened the events.
Subtle declines in standards and performance went unnoticed because managers and supervisors were not sufficiently engaged in activities. Often, the focus on results overshadowed the emphasis on correct behaviors.

SOER 96-1, Control Room Supervision, Operational Decision-Making, and Teamwork

The SOER discusses nine significant events caused by deficiencies in supervisory oversight, reactivity control, teamwork, and crew decision-making. The safety culture weaknesses existed in the following areas: Control Room oversight, crew distractions, control of core reactivity, conservative decision-making, application of knowledge, teamwork, operating practices, crew composition, station management, and support organizations.

Crew performance is affected by the leadership of the shift manager and control room supervisor. The individuals filling the roles of these positions must function as team leaders and maintain close oversight of control room activities to detect errors or lapses in judgment or a breakdown in role responsibilities by other crew members. The supervisors must remain fully involved in all control room evolutions and be prepared to assert their authority for command and control whenever high standards are not being maintained.

Each of the nine events analyzed in this SOER resulted in operations outside the operational limits established by plant procedures. Often, the operational limits were made ineffective by non-conservative decisions, such as not following procedures, incorrect interpretation of a procedure’s intent, a reluctance to question the appropriateness of intended actions, or a lack of awareness of the importance of certain operating limits. Although crew control room crew members appeared to be functioning as a team, they were not. In some cases, this stemmed from the reluctance of crew members to question or challenge other members or to advocate a concern. In several cases, adding support personnel or personnel from another crew may have impacted team performance.

Operating Experience	*Reference Procedure Step 5.6*

When control room crews are augmented by support personnel or off-shift operators, the authorities and responsibilities of each person in the control room need to be emphasized and understood by the crew members. Station management should also develop a systematic process for crew rotations or personnel changes, with sufficient planning to allow new crew members to train together as a team.

SOER 94-1, Non-Conservative Decisions and equipment performance problems result in a Reactor SCRAM, two safety injections, and water-solid conditions.

Brief Summary: Salem Unit 1 rapidly reduced power because marsh grass was clogging the Circulating Water Intake Screens, resulting in an automatic trip of the Circulating Water Pumps. Reactor power reduction was not balanced with the Turbine load reduction, and changes in Reactor Coolant temperature were not well-controlled. Excess negative reactivity was inserted, causing Reactor Coolant temperature to decrease below the minimum temperature for criticality. Reactor Coolant pressure and Pressurizer level began to decrease rapidly. In an effort to restore temperature to the range required for critical operation, Control Rods were withdrawn continuously (for about 55 seconds), until this action was terminated by an automatic Reactor SCRAM at the 25% low-power, high-flux SCRAM setpoint that was unanticipated by the crew.

Conservative operational decisions, including removing the Main Turbine from service, and especially initiating a manual Reactor SCRAM, should be made without hesitation when faced with uncertain or degrading conditions that affect the reactor. Management support for conservative decision-making during plant operation must be communicated in clear and unequivocal terms and frequently reinforced.

These and other desired crew behaviors, including attention to key plant parameters, communications, and teamwork, must be a principal focus of operations management in selection and crew composition, and must be reinforced at every opportunity through training, observation, and coaching both in the plant and on the Simulator.

Equipment problems (workarounds) that can impair an operator's ability to control plant parameters, especially during transient conditions, must be resolved promptly.

Process changes, oversight and training are in place for these SOERs. These provisions were not effective in the crew failed to direct or insert a manual SCRAM instead of performing a power reduction. The Crew believed the reactor was safe and they were acting conservatively.

Operating Experience	*Reference Procedure Step 5.6*

Conclusions Related to Causes, Barrier and Corrective Actions:
The commonality of cause in the OE incidents reviewed supports the conclusion that supervisors must remain in role, crew members must challenge and question decisions openly and honestly, and finite termination points must be clearly communicated to all team members when troubleshooting. The primary barrier to preventing non-conservative decisions is frequent reinforcement from senior station leaders. As a corrective action, it is prudent to perform an assessment related to operator fundamentals, as recommended in IER L1-11-3.

Conclusions Related to Missed Opportunity:
Other nuclear facilities have experienced a lapse in shift management working out of role. The Entergy Crew Performance Evaluation (ECPE) conducted earlier in the week identified this crew had an opportunity for improvement in conducting crew briefs.

Also, the station missed an opportunity to conduct a Critical Evolutions Meeting for performing the Turbine Stop and Control Valve Operability Surveillance because the surveillance had not been performed in several months, and because of the additional tasks scheduled to be performed that shift. The CEM would have directed the Operations Department to present the work plan for that shift and contingency measures in place to offset the work scheduled.

As discussed in the Internal OE Section, the station had opportunities in 2015 to place an increased focus on all Operator Fundamentals. The two CRs listed in this section specifically target NLO Operator Fundamentals, and presented an opportunity for the Operations Department to focus on RO and SRO (SM, CRS, and STA) fundamentals.

Cause Evaluation	*Reference Procedure Step 5.7*

Analysis Discussion:
An Extended Comparative Timeline (Attachment 2) was assembled to accurately depict the sequence of events for the transient. In that timeline, the procedurally-required or management-preferred operator response is described. This tool helped the team determine the Direct Cause.

An Organizational & Programmatic Evaluation (Attachment 5) was completed to depict the factors and breakdowns within the organization and programs. That tool developed the Root Cause and most of the Contributing Causes.

A Gap Analysis (Attachment 4) to Operator Roles and Responsibilities was completed, and determined the Extended Comparative Timeline (Attachment 2) and O&P Evaluation (Attachment 5) had reached the appropriate conclusions.

Interviews helped develop CC1 (communications between the Shift Manager and off-shift members of Site Leadership). The Extended Comparative Timeline supports the conclusions drawn from the interviews.

Causes:
Direct Cause:
The direct cause of the operators not directing or inserting a manual SCRAM is the crew believed the reactor was safe and that performing a power reduction after attempting a valve reset was a conservative action. The crew, in this event, was comprised of the Shift Manager, Control Room Supervisor, Operations Manager – Support, Reactor Operators, and Reactor Engineers.

Root Cause(s):
[EMFM Cause] RC1: The Root Cause of the event is Station Management has not effectively implemented a Conservative Decision Making (CDM) strategy which would include training, procedures, and reinforcement of CDM Fundamentals such that Shift Management will consistently make a conservative decision when faced with abnormal, but not SCRAM-imminent events. This Root Cause resulted in the crew focusing on re-opening the ‘B’ Stop Valve and Shift Management’s failure to direct a manual SCRAM be inserted when plant conditions warranted. This cause produced the extended duration of the transient. **[FX07: (PII S2) Strategic Planning – Inadequate Assessment of Company Capabilities.]**

Contributing Cause(s)
[O&P Cause] CC1: The first Contributing Cause of the event is inadequate crew communication. The CRS failed to conduct a transient brief with the entire crew in accordance with EN-OP-200: Plant Transient Response Rules. This inadequate communication contributed to the event by delaying transient termination. **[FO10: (PII O4) Organizational – Inadequate Communication Within an Organization]**

Cause Evaluation	*Reference Procedure Step 5.7*

[O&P Cause] CC2: The second contributing cause of the event was ineffective implementation of Shift Management (SM, CRS, and STA) and oversight roles and responsibilities in the control room during this transient. This failure to effectively implement roles and responsibilities, as defined in EN-OP-115: Conduct of Operations and EN-OP-120: Operator Fundamentals Program, contributed to the event by delaying transient termination. The crew focused on the turbine controls versus reactor stability. **[FO03: (PII OP1): Organization-to-Program – Lack of Commitment to Program Implementation]**

[O&P Cause] CC3: The third contributing cause of the event is the station did not create the necessary procedural guidance to address operational impacts of equipment issues related to the Turbine Controls System (N32). This contributed to the event because the operators were not sufficiently prepared for unanticipated issues where a conservative decision would be required, ultimately delaying the termination of the transient. **[FO08: (PII O2) Organizational – Inadequate Attention to Emerging Problems]**

Possible Cause(s):
There are no possible causes for this event.

Extent of Condition

Reference Procedure Step 5.8

Extent of Condition Table:

Condition Statement:	Gaps in Control Room supervision performance resulted in the failure to take the appropriate conservative action and initiate a manual SCRAM. This resulted in reactor power, pressure, and level oscillations over a 44 minute period.		
Object:	Control Room supervision performance (SM, CRS, and STA/FSS)	**Defect:**	Failed to initiate a manual SCRAM
Tier	**Object**	**Defect**	**Comments**
Same-Same	SROs (SM, CRS, and STA/FSS)	Failed to direct a manual SCRAM.	Probability: Medium Consequence: High Risk: High Actions to correct cause discussed below.
Same-Similar	SROs (SM, CRS, and STA/FSS)	Failed to direct equipment to be shut down with abnormal operating parameters.	Probability: Medium Consequence: Medium Risk: Medium Actions to correct cause discussed below.
	SROs (SM, CRS, and STA/FSS)	Failed to direct a power reduction.	Probability: Medium Consequence: High Risk: High Actions to correct cause discussed below.
Similar-Same	ROs	Failed to insert a manual SCRAM, when directed.	Probability: Low Consequence: High Risk: Medium Actions to correct cause discussed below.
Similar-Similar	ROs	Failed to shut down equipment with abnormal operating parameters, when directed.	Probability: Low Consequence: Medium Risk: Low No actions required; basis discussed below.
	ROs	Failed to reduce power, when directed.	Probability: Low Consequence: Medium Risk: Low No actions required; basis discussed below.

Discussion:
All licensed operators are charged with protecting the health and safety of the public; and are licensed to make reactivity changes with that thought in mind. In this instance, the SROs and ROs both failed to direct or initiate a manual SCRAM when reactor parameters warranted (power, pressure, and level oscillations). The similar-similar conditions (failed to shut down equipment with abnormal operating parameters and failed to reduce power when directed) do not warrant correction based on the current training and expectations set forth in EN-OP-115 and EN-OP-120.

The Extent of Condition is corrected by implementing a Conservative Decision Making methodology that addresses short term decisions where off normal equipment response is not addressed by current procedures and an automatic SCRAM is not imminent. (CA-007).

Extent of Cause

Reference Procedure Step 5.9

Extent of Cause Table:

Cause Statement:	**RC1:** Station Management has not effectively implemented a Conservative Decision Making (CDM) strategy which would include training, procedures, and reinforcement of CDM Fundamentals such that Shift Management will consistently make a conservative decision when faced with abnormal, but not SCRAM-imminent events.		
Object:	Conservative Decision Making strategy	**Defect:**	Not effectively implemented
Tier	**Object**	**Defect**	**Comments**
Same-Same	Conservative Decision Making strategy	not effectively implemented	High Risk. High Probability – Process does not exist. Medium Consequence – Results in Automatic Trip versus manual. Address with actions for cause.
Same-Similar	Conservative Decision Making strategy	Inconsistent expectations Not reinforced	High Risk. High Probability – Process does not exist. Medium Consequence – Results in Automatic Trip versus manual. Address with actions for cause. Change Management for new process requires communication of expectations, training and reinforcement.
Similar-Same	Risk Evaluations strategy Operational Decision Making Process	not effectively implemented	Low Risk – Programs exist. See discussion below.
Similar-Similar	Risk Evaluations strategy Operational Decision Making Process	Inconsistent expectations Not reinforced	Low Risk – Programs and WILL Sheets exist. Programs have been subjects of assessments and Management Focus areas for multiple years. See discussion below.

Discussion: The Extent of Cause will be addressed by the development and change management for the Conservative Decision Making methodology described in CA 007. Other similar programs already exist and are being implemented. For example, EN-HU-104 Engineering Task Risk and Rigor, EN-OU-108 Shutdown Safety Management Program, EN-WM-104 Online Risk Assessment, and EN-OP-111 Operational Decision Making Process are all corporate procedures, and are fully implemented at GGNS.

Extent of Cause	*Reference Procedure Step 5.9*

Extent of Cause Table:

Cause Statement:	**CC1:** The first contributing cause of the event is inadequate crew communications. The CRS failed to conduct a transient brief with the entire crew in accordance with EN-OP-200.		
Object:	Crew Communications	**Defect:**	inadequate
Tier	**Object**	**Defect**	**Comments**
Same-Same	Crew Communications	inadequate	High Risk. High Probability – Process does not exist. Medium Consequence – on-call site management did not fully understand the status of the plant. Address with actions for cause.
Same-Similar	Crew Communications	Inconsistent expectations Not reinforced	High Risk. High Probability – Process does not exist. Medium Consequence – on-call site management did not fully understand the status of the plant. Address with actions for cause.
Similar-Same	Other offsite notification processes	Inadequate	Low Risk – Programs exist. These programs are addressed through Duty Manager, Corporate and Station Management Notifications. See discussion below.
Similar-Similar	Other offsite notification processes	Inconsistent expectations Not reinforced	Low Risk – Programs exist. See discussion below.

Discussion: The Extent of Cause will be addressed by two Corrective Actions. CA-008 will revise Management Standard 20 to have a standardized script to quickly relay information to the off-shift Operations Manager(s) and or Duty Manager. CA-009 will focus on inter-crew communications during Simulator and Control Room events. The communications can include a crew-wide update and or transient brief. Other similar programs already exist and are being implemented. For example, 10-S-01-6: Notification of Offsite Agencies and Plant On-Call Emergency Personnel, 01-S-06-5: Reportable Events or Conditions, EN-LI-108- Event Notification and Reporting, EN-NS-200 – Security Reporting Requirements, EN-RP-113 – Response to Contaminated Spills /Leaks, and EN-FAP-OM-012 – Prompt Investigational and Notifications are all fleet procedures and currently implemented at GGNS.

Extent of Cause

Reference Procedure Step 5.9

Extent of Cause Table:

Cause Statement:	**CC2:** The second contributing cause of the event was ineffective implementation of Shift Management (SM, CRS, and STA) and oversight roles and responsibilities in the control room during this transient.		
Object:	Shift Management and oversight Roles and Responsibilities	**Defect:**	ineffective implementation
Tier	**Object**	**Defect**	**Comments**
Same-Same	Shift Management (SM, CRS, and STA) and oversight Fundamental Roles and Responsibilities	ineffective implementation	High Risk. High Probability – Process not reinforced. Medium Consequence – Shift Management did not remain in role during transient conditions. Address with actions for cause.
Same-Similar	Shift Management (SM, CRS, and STA) oversight Fundamental Roles and Responsibilities	Not Reinforced or Negative Reinforcement	High Risk. High Probability – Process not reinforced. Medium Consequence – Shift Management did not stay in role during the transient.
Similar-Same	Fundamental Roles and Responsibilities for other positions NLO, RO Maintenance Engineering RP Chemistry	ineffective implementation	Low Risk: Expectations are reinforced. Probability: Medium – previous fundamental issues have been identified Consequences: High – Equipment Damage, personnel exposure or injury.
Similar-Similar	Fundamental Roles and Responsibilities for other positions NLO, RO Maintenance Engineering RP Chemistry	Not Reinforced or Negative Reinforcement	Low Risk: Expectations are reinforced. Probability: Medium – previous fundamental issues have been identified Consequences: High – Equipment Damage, personnel exposure or injury.

Extent of Cause	*Reference Procedure Step 5.9*

Discussion: The Extent of Cause has been addressed by Operator and Leadership Fundamentals in Operations (LO-GLO-2016-0054), and will be addressed by assessing similar Fundamental Programs in other GGNS departments.

1. Maintenance does not need to perform another assessment of Maintenance Fundamentals because LO-GLO-2016-0003 was recently completed. That assessment is a Mid-Cycle Readiness Assessment, and a Standards Performance Deficiency was identified by CR-GGN-2016-4978. That CR states the corrective actions that have been taken to correct issues identified in previous Mid-Cycle, AFI, and Maintenance Assessments were reviewed and determined to not be sustainable. The CR is driving the creation and completion of sustainable actions from previous assessments.
2. Engineering does not have an Entergy Fleet procedure that defines Engineering Fundamentals. However, Entergy has adopted a philosophy to follow INPO guidance for Technical Conscience (IER 14-20), Traits of a Healthy Nuclear Safety Culture (INPO 12-012), and Leadership and Team Effectiveness (INPO 15-005). Engineering is consistently focusing on these three documents by implementing and performing actions from CR-GGN-2015-4288, an INPO AFI from the 2015 Mid Cycle Assessment.
3. Chemistry and Radiation Protection will need to perform an assessment of fundamentals in each department. CAs 012 and 013 have been issued to conduct these assessments.

Extent of Cause

Reference Procedure Step 5.9

Extent of Cause Table:

Cause Statement:	**CC3:** The third contributing cause of the event is the station did not create procedure guidance to address operational impacts of long standing equipment issues related to the Turbine Controls System (N32).		
Object:	long standing Turbine Controls System (N32) equipment issues	**Defect:**	Did not create procedure guidance
Tier	**Object**	**Defect**	**Comments**
Same-Same	long standing Turbine Controls System (N32) equipment issues	Did not create procedure guidance	High Risk Frequency – High Frequency – High Consequence – High; Trip Occurred. Actions to correct cause address this extent.
Same-Similar	Turbine Controls System (N32) equipment issues	Tools License Basis Training Oversight System Experts	Frequency – High Frequency – High Consequence – High; Trip Occurred. Actions to correct cause address this extent of cause.
Similar-Same	Other Long Term Equipment issues. Reference ODMI and Plant Health Lists.	Did not create procedure guidance	Risk High Frequency – High Consequence – High Trip Risk Action to review the current ODMIs and long term equipment issues list and determine if procedure revisions are required.
Similar-Similar	Other Long Term Equipment issues. Reference ODMI and Plant Health Lists.	Tools License Basis Training Oversight System Experts	Risk High Frequency – High Consequence – High Trip Risk Action to review the current ODMIs and long term equipment issues list and determine if additional resources or controls are needed.

Discussion: The Extent of Cause will be addressed by benchmarking other BWR procedures (CA-015) to identify and implement and additional procedure instructions and or resources needed. The resources include tools to perform system manipulations, license bases revisions as appropriate, and oversight (management and system experts) during system manipulations. Additionally, a comparison of GGNS procedures to those required by Reg. Guide 1.33 will be tracked in CA-016.

Safety Culture	*Reference Procedure Step 5.10*

Root Cause 1 of the event is Station Management has not established and implemented a Conservative Decision Making strategy which would include training, procedures, and reinforcement of CDM Fundamentals such that Shift Management will consistently make a conservative decision when faced with abnormal, but not SCRAM-imminent events. This cause was evaluated for safety culture aspects using EN-LI-121-01, Trend Codes. The following Nuclear Safety Culture Codes related to this cause are reflective of current station performance.

- *NCO4: (NRC X.10)* Expectations: Leaders frequently communicate and reinforce the expectation that nuclear safety is the organization's overriding priority.
- *NDM2: (NRC H.14)* Conservative Bias: Individuals use decision-making practices that emphasize prudent choices over those that are simply allowable. A proposed action is determined to be safe in order to proceed, rather than unsafe in order to stop.

This Nuclear Safety Culture Aspect is addressed by the following corrective actions:

- Implement a Conservative Decision Making methodology that addresses short term decisions where off normal equipment response is not addressed by current procedures and an automatic SCRAM is not imminent. (CA-008).

Contributing Cause 1 of the event is inadequate communications. This cause was evaluated for safety culture aspects using EN-LI-121-01, Trend Codes. The following Nuclear Safety Culture Codes related to this cause are reflective of current station performance.

- *NDM1: (NRC H.13)* Consistent Process: Individuals use a consistent, systematic approach to make decisions. Risk insights are incorporated as appropriate. {LF.1-4}.
- *NQA2:* (NRC H.11) Challenge the Unknown: Individuals stop when faced with uncertain conditions. Risks are evaluated and managed before work proceeds. {NPA.1-1, EN.1-2, EN.2-6, RP.1-27, RP.1-30}

This Nuclear Safety Culture Aspect is addressed by the following corrective actions:

- CA-009: Revise Management Standard 20 to have a standardized script to quickly relay information to the off-shift Operations Manager(s) and or Duty Manager.
- CA-010*:* Place an increased focus on inter-crew communications during activities in the Main Control Room and Simulator. These inter-crew communications can be in the form of a crew update, a crew brief, and or a transient brief when applicable.

Contributing Cause 2 of the event is ineffective implementation of Shift Management (SM, CRS, and STA) and oversight roles and responsibilities in the control room during this transient. This cause was evaluated for safety culture aspects using EN-LI-121-01, Trend Codes. The following Nuclear Safety Culture Codes related to this cause are reflective of current station performance.

- *NLA8: (NRC X.5)* Leader Behaviors: Leaders exhibit behaviors that set the standard for safety.

This Nuclear Safety Culture Aspect is addressed by the following corrective actions:

- Implement a Conservative Decision Making methodology that addresses short term decisions where off normal equipment response is not addressed by current procedures and an automatic SCRAM is not imminent. (CA-008).
- Implement an "Operations High Intensity Oversight Plan." This plan will bring in contractors that will meet with each crew to discuss operator fundamentals in the Control Room and Simulator. The contractors will debrief the Site Vice President, General Manager of Plant Operations, and Senior Operations Manager at a frequency determined by the SVP, GMPO and Sr. Operations Manager. (CA-011)

Safety Culture	*Reference Procedure Step 5.10*

Contributing Cause 3 of the event is the station did not create procedure guidance to address operational impacts of long standing equipment issues related to the Turbine Controls System (N32). This cause was evaluated for safety culture aspects using EN-LI-121-01, Trend Codes. The following Nuclear Safety Culture Codes related to this cause are reflective of current station performance.

- *NDM2: (NRC H.14)* Conservative Bias: Individuals use decision-making practices that emphasize prudent choices over those that are simply allowable. A proposed action is determined to be safe in order to proceed, rather than unsafe in order to stop.

This Nuclear Safety Culture Aspect is addressed by the following corrective actions:

- Implement a Conservative Decision Making methodology that addresses short term decisions where off normal equipment response is not addressed by current procedures and an automatic SCRAM is not imminent. Benchmark of READE process and INPO Best Practices for example details. (CA-008)
- Created a new ONEP to have clear guidance for conservative operation for unexpected equipment failures that affect Reactor pressure control.

Safety Significance	*Reference Procedure Step 5.11*

The actual consequences as stated in the problem statement were uncontrolled reactor power, pressure, and level oscillations. There were no other actual consequences to general safety of the public, nuclear safety, industrial safety and radiological safety for this event.

The potential consequence to general safety of the public, nuclear safety, industrial safety and radiological safety of this event if the automatic OPRM trip was delayed was fuel cladding failure, resulting in a reduced margin to nuclear and radiological safety, as well as the potential for elevated radioactive discharge through the Offgas System .

The potential consequence to general safety of the public, nuclear safety, industrial safety and radiological safety of this event if the automatic OPRM trip was removed was fuel cladding failure, resulting in a reduced margin to nuclear and radiological safety, as well as the potential for elevated radioactive discharge through the Offgas System.

Based on the subsequent startup and "normal" Offgas System radioactivity levels, the risk is considered Low.

The actions to reduce the frequency or consequence are:

- CA-008: Implement a Conservative Decision Making methodology that addresses short term decisions where off normal equipment response is not addressed by current procedures and an automatic SCRAM is not imminent. Benchmark of READE process and INPO Best Practices for example details.

Corrective Action Plan

Reference Procedure Step 5.12

Identified Cause	Completed Actions	Responsible Dept.	Date Completed
DC1	Shift Manager and Control Room Supervisor were disqualified to stand watch, and remediated through interviews with Senior Station Management, discussions with Training, and Simulator evaluations.	Operations	06/18/16
AC1	Fleet peers with on-shift SRO experience were assigned to monitor Control Room activities on each shift worked. The fleet peers documented positive and negative observations, and provided their feedback to the Operations Management, GMPO, and SVP.	Operations	07/19/16
DC1	Site Vice President led a discussion with each Control Room shift about the industry events similar to this one, and on what the expectations for conservative decisions are.	Site Vice President	07/13/16
DC1	GMPO issued letter to all Licensed Operators (ROs, SROs, and STAs). The letter discussed his expectations for all Operators operating with a conservative bias. The letter is expected to be read and signed by 07/15/16	GMPO	07/15/16
CC3	Reactor Pressure Control Malfunctions ONEP (05-1-02-V-21 Revision 000) developed and issued.	Operations	08/08/16
CC2	Performed an assessment of Operator Fundamentals, specifically focusing on Leader Observations under LO-GLO-2016-0054.	Operations	08/10/16

Identified Cause	Actions	Responsible Dept.	Due Date
RC1 - CAPR EMFM Cause Extent of Cause for RC1	ACTIONS: Implement Conservative Decision Making methodology that addresses short term decisions where off normal equipment response is not addressed by current procedures and an automatic SCRAM is not imminent. INTENT: Operations implements a comprehensive Conservative Decision Making strategy, based on benchmarking INPO recommended stations and best practices, which accounts for generic transients so that conservative decisions are consistently made by all operating crews.	Operations	CA-008 09/18/16
Additional Action	ACTION: Revise Management Standard 20 to have a standardized script to quickly relay information to the off-shift Operations Manager(s) and or Duty Manager. INTENT: Shift Manager notifications to off-shift management contain sufficient information related to key plant parameters to fully understand plant conditions. Change Management includes communication and reinforcement of standard.	Operations	CA-009 09/15/16

Identified Cause	Actions	Responsible Dept.	Due Date
CC1 [O&P]	ACTION: Collaborate with Operations Training to focus on inter-crew communications during Simulator and Control Room events. Training will focus on ensuring the CRS includes a crew-wide update and or transient brief when appropriate. INTENT: Inter-crew communications are more formal and frequent to increase the crew's awareness of on-going activities.	Operations	CA-010 2/15/17
CC2 [O&P]	ACTION: Implement an "Operations High Intensity Oversight Plan." This plan will bring in contractors that will meet with each crew to discuss operator fundamentals in the Control Room and Simulator. The contractors will debrief the Site Vice President, General Manager of Plant Operations, and Senior Operations Manager at a frequency determined by the SVP, GMPO and Sr. Operations Manager. INTENT: Contractors are assigned to monitor and mentor each shift on fulfilling their Operator Fundamentals roles and responsibilities until Shift Managers are proficient at providing this oversight. This action will continue until Operations Manager determines Operator Fundamental performance is acceptable and the Shift Managers are adequately providing oversight. This Oversight Plan will conclude with successful closure of the Effectiveness Review Action (LO-GLO-2016-0009, CA-016).	Operations	CA-011 09/15/16
CC2 Extent of Cause	ACTION: Perform a Snapshot Self-Assessment to assess the health of your department's fundamentals. INTENT: Radiation Protection and Chemistry Departments assess the fundamentals in their respective department to prevent an event related to a lapse in fundamentals.	RP Chemistry Operations	CA-012 09/30/16 CA-013 09/30/16 CA-014 08/30/16
Extent of Cause CC3	Action: Compare GGNS procedures to those identified in a benchmark of other BWRs to ensure GGNS has requisite procedures. INTENT: Benchmarks are reviewed and procedure revisions are implemented, as necessary. This action may be closed each identified gap has applicable procedure created.	Operations	CA-015 10/07/16
Extent of Cause CC3	Action: Compare GGNS procedures to those required by Reg. Guide 1.33 to ensure GGNS has requisite procedures. INTENT: Gaps are identified and procedure revisions are implemented, as necessary. This action may be closed when each identified gap has applicable procedure changes initiated to incorporate trigger points and actions to take.	Operations	CA-016 09/01/16

Identified Cause	Actions	Responsible Dept.	Due Date
CC2 [O&P]	ACTION: Provide Simulator scenarios for Operations Managers and Duty Manager to practice staying in control room oversight role during transients. INTENT: Operations Managers and Duty Managers have sufficient practice receiving MS-20 notifications.	Operations Training	CA-017 11/01/16
RC1	ACTION: Create “Entergy Crew Performance Evaluation” type scenarios that drive Operators to respond to Simulator equipment malfunctions where no specific procedural guidance exists. INTENT: Each crew is subjected to an ECPE-style scenario, and graded on remaining in role and making conservative decisions.	Operations Training	CA-019 02/22/17
RC1	ACTION: Create an oversight plan to provide management observers of the ECPE-style scenario(s) developed under CA-019. INTENT: GGNS Site Leadership has a defined method to perform observations of the ECPE-style scenarios developed under CA-019.	Operations	CA-020 12/15/16
CC3 Extent of Cause	ACTION: Review ODMIs and the Plant Health Committee Top Ten Lists to identify operational challenges that should be addressed with official procedural guidance. INTENT: Clear procedural guidance is provided for ODMIs and equipment on the Top Ten List.	Operations	CA-021 11/01/16

Effectiveness Review Plan	*Reference Procedure Step 5.13*

This section should contain an Effectiveness Review strategy that includes the following:

Method: Describe the method that will be used to verify that the actions taken had the desired outcome. Methods could include performance of a self-assessment, walkthrough, mock-up or simulation, document review, performance indicator monitoring, etc.

Attributes: Describe the particular process attributes to be monitored or evaluated for effectiveness (e.g., process timeliness, component alignment or position, system performance, etc.).

Success: Establish the acceptance criteria for the attributes to be monitored or evaluated.

Timeliness: Define the optimum time to perform the Effectiveness Review. The timing of the review should allow sufficient time for the corrective action(s) to be implemented. The review should also be performed as early as practicable to detect ineffective corrective actions before the next opportunity for recurrence of the event.

LO Number:	**LO-GLO-2016-0009, CA-015**		
	DESCRIPTION		
Corrective Action:	CA-008 ACTIONS: Implement Conservative Decision Making methodology that addresses short term decisions where off normal equipment response is not addressed by current procedures and an automatic SCRAM is not imminent. INTENT: Operations implements a comprehensive Conservative Decision Making strategy, based on benchmarking INPO recommended stations and best practices, which accounts for generic transients so that conservative decisions are consistently made by all operating crews.		
Method:	EN-OP-117 Attachments 9.1, 9.2, and 9.5 management observations of conservative fundamentals in simulated and or transient situations.		
Attributes:	Conservative Decision Making Process is used and gets desired results.		
Success:	Operators make the appropriate conservative decision(s) during simulator observations. This will be based on two observations per crew with satisfactory conservative decision making as determined by the Operations Manager and no instances of non-conservative decisions in actual transients.		
Timeliness:	6 months after implementation of Conservative Decision Making Process procedure.		
Owner Group:	Operations	**Due Date:**	03/18/17

LO Number:	LO-GLO-2016-0009, CA-016		
	DESCRIPTION		
Corrective Action:	CA-011 ACTION: Implement an "Operations High Intensity Oversight Plan." This plan will bring in contractors that will meet with each crew to discuss operator fundamentals in the Control Room and Simulator. The contractors will debrief the Site Vice President, General Manager of Plant Operations, and Senior Operations Manager at a frequency determined by the SVP, GMPO and Sr. Operations Manager. INTENT: Contractors are assigned to monitor and mentor each shift on fulfilling their Operator Fundamentals roles and responsibilities until Shift Managers are proficient at providing this oversight. This action will continue until Operations Manager determines Operator Fundamental performance is acceptable and the Shift Managers are adequately providing oversight. This Oversight Plan will conclude with closure of the Effectiveness Review Action.		
Method:	EN-OP-117 Attachment 9.1, 9.2, and 9.5 management observations of Licensed Operators fundamentals in the control room and simulator.		
Attributes:	RO, CRS, STA, and SM perform roles and responsibilities described in EN-OP-120.		
Success:	Operators fulfill roles and responsibilities during simulator observations. This will be based on two observations per crew with satisfactory performance as determined by the Operations Manager and no instances of performing out of role in actual transients.		
Timeliness:	6 months after implementing the "Operations High Intensity Oversight Plan".		
Owner Group:	Operations	**Due Date:**	03/15/17

Trend Data						*Reference Procedure Step 5.14*
Cause	**Work Group**	**Event**	**Process**	**Failure Mode**	**Nuclear Safety Culture**	**Keyword**
RC1	WGSG	EO02	PO04	FX07	NCO4 NDM2	Team C Command & Control OFUN Leader – Conservatism Fundamental OFUN Worker – Conservatism Fundamental
CC1	WGSG WGOP	EX10	PX21	FO10	NDM1 NQA2	
CC2	WGOP	EX10	PO04	FO03	NLA8	
CC3	WGOP WGES WGMI	EE06	PE03	FO08	NDM2	Turbine Controls

Work Group

WGOP	Operations
WGSG	Site Management
WGES	Systems and Components Engineering
WGMI	I&C Maintenance

Event Code

EO02	Reactivity Management Event, as defined in EN-FAP-OP-008. Utilize keywords to specify the severity level. {SOER 07-1, SOER 94-2, SOER 88-2, IERL2-10-1, OP.1-9, CM.4-1, CM.4-2}
EX10	Administrative Requirement not Met
EE06	Obsolete Component {ER.3-3}

Process Code

PO04	Control Room Operations. Utilize keywords to specify Operator Fundamentals. {SOER 96-1, OP.1-1, OP.2-3, OP.2-7}
PX21	Organizational Communications {PI.2-9, OR.3-3}
PE03	System/Component Monitoring. Utilize keywords to specify system. {EN.1-1, EN.1-3, ER.1-5, ER.1-6, ER.2-9, ER.2-16, CM.2-11}

Failure Mode Code

FX07	(PII S2) Strategic Planning – Inadequate Assessment of Company Capabilities
FO03	(PII OP1): Organization-to-Program – Lack of Commitment to Program Implementation
FO08	(PII O2) Organizational – Inadequate Attention to Emerging Problems
FO10	(PII O4) Organizational – Inadequate Communication Within an Organization

Nuclear Safety Culture Code

NCO4	(NRC X.10) Expectations
NDM2	(NRC H.14) Conservative Bias
NDM1	(NRC H.13) Consistent Process
NLA8	(NRC X.5) Leader Behaviors
NQA2	(NRC H.11) Challenge the Unknown

References

Documents Reviewed

- 06-OP-1N32-V-0001, Revision 120: “Turbine Stop and Control Valve Operability”
- 04-1-01-N32-1, Revision 060: “EHC Control Fluid System Operating Instructions”
- 04-1-01-N32-2, Revision 031: “Turbine Generator Control System Operating Instructions”
- 04-1-03-N32-5, Revision 025: “ATT Safety Devices Test Equipment Performance Instructions”
- 04-1-03-N32-7, Revision 014: “ATT Turbine Stop & Control Valve Test During Shutdown Equipment Performance Instructions”
- 03-1-01-1, Revision 169: “Cold Shutdown to Generator Carrying Minimum Load Integrated Operating Instructions”
- 03-1-01-2, Revision 167: “Power Operations Integrated Operating Instructions”
- 05-1-02-III-3, Revision 113: “Reduction in Recirculation System Flow Rate Off-Normal Event Procedure”
- 02-S-01-27, Revision 066: “Operations Philosophy”
- 02-S-01-43, Revision 002: “Transient Mitigation Strategy”
- 01-S-06-4, Revision 013: “Access and Conduct in the Control Room”
- EN-OP-115, Revision 017: “Conduct of Operations”
- EN-OP-120, Revision 001: “Operator Fundamentals Program”
- EN-OP-200, Revision 003: “Plant Transient Response Rules”
- EN-OP-117, Revision 009: “Operations Assessment Resources”
- CR-GGN-2015-4299: Operator Programs INPO AFI
- CR-GGN-2015-4300: Operator Fundamentals INPO AFI
- CR-GGN-2015-2061: Turbine Stop and Control Valve Surveillance has Div 2 and Div 4 Half SCRAMs separately during the surveillance.
- CR-GGN-2016-3794: Turbine Control Valve Swings Results in Reactor Power Increase

Personnel Contacted

- Johnnie Clack
- Jodi Cheroni
- Chase Miller
- James Mergner
- Sean Dunfee
- Jay Comfort
- Robert Mitchell
- Mark Goodwin
- Ryan Meyer
- Bob Busick
- Vin Fallacara
- Kevin Mulligan
- Paul Salgado
- Mike Milly
- Richard Sumrall
- Brad Wertz
- Ricky Liddell
- Patrick Williams

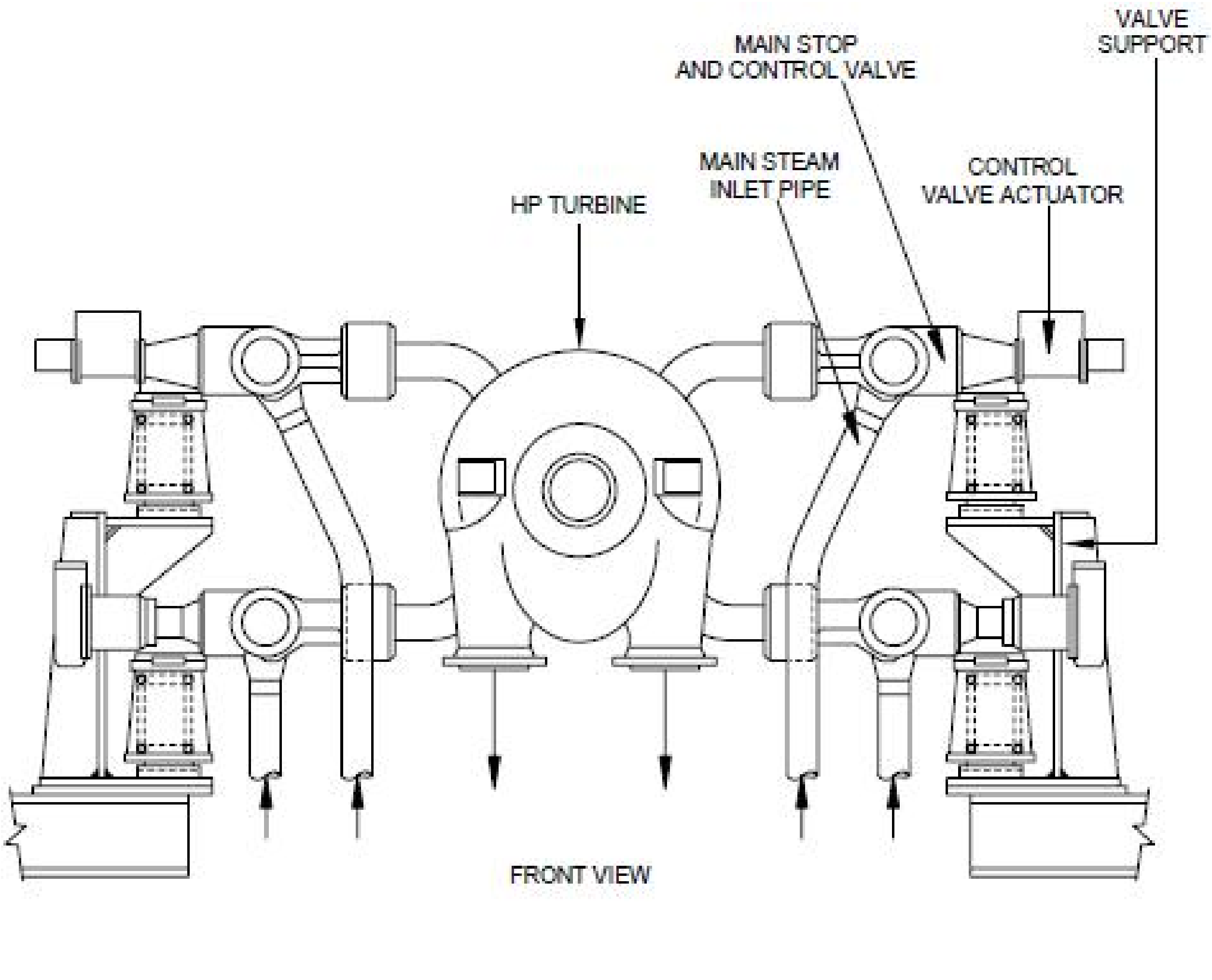
Team Members
• Jim Nadeau, Regulatory Assurance Manager • Wesley Johnson, Operations Specialist • Dana Smith, Operations Training Instructor • Robert Mitchell, Operations • Heidi Cannon, Operating Experience Coordinator • Greg Duffy, Industry Consultant • Mel Leach, Industry Consultant • Robert Carroll, South Mississippi Electric Power Association Representative • Mike Ariano, Fleet Licensed Operator Requalification Training Lead

Attachments	
Attachment 1.	Detailed Sequence of Events
Attachment 2.	Extended Comparative Timeline Worksheet
Attachment 3.	Performance Analysis
Attachment 4.	Gap Analysis
Attachment 5.	Organizational & Programmatic Evaluation
Attachment 6.	Nuclear Safety Culture
Attachment 7.	Event and Causal Factor Chart
Attachment 8.	Gaps in GGNS Training related to SOERs

Attachment 1: Detailed Timeline and System Description

Turbine System Description
The Main, Reheat, and Extraction Steam Systems deliver steam from the Reactor to the Main Turbine and to other plant auxiliaries during various modes of plant operation.

Steam from the Reactor flows equally through four 28-inch Main Steam Lines (MSLs), with each MSL having two Main Steam Isolation Valves (MSIVs) and an individual Main Steam Shutoff Valve. The steam then flows equally to the High Pressure Turbine through four Combined Main Stop and Control Valves (CMS/CV), with two CMS/CVs located on each side of the HP Turbine. Steam flows through the CMS/CVs into the HP Turbine in a symmetrical flow arrangement, with two steam lines entering the upper turbine casing, and two entering the lower casing. In this manner, steam is admitted to the HP turbine in a full arc, reducing unequal forces on the turbine rotor. The steam passes directly from the CMS/CVs into the blading at the center of the HP turbine, and flows in both directions, axially, through ten stages in each direction. After the steam passes through the HP Turbine, it is exhausted into four, 52-inch lines leading to the Moisture Separator Reheaters (MSRs).
Each CMS/CV consists of stop and control valves housed within a common valve body. The stop valve section of the CMS/CVs isolates steam from the turbine when required, and is engineered for extremely fast closing times (such as following a turbine trip).



Main Stop and Control Valve Arrangement

The control valve section of the CMS/CVs controls Reactor pressure and the steam supply to the turbines. The adjacent location of the CMS/CVs minimizes the volume of steam that is trapped on the turbine side of the valve in the event of a valve closure. The small volume of this trapped steam reduces the potential for turbine overspeed following a turbine trip.

The normally-open Main Stop Valves are hydraulically opened by the EHC System, and spring-closed when EHC Hydraulic pressure is removed. The valves are designed to close in 120 milliseconds (ms) in the event of a main turbine trip to isolate the steam to the turbines.

The normally-open Main Control Valves are regulated by the EHC System to control Reactor pressure and steam supply to the turbines. The four control valves open in unison to equalize steam flow through the Turbine. Each control valve is a single venturi seat plug-type valve, opened hydraulically by the EHC Control System and closed by spring force when the hydraulic pressure is removed. Each Main Control Valve is provided with a backseat and seal steam to prevent steam out-leakage.

In addition, both the Main Stop and Control Valve sections can be individually opened and closed for testing by the Automatic Turbine Tester (ATT). With Reactor power and Main Turbine load confirmed to be less than 70% of rated, an individual CMS/CV is selected for testing. The Control Valve of the selected CMS/CV is automatically closed while the remaining three normally operating CMS/CVs automatically control (open/close) to maintain a stable generator load. Once the Control Valve is full-closed, the associated Stop Valve automatically closes. The Stop and Control Valve sections then automatically re-open to complete the ATT testing.

Turbine Controls

The initial investigation determined the ‘B’ Stop Valve Reset Valve (1N32F514C) stuck in an intermediate position. The Root Cause Evaluation for the plant SCRAM is being evaluated under CR-GGN-2016-4766.

Average Power Range Monitoring (APRM) System

The APRM system provides the primary indication of neutron flux within the Reactor core and responds almost instantaneously to neutron flux increases. The Power Range Neutron Monitoring System (PRNMS) through the APRM chassis utilizes signals from the Local Power Range Monitors (LPRMs) within the core to provide an indication of the power distribution and local power changes. The APRM chassis averages these LPRM signals to provide a continuous indication of average reactor power from a few percent to greater than rated thermal power (1% to 125% rated thermal power). Each APRM also includes an Oscillation Power Range Monitor (OPRM) function, which provides detection and automatic core protection signals to suppress thermal-hydraulic oscillations when Reactor core instability is detected. If setpoints are exceeded, the OPRM system generates alarms and SCRAM signals to the Reactor Protection System (RPS).

Each APRM system consists of four separate, but identical channels. Each APRM Channel averages inputs from 44 permanently assigned LPRM channels. Permanent LPRM assignments ensure that each APRM channel receives an adequate representation of the local flux throughout the core, both radially and axially. Each APRM requires inputs from at least 20 LPRMs, with at least three per level to remain operable.

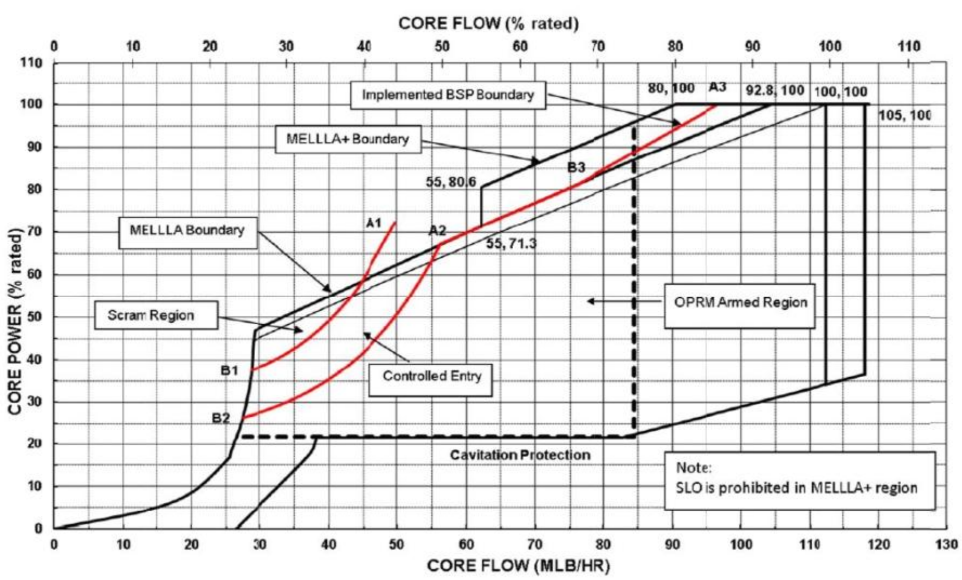
<u>OPRM System</u>
The OPRM System is an internal feature of the APRM Chassis. OPRM provides a method of detecting and suppressing the stability-related neutron oscillations prior to exceeding specified acceptable fuel design limits (avoids exceeding the Minimum Critical Power Ration [MCPR] safety limit). OPRM monitors the LPRM detector signals to detect reactor thermal-hydraulic instabilities (THI) and generates an automatic trip signal to RPS. THI has been observed in BWRs during low core flow conditions at high power levels.

Each OPRM channel generates a safety trip signal as detected by any of three algorithms: Period Based Detection Algorithm (PBDA), Amplitude Based Algorithm (ABA), and Growth Rate Based Algorithm (GRBA). The OPRM channel provides a trip signal, through the APRM Voter that is a part of RPS, when any algorithm setpoint is exceeded while operating in the OPRM Armed Region of the Power-to-Flow Map. A single OPRM “cell” can cause an OPRM channel trip. It takes two OPRM “channel” trips to initiate a Reactor Trip.

The OPRM system detects THI by monitoring the assigned LPRM detector signals. Pressure and flow perturbations that occur during THI cause localized oscillations on the LPRM detector. Detectors are grouped within the OPRM and are assigned “cells.” These cells provide indication that corresponds to local regions of the core. Each OPRM channel receives the processed LPRM data, Recirculation System flow data, and Simulated Thermal Power (STP) from the associated APRM channel. All OPRM signal processing is performed by the associated APRM chassis.

Each OPRM channel has 36 “cells” which are defined as 3 or 4 LPRMs at different detector levels. There are a total of 144 cells in the core (some LPRMs are shared within the same OPRM channel). Each geographical area of the core has a cell from each OPRM channel (for example, the geographical area that OPRM Channel 1, Cell #2 is located, OPRM Channel 2, 3, and 4 also have their Cell #2 in that same geographical area). This arrangement ensures all four OPRM channels have a representation of LPRM power level changes in the same geographical area of the reactor core.

Since it is necessary to have high reactor power and low flow conditions for THI, the OPRM Trip does not become enabled until entry into the OPRM Armed Region. Refer to the Power-to-Flow Map from “Reduction in Recirculation System Flow Rate Off-Normal Event Procedure” (05-1-02-III-3 Rev 113) shown to the left.



Operating Crew Size:
Normally, GGNS Operations crews are made up of the following compliment of Operators:
1. (1) Shift Manager (SRO License required)
2. (1) Control Room Supervisor (SRO License required)
3. (1) Shift Technical Advisor/Field Support Supervisor (SRO License not required)
4. (3) Reactor Operators (RO License required)
5. (4) Building Operators (no license required)
6. (2) Non-Licensed Operators in Radwaste (no license required)

On the night of the event, the shift was scheduled to perform a power reduction from 100% to 65% reactor power, a Control Rod sequence exchange, a Natural Draft Cooling Tower flush, Auxiliary Cooling Tower shut down, a Steam Jet Air Ejector swap, and a Main Turbine Stop and Control Valve Operability Surveillance. Because of the amount of work scheduled, extra operators were called in to support the shift:
1. (1) Extra SRO for Reactivity Management
2. (1) Operations Manager – Support (with SRO license)
3. (3) Extra ROs
4. (4) Extra Building Operators

Event Timeline

All operators interviewed expressed a sense of “time compression,” and didn’t realize exactly how long the transient lasted. The following timeline has been assembled using Plant Data System (PDS) plots, written statements, and interviews.

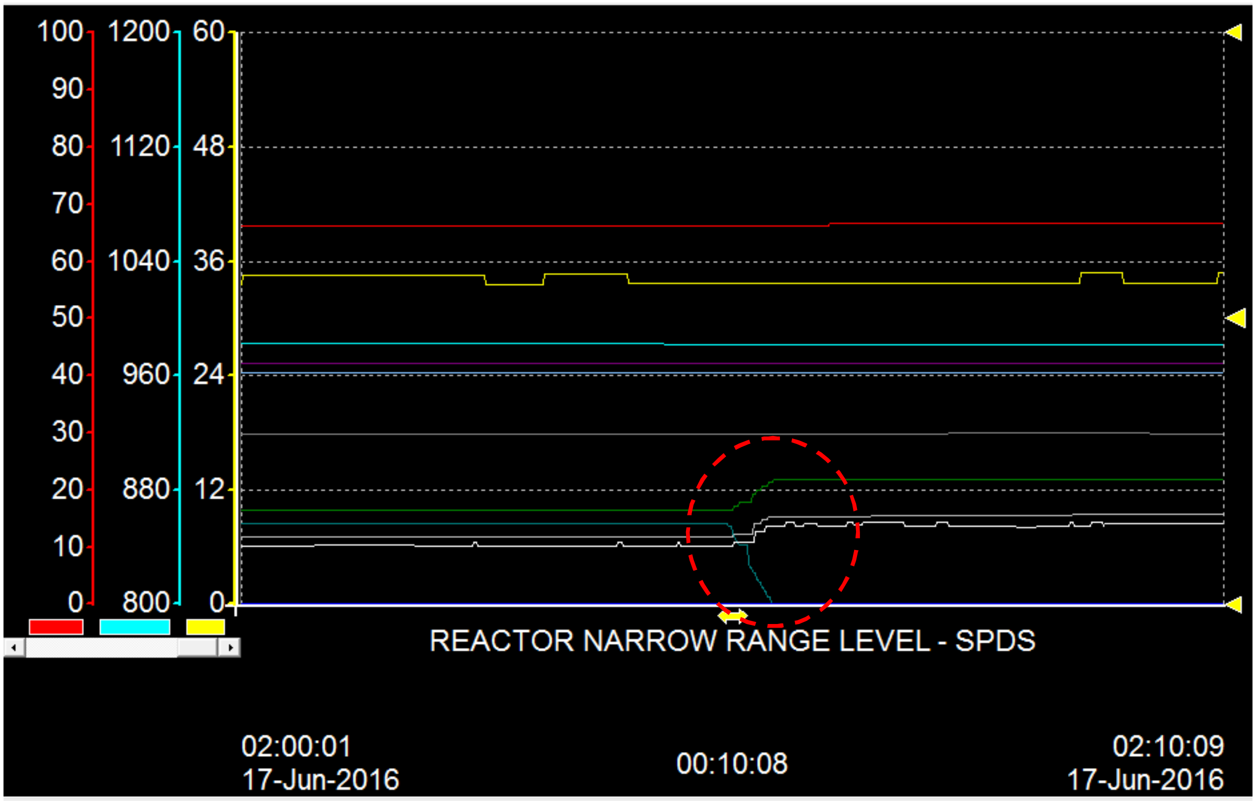
[1] 6/16/16 22:24

The At-The-Controls-Operator (ACRO) reduced total core flow from approximately 108 million pounds-mass per hour (Mlbm/hr) to 70 Mlbm/hr using Reactor Recirculation System Flow Control Valves (FCVs) in preparation for the control rod sequence exchange using IOI-2 “Power Operations” Attachment VIII “Temporary Downpower” (03-1-01-2, Att. VIII). Reactor pressure decreased from approximately 1040 psig to approximately 990 psig, as expected. Reactor Engineering ran an automatic MON Case at 06/17/2016 02:00.

✔	Point ID	Description	Value	Engr	Qual	Y Min	Y Max	Value Min	Value Max	Value Avg
✔	C51NA051	APRM 1 FLUX LEVEL	0.0000	%PWR	GOOD	50.00...	100.0...	65.6008	101.9477	93.2025
✔	C34NA001	STEAM DOME PRESSURE	-0.4511	PSIG	LOW...	800.0...	1200....	980.7361	1034.3802	1006.8554
✔	C93CA001	REACTOR NARROW RANGE LEVEL - SPDS	31.1098	INCHES	GOOD	0.000...	60.00...	32.7960	37.4071	34.8122
✔	B33NA001	RTR TOTAL CORE FLOW	42.1705	MLBS/H	GOOD	30.00...	120.0...	69.5469	108.8502	90.9203

Figure 1 - Downpower for Sequence Exchange

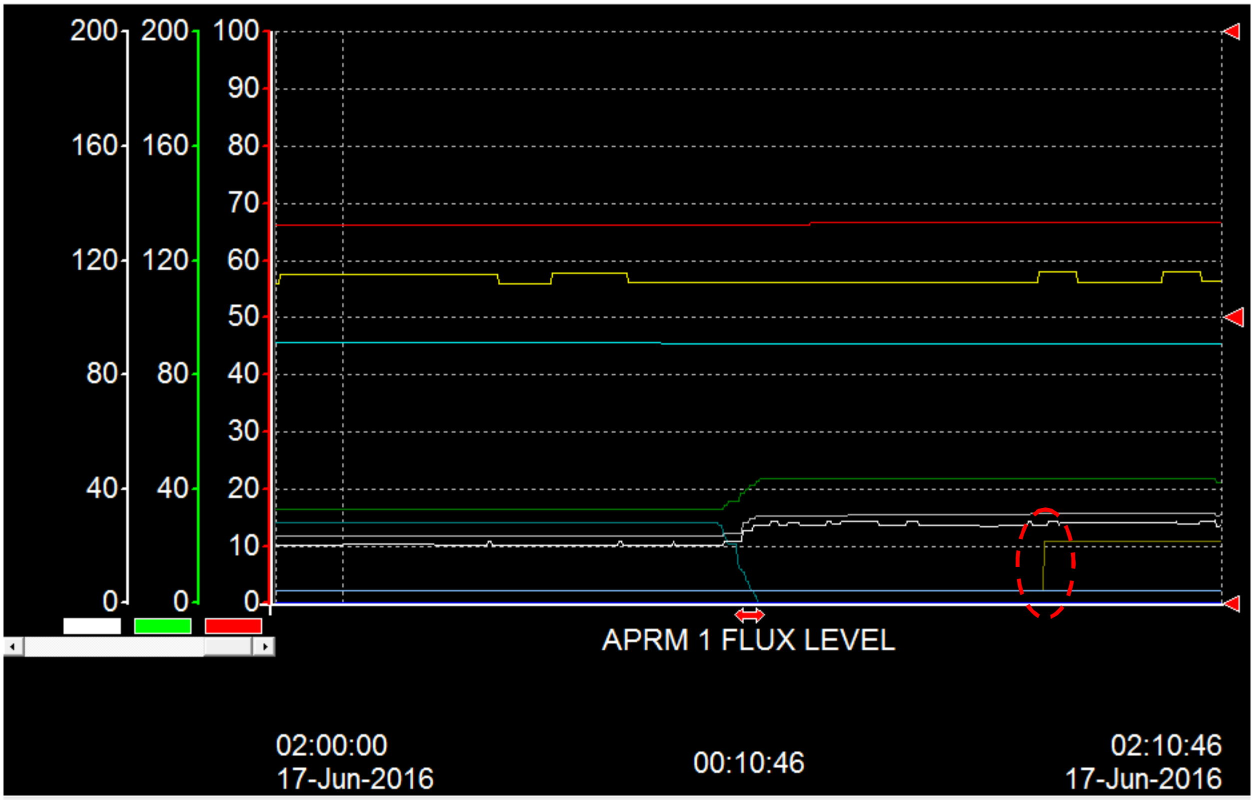
[2] 6/17/16 02:04
The Field Support Supervisor/Shift Technical Advisor (FSS/STA, one individual fulfilling two roles) provided supervisory oversight to a team of NLOs performing the Turbine Stop and Control Valve Operability Surveillance (06-OP-1N32-V-0001). At this time, the team of NLOs completed step 5.2.7.a through 5.2.7.n to close HP Turbine Control Valve (TCV) ‘B’ (1N11F026B). The NLOs manipulated keyswitches to close TCV ‘B’ from approximately 28% open to 0% open. HP TCVs ‘A,’ ‘C,’ and ‘D’ (1N11F026A/C/D) all opened, as expected to account for the closed ‘B’ TCV. ‘A’ TCV opened from approximately 20% open to approximately 27% open. ‘C’ TCV opened from approximately 23% open to approximately 31% open. ‘D’ TCV opened from approximately 33% open to approximately 43% open. Reactor power, pressure and level remained stable.



✔	Point ID	Description	Value	Engr	Qual	Y Min	Y Max	Value Min	Value Max	Value A
✔	C51NA051	APRM 1 FLUX LEVEL	0.0000	%PWR	GOOD	0.0000*	100.0000*	66.5962	66.5962	0.00
✔	C34NA001	STEAM DOME PRESSURE	-1.1663	PSIG	LOW...	800.0000*	1200.0000*	981.5229	982.3097	981.52
✔	C93CA001	REACTOR NARROW RANGE LEVEL - SPDS	30.8319	INCHES	GOOD	0.0000*	60.0000*	33.5400	34.8780	34.22
✔	N30N023A.C88	HP CONTROL VALVE A POSITION	1.2329	%	GOOD	0.0000*	200.0000*	20.3369	28.8818	25.71
✔	N30N023B.C88	HP CONTROL VALVE -B- POSITION	-0.2319	%	LOW...	0.0000*	200.0000*	-0.6287	28.4851	5.19
✔	N30N023C.C88	HP CONTROL VALVE -C- POSITION	1.3245	%	GOOD	0.0000*	200.0000*	23.5107	31.4758	28.26
✔	N30N023D.C88	HP CONTROL VALVE -D- POSITION	1.5991	%	GOOD	0.0000*	200.0000*	33.0322	43.8660	39.72
✔	N30N021A.C88	HP STOP VALVE A POSITION	78.9969	%	GOOD	0.0000*	200.0000*	80.8925	81.1862	81.07
✔	N30N021B.C88	HP STOP VALVE -B- POSITION	-2.1868	%	LOW...	0.0000*	200.0000*	-2.1868	-2.1868	-2.18
✔	N30N021C.C88	HP STOP VALVE -C- POSITION	52.3886	%	GOOD	0.0000*	200.0000*	59.5572	60.1460	59.83
✔	N30N021D.C88	HP STOP VALVE -D- POSITION	0.3274	%	GOOD	0.0000*	200.0000*	84.1908	84.3542	84.25
✔	N30N026A	BYPASS CONT VALVE 1 POSN	-0.8594	%	GOOD	0.0000*	200.0000*	-107374...	-107374...	0.00
✔	N30N026B	BYPASS CONT VALVE 2 POSN	-0.7813	%	GOOD	0.0000*	200.0000*	-107374...	-107374...	0.00
✔	N30N026C	BYPASS CONT VALVE 3 POSN	-0.6250	%	GOOD	0.0000*	200.0000*	-0.1172	-0.1172	0.00

Figure 2 - 'B' Control Valve Closed, 'A' 'C' and 'D' TCVs Open

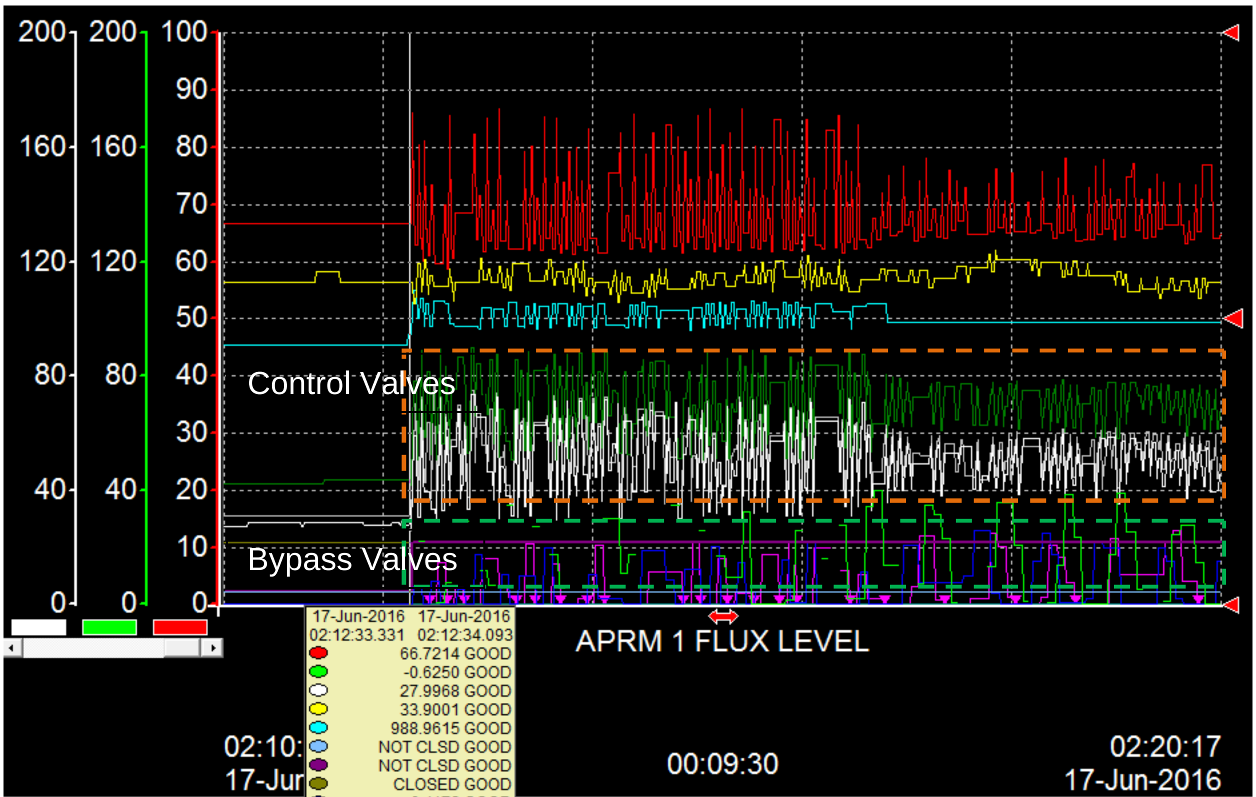
[3] 06/17/16 02:08
HP Turbine Stop Valve (TSV) ‘B’ (1N11F026B) was closed using Steps 5.2.7.o through 5.2.7.q. These steps have NLOs depress and hold the plunger on Test Solenoid Valve 1N32F515C to close the ‘B’ TSV. There was no change in any of the TCV positions due to closure of ‘B’ TSV. There were also no changes in Reactor power, pressure or level due to ‘B’ TSV closure.



✓	Point ID	Description	Value	Engr	Qual	Y Min	Y Max	Value Min	Value Max	Value A
✓	C51NA051	APRM 1 FLUX LEVEL	0.0000	%PWR	GOOD	0.0000*	100.0000*	66.5962	66.7214	66.72
✓	C34NA001	STEAM DOME PRESSURE	-0.9518	PSIG	LOW...	800.0000*	1200.0000*	981.5229	982.3097	981.52
✓	C93CA001	REACTOR NARROW RANGE LEVEL - SPDS	31.1220	INCHES	GOOD	0.0000*	60.0000*	33.5400	34.8780	34.17
✓	N30N023A.C88	HP CONTROL VALVE A POSITION	1.2329	%	GOOD	0.0000*	200.0000*	20.3369	29.2786	26.14
✓	N30N023B.C88	HP CONTROL VALVE -B- POSITION	-0.1709	%	LOW...	0.0000*	200.0000*	-0.6287	28.4851	4.37
✓	N30N023C.C88	HP CONTROL VALVE -C- POSITION	1.3245	%	GOOD	0.0000*	200.0000*	23.5107	31.4758	28.71
✓	N30N023D.C88	HP CONTROL VALVE -D- POSITION	1.5991	%	GOOD	0.0000*	200.0000*	33.0322	43.8660	39.96
✓	N30N026A	BYPASS CONT VALVE 1 POSN	-0.8594	%	GOOD	0.0000*	200.0000*	-107374...	-107374...	0.00
✓	N30N026B	BYPASS CONT VALVE 2 POSN	-0.7813	%	GOOD	0.0000*	200.0000*	-107374...	-107374...	0.00
✓	N30N026C	BYPASS CONT VALVE 3 POSN	-0.6250	%	GOOD	0.0000*	200.0000*	-0.1172	-0.1172	0.00
✓	N30N021A	MSV A POSN	CLOSED		GOOD	N/A	N/A	N/A	N/A	
✓	N30N021B	MSV B POSN	CLOSED		GOOD	N/A	N/A	N/A	N/A	
✓	N30N021C	MSV C POSN	CLOSED		GOOD	N/A	N/A	N/A	N/A	
✓	N30N021D	MSV D POSN	CLOSED		GOOD	N/A	N/A	N/A	N/A	

Figure 3 - 'B' TSV Closed after 'B' TCV Closed

[4] 06/17/16 02:12
'D' TSV (1N11F026D) unexpectedly closed while performing Step 5.2.7.r. (depress plunger of right-hand Reset Solenoid Valve 1N32F514C), resulting in a Division 2 Reactor Protection System (RPS) half scram. Operators had performed the step in the procedure to reset the hydraulic circuit which had the 'B' TSV to be stroked to the closed position (completed Step 5.2.7.r). The correct solenoid was selected, the correct action was performed, and the sequence of actions taken were correct. The expected pressure response on local gauges did not occur as expected, and the Team notified the Control Room. The Team was directed to hold the plungers in the left-hand Test Solenoid (1N32F515C) and the right-hand Reset Solenoid (1N32F514C) until further direction was given from the Control Room.



✓	Point ID		Value	Engr	Qual	Y Min	Y Max	Value Min	Value Max	Value A
✓	C51NA051	APRM 1 FLUX L	0.0000	%PWR	GOOD	0.0000*	100.0000*	58.8596	86.8976	69.40
✓	C34NA001	STEAM DOME	-0.9518	PSIG	LOW...	800.0000*	1200.0000*	988.9615	1019.6461	1002.59
✓	C93CA001	REACTOR NAR PDS	31.0064	INCHES	GOOD	0.0000*	60.0000*	31.6341	37.2664	34.29
✓	N30N023A.C88	HP CONTROL VALVE A POSITION	1.2024	%	GOOD	0.0000*	200.0000*	25.9521	73.5596	49.23
✓	N30N023B.C88	HP CONTROL VALVE -B- POSITION	-0.2319	%	LOW...	0.0000*	200.0000*	-0.1709	0.1648	0.00
✓	N30N023C.C88	HP CONTROL VALVE -C- POSITION	1.3245	%	GOOD	0.0000*	200.0000*	29.6448	79.8157	53.28
✓	N30N023D.C88	HP CONTROL VALVE -D- POSITION	1.6296	%	GOOD	0.0000*	200.0000*	41.6992	90.1611	70.13
✓	N30N026A	BYPASS CONT VALVE 1 POSN	-0.8594	%	GOOD	0.0000*	200.0000*	-0.8203	39.9609	12.95
✓	N30N026B	BYPASS CONT VALVE 2 POSN	-0.7813	%	GOOD	0.0000*	200.0000*	-1.9141	25.8203	7.48
✓	N30N026C	BYPASS CONT VALVE 3 POSN	-0.6250	%	GOOD	0.0000*	200.0000*	-0.1953	25.9375	8.20
✓	N30N021A	MSV A POSN	CLOSED		GOOD	N/A	N/A	N/A	N/A	N
✓	N30N021B	MSV B POSN	CLOSED		GOOD	N/A	N/A	N/A	N/A	N
✓	N30N021C	MSV C POSN	CLOSED		GOOD	N/A	N/A	N/A	N/A	N
✓	N30N021D	MSV D POSN	CLOSED		GOOD	N/A	N/A	N/A	N/A	N

Figure 4 - 'D' TSV Closed Unexpectedly

[5] 06/17/16 02:12 – 02:16

'B' and 'D' TSVs were both closed, but 'A', 'C', and 'D' TCVs cycled to attempt to control reactor pressure. The 'D' TCV was cycling, but not controlling steam flow into the HP Turbine because of the closed 'D' TSV. The three Bypass Valves (1N37F001A/B/C) also began to cycle open and closed. The Bypass Valves were cycling because the steam produced by the Reactor was in excess of the steam demanded by the Turbine. The Bypass Valves opened to dump the excess steam directly to the Main Condenser. Reactor power, pressure, and level all began to oscillate due to the cycling of the 'A' and 'C' TCVs and all three Bypass Valves.

Parameter	Minimum	Maximum
Rx Power	58%	86%
Rx Pressure	988 psig	1019 psig
Rx Level	31.6" NR	36.7" NR
'A' Control Valve	26% Open	73% Open
'C' Control Valve	29% Open	79% Open
'A' Bypass Valve	0% Open	34% Open
'B' Bypass Valve	0% Open	22% Open
'C' Bypass Valve	0% Open	21% Open

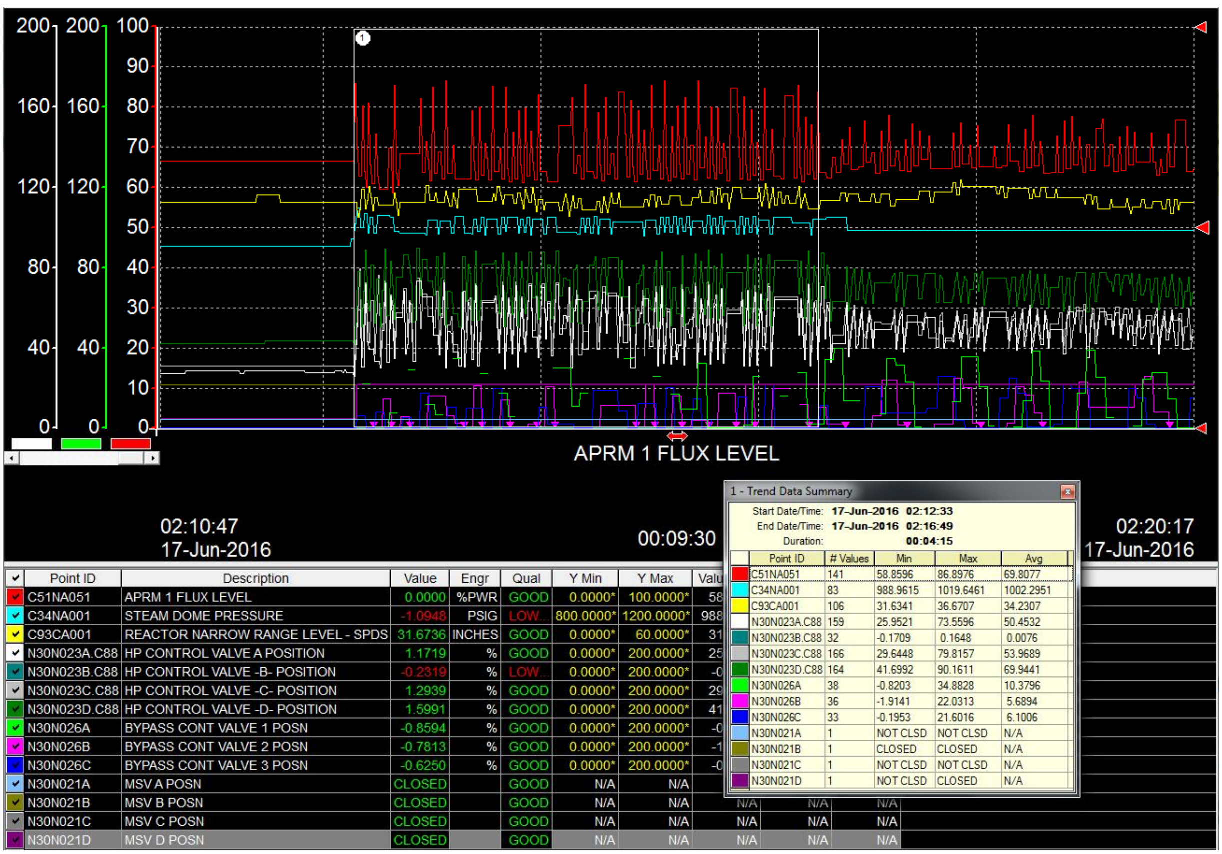


Figure 5 - First 4 minutes of transient

06/17/16 02:12 – 02:16 Operators' Response
ACRO: The original (signed into eSOMS) At-The-Controls-Reactor-Operator (ACRO) was on a break, and immediately returned to the control room and began to monitor Reactor pressure and level. The ACRO at the onset of the transient immediately reported a High Reactor Water Level Alarm and recognized the Control Valves and Bypass Valves cycling. This ACRO asked the CRS if the power oscillations were Thermal Hydraulic Instability (THI) and recommended reducing power or initiating a manual SCRAM due to the changing reactor power to the CRS.

CRO: The Control Room Operator (CRO) began to search PCRS for previous Condition Reports depicting actions taken in previous instances of this surveillance.

Extra RO #1 was on a headset communicating with the NLO Team at the Front Standard. After conferring with the CRS, he directed NLOs to follow the instructions to reset the 'B' Stop Valve by releasing the solenoid plungers in the order directed by the surveillance procedure.

Extra RO #2 was assigned to monitor LP Turbine inlet temperatures and to provide an update should any of the points approach a delta-T of 50^{o}F. (IOI-2 Precautions & Limitations 2.41.3)

The STA/FSS was providing continuous oversight to the NLO Team performing the surveillance at the Turbine Front Standard, fulfilling his Field Support Supervisor role. He was not in direct contact with the Main Control Room, and radios are prohibited from being keyed in that area of the building. An NLO was on a headset in continuous contact with the Control Room. During this time, the Control Room informed the NLO that a half SCRAM had occurred as a result of 'D' TSV unexpectedly closing. The NLO relayed this information to the STA/FSS.

CRS: The Control Room Supervisor (CRS) directed the Control Room staff to attempt to open the 'B' Stop Valve (recently closed by the surveillance). He also informed the team that the transient was not THI, but was caused by the Control Valve and Bypass Valve oscillations. The CRS informed the Shift Manager (SM) and Operations Manager – Support (OMS) of his decision. Both the SM and OMS agreed that it was acceptable to continue with the attempt to open the 'B' TSV. The CRS assigned Reactor power, pressure, and level to operators to monitor. No clear guidance was provided for limits or actions to take if parameters approached those limits.

SM: The SM recognized the two TSVs were closed and the onset of the plant transient. He spoke with the CRS about how the transient was caused by the oscillating TCVs. The CRS indicated he was going to attempt to reset the 'B' TSV in order to get the plant in a more stable place.

During this time, the SM discussed the transient with Operations Manager – Support. The OMS recognized the transient and began looking in PDS for additional data. The SM then contacted the Engineering Duty Manager (EDM) to find an EHC Engineer (or Turbine Controls System Engineer) to help with trying to back out of the situation.

Operations Manager – Support: The OMS was stationed near the Reactor Engineers and began to pull up PDS plots to monitor Turbine Valve position and the LPRM strings.

[6] 06/17/16 02:16 – 02:27

At this point, there was a decrease in the amplitude of the plant oscillations. At this time, it is unknown why the amplitude of oscillations decreased. One possible reason is that the NLO Team was directed to release the Solenoid Valve plungers at this time. Those plungers were released shortly after the transient started. Reactor Engineering (RE) runs a MON Case time-stamped at 02:17. RE reports to the CRS the margin to Thermal Limits, but MON Cases are unreliable if reactor conditions are not stable.

Parameter	Minimum	Maximum
Rx Power	63%	80%
Rx Pressure	997 psig	1010 psig
Rx Level	31.9" NR	37.3" NR
'A' Control Valve	33% Open	70% Open
'C' Control Valve	38% Open	62% Open
'A' Bypass Valve	0% Open	39% Open
'B' Bypass Valve	0% Open	29% Open
'C' Bypass Valve	0% Open	26% Open

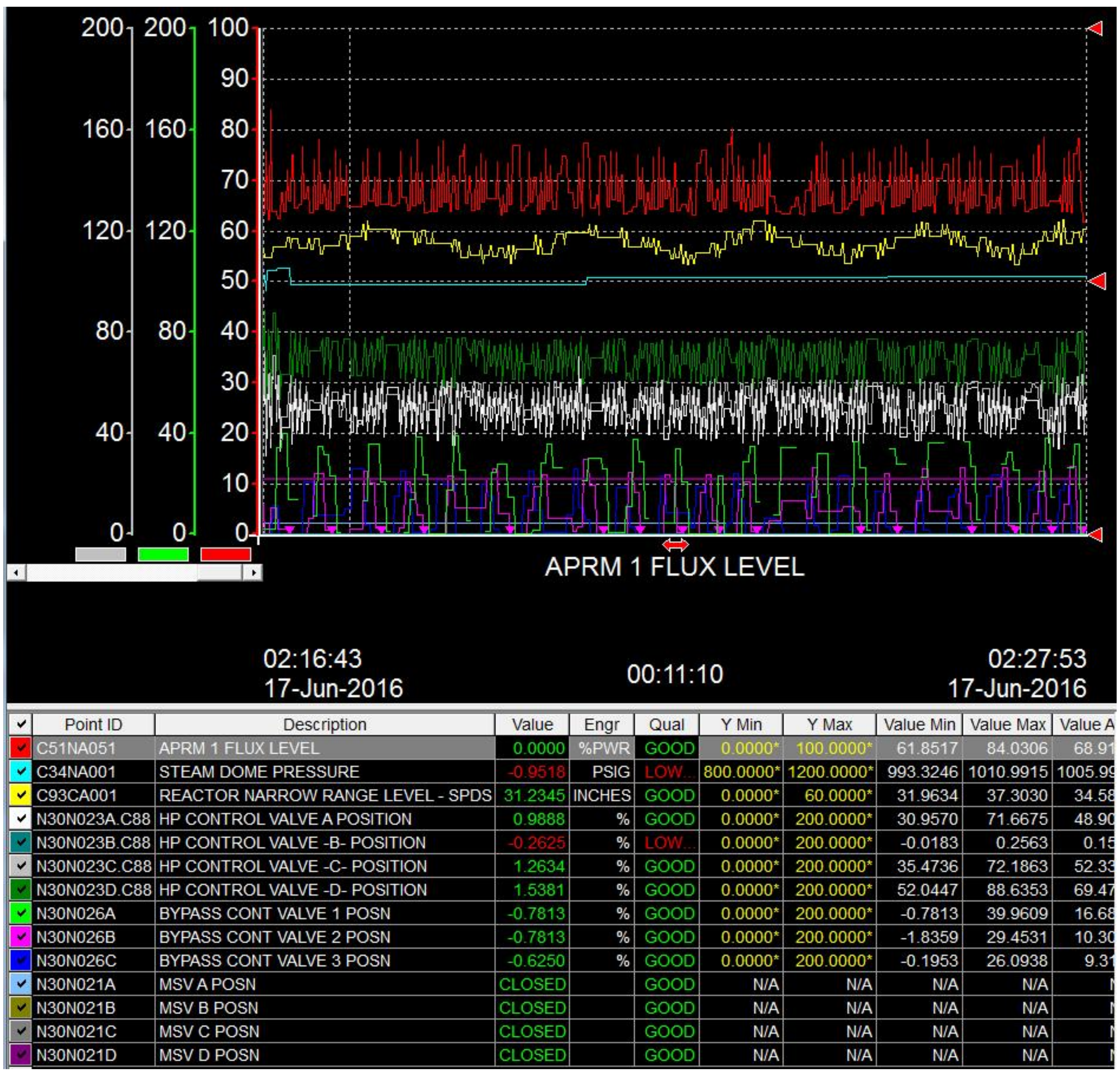


Figure 6 - 02:16 - 02:27

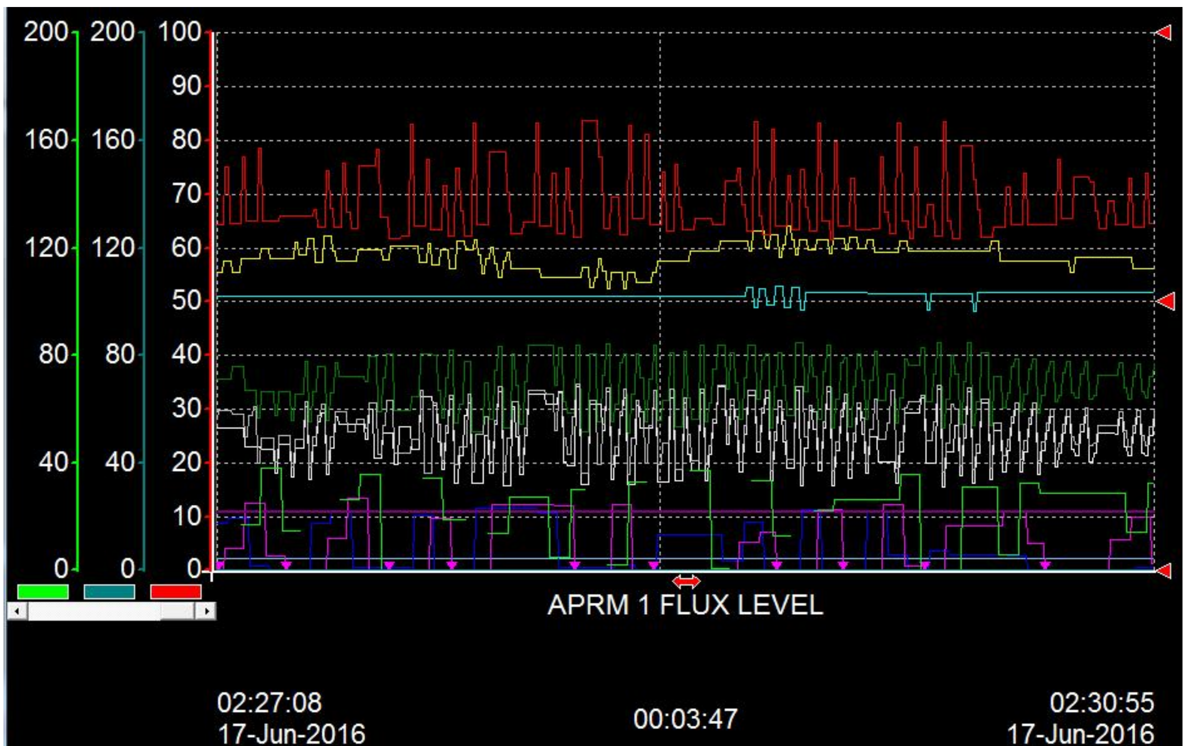
06/17/16 02:16 – 02:27 Operator Response
During this time, the RO directed the NLO Team at the Front Standard to reset the ‘B’ TSV using Steps 5.2.7.z – 5.2.7.ff of the “Turbine Stop and Control Valve Operability Surveillance” (06-OP-1N32-V-0001 Rev 120 Attachment II). These steps were performed in an attempt to send another CLOSE signal to the ‘B’ TSV. These steps have the NLOs rotate Manual Test Valve 1N32FD31 fully in the clockwise direction. Typically, the ‘B’ TSV would close when the Manual Test Valve is closed. The NLOs rotate Manual Test Valve fully in the counter-clockwise direction in an attempt to reopen the ‘B’ TSV. The NLO Team at the Front Standard indicated EHC pressures were changing, but not as expected.

During this time, the SM contacted the Operations Manager – Shift to inform him of the transient and direction the crew was taking. The Site Duty Manager was also contacted and informed of the transient, but an “Emergent Issues Phone Call” was not requested by the Shift Manager, nor offered by the Site Duty Manager.

The Shift Manager did not mention APRM oscillations to the Operations Manager – Shift or to the Site Duty Manager. Additionally, neither the Operations Manager – Shift or Site Duty Manager requested information related to the APRMs. Later, the Site Duty Manager was called a second time and informed of the Reactor SCRAM.

[7] 06/17/16 02:27 – 02:30
The NLO Team at the Front Standard begins to close Manual Test Valve 1N32FD31 using Steps 5.2.7.z – 5.2.7.ff. This action caused some sort of perturbation in the EHC System, and possibly caused Reactor power, pressure, and level oscillations to occur at higher amplitudes. RE runs a third MON Case at 02:26.

Parameter	Minimum	Maximum
Rx Power	62%	84%
Rx Pressure	992 psig	1011 psig
Rx Level	31.4" NR	38.5" NR
'A' Control Valve	31% Open	69% Open
'C' Control Valve	36% Open	70% Open
'A' Bypass Valve	0% Open	38% Open
'B' Bypass Valve	0% Open	27% Open
'C' Bypass Valve	0% Open	23% Open

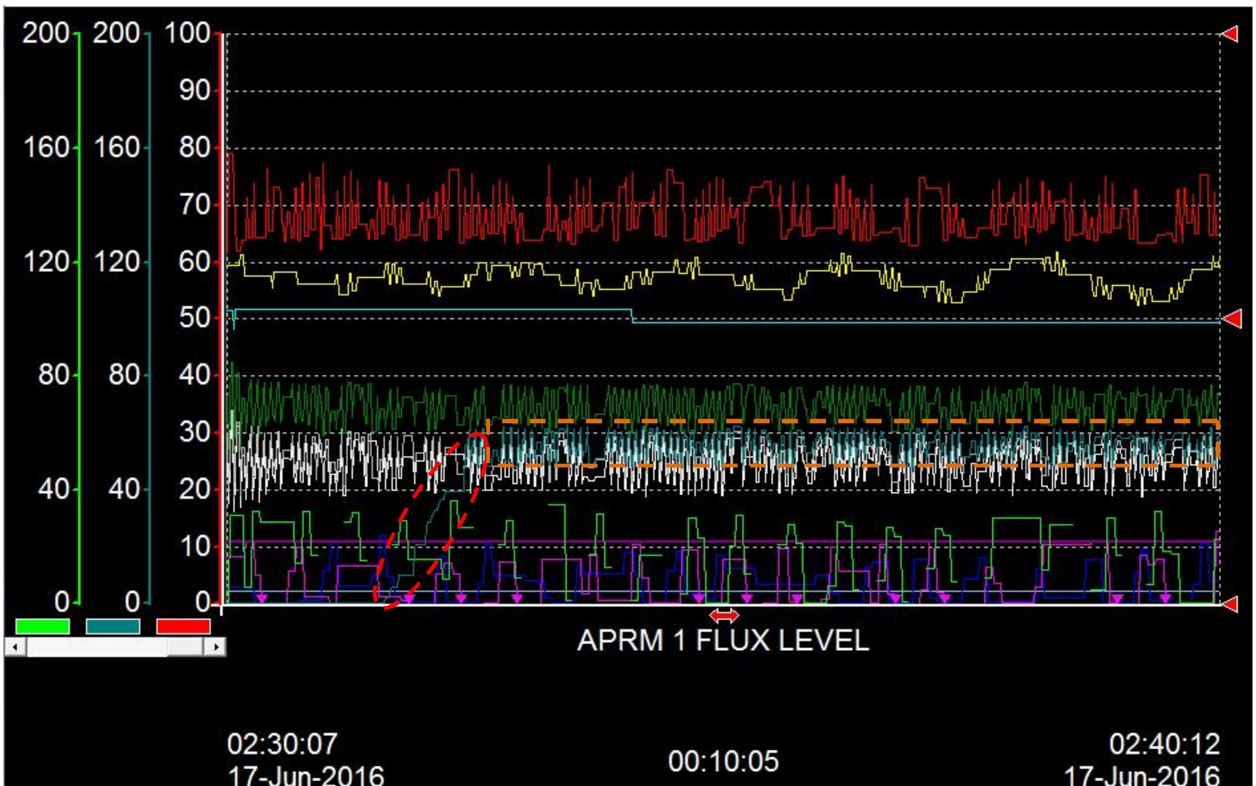


Point ID	Description	Value	Engr	Qual	Y Min	Y Max	Value Min	Value Max	Value A
C51NA051	APRM 1 FLUX LEVEL	0.0000	%PWR	GOOD	0.0000*	100.0000*	61.5179	83.6968	69.35
C34NA001	STEAM DOME PRESSURE	0.2642	PSIG	GOOD	800.0000*	1200.0000*	992.8955	1011.2775	1002.25
C93CA001	REACTOR NARROW RANGE LEVEL - SPDS	31.3049	INCHES	GOOD	0.0000*	60.0000*	31.4390	38.4983	35.15
N30N023A.C88	HP CONTROL VALVE A POSITION	0.9888	%	GOOD	0.0000*	200.0000*	31.2622	68.6157	49.32
N30N023B.C88	HP CONTROL VALVE -B- POSITION	-0.1709	%	LOW...	0.0000*	200.0000*	0.1953	0.1953	0.19
N30N023C.C88	HP CONTROL VALVE -C- POSITION	1.2634	%	GOOD	0.0000*	200.0000*	35.9009	69.5007	52.89
N30N023D.C88	HP CONTROL VALVE -D- POSITION	1.5076	%	GOOD	0.0000*	200.0000*	51.2817	85.0342	69.17
N30N026A	BYPASS CONT VALVE 1 POSN	-0.7813	%	GOOD	0.0000*	200.0000*	-0.7031	38.2031	17.30
N30N026B	BYPASS CONT VALVE 2 POSN	-0.7813	%	GOOD	0.0000*	200.0000*	-1.7188	26.6797	9.45
N30N026C	BYPASS CONT VALVE 3 POSN	-0.6250	%	GOOD	0.0000*	200.0000*	-0.0781	23.1641	8.33
N30N021A	MSV A POSN	CLOSED		GOOD	N/A	N/A	N/A	N/A	[illegible]
N30N021B	MSV B POSN	CLOSED		GOOD	N/A	N/A	N/A	N/A	[illegible]
N30N021C	MSV C POSN	CLOSED		GOOD	N/A	N/A	N/A	N/A	[illegible]
N30N021D	MSV D POSN	CLOSED		GOOD	N/A	N/A	N/A	N/A	[illegible]

Figure 7 - 02:27 - 02:31

[8] 06/17/16 02:30 – 02:32
The crew was unsuccessful in opening the 'B' TSV using either of the two methods attempted (Test Solenoid (normal) [5.2.7.q – 5.2.7.w] and a Test Valve (manual) [Steps 5.2.7.z – 5.2.7.ff]), the Control Room directed the NLO Team at the Front Standard to continue performing Steps 5.2.7.gg – 5.2.7.mm to open the 'B' TCV. No changes in the amplitude of Reactor power, pressure, and level oscillations were observed after the 'B' TCV was opened using Steps 5.2.7.gg – 5.2.7.mm. The 'B' TCV then oscillated in a similar fashion to the 'A' and 'C' TCVs. RE ran a fourth MON Case at 02:31, presumably to develop a CRAM Rod pattern to reduce power.

Approximately 02:30, the Shift Manager fielded a call from the Load Dispatcher and was asked "Did you realize that GGNS is cycling the grid?" The Shift Manager answered in an affirmative manner, and the Control Room was taking action to stabilize the plant.

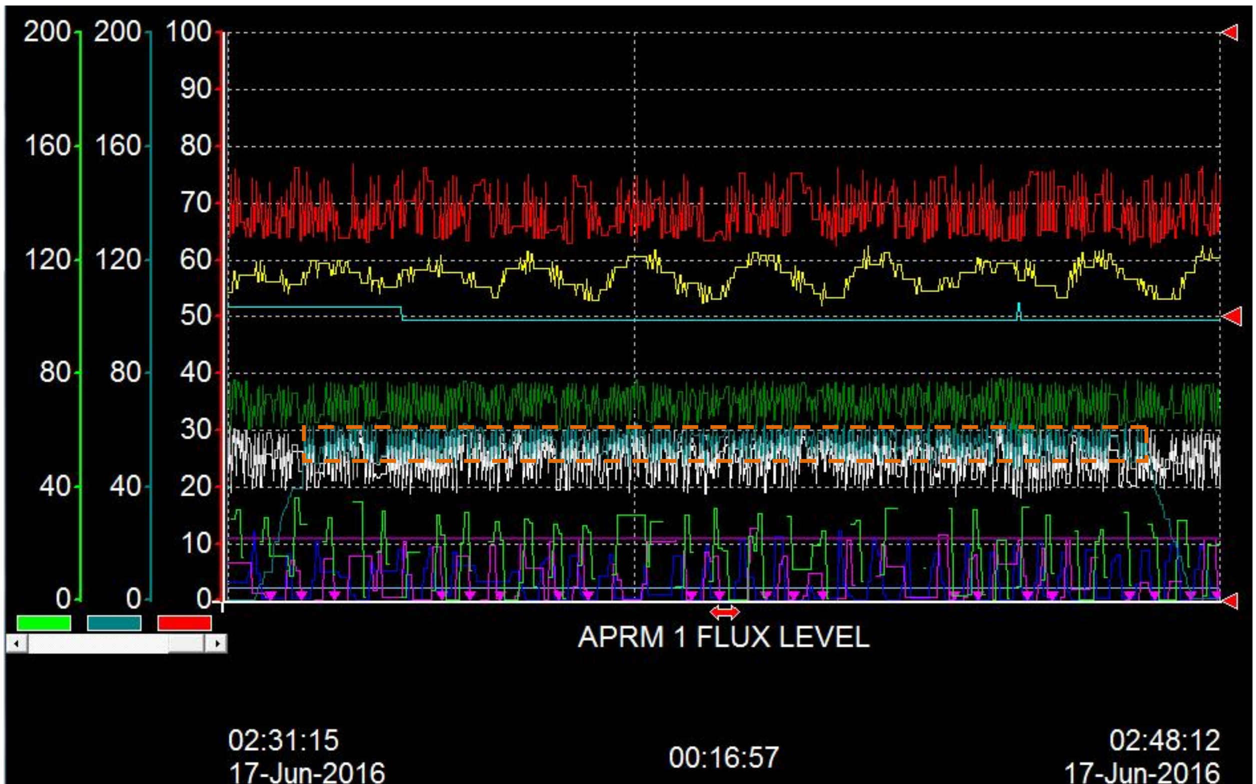


✔	Point ID	Description	Value	Engr	Qual	Y Min	Y Max	Value Min	Value Max	Value A
✔	C51NA051	APRM 1 FLUX LEVEL	0.0000	%PWR	GOOD	0.0000*	100.0000*	62.0484	79.0596	68.61
✔	C34NA001	STEAM DOME PRESSURE	0.5503	PSIG	GOOD	800.0000*	1200.0000*	992.8955	1006.9145	1002.44
✔	C93CA001	REACTOR NARROW RANGE LEVEL - SPDS	31.6191	INCHES	GOOD	0.0000*	60.0000*	31.5244	37.0102	34.22
✔	N30N023A.C88	HP CONTROL VALVE A POSITION	0.9888	%	GOOD	0.0000*	200.0000*	32.4524	66.5405	49.22
✔	N30N023B.C88	HP CONTROL VALVE -B- POSITION	-0.2014	%	LOW...	0.0000*	200.0000*	0.2258	62.6343	54.36
✔	N30N023C.C88	HP CONTROL VALVE -C- POSITION	1.2634	%	GOOD	0.0000*	200.0000*	37.7930	67.9443	52.46
✔	N30N023D.C88	HP CONTROL VALVE -D- POSITION	1.5381	%	GOOD	0.0000*	200.0000*	53.8757	85.0342	69.73
✔	N30N026A	BYPASS CONT VALVE 1 POSN	-0.7813	%	GOOD	0.0000*	200.0000*	-0.6641	36.0938	15.22
✔	N30N026B	BYPASS CONT VALVE 2 POSN	-0.7813	%	GOOD	0.0000*	200.0000*	-1.6016	25.4688	7.73
✔	N30N026C	BYPASS CONT VALVE 3 POSN	-0.6250	%	GOOD	0.0000*	200.0000*	0.0781	24.2188	8.79
✔	N30N021A	MSV A POSN	CLOSED		GOOD	N/A	N/A	N/A	N/A	N
✔	N30N021B	MSV B POSN	CLOSED		GOOD	N/A	N/A	N/A	N/A	N
✔	N30N021C	MSV C POSN	CLOSED		GOOD	N/A	N/A	N/A	N/A	N
✔	N30N021D	MSV D POSN	CLOSED		GOOD	N/A	N/A	N/A	N/A	N

Figure 8 - 'B' Control Valve Opened

[9] 06/17/16 02:32 – 02:47
The ‘B’ TCV oscillates between 46% and 64% open, in a similar fashion to the ‘A’ and ‘C’ TCVs. The Bypass Valves continue to oscillate. Also, Reactor power, pressure and level continued to oscillate due to the TCV and Bypass Valve oscillations.

Between 02:32 and 02:47, the Control Room directed the NLO Team at the Front Standard to begin re-performing Steps 5.2.7.a – 5.2.7.w to test the ‘B’ TCV and TSV. At 02:47, the ‘B’ TCV is re-closed using Step 5.2.7.q. When the NLO Team performed Steps 5.2.7.r through 5.2.7.w (releasing plungers on Solenoid Valves), the ‘B’ TSV again failed to re-open and there was no change in the amplitude of Reactor power, pressure, or level oscillations.



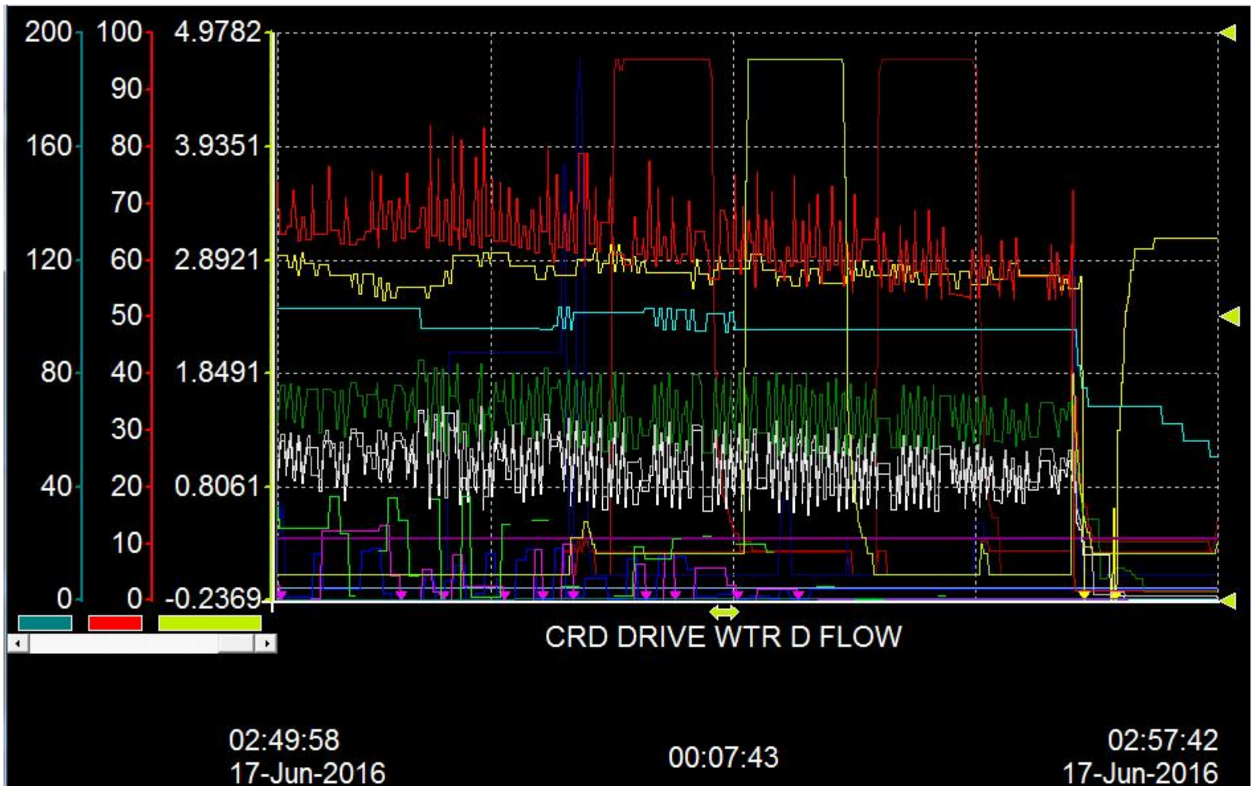
✔	Point ID	Description	Value	Engr	Qual	Y Min	Y Max	Value Min	Value Max	Value A
✔	C51NA051	APRM 1 FLUX LEVEL	0.0000	%PWR	GOOD	0.0000*	100.0000*	62.2213	77.0390	68.81
✔	C34NA001	STEAM DOME PRESSURE	-1.0233	PSIG	LOW...	800.0000*	1200.0000*	997.7592	1009.9901	1001.88
✔	C93CA001	REACTOR NARROW RANGE LEVEL - SPDS	31.4540	INCHES	GOOD	0.0000*	60.0000*	31.2317	37.5366	34.40
✔	N30N023A.C88	HP CONTROL VALVE A POSITION	0.9888	%	GOOD	0.0000*	200.0000*	36.2366	60.8337	49.20
✔	N30N023B.C88	HP CONTROL VALVE -B- POSITION	-0.2625	%	LOW...	0.0000*	200.0000*	0.5005	64.1296	53.98
✔	N30N023C.C88	HP CONTROL VALVE -C- POSITION	1.2634	%	GOOD	0.0000*	200.0000*	40.4480	62.0850	52.47
✔	N30N023D.C88	HP CONTROL VALVE -D- POSITION	1.5381	%	GOOD	0.0000*	200.0000*	57.7820	78.6865	69.82
✔	N30N026A	BYPASS CONT VALVE 1 POSN	-0.7813	%	GOOD	0.0000*	200.0000*	-0.6641	36.0938	13.59
✔	N30N026B	BYPASS CONT VALVE 2 POSN	-0.7813	%	GOOD	0.0000*	200.0000*	-1.6406	25.4688	7.16
✔	N30N026C	BYPASS CONT VALVE 3 POSN	-0.6250	%	GOOD	0.0000*	200.0000*	0.1563	24.7656	8.75
✔	N30N021A	MSV A POSN	CLOSED		GOOD	N/A	N/A	N/A	N/A	N
✔	N30N021B	MSV B POSN	CLOSED		GOOD	N/A	N/A	N/A	N/A	N
✔	N30N021C	MSV C POSN	CLOSED		GOOD	N/A	N/A	N/A	N/A	N
✔	N30N021D	MSV D POSN	CLOSED		GOOD	N/A	N/A	N/A	N/A	N

Figure 9 - 'B' Control Valve is open and then closed

Also, the CRS requested RE to determine a control rod movement plan to further reduce power. The first control rod movement plan was determined, but the initial control rods were already at position 08 (nearly full-in). The second control rod movement plan was developed, steps for inserting the control rods were hand-written by the qualified RE, and provided to the ROs at approximately 02:50.

[10] 06/17/16 02:47 – 02:56

The control rod movement plan was briefed, with the first control rod being inserted from 02:51 until 02:52. All four control rod insertions were accomplished between 02:51 and 02:55. Average Reactor power decreased from ~65% to ~60%, and the oscillations decreased in amplitude. After the second control rod was inserted at 02:53, the Bypass Valves closed and remained closed. The Reactor SCRAMMED at 02:56 due to the Period Based Detection Algorithm of the OPRMs.



✓	Point ID	Description	Value	Engr	Qual	Y Min	Y Max	Value Min	Value Max	Valu
✓	C51NA051	APRM 1 FLUX LEVEL	0.0000	%PWR	GOOD	0.0000*	100.0000*	1.7762	83.7683	63
✓	C34NA001	STEAM DOME PRESSURE	-1.3094	PSIG	LOW...	800.0000*	1200.0000*	900.9852	1007.0576	983
✓	C93CA001	REACTOR NARROW RANGE LEVEL - SPDS	31.0732	INCHES	GOOD	0.0000*	60.0000*	-15.0000	38.3049	30
✓	N30N023A.C88	HP CONTROL VALVE A POSITION	0.9888	%	GOOD	0.0000*	200.0000*	-0.0488	66.9983	45
✓	N30N023B.C88	HP CONTROL VALVE -B- POSITION	-0.1709	%	LOW...	0.0000*	200.0000*	0.4395	0.5920	0
✓	N30N023C.C88	HP CONTROL VALVE -C- POSITION	1.2634	%	GOOD	0.0000*	200.0000*	0.6836	68.5547	49
✓	N30N023D.C88	HP CONTROL VALVE -D- POSITION	1.5381	%	GOOD	0.0000*	200.0000*	3.2471	84.6375	64
✓	N30N026A	BYPASS CONT VALVE 1 POSN	-0.7813	%	GOOD	0.0000*	200.0000*	-0.6250	36.7969	10
✓	N30N026B	BYPASS CONT VALVE 2 POSN	-0.7813	%	GOOD	0.0000*	200.0000*	-1.6406	26.4453	6
✓	N30N026C	BYPASS CONT VALVE 3 POSN	-0.6250	%	GOOD	0.0000*	200.0000*	0.0781	18.6328	6
✓	N30N021A	MSV A POSN	CLOSED		GOOD	N/A	N/A	N/A	N/A	
✓	N30N021B	MSV B POSN	CLOSED		GOOD	N/A	N/A	N/A	N/A	
✓	N30N021C	MSV C POSN	CLOSED		GOOD	N/A	N/A	N/A	N/A	
✓	N30N021D	MSV D POSN	CLOSED		GOOD	N/A	N/A	N/A	N/A	

Figure 10 - Control Rod insertion and SCRAM

Attachment 2: Extended Comparative Timeline Worksheet

Time Line #	Barrier / Change	When? Date/ Time	What Happened?	What Should Have Happened?	Immediate Result (Consequence)	Significance (Impact on this Event)	Signifi-cance Code
1.	IOI-2 Temporary Downpower (03-1-01-2 Att VIII)	6/16/16 22:24	ACRO lowered Total Core Flow Rate from 108 Mlbm/hr to 70 Mlbm/hr using Recirc FCVs for sequence exchange using IOI-2 Temporary Downpower	OPRM Armed region of Power-to-Flow Map entered at ~22:20 when total core flow reached 85 Mlbm/hr.	OPRMs were confirmed operable and then armed when total core flow reached 85 Mlbm/hr	Set initial conditions	SU
2.	06-OP-1N32-V-0001 Att 2 Step 5.2.7.k.	6/17/16 02:04	Closed ‘B’ HP Turbine Control Valve.	Only the ‘B’ HP Turbine Control Valve (1N11F026B) should have closed after given a CLOSE signal.	‘A’, ‘C’, and ‘D’ Turbine Control Valves reposition to make up for the ‘B’ Stop Valve closing, as expected. .	Surveillance progresses as expected.	SU
3.	06-OP-1N32-V-0001 Att 2 Step 5.2.7.o	02:08	Closed ‘B’ HP Turbine Stop Valve	Only the ‘B’ HP Turbine Stop Valve should have closed after given a CLOSE signal	‘A’, ‘C’, and ‘D’ Turbine Control Valves maintain their previous position	Surveillance progresses as expected	SU
4.	06-OP-1N32-V-0001 Att 2 Step 5.2.7.r through 5.2.7.w.	02:08-02:12	NLOs attempt to reset ‘B’ Stop Valve	‘B’ Stop Valve above piston rises to ~60 psig and oscillates for ~30 seconds. After the piston spring is compressed, above-piston pressure rises to ~120 psig. When pressure rises to ~120 psig, release plunger of 1N32F515C. Then release the plunger of 1N32F514C.	The above-piston pressure did not rise to ~60 psig. NLOs reported this to the Control Room.	This was the first indication that the ‘B’ Stop Valve would not re-open.	SU
5.		02:12	‘D’ Stop Valve unexpectedly closed. Bypass Valves A/B/C begin to cycle open and closed; Control Valves ‘A’ and ‘C’ begin to cycle. ‘D’ Control Valve also cycles, but has no effect on the transient because of the closed ‘D’ Stop Valve. ‘B’ Stop and Control Valves were closed as part of the surveillance.	‘D’ Stop Valve should have remained open. When ‘B & D’ Stop Valves both close, RPS will provide a Half-SCRAM on ‘B’ channel by design. This did actually happen. Bypass valves cycle open and closed to admit steam directly to the Condenser when steam produced is in excess of steam demand.	Reactor power and pressure change due to ‘A’ and ‘C’ Control Valves repositioning Reactor Power and Pressure began to oscillate 10-20% and 20 psig, respectively, peak to peak.	Equipment issue resulted in the transient	SU
6.	EN-OP-115-08, Section 5.2 Annunciator Response EN-OP-120 Att 9.3 “STA Monitoring”	02:12	ROs informed CRS and NLO performing surveillance of the ‘D’ Stop Valve closing unexpectedly and the RPS ‘B’ half SCRAM alarm.	SM/CRS should have notified STA of reactor power, pressure, level response to closed ‘D’ Stop Valve and Control Valve response.	None	STA/FSS remained in his FSS role instead of transitioning back to STA role for the transient. Sr. OPS Mgr indicates this is a correct response by STA/FSS.	N/A BB

Time Line #	Barrier / Change	When? Date/ Time	What Happened?	What Should Have Happened?	Immediate Result (Consequence)	Significance (Impact on this Event)	Signifi-cance Code
7.	EN-OP-120 Att 9.3 "STA Monitoring"	02:12 – 02:56	STA was never requested nor offered to return to the Control Room for the duration of the transient. The STA remained in his FSS roll at the Front Standard for the duration of the transient.	STA should have returned to the Control Room to fulfill his EN-OP-120 Operator Fundamentals to provide "eyes-on monitoring."	STA never provided input to the CRS/SM about actions being taken from the Control Room.	STA/FSS remained in FSS role instead of transitioning back to STA role.	MO
8.	EN-OP-120 Att 9.3 "STA Monitoring"	02:12-02:16	STA/FSS learned from NLO on headset with RO in control room of 'D' stop valve closing. STA/FSS heard flow oscillations occurring behind the BioShield wall.	STA/FSS should have questioned the Control Room about reactor conditions and asked to return to Control Room	None	None	BB
9.	EN-OP-115 Section 5.2 [1]	02:12-02:16	Reactor power, pressure, and level oscillations reported by the ACRO. He raises concern to CRS that THI is occurring.	ACRO should have also considered Reactor instabilities in a broad sense and advocated for Manual SCRAM	CRS/ACRO allowed continued operation with reactor power, pressure, and level oscillations.	This was a missed opportunity to identify that the Reactor was unstable and advocate for Reactor SCRAM.	MO
10.		02:12-02:16	CRS/SM/AOM discussed and determined that transient was not THI.	CRS/SM/AOM should have considered Reactor Instabilities in a broad sense	CRS/SM allowed continued operation with reactor power, pressure, and level oscillations.	This was a missed opportunity to identify that the Reactor was unstable and advocate for Reactor SCRAM.	MO
11.	EN-OP-115 Section 5.2 [1]	02:12-02:16	CRS informs SM that he will attempt to open 'B' Stop and Control Valve, and announces that the oscillations are caused by the Turbine Control Valves, and are not THI. CRS assigned ROs to monitor power, pressure, and level. A different RO was assigned to monitor LP Turbine inlet temperatures.	'B' Stop and Control Valve should have been attempted to be recovered, per Sr. OPS Mgr.	None	None	C [RC1 & CC3]
12.	EN-OP-115 Section 5.2 [1]	02:12-02:16	SM discussed proposed action with AOM Support, and obtained his concurrence with the action. A discussion was had that a SCRAM on LP Turbine inlet temps would be very likely if a Stop Valve wasn't recovered.	Critical Parameters to monitor in the Reactor and SCRAM criteria should also been established for Power, Pressure, level.	Clear SCRAM criteria were not established.		BB
13.		02:16-02:30	RE was directed by the CRS to check core thermal limits and verify the fuel integrity was not being challenged.	RE consulted by SM and or CRS about the possibility of THI.	The "experts" on the reactor core were consulted about what was happening inside the core, but may not have been engaged to the fullest extent of their knowledge or expertise.		MO
14.		02:16-02:27	NLO Team briefs to open 'B' Stop Valve using Steps 5.2.7.gg – 5.2.7.mm. ROs monitoring LP Turbine differential temperatures. [1st attempted reset]	Same	No system response, transient continued	Transient was attempted to be mitigated.	C

Time Line #	Barrier / Change	When? Date/ Time	What Happened?	What Should Have Happened?	Immediate Result (Consequence)	Significance (Impact on this Event)	Signifi-cance Code
15.	EN-OP-120 02-S-01-27	02:16-02:27	AOM Support reviewing PDS for Trouble Shooting clues	AOM Support maintains an oversight role instead of attempting to help solve problems. AOM should have coached crew to conduct a transient brief and to set limits on power, pressure and level. AOM should have also coached SM on establishing and Emergent Issue Call.	AOM Support loses oversight role by not providing coaching on expectations for conservative bias.	Missed opportunity to coach SM and CRS on conservative bias when presented with unexpected conditions	C [CC2]
16.	EN-OP-120 02-S-01-27	02:16-02:27	SM down one level providing oversight of response and Trouble Shooting	SM maintains an oversight role instead of attempting to help solve problems. AOM should have coached crew to conduct a briefing and to set limits on power, pressure and level. SM should have also established and Emergent Issue Call.	SM Support loses oversight role by not providing coaching on expectations for conservative bias.	Missed opportunity to coach CRS on conservative bias when presented with unexpected conditions	C [CC2]
17.	06-OP-1N32-V-0001 Steps 5.2.7.z – 5.2.7.ff	02:27-02:30	NLO Team reports to Control Room that their attempts to reset the 'B' Stop Valve were unsuccessful, but pressure changes on local indicators provided some indication that something was happening.	Manual SCRAM initiated by ROs or directed to be initiated by SROs	Transient continued	No manual SCRAM initiated	MO
18.		~02:30	Load Dispatcher calls GGNS. Shift Manager takes the call and is asked "Did you know that GGNS is cycling the grid?"	SM clued in that GGNS is affecting the US grid, and immediately directed a manual SCRAM.	Transient continued	No manual SCRAM initiated	MO C [CC2]
19.	06-OP-1N32-V-0001 Steps 5.2.7.gg	02:30-02:32	CRS directs the NLO Team to perform the steps to reset the 'B' Control Valve. 5.2.7.gg – 5.2.7.mm	'B' Control Valve opened when given a signal to open.	Transient continued because 'B' Stop Valve remained closed.	No manual SCRAM initiated	MO
20.		02:30-02:45	CRS directed RE to develop a CRAM Rod pattern and directed to re-verify Thermal Limits.	Same	CRAM rods determined and sequenced. Thermal Limits verified to be met	RE hand-wrote CRAM rod pattern. 1st attempt at CRAM Rod pattern identified 4 rods at position 08. 2nd attempt identified 4 rods at position 48.	BD
21.	06-OP-1N32-V-0001 Steps 5.2.7.a – 5.2.7.w	~02:40	CRS decides to attempt a 2nd reset of the 'B' Stop Valve by re-performing Steps 5.2.7.a – 5.2.7.w	Same	Transient continued	No manual SCRAM initiated	MO
22.		02:47	'B' Control Valve re-closes, and 'B' and 'D' Stop Valves remain closed.	Same	Transient continued	No manual SCRAM initiated	MO

Time Line #	Barrier / Change	When? Date/ Time	What Happened?	What Should Have Happened?	Immediate Result (Consequence)	Significance (Impact on this Event)	Signifi-cance Code
23.		~02:47	RO and other NLOs dispatched to Front Standard to provide assistance. STA informed by RO of power oscillations.	Same	None	None	N/A
24.	06-OP-1N32-V-0001 Steps 5.2.7.a – 5.2.7.w	02:47 until 02:56	NLO team re-performs surveillance steps 5.2.7.a – 5.2.7.w	Same	None. The NLO team was attempting to open the 'B' Stop and Control Valve, at the direction of CRS/SM	Transient continued	MO
25.		02:51	(4) CRAM Rods inserted to reduce Reactor power, and Bypass valves stop cycling. Reactor power and pressure oscillations reduce in amplitude.	Same	Power reduced from ~65% to ~60%, but power oscillations did not subside	No manual SCRAM initiated	MO
26.		02:56	GGNS Unit 1 automatically SCRAMMED	SCRAM	Entered EP-2, Reactor SCRAM ONEP, Turbine/Generator Trip ONEP	Power and pressure oscillations subsided due to SCRAM	N/A

Code	Explanation of Significance Codes for Significance (Impact on This Event)
SU	**SETUP FACTOR**: circumstances necessary to have existed for the consequential event being investigated to occur but may or may not represent conditions.
MO	**MISSED OPPORTUNITY**: A previous occurrence or identified condition that if different actions had been taken may have prevented or reduced the significance of the consequential event.
P	**PRECURSOR**: An indication, previous condition, or trend that could have forewarned the organization of the consequential event.
BF	**FAILED BARRIER**: The barrier was implemented but was not effective at preventing the consequential event
BB	**BYPASSED BARRIER**: The barrier was not implemented
BD	**DEGRADED BARRIER**: The barrier was implemented but was only partially consequential effective
T	**EVENT TRIGGER**: The human actions or injection of energy that was necessary to directly cause the event. This is also referred to as a Direct Cause in EN-LI-118.
C	**CAUSAL**: Any Causal Factor that was necessary to have or contributed to the significance of the consequential event, Root, Apparent, Contributing, or Common Cause.
ECAQ	**EXTRANEOUS CONDITION ADVERSE TO QUALITY**: A condition found during the investigation of the consequential event that has no bearing on the consequential event. Report these conditions under separate CRs.
MA	**MITIGATING ACTION**: An action that reduced the severity or consequences of the event.
N/A	**NOT APPLICABLE**: An action taken or equipment response that was appropriate and in accordance with process for the situations. Note - If this action was necessary for the event to occur code as a SETUP FACTOR. If this action reduced the severity or consequences of the event then code as a MITIGATING ACTION

Attachment 3: Performance Analysis

Problem Statement:

The Control Room staff, when faced with unexpected and uncertain conditions, did not place the plant in a safe condition and hesitated to reduce power or insert a manual SCRAM.

CR-GGN-2016-4834: At Grand Gulf Nuclear Station on June 17, 2016 from 02:12 until 02:56, the Control Room staff did not initiate a manual SCRAM when observing 10-20% (peak to peak) Reactor power oscillations. This resulted in uncontrolled Reactor power, pressure, and level oscillations over a 39 minute period. The Control Room staff did not take timely actions to place the unit in a safe condition when unexpected complications from surveillance testing challenged reactor power/pressure/level. This performance analysis addresses the roles of ROs, CRS, STA, and SM specifically.

Question	Y	N	Comments
Section I: Standards and Expectations			
Have expectations with respect to performance been established? • If "NO", then develop actions to establish expectations.	☒	☐	Expectations have been established at the fleet level with respect to the timeliness and conservative actions to take when faced with unexpected/uncertain conditions. (ref. EN-OP-115)
Are expectations clear? Do performers know what they're expected to do or accomplish? • If "NO", then develop actions to clarify expectations.	☐	☒	Alignment throughout the GGNS management chain is not entirely consistent for this particular event. While the consensus was a manual SCRAM should have been inserted, actions to mitigate the transient (i.e., reopen the "B" Turbine Stop) have been deemed appropriate by some senior managers. Clear expectations to manually SCRAM the reactor must be reinforced from all levels of management to ensure consistent behaviors in any situation involving uncertainty.
Are performers aware of the expectations? • If "NO", then develop actions to communicate expectations.	☒	☐	While the crew is clearly aware of their duties and responsibilities to protect the health and safety of the public, during this event they lost focus of that fundamental principle.
Does a procedure/process exist for the task? • If "NO", then determine whether a procedure should exist and issue follow-on actions.	☒	☐	EN-OP-115, EN-OP-120, and EN-OP-200 contain a "blanket" statement that directs all Licensed Operators to place the plant in a safe condition when faced with unexpected or uncontrolled equipment operation. However, for this particular event, there may need to be a new ONEP to address Reactor Pressure Control issues if it is ultimately determined to be an equipment issue.

Are the processes/procedures appropriate for the task (including consideration for whether there is a better method to perform the task)? • If "NO", then develop actions to revise the process.	☒	☐	
Are work instructions and procedures for the task accurate and usable? Do procedures or other work guidance documents provide clear and concise directions? • If "NO", then develop actions to revise the process.	☐	☒	A new Off-Normal Event Procedure has been created and issued for responding to Reactor Pressure Control Malfunctions.
Are performers aware of the performance issue? Is performance feedback provided by supervision? • If "NO", then develop actions to provide performance feedback.	☒	☐	Multiple communications have been distributed to employees. Focused group meetings have been held. Continue to provide information concerning this event as details are finalized.
Do performers have everything they need with which to do the task (tools, equipment, resources, etc.)? • If "NO", then develop actions to provide the resources.	☐	☒	A new Off-Normal Event Procedure has been created and issued for responding to Reactor Pressure Control Malfunctions.

Question	**Y**	**N**	**Comments**
Will the above actions sufficiently improve performance to resolve the gap? • If "No", then continue to the next section. • If "Yes," then implement actions and monitor performance. The next section may be completed, if desired.	☐	☒	
Section II: Consequences			
Put yourself in the performers' shoes. Consider everything (good or bad) that happens *to them* when they do it right. Are any of these consequences punishing to *the performer*? • If "YES", then develop actions to remove the punishment.	☐	☒	
Consider everything (good or bad) that happens *to the performers* when they don't perform as desired. Are any of these consequences reinforcing undesired performance? • If "YES", then develop actions to remove the rewards.	☐	☒	
Are consequences for undesired performance adequate and consistently utilized? • If "NO", then develop actions to strengthen or improve consistency of consequences.	☒	☐	
Will the above actions sufficiently improve performance to resolve the gap? • If "No", then continue to the next section. • If "Yes," then implement actions and monitor performance. The next section may be completed, if desired.	☐	☒	

Question	Y	N	Comments
Section III: Knowledge and Skills			
Is there a genuine knowledge and skill deficiency? • If "Yes", then quantify the deficiency and continue with this section. • If "No", then continue to the next section.	☐	☒	
Did past performance meet expectations? • If "Yes", then continue with this section. • If "No", then continue to the next section.	☒	☐	The crew has clearly demonstrated (both in-plant and in the simulator) conservative actions and decision making.
Do the performer(s) have adequate practice to remain proficient? • If "Yes," then develop actions to provide performance feedback and continue to the next section. • If "No", then develop actions to provide practice, then continue to the next section	☒	☐	

Question	Y	N	Comments
Section IV: Task Performance			
Could you change criteria, provide assistance (including performance aids), or redesign the job to make the task easier? • If "YES", then develop actions to redesign the task.	☒	☐	A performance aid such as the (R.E.A.D.E. Tool) may ensure a deliberate and conservative decision is made at critical times (ref. INPO 07-006 for additional information see excerpt below) [CA-007]
Is the work place free of distractions that could impact task completion? • If "NO", then develop actions to improve the work environment.	☒	☐	
Are there other obstacles impeding desired performance? • If "YES", then develop actions to remove the obstacles.	☐	☒	
Is there a way to improve the efficiency of the process? • If "YES", then develop actions to revise the process.	☒	☐	A performance aid such as the (R.E.A.D.E. Tool) may ensure a deliberate and conservative decision is made at critical times (ref. INPO 07-006 for additional information see excerpt below) [CA-007]
Given past performance, will actions to provide training improve individual performance? • If "YES", then develop actions to provide training. • If "No," then continue with this section.	☐	☒	
Given the same conditions, would other personnel have responded/acted in the same manner? • If "YES", then develop actions to provide training. • If "No," then develop actions to provide performance feedback.	☐	☒	

As part of the analysis, the following knowledge and/or skill gaps were identified and should be addressed through training (Refer to EN-TQ-201-01):

Knowledge:	
Skill(s):	
TEAR #:	**(Attach this Analysis to the TEAR)**

Section IV "Task Performance" Discussion

Conservative Decision-Making

Background:

Conservatism is a state of mind that permeates an organization. A conservative attitude prioritizes the safety of the plant and personnel over the near-term production goals of the task at hand. When safety limits are approached or exceeded, or when equipment responds unpredictably, people act promptly to place the system in a safe state. Most often, the choice to make is clear. However, for knowledge-based situations, the choice may not be so apparent. A deliberate method to respond to such situations promotes better decision-making. People are trained not to proceed with an activity if uncertainty materializes, to place the system or equipment in a safe, stable condition, and to obtain guidance before proceeding. This is particularly important when people perform work independently and guidance is unclear—knowledge-based performance. Knowledge based decision-making is exacerbated in a time-critical crisis, multiplying the chances of a costly mistake. A crisis atmosphere exists under the following conditions:

- A decision must be made under pressure.
- A fixed deadline must be met.
- A wrong decision will result in grave consequences.
- Irregularities and/or uncertainties are present.
- How to handle the situation is unclear.

To respond safely to knowledge-based situations in a crisis atmosphere, a philosophy for conservatism must permeate the hearts and minds of the people in the organization. Through uncompromising leadership, executives, senior managers, line managers and supervision, and even instructors continuously and consistently reinforce this philosophy. Management support for conservative decision-making must be communicated in clear, unequivocal terms and frequently reinforced during personnel training and daily interactions. When people take conservative actions (such as shutting down the plant or stopping a job) in response to unexpected situations, they should be commended publicly; not only to recognize them personally for the appropriateness of their actions, but to convey the importance of conservative decision-making to others in the organization. This approach to conservative decision-making differs from *operational* decision-making in that this method is designed to aid conservatism in a crisis atmosphere, without the immediate support of experts or ready references. Without such support, people weigh the consequences of failure more heavily than the potential for success.

Refer to INPO Principle Series Document, *Principles for Effective Operational Decision-Making* (December 2001), and to INPO 05-002 (Rev. 1), *Human Performance Tools for Engineers and Other Knowledge Workers* (March 2007), for additional insights into decision-making.

When to Use the Tool:

A conservative approach is necessary when encountering the following conditions, or others similar, during activities or processes that could affect safety:

- unexpected results
- uncertain, degraded, or unstable conditions
- no slack—low margin for error
- no opportunities to redo or recover—irreversible actions
- inability to improvise when things go wrong
- complexity—hard to understand
- limited guidance—unclear guidance in procedures
- need for high levels of precision
- significant degree of coordination
- multiple concurrent activities
- lack of feedback—inability to observe critical activities or parameters

Other situations that call for a conservative approach occur in the following situations:

- A serious performance gap to excellence exists.
- A significant change to an important plant process or program is being considered that could impact personnel performance.
- Fast-track job or work assignments are made.

Best Practice:
R.E.A.D.E.
1. **Recognize** the degraded condition or uncertain situation that threatens safety.
2. **Express** the situation in terms of consequence, if left alone, related to the following:
   - plant safety and reliability
   - personal safety and well-being
   - environmental safety
3. **Appraise** the situation, with a questioning attitude, to identify conditions that could threaten safety, such as the following:
   - conflicts with safety and pressure to proceed with the plan
   - degree of familiarity with the situation—how novel it is
   - proximity to safety limits or reduced margins
   - degree of human involvement (increasing variation)
   - time available to make a decision
   - degree of coordination, complexity, and margin
   - sources of stress
   - availability of resources and support
   - assumptions that may need validation

NOTE: The less time available to make an informed decision, then the more readily one should yield to safety.

4. **Decide** what to do to resolve the situation safely. Compare appraisal (step 3) to critical parameters, safety limits, or abort criteria. Consider what absolutely has to go right. Stop when unsure. **Do not proceed in the face of uncertainty.**
5. **Evaluate** the effectiveness of the action(s) (step 4) in achieving the desired results. Perform a post-job review or an after-action review.

At-Risk Practices:
- relaxing policies, rules, and expectations in times of crisis
- being insensitive to or not recognizing degraded or hazardous conditions
- not defining the problem clearly
- thinking in terms of likelihood (I will not make a mistake.) instead of potential consequences (What is the worst that can happen?)
- relying on rules of thumb
- focusing only on success; relying on past successes for a similar situation
- not evaluating the results of the decision
- not buying time to improve the decision-making process
- making key decisions without communicating the decision and the basis for the decision that affects multiple groups
- establishing unrealistic goals and schedules that put excessive pressure on personnel in critical roles

Attachment 4: Gap Analysis

GAP Analysis Worksheet for the Licensed Operators

Desired Performance Standards	Current Process	Gap *(e.g., missing process segment, additional guidance needed, etc.)*	Actions to resolve gap
Understand plant conditions and know the appropriate action to take when control of the plant or component cannot be maintained, including stopping the evolution, involving supervision, tripping the component, and scramming the reactor.	The desired performance standard is outlined in procedure EN-OP-120, Attachment 9.2, Licensed Operator's Role in Operator Fundamentals, Conservatism. Training on Operator Fundamentals is consistent with the desired performance standard. Upper management and training is expected to reinforce the desired performance standard via EN-OP-117 and EN-TQ-210 observations respectively.	There is no gap with regard to the process outlined in EN-OP-120. Reactor Operators did not place the plant in a safe condition when faced with the unexpected and uncertain conditions encountered in this event. Since the oscillations appeared to be stable, they did not see a degrading trend that required a manual action to prevent an automatic scram. Conservative decision making was not reinforced adequately by members of upper management and/or training during their interactions with Reactor Operators.	No actions needed for the process outlined in EN-OP-120. CA-007: Implement Conservative Decision Making methodology that addresses short term decisions where off normal equipment response is not addressed by current procedures and a SCRAM is not imminent. Benchmark of READE process and INPO Best Practices for example details.
Question conditions and situations that are out of the ordinary, unexpected, or that could erode margins to operating the plant conservatively, and resolve before continuing.	The desired performance standard is outlined in procedure EN-OP-120, Attachment 9.2, Licensed Operator's Role in Operator Fundamentals, Conservatism. Training on Operator Fundamentals is consistent with the desired performance standard. Upper management and training is expected to reinforce the desired performance standard via EN-OP-117 and EN-TQ-210 observations respectively.	There is no gap with regard to the process outlined in EN-OP-120. Reactor Operators did not question the decision to attempt multiple resets of the stop valve during the transient. They followed the direction set by the CRS and SM instead of advocating for a different course of action. The importance of having a questioning attitude was not reinforced adequately by members of upper management and/or training during their interactions with Reactor Operators.	No actions needed for the process outlined in EN-OP-120. CA-007

Desired Performance Standards	Current Process	Gap *(e.g., missing process segment, additional guidance needed, etc.)*	Actions to resolve gap
Advocate your position when an action is being taken that appears inappropriate or not expected for given conditions.	The desired performance standard is outlined in procedure EN-OP-120, Attachment 9.2, Licensed Operator's Role in Operator Fundamentals, Teamwork. Training on Operator Fundamentals is consistent with the desired performance standard. Upper management and training is expected to reinforce the desired performance standard via EN-OP-117 and EN-TQ-210 observations respectively.	There is no gap with regard to the process outlined in EN-OP-120. Reactor Operators did not advocate for a manual scram during the transient. This may have happened because no formal Transient Brief was conducted during the event. The importance of advocating for position was not reinforced adequately by members of upper management and/or training during their interactions with Reactor Operators.	No actions needed for the process outlined in EN-OP-120. See CA-007 above. CA-010: Implement an "Operations High Intensity Oversight Plan." This plan will bring in contractors that will meet with each crew to discuss operator fundamentals in the Control Room and Simulator. The contractors will debrief the Site Vice President, General Manager of Plant Operations, and Senior Operations Manager at a frequency determined by the SVP, GMPO and Sr. Operations Manager.

GAP Analysis Worksheet for the Shift Technical Advisor

Desired Performance Standards	Current Process	Gap *(e.g., missing process segment, additional guidance needed, etc.)*	Actions to resolve gap
Provide "eyes on" monitoring and oversight for reactivity changes and transients.	The desired performance standard is outlined in procedure EN-OP-120, Attachment 9.3, Shift Technical Advisor's Role in Operator Fundamentals, Monitoring. Training on Operator Fundamentals is consistent with the desired performance standard. Upper management and training is expected to reinforce the desired performance standard via EN-OP-117 and EN-TQ-210 observations respectively.	There is no gap with regard to the process outlined in EN-OP-120. The dual role STA/FSS did not provide monitoring and oversight since he remained in the field as the FSS during the transient and was not present in the control room to perform in the STA role. He was not called back to the control room until the scram occurred and did not make the decision to return during the transient since he was supervising the attempts to reset the cause of the transient in the field. The importance of staying in role was not reinforced adequately by members of upper management and/or training during their interactions with FSS/STAs.	No actions needed for the process outlined in EN-OP-120. Coach all Shift Managers on the necessity to call the STA to the control room at the onset of a plant transient. [No CA] Coach all dual role FSS/STAs on the necessity to report to the control room as soon as they become aware of a plant transient, even if they are in the FSS role in the field at the time. [No CA] CA-010
Maintain broad awareness of all parameters to prevent integrated plant operating problems.	The desired performance standard is outlined in procedure EN-OP-120, Attachment 9.3, Shift Technical Advisor's Role in Operator Fundamentals, Monitoring. Training on Operator Fundamentals is consistent with the desired performance standard. Upper management and training is expected to reinforce the desired performance standard via EN-OP-117 and EN-TQ-210 observations respectively.	There is no gap with regard to the process outlined in EN-OP-120. The dual role STA/FSS did not maintain a broad awareness of plant parameters since he remained in the field as the FSS during the transient and was not present in the control room to perform in the STA role. He was not called back to the control room until the scram occurred and did not make the decision to return during the transient since he was supervising the attempts to reset the cause of the transient in the field. The importance of staying in role was not reinforced adequately by members of upper management and/or training during their interactions with FSS/STAs.	No actions needed for the process outlined in EN-OP-120. Coach all Shift Managers on the necessity to call the STA to the control room at the onset of a plant transient. Coach all dual role FSS/STAs on the necessity to report to the control room as soon as they become aware of a plant transient, even if they are in the FSS role in the field at the time. CA-010

Desired Performance Standards	Current Process	Gap *(e.g., missing process segment, additional guidance needed, etc.)*	Actions to resolve gap
Independently assess proper plant response to planned and unplanned reactor and thermal power changes.	The desired performance standard is outlined in procedure EN-OP-120, Attachment 9.3, Shift Technical Advisor's Role in Operator Fundamentals, Control. Training on Operator Fundamentals is consistent with the desired performance standard. Upper management and training is expected to reinforce the desired performance standard via EN-OP-117 and EN-TQ-210 observations respectively.	There is no gap with regard to the process outlined in EN-OP-120. The dual role STA/FSS did not provide an independent assessment of plant response since he remained in the field as the FSS during the transient and was not present in the control room to perform in the STA role. He was not called back to the control room until the scram occurred and did not make the decision to return during the transient since he was supervising the attempts to reset the cause of the transient in the field. The importance of staying in role was not reinforced adequately by members of upper management and/or training during their interactions with FSS/STAs.	No actions needed for the process outlined in EN-OP-120. Coach all Shift Managers on the necessity to call the STA to the control room at the onset of a plant transient. Coach all dual role FSS/STAs on the necessity to report to the control room as soon as they become aware of a plant transient, even if they are in the FSS role in the field at the time. See CA-010 above.
Independently assess operator control of and response to planned and unplanned reactor and thermal power changes.	The desired performance standard is outlined in procedure EN-OP-120, Attachment 9.3, Shift Technical Advisor's Role in Operator Fundamentals, Control. Training on Operator Fundamentals is consistent with the desired performance standard. Upper management and training is expected to reinforce the desired performance standard via EN-OP-117 and EN-TQ-210 observations respectively.	There is no gap with regard to the process outlined in EN-OP-120. The dual role STA/FSS did not independently assess operator control and response since he remained in the field as the FSS during the transient and was not present in the control room to perform in the STA role. He was not called back to the control room until the scram occurred and did not make the decision to return during the transient since he was supervising the attempts to reset the cause of the transient in the field. The importance of staying in role was not reinforced adequately by members of upper management and/or training during their interactions with FSS/STAs.	No actions needed for the process outlined in EN-OP-120. Coach all Shift Managers on the necessity to call the STA to the control room at the onset of a plant transient. Coach all dual role FSS/STAs on the necessity to report to the control room as soon as they become aware of a plant transient, even if they are in the FSS role in the field at the time. See CA-010 above.

Desired Performance Standards	Current Process	Gap *(e.g., missing process segment, additional guidance needed, etc.)*	Actions to resolve gap
Provide technical advice to ensure the plant is operated in accordance with its design and procedures.	The desired performance standard is outlined in procedure EN-OP-120, Attachment 9.3, Shift Technical Advisor's Role in Operator Fundamentals, Control. Training on Operator Fundamentals is consistent with the desired performance standard. Upper management and training is expected to reinforce the desired performance standard via EN-OP-117 and EN-TQ-210 observations respectively.	There is no gap with regard to the process outlined in EN-OP-120. The dual role STA/FSS did not provide technical advice to the control room since he remained in the field as the FSS during the transient and was not present in the control room to perform in the STA role. He was not called back to the control room until the scram occurred and did not make the decision to return during the transient since he was supervising the attempts to reset the cause of the transient in the field. The importance of staying in role was not reinforced adequately by members of upper management and/or training during their interactions with FSS/STAs.	No actions needed for the process outlined in EN-OP-120. Coach all Shift Managers on the necessity to call the STA to the control room at the onset of a plant transient. Coach all dual role FSS/STAs on the necessity to report to the control room as soon as they become aware of a plant transient, even if they are in the FSS role in the field at the time. See CA-010 above.
Provide independent assessment of those activities that impact or have the potential to impact safety functions.	The desired performance standard is outlined in procedure EN-OP-120, Attachment 9.3, Shift Technical Advisor's Role in Operator Fundamentals, Conservatism. Training on Operator Fundamentals is consistent with the desired performance standard. Upper management and training is expected to reinforce the desired performance standard via EN-OP-117 and EN-TQ-210 observations respectively.	There is no gap with regard to the process outlined in EN-OP-120. The dual role STA/FSS did not provide independent assessment since he remained in the field as the FSS during the transient and was not present in the control room to perform in the STA role. He was not called back to the control room until the scram occurred and did not make the decision to return during the transient since he was supervising the attempts to reset the cause of the transient in the field. The importance of staying in role was not reinforced adequately by members of upper management and/or training during their interactions with FSS/STAs.	No actions needed for the process outlined in EN-OP-120. Coach all Shift Managers on the necessity to call the STA to the control room at the onset of a plant transient. Coach all dual role FSS/STAs on the necessity to report to the control room as soon as they become aware of a plant transient, even if they are in the FSS role in the field at the time. See CA-010 above.

Desired Performance Standards	**Current Process**	**Gap** *(e.g., missing process segment, additional guidance needed, etc.)*	**Actions to resolve gap**
Maintain an independent perspective from the operating crew.	The desired performance standard is outlined in procedure EN-OP-120, Attachment 9.3, Shift Technical Advisor's Role in Operator Fundamentals, Teamwork. Training on Operator Fundamentals is consistent with the desired performance standard. Upper management and training is expected to reinforce the desired performance standard via EN-OP-117 and EN-TQ-210 observations respectively.	There is no gap with regard to the process outlined in EN-OP-120. The dual role STA/FSS did not provide an independent perspective from the operating crew since he remained in the field as the FSS during the transient and was not present in the control room to perform in the STA role. He was not called back to the control room until the scram occurred and did not make the decision to return during the transient since he was supervising the attempts to reset the cause of the transient in the field. The importance of staying in role was not reinforced adequately by members of upper management and/or training during their interactions with FSS/STAs.	No actions needed for the process outlined in EN-OP-120. Coach all Shift Managers on the necessity to call the STA to the control room at the onset of a plant transient. Coach all dual role FSS/STAs on the necessity to report to the control room as soon as they become aware of a plant transient, even if they are in the FSS role in the field at the time. See CA-010 above.
Challenge the operating crew with alternatives and candid discussions.	The desired performance standard is outlined in procedure EN-OP-120, Attachment 9.3, Shift Technical Advisor's Role in Operator Fundamentals, Teamwork. Training on Operator Fundamentals is consistent with the desired performance standard. Upper management and training is expected to reinforce the desired performance standard via EN-OP-117 and EN-TQ-210 observations respectively.	There is no gap with regard to the process outlined in EN-OP-120. The dual role STA/FSS did not challenge the operating crew with alternatives since he remained in the field as the FSS during the transient and was not present in the control room to perform in the STA role. He was not called back to the control room until the scram occurred and did not make the decision to return during the transient since he was supervising the attempts to reset the cause of the transient in the field. The importance of staying in role was not reinforced adequately by members of upper management and/or training during their interactions with FSS/STAs.	No actions needed for the process outlined in EN-OP-120. Coach all Shift Managers on the necessity to call the STA to the control room at the onset of a plant transient. Coach all dual role FSS/STAs on the necessity to report to the control room as soon as they become aware of a plant transient, even if they are in the FSS role in the field at the time. See CA-010 above.

Desired Performance Standards	Current Process	Gap *(e.g., missing process segment, additional guidance needed, etc.)*	Actions to resolve gap
Advocate for operating the plant within system design margins.	The desired performance standard is outlined in procedure EN-OP-120, Attachment 9.3, Shift Technical Advisor's Role in Operator Fundamentals, Teamwork. Training on Operator Fundamentals is consistent with the desired performance standard. Upper management and training is expected to reinforce the desired performance standard via EN-OP-117 and EN-TQ-210 observations respectively.	There is no gap with regard to the process outlined in EN-OP-120. The dual role STA/FSS did not advocate for operating the plant within system design margins since he remained in the field as the FSS during the transient and was not present in the control room to perform in the STA role. He was not called back to the control room until the scram occurred and did not make the decision to return during the transient since he was supervising the attempts to reset the cause of the transient in the field. The importance of staying in role was not reinforced adequately by members of upper management and/or training during their interactions with FSS/STAs.	No actions needed for the process outlined in EN-OP-120. Coach all Shift Managers on the necessity to call the STA to the control room at the onset of a plant transient. Coach all dual role FSS/STAs on the necessity to report to the control room as soon as they become aware of a plant transient, even if they are in the FSS role in the field at the time. See CA-010 above.
Be the "conscience" for the core and for critical safety functions.	The desired performance standard is outlined in procedure EN-OP-120, Attachment 9.3, Shift Technical Advisor's Role in Operator Fundamentals, Teamwork. Training on Operator Fundamentals is consistent with the desired performance standard. Upper management and training is expected to reinforce the desired performance standard via EN-OP-117 and EN-TQ-210 observations respectively.	There is no gap with regard to the process outlined in EN-OP-120. The dual role STA/FSS did not act as the conscience of the core during this event since he remained in the field as the FSS during the transient and was not present in the control room to perform in the STA role. He was not called back to the control room until the scram occurred and did not make the decision to return during the transient since he was supervising the attempts to reset the cause of the transient in the field. The importance of staying in role was not reinforced adequately by members of upper management and/or training during their interactions with FSS/STAs.	No actions needed for the process outlined in EN-OP-120. Coach all Shift Managers on the necessity to call the STA to the control room at the onset of a plant transient. Coach all dual role FSS/STAs on the necessity to report to the control room as soon as they become aware of a plant transient, even if they are in the FSS role in the field at the time. See CA-010 above.

GAP Analysis Worksheet for the Control Room Supervisor

Desired Performance Standards	Current Process	Gap *(e.g., missing process segment, additional guidance needed, etc.)*	Actions to resolve gap
Establish limits for systems and parameters to ensure that systems are not operated outside of the intended design and that operating margins are not eroded.	The desired performance standard is outlined in procedure EN-OP-120, Attachment 9.4, Control Room Supervisor's Role in Operator Fundamentals, Control. Training on Operator Fundamentals is consistent with the desired performance standard. Upper management and training is expected to reinforce the desired performance standard via EN-OP-117 and EN-TQ-210 observations respectively.	There is no gap with regard to the process outlined in EN-OP-120. The CRS directed reactor operators to monitor parameters but did not establish limits or "lines in the sand" with associated actions for some of those parameters. He felt like power, pressure, and level were oscillating but not challenging automatic scram set points. The importance of establishing clear limits for important plant parameters was not reinforced adequately by members of upper management and/or training during their interactions with Control Room Supervisors.	No actions needed for the process outlined in EN-OP-120. Coach all Control Room Supervisors on the necessity of providing clear lines in the sand for all critical parameters during a transient. [No CA] CA-007: Implement Conservative Decision Making methodology that addresses short term decisions where off normal equipment response is not addressed by current procedures and a SCRAM is not imminent. Benchmark of READE process and INPO Best Practices for example details. See CA-010.
Ensure control room activities are conducted in a deliberate and careful manner.	The desired performance standard is outlined in procedure EN-OP-120, Attachment 9.4, Control Room Supervisor's Role in Operator Fundamentals, Conservatism. Training on Operator Fundamentals is consistent with the desired performance standard. Upper management and training is expected to reinforce the desired performance standard via EN-OP-117 and EN-TQ-210 observations respectively.	There is no gap with regard to the process outlined in EN-OP-120. The CRS did not carefully consider all options before proceeding with actions both at the onset and during the bulk of the transient. He did not perform a formal Transient Brief which may have allowed for more input from the operating crew before proceeding with attempting multiple resets of the stop valve. The importance of not proceeding in the face of uncertain conditions was not reinforced adequately by members of upper management and/or training during their interactions with Control Room Supervisors.	No actions needed for the process outlined in EN-OP-120. Coach all Control Room Supervisors on the necessity of a Transient Brief so that planned actions can be effectively challenged by the operating crew. See CA-007 and CA-010. .

Desired Performance Standards	Current Process	Gap *(e.g., missing process segment, additional guidance needed, etc.)*	Actions to resolve gap
Maintain effective command and control.	The desired performance standard is outlined in procedure EN-OP-120, Attachment 9.4, Control Room Supervisor's Role in Operator Fundamentals, Teamwork. Training on Operator Fundamentals is consistent with the desired performance standard. Upper management and training is expected to reinforce the desired performance standard via EN-OP-117 and EN-TQ-210 observations respectively.	There is no gap with regard to the process outlined in EN-OP-120. The CRS did not give the operating crew a clear vision of where we were and where we were going during the transient. A Transient Brief would have helped with this issue. The importance of maintaining effective command and control was not reinforced adequately by members of upper management and/or training during their interactions with Control Room Supervisors.	No actions needed for the process outlined in EN-OP-120. Coach all Control Room Supervisors on the necessity of a Transient Brief so that the operating crew can all be on the same page during an event. See CA-007 and CA-010.
Stay in role and maintain a broad overview of a transient or evolution and avoid becoming overly involved in the performance of a single task.	The desired performance standard is outlined in procedure EN-OP-120, Attachment 9.4, Control Room Supervisor's Role in Operator Fundamentals, Teamwork. Training on Operator Fundamentals is consistent with the desired performance standard. Upper management and training is expected to reinforce the desired performance standard via EN-OP-117 and EN-TQ-210 observations respectively.	There is no gap with regard to the process outlined in EN-OP-120. The CRS was overly focused on resetting the 'B' stop valve and did not maintain a broad overview of the status of the plant during the transient. The importance of staying in role was not reinforced adequately by members of upper management and/or training during their interactions with Control Room Supervisors.	No actions needed for the process outlined in EN-OP-120. Coach all Control Room Supervisors on the importance of staying in role during plant transients. The performance of a Transient Brief can ensure that all members of the operating crew are clear about their roles and responsibilities going forward. See CA-007 and CA-010.
Perform briefings and updates to keep crewmembers aware of plant conditions and upcoming operations.	The desired performance standard is outlined in procedure EN-OP-120, Attachment 9.4, Control Room Supervisor's Role in Operator Fundamentals, Teamwork. Training on Operator Fundamentals is consistent with the desired performance standard. Upper management and training is expected to reinforce the desired performance standard via EN-OP-117 and EN-TQ-210 observations respectively.	There is no gap with regard to the process outlined in EN-OP-120. The CRS did not perform a formal Transient Brief which might have allowed for more input from the operating crew. The importance of performing a Transient Brief was not reinforced adequately by members of upper management and/or training during their interactions with Control Room Supervisors.	No actions needed for the process outlined in EN-OP-120. Coach all Control Room Supervisors on the necessity of a Transient Brief so that each member the operating crew is clear about their role and responsibility during an event. See CA-007 and CA-010.

GAP Analysis Worksheet for the Shift Manager

Desired Performance Standards	Current Process	Gap *(e.g., missing process segment, additional guidance needed, etc.)*	Actions to resolve gap
Maintain oversight of plant and crew response during transient and emergency conditions.	The desired performance standard is outlined in procedure EN-OP-120, Attachment 9.5, Shift Manager's Role in Operator Fundamentals, Monitoring. Training on Operator Fundamentals is consistent with the desired performance standard. Upper management and training is expected to reinforce the desired performance standard via EN-OP-117 and EN-TQ-210 observations respectively.	There is no gap with regard to the process outlined in EN-OP-120. The Shift Manager did not maintain a broad overview of the status of the plant during the transient. The Shift Manager did not ensure that all members of the crew remained in role during the transient. For example, the Shift Manager did not call the STA to the control room at the onset of the transient. The importance of staying in role and maintaining oversight was not reinforced adequately by members of upper management and/or training during their interactions with Shift Managers.	No actions needed for the process outlined in EN-OP-120. Coach all Shift Managers on the importance of staying in role and maintaining oversight of the crew during plant transients. See CA-007 and CA-010.
Intervene as necessary to ensure proper monitoring and control of the plant.	The desired performance standard is outlined in procedure EN-OP-120, Attachment 9.5, Shift Manager's Role in Operator Fundamentals, Control. Training on Operator Fundamentals is consistent with the desired performance standard. Upper management and training is expected to reinforce the desired performance standard via EN-OP-117 and EN-TQ-210 observations respectively.	There is no gap with regard to the process outlined in EN-OP-120. The Shift Manager did not intervene when it became apparent that the plant was out of our control and needed to be placed in a safe condition. The importance of conservative decision making was not reinforced adequately by members of upper management and/or training during their interactions with Shift Managers.	No actions needed for the process outlined in EN-OP-120. Coach all Shift Managers on conservative decision making. See CA-007 and CA-010.
Give highest priority to nuclear safety – ensure readiness and understanding when proceeding with infrequent, elevated risk, or abnormal conditions.	The desired performance standard is outlined in procedure EN-OP-120, Attachment 9.5, Shift Manager's Role in Operator Fundamentals, Conservatism. Training on Operator Fundamentals is consistent with the desired performance standard. Upper management and training is expected to reinforce the desired performance standard via EN-OP-117 and EN-TQ-210 observations respectively.	There is no gap with regard to the process outlined in EN-OP-120. The Shift Manager, when faced with abnormal plant conditions, did not direct the operating crew to place the plant in a safe condition. The importance of conservative decision making was not reinforced adequately by members of upper management and/or training during their interactions with Shift Managers.	No actions needed for the process outlined in EN-OP-120. Coach all Shift Managers on conservative decision making. See CA-007 and CA-010.

Desired Performance Standards	Current Process	Gap *(e.g., missing process segment, additional guidance needed, etc.)*	Actions to resolve gap
Ensure that operators understand that when faced with unexpected or uncertain conditions, place the plant in a safe condition, and do not hesitate to reduce power or scram the reactor.	The desired performance standard is outlined in procedure EN-OP-120, Attachment 9.5, Shift Manager's Role in Operator Fundamentals, Conservatism. Training on Operator Fundamentals is consistent with the desired performance standard. Upper management and training is expected to reinforce the desired performance standard via EN-OP-117 and EN-TQ-210 observations respectively.	There is no gap with regard to the process outlined in EN-OP-120. The Shift Manager did not reinforce the expectation that any licensed operator on the crew should place the plant in a safe condition when faced with unexpected or uncertain conditions during the transient. The role of Shift Managers in making sure that all members of the crew under their role in operating the reactor conservatively was not reinforced adequately by members of upper management and/or training during their interactions with Shift Managers.	No actions needed for the process outlined in EN-OP-120. Coach all Shift Managers on conservative decision making. See CA-007 and CA-008.

Attachment 5: Organizational & Programmatic Evaluation Worksheet

Step 1: O&P influences on factors shaping the triggering event			
Triggering Event (HU Failure Mode, Equipment Failure Mode, condition) Step 5.3[5]	Factor Present at the Time of the Event that shaped the Triggering Event Step 5.3[6](a)	Describe how the O&P Failure Mode impacted the triggering event (description, code) Step 5.3 [6]	Describe the O&P Cause (Why) Step 5.3 [9]
Transient caused by Stop Valves 'B' and 'D' concurrently closed. Reactor power, pressure, and level oscillations in uncontrolled fashion.	No standardized communication protocol such that off-shift personnel are aware of key plant parameters to understand plant conditions.	FO01: (PII OO1) Organization-to-Organization – Inadequate Interface Between Organizations	The Duty Manager and Operations Manager – Shift did not receive complete information from the Shift Manager. The Duty Manager and Operations Manager – Shift also did not request specific information from the Shift Manager. This activity was considered a causal factor, but not impactful on the overall event to be considered a contributing cause.
Transient caused by Stop Valves 'B' and 'D' concurrently closed. Reactor power, pressure, and level oscillations in uncontrolled fashion.	Lack of reinforcement of Shift Management (SM, CRS, and STA) fulfilling their roles and responsibilities, as defined in EN-OP-115 (Conduct of Operations) and EN-OP-120 (Operator Fundamentals Program).	FO03: (PII OP1): Organization-to-Program – Lack of Commitment to Program Implementation **[CC2]**	This contributed to the event by delaying transient termination. Had the SM, CRS, or STA remained in role (as oversight), they may have recognized the large impact of the transient and directed a manual SCRAM to be initiated.

Step 2: O&P influences on the barriers designed to prevent an event			
Triggering Event (HU Failure Mode, Equipment Failure Mode, condition) Step 5.3[5]	Barrier Designed to Prevent an Event Step 5.3[7](a)	Describe how the O&P Failure Mode impacted the barrier (description, code) Step 5.3[7](c)(3)	Describe the O&P Cause (Why) Step 5.3[9]
Transient caused by Stop Valves 'B' and 'D' concurrently closed. Reactor power, pressure, and level oscillations in uncontrolled fashion.	Ineffective communication between crew members.	FO10: (PII O4) Organizational – Inadequate Communication Within an Organization **[CC1]**	The CRS did not conduct a Transient Brief to formally solicit input from the individuals stationed inside the Control Room during the transient. This contributed to the event by delaying the termination of the transient.
Transient caused by Stop Valves 'B' and 'D' concurrently closed. Reactor power, pressure, and level oscillations in uncontrolled fashion.	The station did not create procedure guidance to address operational impacts of long standing equipment issues related to the Turbine Controls System (N32). Corrected by implementing ONEP "Reactor Pressure Control Malfunctions" 05-1-02-V-21, Revision 000.	FO08: (PII O2) Organizational – Inadequate Attention to Emerging Problems **[CC3]**	The operators were not sufficiently prepared for unanticipated issues where conservative decision making would be required. This contributed to the event by delaying the termination of the transient.

Step 3: Determining Executive Management Failure Mode(s)		
O&P Failure Modes from Steps 1 & 2 Step 5.4[3]	Describe the Applicable Management Failure Modes (description, code) Step 5.4[4]	Describe the Executive Management Cause (Why) Step 5.4[5]
FO10: (PII O4) Organizational – Inadequate Communication Within an Organization **[CC1]** FO03: (PII OP1): Organization-to-Program – Lack of Commitment to Program Implementation **[CC2]** FO08: (PII O2) Organizational – Inadequate Attention to Emerging Problems **[CC3]**	FX07: (PII S2) Strategic Planning – Inadequate Assessment of Company Capabilities **[RC1]**	Station Management has not effectively implemented a Conservative Decision Making (CDM) Program which would include training, procedures, and reinforcement of CDM Fundamentals such that Shift Management will consistently make a conservative decision when faced with abnormal, but not SCRAM-imminent events.

Analysis Summary: (Step 5.5)

Stream Analysis –
The failure to implement a Conservative Decision Making process was complicated by all of the contributing causes at the organizational level. Due to the overarching nature of the station's failure to implement this process, the executive management failure mode ultimately led to the event.

A combination of longstanding equipment issues, lack of standardized communications with off-shift personnel, Control Room management stepping out of role, and inadequate communication between Control Room members facilitated the event to occur. The operators are conditioned to mitigate transients related to Turbine Control System due to station "success" in the past (success as defined as "no manual SCRAM required"). The Shift Manager stepped out of role to search for off-normal procedural guidance, but found none for this event. Operators are trained to mitigate transients to a "line in the sand," but there was no official "line in the sand" for reactor power, pressure, or level oscillations drawn. The CRS had an idea of a "line," but never officially verbalized this to the ROs. Essentially, the Operations management (SM, CRS, and STA) stepped out of role because of a tendency to mitigate a transient instead of initiating a manual SCRAM.

Results Summary –
The Organizational, Programmatic, and Organizational & Programmatic failures exhibited in this event can all be traced back to station senior leaders' failure to implement a Conservative Decision Making process.

Attachment 6: Nuclear Safety Culture

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Category: Individual Commitment to Safety			**Issue:** **CR#:**	**Issue:** **CR#:**
Trait:	**1. Personal Accountability**	**All individuals take personal responsibility for safety.** Responsibility and authority for nuclear safety are well defined and clearly understood. Reporting relationships, positional authority, and team responsibilities emphasize the overriding importance of nuclear safety.		
PA.1	CCA: X.6	**Standards:** Individuals understand the importance of adherence to nuclear standards. All levels of the organization exercise accountability for shortfalls in meeting standards. Behavior Examples: a. Individuals encourage each other to adhere to high standards. b. Individuals demonstrate a proper focus on nuclear safety and reinforce this focus through peer coaching and discussions. c. Individuals hold themselves personally accountable for modeling nuclear safety behaviors. d. Individuals across the organization apply nuclear safety standards consistently. e. Individuals actively solicit and are open to feedback. f. Individuals help supplemental personnel understand and practice expected behaviors and actions.	ROs did not place the plant in a safe condition when faced with unexpected or uncertain conditions even though he thought initially the plant should be scrammed. The Shift Manager did not ensure that all members of the crew remained in role during the transient. The Operations Manager – Support did not ensure that all members of the crew remained in role during the transient. The Shift Manager did not intervene when it became apparent that the plant was out of our control and needed to be placed in a safe condition. [**CC2**]	

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Category: Individual Commitment to Safety			Issue: CR#:	Issue: CR#:
PA.2	CCA: X.7	**Job Ownership:** Individuals understand and demonstrate personal responsibility for the behaviors and work practices that support nuclear safety. Behavior Examples: a. Individuals understand their personal responsibility to foster a professional environment, encourage teamwork, and identify challenges to nuclear safety. b. Individuals understand their personal responsibility to raise nuclear safety issues, including those identified by others. c. Individuals take ownership for the preparation and execution of assigned work activities. d. Individuals actively participate in prejob briefings, understanding their responsibility to raise nuclear safety concerns before work begins. e. Individuals ensure that they are trained and qualified to perform assigned work. f. Individuals understand the objective of the work activity, their role in the activity, and their personal responsibility for safely accomplishing the overall objective.	ROs did not advocate strongly for a manual scram during the transient. ROs did not question the decision to attempt multiple resets of the stop valve during the transient. [**CC2**] The CRS did not perform a Transient Brief during this event. The CRS stepped out of role as a supervisor. [**CC2**] The Shift Manager, when faced with abnormal plant conditions, did not direct the operating crew to place the plant in a safe condition. [**RC1**]	
PA.3	CCA: H.4	**Teamwork:** Individuals and work groups communicate and coordinate their activities within and across organizational boundaries to ensure nuclear safety is maintained. Behavior Examples: a. Individuals demonstrate a strong sense of collaboration and cooperation in connection with projects and operational activities. b. Individuals work as a team to provide peer-checks, verify certifications and training, ensure detailed safety practices, actively peer coach new personnel, and share tools and publications. c. Individuals strive to meet commitments.	The dual role STA/FSS remained in the field as the FSS during the transient and was not present in the control room to perform in the STA role. [**CC2**] The Shift Manager did not reinforce the expectation that any licensed operator on the crew should place the plant in a safe condition when faced with unexpected or uncertain conditions during the transient. The SM did not notify the AOM (shift) or the DM of the APRM swings. [**CC1**]	

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Category: Individual Commitment to Safety			**Issue:** **CR#:**	**Issue:** **CR#:**
Trait:	**2. Questioning Attitude**	**Individuals avoid complacency and continuously challenge existing conditions and activities in order to identify discrepancies that might result in error or inappropriate action.** All employees are watchful for assumptions, anomalies, values, conditions, or activities that can have an undesirable effect on plant safety.		
QA.1	CCA: (N/A)	**Nuclear is Recognized as Special and Unique:** Individuals understand that complex technologies can fail in unpredictable ways. Behavior Examples: a. The organization ensures that activities that could affect reactivity are conducted with particular care, caution, and oversight. b. Individuals recognize the special characteristics and unique hazards of nuclear technology, including radioactive byproducts, concentration of energy in the core, and decay heat. c. Individuals recognize the particular importance of features designed to maintain critical safety functions, such as core and spent fuel cooling. d. Executives and senior managers ask probing questions to understand the implications and consequences of anomalies in plant conditions. e. Executives and senior managers challenge managers to ensure degraded conditions are fully understood and appropriately resolved, especially those involving equipment important to nuclear safety.	The CRS was overly focused on resetting the 'B' stop valve and did not maintain a broad overview of the status of the plant during the transient. The Shift Manager did not maintain a broad overview of the status of the plant during the transient. [**CC2**]	

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Category: Individual Commitment to Safety			Issue: CR#:	Issue: CR#:
QA.2	CCA: H.11	**Challenge the Unknown:** Individuals stop when faced with uncertain conditions. Risks are evaluated and managed before proceeding. Behavior Examples: a. Leaders reinforce expectations that individuals take the time to do the job right the first time, seek guidance when unsure, and stop if an unexpected condition or equipment response is encountered. b. Individuals maintain a questioning attitude during prejob briefings and job-site reviews to identify and resolve unexpected conditions. c. Individuals challenge unanticipated test results rather than rationalizing them. For example, abnormal indications are not automatically attributed to indication problems but are thoroughly investigated before activities are allowed to continue. d. Individuals communicate unexpected plant responses and conditions to the control room. e. Individuals stop work activities when confronted with an unexpected condition, communicate with supervisors, and resolve the condition prior to continuing work activities. When appropriate, individuals consult system and equipment experts. f. If a procedure or work document is unclear or cannot be performed as written, individuals stop work until the issue is resolved.	The CRS did not carefully consider all options before proceeding with actions both at the onset and during the transient. The CRS/SM/AOM did not question the ability to reset the valve being tested or whether it was connected to the valve that inadvertently closed. The CRS/SM/AOM did not question their ability to stop reactor power swings. **[CC2]**	
QA.3	CCA: X.11	**Challenge Assumptions:** Individuals challenge assumptions and offer opposing views when they think something is not correct Behavior Examples: a. Leaders solicit challenges to assumptions when evaluating nuclear safety issues. b. Individual contributors ask questions to fully understand the bases of operational and management decisions that appear to be contrary to nuclear safety. c. Managers question assumptions, decisions, and justifications that do not appear to consider impacts to nuclear safety sufficiently.	Involved personnel did not challenge the assumption that restoration (or ability to restore) of the valve being tested would stop the transient.	

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Category: Individual Commitment to Safety			**Issue:** **CR#:**	**Issue:** **CR#:**
QA.4	CCA: H.12	**Avoid Complacency:** Individuals recognize and plan for the possibility of mistakes, latent problems, and inherent risk, even while expecting successful outcomes. Behavior Examples: a. The organization is aware that latent conditions can exist, addresses them as they are discovered, and considers the extents of the conditions and their causes. b. Prior to authorizing work, individuals verify procedure prerequisites are met rather than assuming they are met based on general plant conditions. c. Individual contributors perform a thorough review of the work site and the planned activity every time work is performed rather than relying on past successes and assumed conditions. d. Leaders ensure specific contingency actions are discussed and understood during job planning and prejob briefings. e. Individuals consider potential undesired consequences of their actions prior to performing work and implement appropriate error reduction tools.	Operations personnel did not question inherent risk associated with performing the test event though there have been problems previously.	
Trait:	**3. Effective Safety Communica-tion**	**Communications maintain a focus on safety.** Safety communication is broad and includes plant-level communication, job-related communication, worker-level communication, equipment labeling, operating experience, and documentation. Leaders use formal and informal communication to convey the importance of safety. The flow of information up the organization is considered to be as important as the flow of information down the organization.		

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Category: Individual Commitment to Safety			**Issue:** **CR#:**	**Issue:** **CR#:**
CO.1	CCA: X.9	**Work Process Communications:** Individuals incorporate safety communications in work activities. Behavior Examples: a. Communications within work groups are timely, frequent, and accurate. b. Work groups and supervisors communicate work statuses with other work groups and supervisors during the performance of their work activities. c. Individuals communicate with each other such that everyone has the information necessary to accomplish work activities safely and effectively. d. Communications during shift turnovers and prejob briefings provide information necessary to support nuclear safety. e. Work groups integrate nuclear safety messages into daily activities and meetings.	The RE was requested to run a case monitor to check thermal limits and did so but was not aware the APRM oscillations were in progress. [**CC1**]	
CO.2	CCA: H.10	**Bases for Decisions:** Leaders ensure that the bases for operational and organizational decisions are communicated in a timely manner. Behavior Examples: a. Leaders promptly communicate expected outcomes, potential problems, planned contingencies, and abort criteria for important operational decisions. b. Leaders share information on a wide range of issues with individuals and periodically verify their understanding of the information. c. Leaders take steps to avoid unintended or conflicting messages that may be conveyed by operational decisions. d. Leaders encourage individuals to ask questions if they do not understand the basis of an operational or management decision. e. Executives and senior managers communicate the reasons for resource allocation decisions, including the nuclear safety implications of those decisions.	Leaders did not take steps to avoid unintended or conflicting messages when establishing the expectation that the STA be used in the Field support supervisor position. [**CC2**]	

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Category: Individual Commitment to Safety			**Issue:** **CR#:**	**Issue:** **CR#:**
CO.3	CCA: S.3	**Free Flow of Information:** Individuals communicate openly and candidly, both up, down, and across the organization and with oversight, audit, and regulatory organizations. Behavior Examples: a. Leaders encourage the free flow of information. b. Individuals share information openly and candidly. c. Leaders respond to individuals in an open, honest, and nondefensive manner. d. Individuals provide complete, accurate, and forthright information to oversight, audit, and regulatory organizations. e. Leaders actively solicit feedback, listen to concerns, and communicate openly with all individuals. f. Leaders candidly communicate the results of monitoring and assessments throughout the organization and with independent oversight organizations.	No issues were identified in this area	

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Category: Individual Commitment to Safety			**Issue:** **CR#:**	**Issue:** **CR#:**
CO.4	CCA: X10	**Expectations:** Leaders frequently communicate and reinforce the expectation that nuclear safety is the organization's overriding priority. Behavior Examples: a. Executives and senior managers communicate expectations regarding nuclear safety so that individuals understand that safety is the highest priority. b. Executives and senior managers implement a strategy of frequent communication using a variety of tools to reinforce that nuclear safety is the overriding priority. c. Executives and senior managers reinforce the importance of nuclear safety by clearly communicating its relationship to strategic issues, including budget, workforce planning, equipment reliability, and business plans. d. Leaders communicate desired nuclear safety behaviors to individuals, providing examples of how behaviors positively or negatively affect nuclear safety. e. Leaders routinely verify that communications on the importance of nuclear safety have been heard and understood. f. Leaders ensure supplemental personnel understand expected behaviors and actions necessary to maintain nuclear safety.	No issues were identified in this area	

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Category: Management Commitment to Safety			**Issue:** **CR#:**	**Issue:** **CR#:**
Trait:	**4. Leadership Safety Values and Actions**	**Leaders demonstrate a commitment to safety in their decisions and behaviors.** Executive and senior managers are the leading advocates of nuclear safety and demonstrate their commitment both in word and action. The nuclear safety message is communicated frequently and consistently, occasionally as a stand-alone theme. Leaders throughout the nuclear organization set an example for safety. Corporate policies emphasize the overriding importance of nuclear safety.		
LA.1	CCA: H.1	**Resources:** Leaders ensure that personnel, equipment, procedures, and other resources are available and adequate to support nuclear safety. Behavior Examples: a. Managers ensure staffing levels are consistent with the demands related to maintaining safety and reliability. b. Managers ensure sufficient qualified personnel are available to maintain work hours within working hour guidelines during all modes of operation. c. Managers ensure facilities are available and are regularly maintained, including physical improvements, simulator fidelity, and emergency facilities. d. Leaders ensure tools, equipment, procedures, and other resource materials are available to support successful work performance, including risk management tools and emergency equipment. e. Executives and senior managers ensure sufficient corporate resources are allocated to the nuclear organization for short- and long-term safe and reliable operation. f. Executives and senior managers ensure a rigorous evaluation of the nuclear safety implications of deferred work.	Personnel (limited experience on shift, shift mentors not used as planned) was not addressed by additional compensatory action. Equipment (ATT) was not available at the time of the test. Procedures (not revised to reflect risk and potential malfunctions during testing) were not developed to address known EHC hydraulics issues. Leadership in the field coaching and mentoring reinforcing positive decision making (mentors not used, no discussion on previous problems on when to trip the unit, AOM (support) was in the CR and did not positively impact decision making). [**RC1**]	

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Category: Management Commitment to Safety			**Issue:** **CR#:**	**Issue:** **CR#:**
LA.2	CCA: H.2	**Field Presence:** Leaders are commonly seen in working areas of the plant observing, coaching, and reinforcing standards and expectations. Deviations from standards and expectations are corrected promptly. Behavior Examples: a. Senior managers ensure supervisory and management oversight of work activities, including contractors and supplemental personnel, such that nuclear safety is supported. b. Leaders from all levels in the organization are involved in overseeing work activities. c. Managers and supervisors practice visible leadership in the field and during safety-significant evolutions by “placing eyes on the problem,” coaching, mentoring, reinforcing standards, and reinforcing positive decision-making practices and behaviors. d. Managers and supervisors discuss their observations in detail with the group they observed and provide useful feedback about how to improve individual performance. e. Managers encourage informal leaders to model safe behaviors and high standards of accountability.	The AOM (support) was in the CR at the time of the event but did not remain in role or coach personnel in decision making. [**CC2**]	

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Category: Management Commitment to Safety			**Issue:** **CR#:**	**Issue:** **CR#:**
LA.3	CCA: X.1	**Incentives, Sanctions, and Rewards:** Leaders ensure incentives, sanctions, and rewards are aligned with nuclear safety policies and reinforce behaviors and outcomes that reflect safety as the overriding priority. Behavior Examples: a. Managers ensure disciplinary actions are appropriate, consistent, and support both nuclear safety and a safety-conscious work environment. b. Managers reward individuals who identify and raise issues that affect nuclear safety. c. Leaders foster an environment that promotes accountability and hold individuals accountable for their actions. d. Managers consider the potential chilling effects of disciplinary actions and other potentially adverse personnel actions and take compensatory actions when appropriate. e. Leaders publicly praise behaviors that reflect a positive safety culture.	No issues were identified in this area	

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Category: Management Commitment to Safety			**Issue:** **CR#:**	**Issue:** **CR#:**
LA.4	CCA: X.2	**Strategic Commitment to Safety:** Leaders ensure plant priorities are aligned to reflect nuclear safety as the overriding priority. Behavior Examples: a. Executives and senior managers reinforce nuclear safety as the overriding priority. b. Managers develop and implement cost and schedule goals in a manner that reinforces the importance of nuclear safety. c. Managers ensure production requirements are established, communicated, and put into practice in a manner that reinforces nuclear safety. d. Executives and senior managers use information from independent oversight organizations to establish priorities that align with nuclear safety. e. Executives and senior managers establish strategic and business plans that reflect the importance of nuclear safety over production. f. Executives and senior managers ensure corporate priorities are aligned with nuclear safety.	No issues were identified in this area	

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Category: Management Commitment to Safety			**Issue:** **CR#:**	**Issue:** **CR#:**
LA.5	CCA: H.3	**Change Management:** Leaders use a systematic process for evaluating and implementing change so that nuclear safety remains the overriding priority. Behavior Examples: a. When making decisions related to major changes, managers use a systematic process for planning, coordinating, and evaluating the safety impacts and potential negative effects on the willingness of individuals to raise safety concerns. This includes decisions concerning changes to organizational structure and functions, leadership, policies, programs, procedures, and resources. b. Executives and senior managers ensure nuclear safety is maintained when planning, communicating, and executing major changes. c. Managers maintain a clear focus on nuclear safety when implementing the change management process, to avoid significant unintended consequences. d. Managers ensure that individuals understand the importance of, and their role in, the change management process. e. Managers anticipate, manage, and communicate the effects of impending changes. f. Managers and supervisors actively monitor and address potential distractions from nuclear safety during periods of change.	Shift management experience has dropped significantly in the recent past. This was not a planned change so there was no active decision to implement it. However, it was a change and should have been recognized as happening and required some degree of evaluation to determine if procedures and policies are of sufficient detail to support safe operation. [**RC1**]	

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Category: Management Commitment to Safety			**Issue:** **CR#:**	**Issue:** **CR#:**
LA.6	CCA: X.3	**Roles, Responsibilities, and Authorities:** Leaders clearly define roles, responsibilities, and authorities to ensure nuclear safety. Behavior Examples: a. Leaders ensure roles, responsibilities, and authorities are clearly defined, understood, and documented. b. Managers appropriately delegate responsibility and authority to promote ownership and accountability. c. Executives and senior managers ensure both corporate managers who support the nuclear organization and managers at the station understand their respective roles and responsibilities. d. Recommendations and feedback from corporate governance, review boards, and independent oversight organizations do not override senior managers' ultimate responsibility for decisions that affect nuclear safety.	Roles and responsibilities were clearly identified. Multiple individuals stepped out of role during this event. This is identified as a contributing cause. [**CC2**]	
LA.7	CCA: X.4	**Constant Examination:** Leaders ensure that nuclear safety is constantly scrutinized through a variety of monitoring techniques, including assessments of nuclear safety culture. Behavior Examples: a. Executives and senior managers ensure that board members and members of independent oversight organizations meet with leaders and individual contributors in their work environments to develop an understanding of the status of the organization's safety culture. b. Executives and senior managers obtain outside perspectives of nuclear safety through the selection of qualified, critical independent safety review board members with diverse backgrounds and perspectives. c. Executives and senior managers use a variety of monitoring tools—including employee surveys, independent and self-assessments, external safety review board member feedback, and employee concern investigations—to regularly monitor station nuclear safety culture. d. Leaders support and participate in candid assessments of workplace attitudes and nuclear safety culture and act on issues that affect trust in management or detract from a positive nuclear safety culture.	No issues were identified in this area.	

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Category: Management Commitment to Safety			**Issue:** **CR#:**	**Issue:** **CR#:**
LA.8	CCA: X.5	**Leader Behaviors:** Leaders exhibit behaviors that set the standard for safety. Behavior Examples: a. Leaders "walk the talk," modeling the correct behaviors, especially when resolving apparent conflicts between nuclear safety and production. b. Leaders act promptly when a nuclear safety issue is raised to ensure it is understood and appropriately addressed. c. Leaders maintain high standards of personal conduct that promote all aspects of a positive nuclear safety culture. d. Leaders demonstrate interest in plant operations and actively seek out the opinions and concerns of workers at all levels. e. Leaders encourage personnel to challenge unsafe behavior and unsafe conditions, and they support personnel who stop plant activities for safety reasons. f. Leaders motivate others to practice positive nuclear safety culture behaviors.	The each shift management team stepped out of role modeling conservative decision making. This is identified as a contributing cause. **[CC2]**	
Trait:	**5. Decision Making**	**Decisions that support or affect nuclear safety are systematic, rigorous, and thorough.** Operators are vested with the authority and understand the expectation, when faced with unexpected or uncertain conditions, to place the plant in a safe condition. Senior leaders support and reinforce conservative decisions.		

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Category: Management Commitment to Safety			**Issue:** **CR#:**	**Issue:** **CR#:**
DM.1	CCA: H.13	**Consistent Process:** Individuals use a consistent, systematic approach to make decisions. Risk insights are incorporated as appropriate. Behavior Examples: a. The organization establishes a well-defined decision-making process, with variations allowed for the complexity of the issue being decided. b. Individuals demonstrate an understanding of the decision-making process and use it consistently. c. Leaders seek inputs from different work groups or organizations as appropriate when making safety- or risk-significant decisions. d. When previous operational decisions are called into question by new facts, leaders reevaluate these decisions to ensure they remain appropriate. e. The organization uses the results of effectiveness reviews to improve future decisions.	There is no consistent systematic process defined at the station for on-shift transient conditions. **[RC1]**	

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Category: Management Commitment to Safety			Issue: CR#:	Issue: CR#:
DM.2	CCA: H.14	**Conservative Bias:** Individuals use decision-making practices that emphasize prudent choices over those that are simply allowable. A proposed action is determined to be safe in order to proceed, rather than unsafe in order to stop. Behavior Examples: a. Managers ensure that conservative assumptions are used when determining whether emergent or unscheduled work can be conducted safely. b. Leaders take a conservative approach to decision-making, particularly when information is incomplete or conditions are unusual. c. Leaders consider long-term consequences when determining how to resolve emergent concerns. d. Managers take timely action to address degraded conditions commensurate with their safety significance. e. Executives and senior managers reinforce the expectation that the reactor will be shut down when procedurally required, when the margin for safe operation has degraded unacceptably, or when the condition of the reactor is uncertain. Managers implement this expectation. f. Individuals do not rationalize assumptions for the sake of completing a task.	There is no indication through analysis that an analysis of "safe to continue" was performed. It appears that because the APRM swing magnitude was not getting worse and there were no alarms, it was acceptable to attempt to restore the valve in test. Once the first reset attempt failed, there was a decision to attempt a second without questioning why it was the safe thing to do. This is an aspect of the root cause. [**RC1**]	

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Category: Management Commitment to Safety			Issue: CR#:	Issue: CR#:
DM.3	CCA: X.12	**Accountability for Decisions:** Single-point accountability is maintained for nuclear safety decisions. Behavior Examples: a. The on-shift licensed operators have the authority and responsibility to place the plant in a safe condition when faced with unexpected or uncertain conditions. b. A designated, on-shift licensed senior reactor operator has the authority and responsibility to determine equipment operability. c. Managers maintain single-point accountability for important safety decisions. d. The organization ensures that important nuclear safety decisions are made by the correct person at the lowest appropriate level.	When the CRS stepped out of role as a supervisor, the single point accountability for the decision to trip the plant was lost. This could have been fulfilled by the SM but the SM accepted the CRS feedback that it was under control. [**CC2**]	

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Category: Management Commitment to Safety			Issue: CR#:	Issue: CR#:
Trait:	**6. Respectful Work Environment**	**The Trust and respect permeate the organization.** A high level of trust is established in the organization, fostered, in part, through timely and accurate communication. Differing professional opinions are encouraged, discussed, and resolved in a timely manner. Employees are informed of steps taken in response to their concerns.		
WE.1	CCA: (N/A)	**Respect is Evident:** Everyone is treated with dignity and respect. Behavior Examples: a. The organization regards individuals and their professional capabilities and experiences as its most valuable asset. b. Individuals at all levels of the organization treat each other with dignity and respect. c. Individuals treat each other with respect within and between work groups. d. Individuals do not demonstrate or tolerate bullying or humiliating behaviors. e. Leaders monitor for behaviors that can have a negative impact on the work environment and address them promptly. f. Leaders ensure policies and expectations are enforced fairly and consistently for individuals at all levels of the organization. g. Individuals treat decision-makers with respect, even when they disagree with a decision. h. Leaders ensure facilities are conducive to a productive work environment and housekeeping is maintained.	There were no issues identified in this area.	

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Category: Management Commitment to Safety			**Issue:** **CR#:**	**Issue:** **CR#:**
WE.2	CCA: (N/A)	**Opinions are Valued:** Individuals are encouraged to voice concerns, provide suggestions, and raise questions. Differing opinions are respected. Behavior Examples: a. The organization encourages individuals to offer ideas, concerns, suggestions, differing opinions, and questions to help identify and solve problems. b. Leaders are receptive to ideas, concerns, suggestions, differing opinions, and questions. c. The organization promotes robust discussions, recognizing that differing opinions are a natural result of differences in expertise and experience. d. Individuals value the insights and perspectives provided by quality assurance, the employee concerns program, and independent oversight organization personnel.	A transient crew brief was not performed. Therefore specific roles were not identified and input was not actively solicited. The RE was not aware of the APRM swings at the time. [**CC1**]	

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Category: Management Commitment to Safety			**Issue:** **CR#:**	**Issue:** **CR#:**
WE.3	CCA: (N/A)	**High Level of Trust:** Trust is fostered among individuals and work groups throughout the organization. Behavior Examples: a. Leaders promote collaboration among work groups. b. Leaders respond to questions and concerns in an open and honest manner. c. Leaders, sensitive to the negative impact of a lack of information, share important information in an open, honest, and timely manner such that trust is maintained. d. Leaders ensure that plant status and important work milestones are communicated throughout the organization. e. Leaders acknowledge positive performance and address negative performance promptly and directly with the individual involved. Confidentiality is maintained as appropriate. f. Leaders welcome performance feedback from throughout the organization and modify their behavior when appropriate.	There were no issues identified in this area.	
WE.4	CCA: (N/A)	**Conflict Resolution:** Fair and objective methods are used to resolve conflicts. Behavior Examples: a. The organization implements processes to ensure fair and objective resolution of conflicts and differing views. b. Leaders ensure conflicts are resolved in a balanced, equitable, and consistent manner, even when outside of defined processes. c. Individuals have confidence that conflicts will be resolved respectfully and professionally.	There were no issues identified in this area.	

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Category: Management Systems			Issue: CR#:	Issue: CR#:
Trait:	**1. Continuous Learning**	**Opportunities to learn about ways to ensure safety are sought out and implemented.** Operating experience is highly valued, and the capacity to learn from experience is well developed. Training, self-assessments, and benchmarking are used to stimulate learning and improve performance. Nuclear safety is kept under constant scrutiny through a variety of monitoring techniques, some of which provide an independent "fresh look."		
CL.1	CCA: P.5	**Operating Experience:** The organization systematically and effectively collects, evaluates, and implements relevant internal and external operating experience in a timely manner. Behavior Examples: a. A process is in place to ensure a thorough review of operating experience provided by internal and external sources. b. Operating experience is implemented and institutionalized effectively through changes to station processes, procedures, equipment, and training programs. c. Operating experience is used to understand equipment, operational, and industry challenges and to adopt new ideas to improve performance. d. Operating experience is used to support daily work functions, with emphasis on the possibility that "it could happen here." e. Station operating experience is shared in a timely manner.	The EHC hydraulic system has been causing issues for several years. Different analyses have been performed and resulted in different corrective actions. These actions have not been effective in resolving issues and station personnel have not performed a detailed analysis to determine why. This is addressed under CR-GGN-2016-4998.	

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Category: Management Systems			Issue: CR#:	Issue: CR#:
CL.2	CCA: P.6	**Self-Assessment:** The organization routinely conducts self-critical and objective assessments of its programs and practices. Behavior Examples: a. Independent and self- assessments, including nuclear safety culture assessments, are thorough and effective and are used as a basis for improvements. b. The organization values the insights and perspectives assessments provide. c. Self-assessments are performed on a variety of topics, including the self-assessment process itself. d. Self-assessments are performed at a regular frequency and provide objective, comprehensive, and self-critical information that drive corrective actions. e. Targeted self-assessments are performed when a more thorough understanding of an issue is required. f. A balanced approach of self-assessments and independent oversight is used and periodically adjusted based on changing needs. g. Self-assessment teams include individual contributors and leaders from within the organization and from external organizations when appropriate.	Internal and external assessments have identified issues with implementation of operations fundamentals. Multiple corrective actions have been developed to address assessment actions. Some actions have been ineffective and other actions have not been fully implemented or not implemented as intended. [**CC2**]	
CL.3	CCA: X.8	**Benchmarking:** The organization learns from other organizations to continuously improve knowledge, skills, and safety performance. Behavior Examples: a. The organization uses benchmarking as an avenue for acquiring innovative ideas to improve nuclear safety. b. The organization participates in benchmarking activities with other nuclear and nonnuclear facilities. c. The organization seeks out best practices by using benchmarking to understand how others perform the same functions. d. The organization uses benchmarking to compare station standards to the industry and to make adjustments to improve performance. e. Individual contributors are actively involved in benchmarking.	No issues were identified in this area.	

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Category: Management Systems			Issue: CR#:	Issue: CR#:
CL.4	CCA: H.9	**Training:** The organization provides training and ensures knowledge transfer to maintain a knowledgeable, technically competent workforce and instill nuclear safety values. Behavior Examples: a. The organization fosters an environment in which individuals value and seek continuous learning opportunities. b. Individuals, including supplemental workers, are adequately trained to ensure technical competency and an understanding of standards and work requirements. c. Individuals master reactor and power plant fundamentals to establish a solid foundation for sound decisions and behaviors. d. The organization develops and effectively implements knowledge transfer and knowledge retention strategies. e. Knowledge transfer and knowledge retention strategies are applied to capture the knowledge and skill of experienced individuals to advance the knowledge and skill of less experienced individuals. f. Leadership and management skills are systematically developed. g. Training is developed and continuously improved using input and feedback from individual contributors and subject-matter experts. h. Executives obtain the training necessary to understand basic plant operation and the relationships between major functions and organizations.	No issues identified in this area	

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Category: Management Systems			Issue: CR#:	Issue: CR#:
Trait:	**2. Problem Identification and Resolution**	**Issues potentially impacting safety are promptly identified, fully evaluated, and promptly addressed and corrected commensurate with their significance.** Identification and resolution of a broad spectrum of problems, including organizational issues, are used to strengthen safety and improve performance.		
PI.1	CCA: P.1	**Identification:** The organization implements a corrective action program with a low threshold for identifying issues. Individuals identify issues completely, accurately, and in a timely manner in accordance with the program. Behavior Examples: a. Individuals recognize deviations from standards. b. Individuals understand how to enter issues into the corrective action program. c. Individuals ensure that issues, problems, degraded conditions, and near misses are promptly reported and documented in the corrective action program at a low threshold. d. Individuals describe the issues entered in the corrective action program in sufficient detail to ensure they can be appropriately prioritized, trended, and assigned for resolution.	There were no issues identified in this area.	

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Category: Management Systems			**Issue:** **CR#:**	**Issue:** **CR#:**
PI.2	CCA: P.2	**Evaluation:** The organization thoroughly evaluates problems to ensure that resolutions address causes and extents of conditions commensurate with their safety significance. Behavior Examples: a. Issues are properly classified, prioritized, and evaluated according to their safety significance. b. Operability and reportability determinations are developed when appropriate. c. Apparent and root cause investigations identify primary and contributing causal factors as required. d. Extent-of-condition and extent-of-cause evaluations are completed in a timely manner, commensurate with the safety significance of the issue. e. Issues are investigated thoroughly according to their safety significance. f. Root cause analyses are rigorously applied to identify and correct the fundamental cause of significant issues. g. The underlying organizational and safety culture contributors to issues are evaluated thoroughly and are given the necessary time and resources to be clearly understood. h. Cause analyses identify and understand the bases for decisions that contributed to issues. i. Managers conduct effectiveness reviews of significant corrective actions to ensure that the resolution addressed the causes effectively.	The station has not thoroughly evaluated some problems to determine cause and as a result have not implemented effective corrective actions. Prior to the 2003 resin breakthrough event, the system experienced very few valve position oscillations. Since then there have been a number of valve partial repositioning events with varying degrees of impact on operation. The continuing nature of the problem has not been evaluated as an issue by itself. Issue discussed under CR-GGN-2016-4998.	

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Category: Management Systems			**Issue:** **CR#:**	**Issue:** **CR#:**
PI.3	CCA: P.3	**Resolution:** The organization takes effective corrective actions to address issues in a timely manner commensurate with their safety significance. Behavior Examples: a. Corrective actions are completed in a timely manner. b. Deferrals of corrective actions are minimized. When required, due dates are extended using an established process that appropriately considers safety significance. c. Appropriate interim corrective actions are taken to mitigate issues while more fundamental causes are being assessed. d. Corrective actions resolve and correct the identified issues, including causes and extents of conditions. e. Corrective actions prevent the recurrence of significant conditions adverse to quality. f. Trends in safety performance indicators are acted on to resolve problems early.	The station has previously identified operations fundamentals implementation issues with corrective actions that included mentoring shift managers and specifically staying in role. The mentoring did not occur with all shift managers as intended and the staying in role action was closed by saying it is done in the simulator which has not been effective. [**CC2**]	
PI.4	CCA: P.4	**Trending:** The organization periodically analyzes information from the corrective action program and other assessments in the aggregate to identify programmatic and common cause issues. Behavior Examples: a. The organization develops indicators that monitor both equipment and organizational performance, including safety culture. b. Managers use indicators that provide an accurate representation of performance and early indications of declining trends. c. Managers routinely challenge the organization's understanding of declining trends. d. Organizational and departmental trend reviews are completed in a timely manner in accordance with program expectations.		

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Category: Management Systems			Issue: CR#:	Issue: CR#:
Trait:	**3. Environment for Raising Concerns**	**A safety-conscious work environment (SCWE) is maintained where personnel feel free to raise safety concerns without fear of retaliation, intimidation, harassment, or discrimination.** The station creates, maintains, and evaluates policies and processes that allow personnel to raise concerns freely.		
RC.1	CCA: S.1	**SCWE Policy:** The organization effectively implements a policy that supports individuals' rights and responsibilities to raise safety concerns and does not tolerate harassment, intimidation, retaliation, or discrimination for doing so. Behavior Examples: a. Individuals feel free to raise nuclear safety concerns without fear of retribution, with confidence that their concerns will be addressed. b. Executives and senior managers set and reinforce expectations for establishing and maintaining a safety-conscious work environment. c. Policies and procedures reinforce that individuals have the right and responsibility to raise nuclear safety concerns. d. Policies and procedures define the responsibilities of leaders to create an environment in which individuals feel free to raise safety concerns. e. Policies and procedures establish the expectation that leaders will respond in a respectful manner and provide timely feedback to the individual raising the concern. f. Leaders are trained to take ownership when receiving and responding to concerns, recognizing confidentiality if appropriate, and ensuring they are adequately addressed in a timely manner. g. Individuals are trained that behaviors or actions that could prevent concerns from being raised, including harassment, intimidation, retaliation, or discrimination, will not be tolerated and are violations of law and policy. h. All claims of retaliation are investigated and any necessary corrective actions are taken in a timely manner, including actions to mitigate any potential chilling effect.	There were no issues identified in this area.	

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Category: Management Systems			Issue: CR#:	Issue: CR#:
RC.2	CCA: S.2	**Alternate Process for Raising Concerns:** The organization effectively implements a process for raising and resolving concerns that is independent of line management influence. Safety issues may be raised in confidence and are resolved in a timely and effective manner. Behavior Examples: a. Executives establish, support, and promote the use of alternative processes for raising concerns and ensure corrective actions are taken. b. Leaders understand their role in supporting alternate processes for raising concerns. c. Processes for raising concerns or resolving differing professional opinions that are alternatives to the corrective action program and operate outside the influence of the management chain are communicated and accessible to individuals. d. Alternative processes are independent, include an option to raise concerns confidentially, and ensure these concerns are appropriately resolved in a timely manner. e. Individuals receive feedback in a timely manner. f. Individuals have confidence that issues raised will be appropriately resolved. g. Individuals assigned to respond to concerns have the appropriate competencies.	There were no issues identified in this area.	

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Category: Management Systems			Issue: CR#:	Issue: CR#:
Trait:	**4. Work Processes**	**The process of planning and controlling work activities is implemented so that safety is maintained.** Work management is a deliberate process in which work is identified, selected, planned, scheduled, executed, closed, and critiqued. The entire organization is involved in and fully supports the process.		
WP.1	CCA: H.5	**Work Management:** The organization implements a process of planning, controlling, and executing work activities such that nuclear safety is the overriding priority. The work process includes the identification and management of risk commensurate to the work. Behavior Examples: a. Work is effectively planned and executed by incorporating risk insights, job-site conditions, and the need for coordination with different groups or job activities. b. The work process appropriately prioritizes work and incorporates contingency plans, compensatory actions, and abort criteria as needed. c. Leaders consider the impact of changes to the work scope and the need to keep personnel apprised of the work status. d. The work process ensures individuals are aware of the plant status, the nuclear safety risks associated with work in the field, and other parallel station activities. e. Insights from probabilistic risk assessments are considered in daily work activities and change processes. f. Work activities are coordinated to address conflicting or changing priorities across the whole spectrum of activities contributing to nuclear safety. g. The work process limits temporary modifications.	There were no issues identified in this area.	

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Category: Management Systems			Issue: CR#:	Issue: CR#:
WP.2	CCA: H.6	**Design Margins:** The organization operates and maintains equipment within design margins. Margins are carefully guarded and changed only through a systematic and rigorous process. Special attention is placed on maintaining fission product barriers, defense-in-depth, and safety-related equipment. Behavior Examples: a. The work process supports nuclear safety and the maintenance of design margins by minimizing long-standing equipment issues, preventive maintenance deferrals, and maintenance and engineering backlogs. b. The work process ensures focus on maintaining fission product barriers, defense-in-depth, and safety-related equipment. c. Design and operating margins are carefully guarded and changed only with great thought and care. d. Safety-related equipment is operated and maintained well within design requirements.	There were no issues identified in this area.	
WP.3	CCA: H.7	**Documentation:** The organization creates and maintains complete, accurate, and up-to-date documentation. Behavior Examples: a. Plant activities are governed by comprehensive, high-quality programs, processes, and procedures. b. Design documentation, procedures, and work packages are complete, thorough, accurate, and current. c. Components are labeled clearly, consistently, and accurately. d. The backlog of document changes is understood, prioritized, and actively managed to ensure quality.	There is no procedural direction on how to deal with non-plant-trip-imminent scenarios where there is a degraded condition but evaluation of continued operation is necessary. [**RC1, CC3**]	

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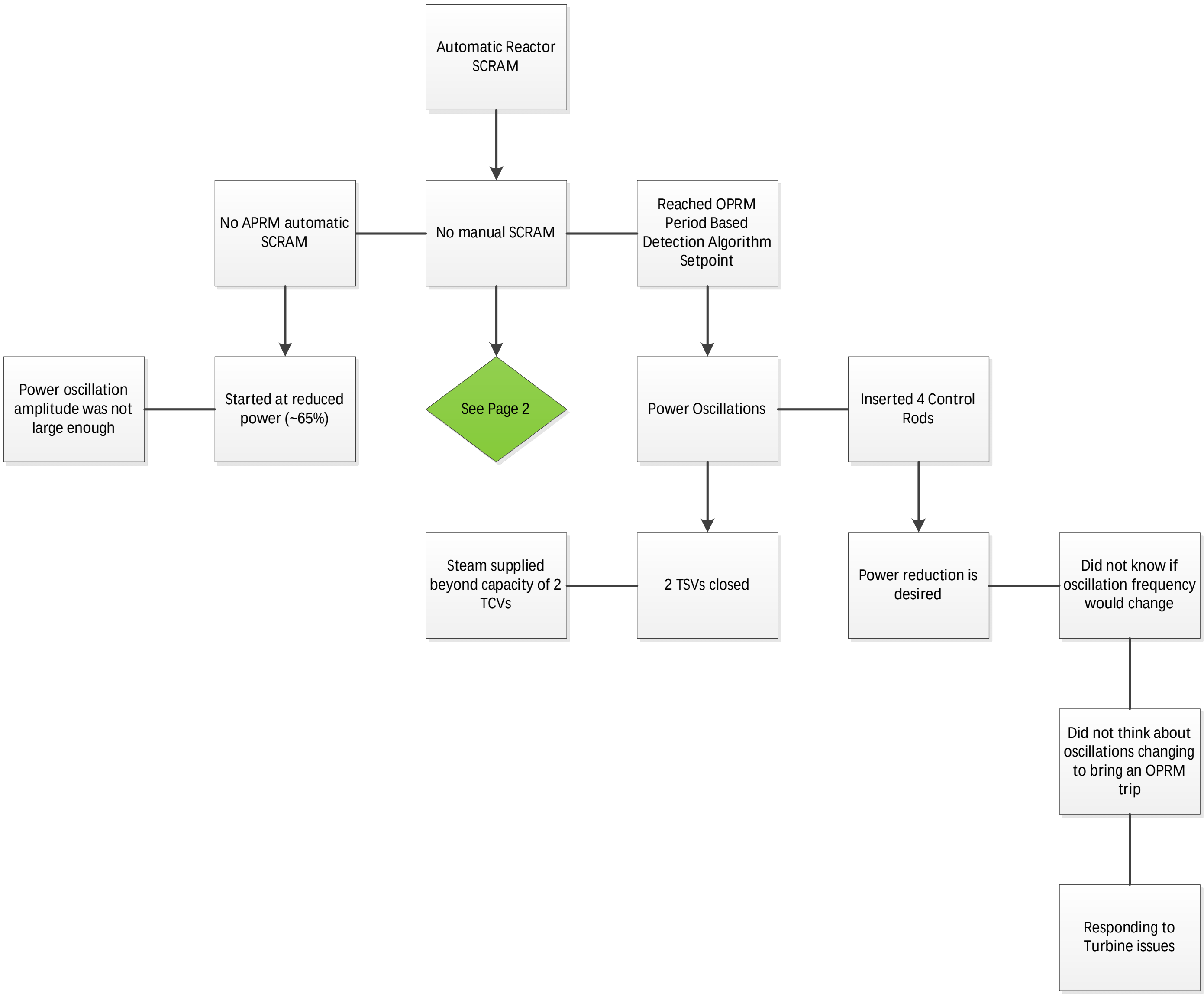
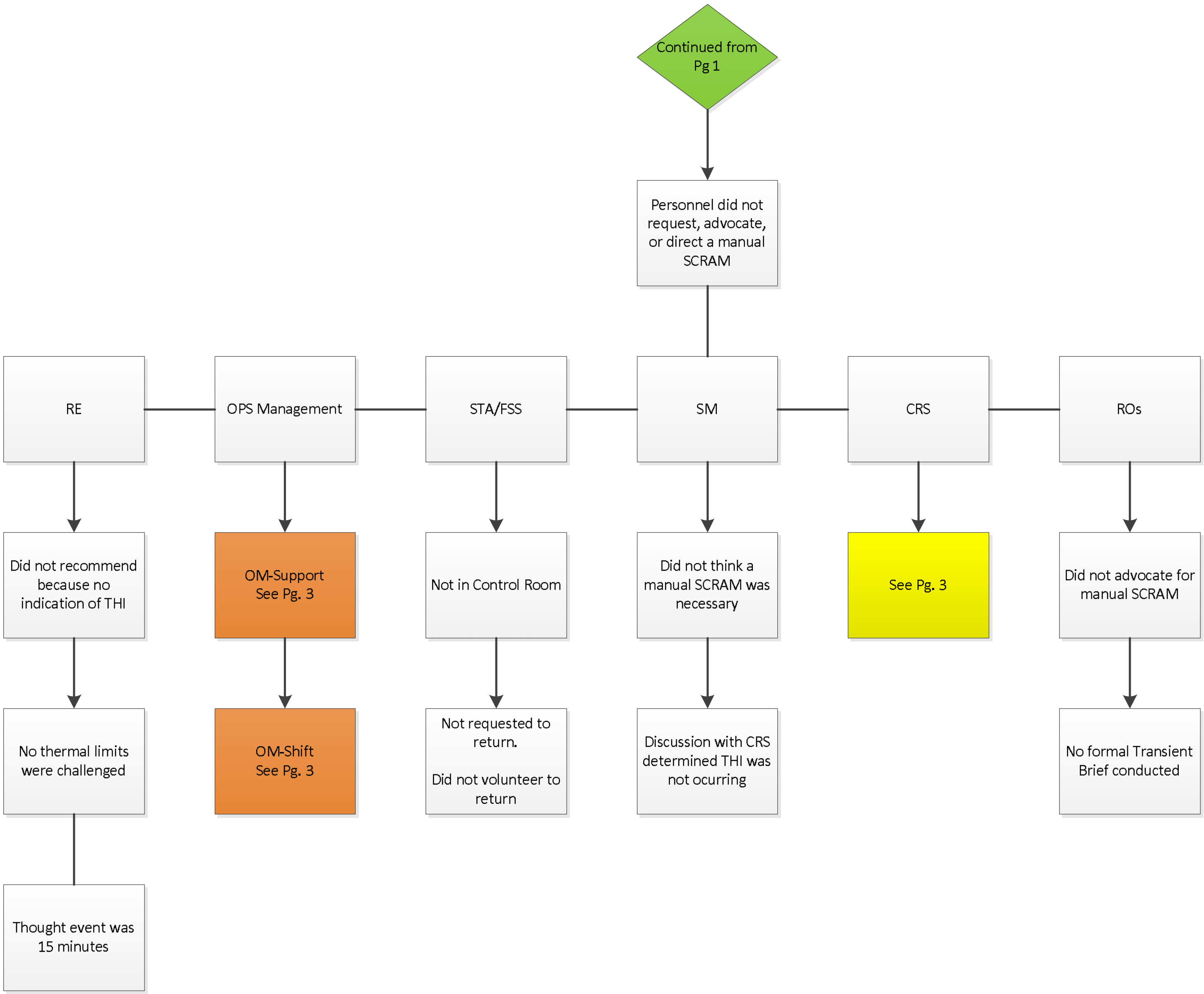
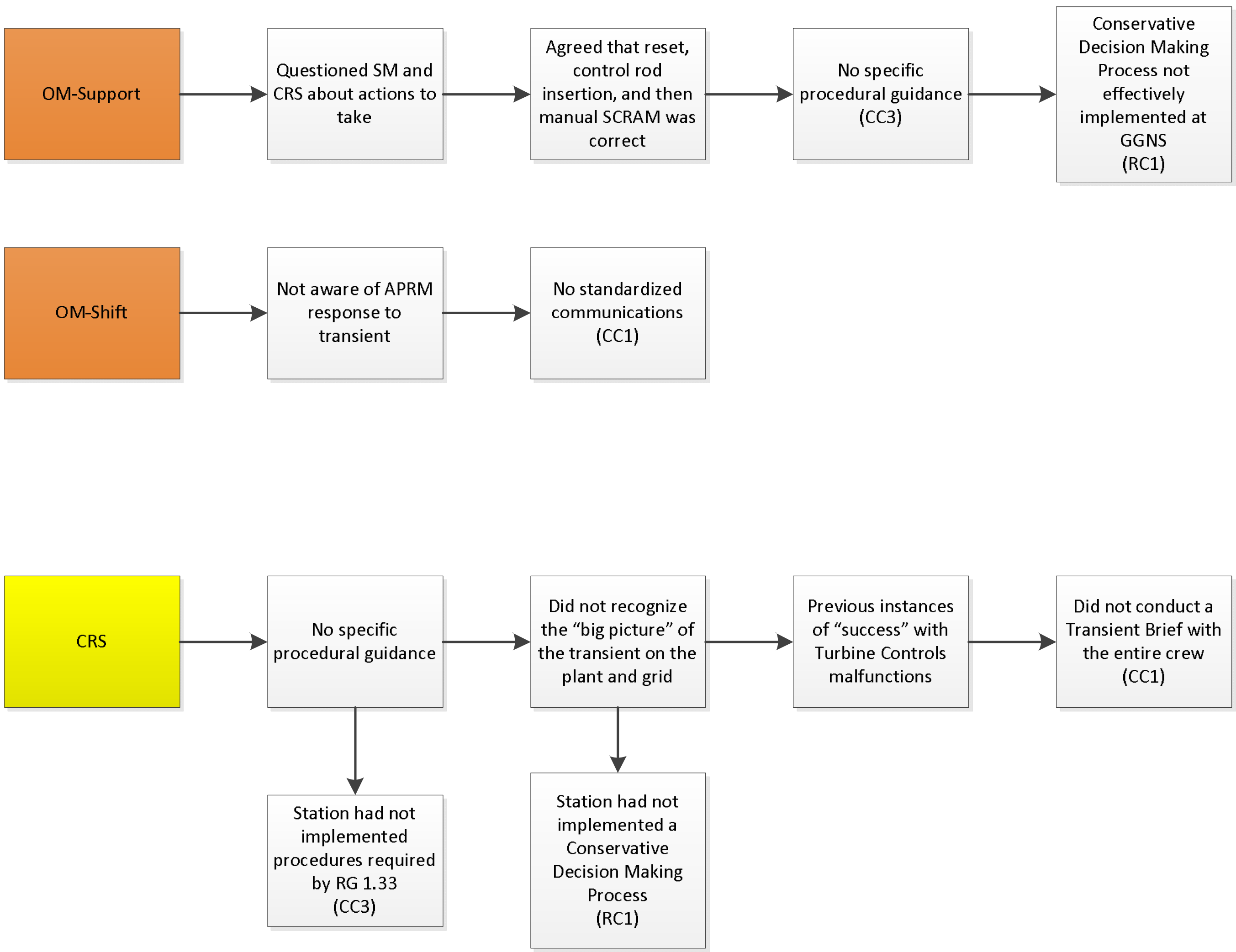
Category: Management Systems			Issue: CR#:	Issue: CR#:
WP.4	CCA: H.8	**Procedure Adherence:** Individuals follow processes, procedures, and work instructions. Behavior Examples: a. Individuals follow procedures. b. Individuals understand and use human error reduction techniques. c. Individuals review procedures and instructions prior to work to validate that they are appropriate for the scope of work and that required changes are completed prior to implementation. d. Individuals manipulate plant equipment only when appropriately authorized and directed by approved plant procedures or work instructions. e. Individuals ensure the statuses of work activities are properly documented.	There was no indication of task related procedure adherence issues. There are instances where shift management did not adhere to or perform their roles and responsibilities. [**CC2**]	

Attachment 7: Event and Causal Factor Chart




Continued from Pg 1
Personnel did not request, advocate, or direct a manual SCRAM
RE
OPS Management
STA/FSS
SM
CRS
ROs
Did not recommend because no indication of THI
OM-Support See Pg. 3
Not in Control Room
Did not think a manual SCRAM was necessary
See Pg. 3
Did not advocate for manual SCRAM
No thermal limits were challenged
OM-Shift See Pg. 3
Not requested to return.
Did not volunteer to return
Discussion with CRS determined THI was not ocurring
No formal Transient Brief conducted
Thought event was 15 minutes


OM-Support
Questioned SM and CRS about actions to take
Agreed that reset, control rod insertion, and then manual SCRAM was correct
No specific procedural guidance (CC3)
Conservative Decision Making Process not effectively implemented at GGNS (RC1)
OM-Shift
Not aware of APRM response to transient
No standardized communications (CC1)
CRS
No specific procedural guidance
Did not recognize the “big picture” of the transient on the plant and grid
Previous instances of “success” with Turbine Controls malfunctions
Did not conduct a Transient Brief with the entire crew (CC1)
Station had not implemented procedures required by RG 1.33 (CC3)
Station had not implemented a Conservative Decision Making Process (RC1)

Attachment 8: Gaps in GGNS Training related to SOERs

Operations training materials implemented between 2013 and present in both classroom and simulator settings were evaluated for their presentation of Operator Fundamentals and Conservative Decision Making processes.

Effectiveness of Operator Fundamentals Training

Operator Fundamentals have not been consistently included in LOR materials in an effective format. A Corporate Comprehensive Assessment of GGNS Operations Training performed in The May, 2016 (HQNLO-2015-78, CA-3) identified that although Operator Fundamentals have been effectively documented and presented in some classroom and simulator sessions, some sessions were observed and materials evaluated that included no Operator Fundamentals, that included Operator Fundamentals throughout the material with no specific or significant focus or that included references to Fundamentals that were not discussed by the instructor. This gap has been documented in CR-GGN-2016-03946.

Effectiveness of Conservative Decision Making Process Training

Although materials are effectively written to challenge and train the operating crews to utilize Conservative Decision Making processes, crews are not frequently given the opportunity to recognize and mitigate risk when a scram is not imminent. All reviewed materials used various known and previously analyzed industry and plant events as a basis for discussion and comparison. LOR simulator sessions trained the operating crews to consistently and correctly enter and implement Off-Normal Event Procedures (ONEPs) to mitigate degrading plant conditions when a plant scram is imminent and/or the conditions are known, analyzed and proceduralized. Neither the classroom sessions nor the simulator sessions routinely challenged the operating crews to assess and recognize risk when a scram condition is not imminent.

For example, the SOER 94-01 analysis of the 1994 Salem Nuclear marsh grass event describes that the Salem operators reacted to uncertain, degrading plant conditions and failed to initiate a manual scram when appropriate. Similar to the GGNS June 2016 plant scram, the Salem operating crew "did not perceive [the plant] conditions as deviating significantly from the expected, and they did not promptly trip the turbine and/or initiate a reactor scram to place the plant in a stable condition as a conservative response to such conditions." The event analysis further stated that "An appropriate balance between efforts to keep the plant on-line and a realization of when these efforts were no longer conservative or reasonable had not been achieved."

This event was presented to Licensed Operator Requalification (LOR) training in 2014 Cycle 6 (GSEM-LOR-SOER 941072-14CYC6) as part of a series of industry intake clogging events. The objectives in this case-study, consistent with those developed by INPO and published on the INPO website, focused on **what not to do** when faced with intake clogging conditions having the operators **discuss** the Salem lessons-learned, **discuss** the issues associated with clogging events and lastly **list** the procedures in place at GGNS that will mitigate similar clogging events at the site. In using this format, the presentation did not address the broader based Conservative Decision Making lessons learned. Using low cognitive, knowledge based objectives to list and discuss, the operators did not have the opportunity to **assess** uncertain and degrading plant conditions and to **implement** a Decision Making strategy as a means of demonstrating the appropriate assessment tool and of reinforcing the desired behaviors.

Material Review Notes:

- 2013 Cycle 1, SOER 96-01: Control room supervision, operational decision making and teamwork. Discussed Operator Fundamental behaviors with respect to industry, NTSB recorded and site events. Discussed CDM and associated processes without application. Objectives:
  - Upon completion of this lesson, the student will be able to identify how occurrence of the events described in SOER 96-1 is prevented by using station procedures.
    - Given SOER 96-1, identify the significant causes and contributors of each event.
    - Given SOER 96-1, identify the actions taken or mechanisms to prevent occurrence, or to minimize the impact of a similar event at GGNS.
- 2013 Cycle 11, SOER 10-2: Engaged, Thinking Organizations. Focus on Questioning Attitude, Procedure Use and Adherence and the six principles of SOER 10-2. Examines a case-study of Zeebrugge ferry disaster. Discusses concepts without application. Objectives:
  - Discuss what led to the creation of SOER 10-2 and who is affected by it.
  - Discuss recommendation 3a as it relates to the individual worker.
  - Demonstrate knowledge of "Engaged, Thinking Workers" by completing the questions associated with the video exercise and comparing findings to work at your station.
- 2014 Cycle 5, SOER 10-2, Fukushima: Focus on repetitive and longstanding issues, risk evaluation, application of lessons learned and operating experience. Includes discussion and high cognitive objectives for analysis of the event and concepts related to Safety Culture without application activities. Objectives:
  - Relate the behavioral cause(s) identified in INPO IER L1 13-10 to the behaviors identified in SOER 10-2
  - Apply key concepts from INPO's Traits of a Healthy Nuclear Safety Culture to this case study
  - Apply key concepts from INPO's Managing By Experience - Some Management Principles for Preventing Events – INPO 98-003 to the events in IER L1 13-10 and 10-2
- 2014 Cycle 7, Risk Mitigation Culture: Focus on latent and active risk recognition and assessment. Analyzed and discussed, without application, risk recognition using a fictitious event with close parallels to the crew behaviors in the GGNS scram. Objectives:
  - Establish habitual practices to:
    - Consistently recognize and assess risk
    - Identify known risk through process documentation
    - Assess and manage latent and active risk
- 2014 Cycle 6, SOER 94-1 CDM: Focus on lessons learned from the 1994 Salem marsh grass event. Discusses without analysis or application the lessons learned from this event. References Operator Fundamental behaviors without analysis or application to specific fundamentals criteria. This gap has been identified as a GGNS weakness in the April 2016 Ops Comprehensive Assessment. CR-GGN-2016-03946 initiated. Objectives:
  - Discuss the key lessons learned from the event that occurred in SOER 94-1 (1.0)
  - Discuss the issues that occurred that caused the events in SOER 07-2. (2.0)
  - Discuss how changes in the environmental conditions can lead to a loss of station cooling water systems. (3.0)
  - List the procedures that are in place at GGNS that will mitigate problems with site cooling water systems. (4.0)

- May 2015 Cycle 11 Simulator Training for application of fundamental behaviors and critical decision making skills to address equipment failures and to mitigate plant events. Required behaviors and skills are similar to those required to address the plant scram. Unlike this plant scram, the events described in the scenario guide are based on analyzed events that are addressed through proceduralized actions with predictable responses. The quality of this simulator guide was identified as a weakness that may impact repeatability and overall effectiveness of the training. May 2016 Corporate Comprehensive Assessment of Ops Training identified a Standards Performance Deficiency in training material quality. This has been documented in CR-GGN-2016-03946.

Conclusion

Some weaknesses were identified in the training of Conservative Decision Making to aid the crew in the assessment and recognition of conditions in which a plant scram is not imminent. Areas for improvement in the training of Operator Fundamentals has been identified and documented in the site corrective action process and actions have been implemented within the Operations Training staff to address this gap. Training for Conservative Decision Making and online risk assessment can be improved through the use of high cognitive and task based objectives developed to support a site proceduralized process that addresses online risk assessment and CDM.

FAQ 17-02

Palo Verde Unit 3 Scram

Plant:	Palo Verde Nuclear Generating Station (PVNGS), Unit 3		
Date of Event:	09/19/2016		
Submittal Date:	03/23/2017		
Licensee Contact:	George Andrews	Tel/email:	623-393-2219
NRC Contact:	Charles Peabody	Tel/email:	623-393-3737

Performance Indicator:

IE03, Unplanned Power Changes per 7000 Critical Hours

Site-Specific FAQ (see Appendix D)? (__) Yes or (X) No

FAQ to become effective (X) when approved or (other date) ___________________

Question Section

Does an unplanned power change caused by a main turbine trip that ends in an elective manual scram and is counted as an unplanned scram also need to be counted as an unplanned power change?

On September 19, 2016, the Palo Verde Nuclear Generating Station (PVNGS) Unit 3 main turbine tripped from 100% power resulting in an automatic reactor power cutback, which reduced power greater than 20%. The reactor power cutback system automatically reduced unit power to approximately 50%, and operators subsequently initiated a power reduction to 12% power in accordance with the load rejection abnormal operating procedure. During the power reduction to 12%, PVNGS management elected to complete a reactor shutdown to troubleshoot and repair the cause of the turbine trip, which was not known. PVNGS counted this event as an unplanned scram because the staff was using an abnormal operating procedure to direct plant actions.

The resident inspector proposed that the main turbine trip event should be counted under both unplanned scram and unplanned power change performance indicators since the cause of the manual scram was discretionary and therefore different than the malfunction that caused the turbine trip-initiated unplanned power change.

PVNGS does not agree that both should be counted and proposes the event be counted solely as an unplanned scram since the reason (the component failure) for the discretionary plant shutdown/manual scram was the same as the turbine trip/unplanned power change.

NEI 99-02 Guidance needing interpretation (include page and line citation):

Section 2.1 of NEI 99-02, Revision 7 (page 11, lines 11-14) provides the following definition:

> "*Unplanned scram* means that the scram was not an intentional part of a planned evolution or test as directed by a normal operating or test procedure. This includes scrams that occurred during the execution of procedures or evolutions in which there was a high chance of a scram occurring but the scram was neither planned nor intended."

Section 2.1 of NEI 99-02, Revision 7 (page 17, lines 1-9) states:

"Off-normal conditions that begin with one or more power reductions and end with an unplanned reactor trip are counted in the unplanned reactor scram indicator only. However, if the cause of the downpower(s) and the scram are different, an unplanned power change and an unplanned scram must both be counted. For example, an unplanned power reduction is made to take the turbine generator off line while remaining critical to repair a component. However, when the generator is taken off line, vacuum drops rapidly due to a separate problem and a scram occurs. In this case, both an unplanned power change and an unplanned scram would be counted. If an off-normal condition occurs above 20% power, and the plant is shut down by a planned reactor trip using normal operating procedures, only an unplanned power change is counted."

Event or circumstances requiring guidance interpretation:

The PVNGS design includes provisions that permit a 100% secondary load rejection without incurring an automatic reactor trip. A load rejection results in a reactor power cutback which automatically drops selected subgroups of regulating bank control rods into the reactor and initiates a steam bypass control system quick-open demand which opens all eight steam bypass control valves to modulate and reduce power to approximately 50%. The load rejection does not result in an automatic reactor trip as demonstrated by this event.

On September 19, 2016, the PVNGS Unit 3 main turbine tripped at 1434 with the unit operating at 100% power. A reactor power cutback occurred automatically, as designed. The control room staff began a power reduction to 12% using abnormal operating procedure 40AO-9ZZ08, "Load Rejection." Subsequently, based on an assessment of need for troubleshooting and repairs, potential reactivity management challenges at the end of core life, and the uncertainty of cause which might delay the return to full power, the control room staff and plant management made a decision to complete a plant shutdown and place the plant in Mode 3 by tripping the reactor using step 3.24 of 40AO-9ZZ08 from approximately 34% power at 1554 to facilitate repairs. No additional, unexpected plant conditions were occurring that would require a plant shutdown other than the loss of the main turbine. Refer to the Figure 1 for a graphical display of the power changes during the event.

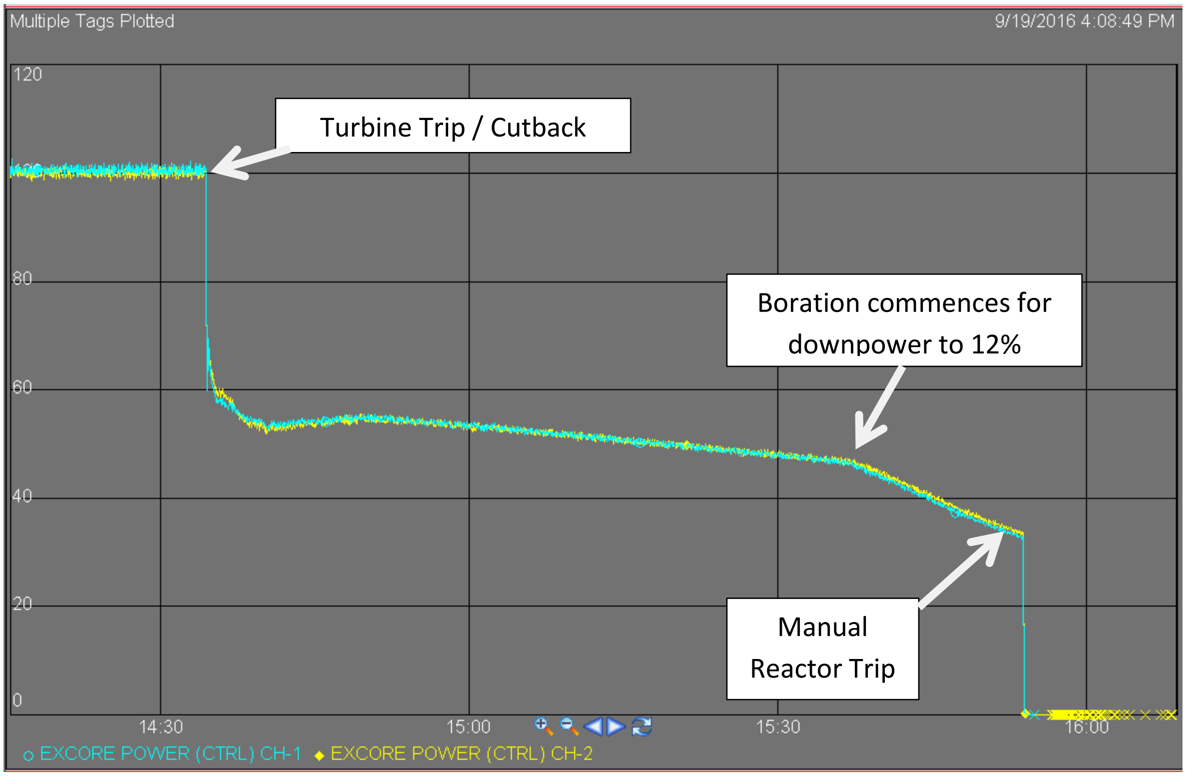


Figure 1: Reactor Power during the Event

Time	Action
1434	Main turbine trip from 100% power, reactor power cutback reduced power to approximately 53% - operators began briefing and development of game plan for power reduction in accordance with the procedure
1532	Commenced 1300 gallon boration at 31 gallons per minute to reduce power to 12% from approximately 45% power based on reactor engineering game plan
1554	Manual trip of the reactor at approximately 34% power to facilitate troubleshooting and repair of the cause of the main turbine trip

Tripping the reactor from 34% power was a permissible step of the abnormal operating procedure to establish plant conditions to perform troubleshooting and conduct repairs. The abnormal operating procedure provides the option of either plant shutdown or holding power at 12% while conducting repairs following a load rejection event. Stabilizing at 12% power at the end of core life presents challenges to the operators that are not warranted for an extended period of operation. However, the reactor protection system was not challenged and plant conditions did not require a reactor scram. The plant was not approaching reactor scram setpoints, and conditions were not likely to result in a scram. The control room staff was provided with a reactor engineering game plan that indicated the plant would be capable of reducing reactor power to 12% and stabilizing there. PVNGS management decided to shutdown the reactor and perform repairs in Mode 3 because the cause of the turbine trip was unknown and placing the plant in Mode 3 was preferred to sustaining 12% power operations for an extended period of time at the end of core life. The control room staff demonstrated conservative decision making with this course of action.

The NEI 99-02 example for a condition that would require counting an event both as an unplanned scram that occurred during an unplanned power change is given beginning on line 4 of page 17 of NEI 99-02. The intent of that discussion is to exemplify the disparate causes of the unplanned scram and unplanned power changes that required inclusion under both performance indicators. The unplanned scram was caused by the loss of condenser vacuum during an unplanned power changed to conduct unplanned turbine generator repairs. The scram was due to a separate degrading condition that, by itself, could have resulted in a reactor scram.

The NEI 99-02 example is dissimilar from the September 19th, 2016, Unit 3 main turbine trip. The manual scram to complete the shutdown of the plant in order to troubleshoot and repair the cause of the main turbine trip was directly related to the cause of the main turbine trip itself and not to some other unrelated failure or degrading condition in the plant. No additional, unexpected plant conditions were occurring that would require a plant shutdown. The ultimate causal linkage of the unplanned power change (turbine trip) ending in a manual scram to correct the cause of the initiating turbine trip should count only as an unplanned scram as described in the referenced NEI guidance.

PVNGS proposed resolution: The event would count only as an unplanned scram.

If licensee and NRC resident/region do not agree on the facts and circumstances, explain:

The resident inspectors generally agree with the event synopsis. However, there is an outstanding question of whether the manual trip was required by station procedures. The manual trip is permitted by the abnormal operating procedure, but it was not specifically directed. There is some question as to whether the plant could have been stabilized at 12% to take the turbine off line. Reactor Engineering was advising the operators to continue the down power rather than scram at the time the licensee's management made the decision to manually trip the reactor. If the plant had been stabilized at 12%, then a reactor trip would not have been required and there would be no issue of double counting; it would only register as an unplanned down power. PVNGS chose to manually trip the reactor, which was a conservative decision that was made at the discretion of the licensee, separate from and in no way directly caused by the spurious turbine trip or required by the procedure. Furthermore, had the station been unable to meet a Power Distribution Limit while continuing to down power that would have satisfied direct causation for inclusion as an unplanned scram only. But, as it stands, PVNGS ultimately made a separate decision to manually trip the reactor on less than 72 hours' notice. Therefore, it should be counted as a separate event under the current language of NEI 99-02, Revision 7.

Potentially relevant FAQs:

FAQ 156: An unplanned runback was terminated by a scram. Should it count as both unplanned scram and unplanned power change? The answer is no without any details.

FAQ 296: An unplanned power change was initiated to repair a stator cooling leak and condenser vacuum was lost requiring a reactor scram. Both were required to be counted because the cause of each was different. No discretionary decision making was involved. This is the example in NEI 99-02.

FAQ 319: Unplanned power change resulted from a loss of a station power transformer induced loss of condenser vacuum (loss of 3 of 6 circulating water pumps). When power was restored, high circulating screen DP resulted in a loss of the fourth circulating water pump and a manual trip of the reactor. No discretionary decision making was involved. The NRC appropriately determined that this event should be counted as both an unplanned power and an unplanned scram because two separate plant equipment failures occurred (loss of transformer and high DP).

FAQ 440: The licensee asked a question: Whether a planned shutdown to repair a reactor recirculation pump motor that faulted two days prior and caused an unplanned power change should result in an unplanned power change or an unplanned scram. The licensee manually tripped the reactor to repair the motor using the normal plant shutdown procedure. The licensee counted this as an unplanned power change and asked whether this should be an unplanned scram or unplanned power change. The NRC answered it should be counted as an unplanned scram because the shutdown from single loop condition from 55% is not its normal method of shutting down the reactor. The NRC did not answer the question whether the event should be counted as an unplanned power change as well.

This FAQ is similar to the Palo Verde event in that it contained an element of discretionary decision making (in the licensee's opinion). It is dissimilar in that the licensee argued the event should not have counted as an unplanned scram and PVNGS is asking whether the main turbine trip should be counted as an unplanned power change. The NRC response only addressed the unplanned scram question.

Response Section

Proposed Resolution of FAQs:

The main turbine trip that ended in a manual scram should count only as an unplanned scram.

If appropriate, provide proposed rewording of guidance for inclusion in next revision:

PRA update required to implement this FAQ? No

MSPI Basis Document update required to implement this FAQ? No