FAQ 20-01: Nine Mile Point Scram – Proposed NRC Response

Plant: Nine Mile Point Unit 1

Date of Event: 9/6/2017

Submittal Date:

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Performance Indicator: Unplanned Scrams with Complications

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

FAQ to become effective when approved.

Question Section:

NEI 99-02 Guidance needing interpretation:

page 27, lines 1-9

Question 6, NEI-99-02 states, "Following initial transient, did stabilization of reactor pressure/level and drywell pressure meet the entry conditions for EOPs?

This step is used to determine if the scram was uncomplicated and did not require using other procedures beyond the normal scram response. Following the initial transient, maintaining reactor and drywell pressures below the Emergency Procedure entry values while ensuring reactor water level is above the Emergency Procedure entry values allows answering "No".

The requirement to remain in the EOPs because of reactor pressure/water level and drywell pressure following the initial transient indicates complications beyond the typical reactor scram."

Event or circumstances requiring guidance interpretation:

**NRC POSITION:**

The inspectors reviewed Nuclear Energy Institute 99-02; N1-EOP-2, “RPV [reactor pressure vessel] Control,” Revision 01600; the post transient review for the scram on September 6, 2017; and IR 04049445 and its associated root cause report; and determined that it appeared that a Scram with Complications should have been classified.

Question 6, NEI-99-02 states "Following the initial transient, did stabilization of reactor pressure/level and drywell pressure meet the entry condition for EOP’s?"

The pressure control leg of N1-EOP-2 states "…stabilize RPV pressure below 1080 psig using the Main Turbine Bypass Valves (TBVs)."

However, operators didn't have TBVs available because Main Steam Isolation Valves (MSIVs) were closed. Instead operators utilized an "alternate pressure control system" listed in N1-EOP-2, the Emergency Condenser (EC). Pressure was controlled using the EC for approximately 8 minutes before the MSIVs were opened and reactor pressure control was re-established using the TBVs. Therefore, Question 6 should have been 'Yes' in the Unplanned Scram with Complications (USwC) Performance Indicator.

The Frequently Asked Questions Log states (FAQ 18-01):

*"Initial Transient* is intended to envelope the immediate and expected changes to BWR parameters as a result of a scram (e.g., pressure, level, etc.) because of the collapsing of voids in the core and the routine response of the main feedwater and turbine control systems. For example, at some BWRs the reflected pressure wave resulting from the rapid closure of turbine valves during a turbine trip may result in a pressure spike in the reactor vessel that causes one or more safety-relief valves (SRVs) to briefly lift. The intent is to allow a licensee to exclude the momentary operation of SRVs when answering "Was pressure control unable to be established?" The sustained or repeated operation of SRVs in response to turbine control bypass valve failures or Main Steam Isolation Valve (Group I) isolations are not a part of routine BWR scram responses and are therefore not considered to occur within the initial transient."

Based on the inspectors' review it appeared that Question 6 should have been answered "Yes," because the ultimate heat sink was lost with main steam isolation valves closed following the initial transient requiring additional time for the use of the alternate pressure control system, emergency condensers, as defined in N1-EOP-2.

**SITE POSITION:**

To answer NEI 99-02 BWR Flowchart Question 6, we will discuss the conditions of the scram and the design basis of the emergency condensers and then discuss each sentence of the question separately as follows:

The initiating event for the scram was a loss of all feedwater flow which caused a scram on Lo RPV Water Level (<53"). As part of this transient, RPV Water Level reached the Lo-Lo RPV Water Level setpoint of (<5") due to initial loss of feedwater and shrink following the scram and prior to RPV Water Level being restored as expected by High Pressure Coolant Injection (HPCI). The Lo RPV Water Level is an entry condition into N1-EOP-2, "RPV Control" and is entered as part of the normal scram response in addition to N1-SOP-1, "Reactor Scram" and N1-OP-43C, "Plant Shutdown." Once N1-EOP-2 is entered, the operators follow the EOP to control both RPV water level and reactor pressure. Due to initiating transient which caused loss of feedwater flow reaching the Lo-Lo RPV Water Level, a Vessel and Containment Isolation Signal occurred as expected which caused the Main Steam Isolation Valves to close. Operators established pressure control in accordance with N1-EOP-2 by manually initiating Emergency Condenser (EC) 11 during the initial transient (as shown in Attachment 1) and maintained reactor pressure below any further EOP entry conditions. This did not require using other procedures beyond the normal scram response and therefore did not require additional time for the use of EC 11. No ERVs/SRVs lifted during the scram response. Once pressure was stabilized (~8 minutes), the Main Steam Isolation Valves were re-opened and pressure control was transferred from the Emergency Condensers to the Turbine Bypass Valves. N1-EOP-2 was later exited as there had been no re-entry conditions and no other EOPs were entered as part of

the scram response. As shown on Attachment 1, RPV Water Level and RPV Pressure responded as expected to the scram and no further equipment issues occurred during the scram response that cause complications required additional operator action to address. The entire transient spanned from the initiating event to the time the ECs were placed into operation.

In accordance with Nine Mile Point Unit 1 Technical Specifications the design basis of the emergency cooling system is to provide a redundant backup for core decay heat removal following reactor isolation and scram.

In accordance with Nine Mile Point Unit 1 UFSAR, the design basis for the emergency condensers is to provide decay heat removal from the reactor fuel in the event that reactor feedwater capability is lost and the main condenser is not available. The emergency condensers serve as an alternate heat sink when the reactor is isolated from its normal heat sink (the main condenser).

As discussed above, the following is Question 6 and the associated response to each portion of the question.

*"This step is used to determine if the scram was uncomplicated and did not require using other procedures beyond the normal scram response."*

NMP Response:

For normal SCRAM recovery, the following procedures are used:
1. N1-EOP-2, "RPV Control"
2. N1-SOP-1, "Reactor SCRAM"
3. N1-OP-43C, "Plant Shutdown"

No procedures were utilized during scram that were not part of the normal scram response. N1-EOP-2 was entered due to Lo RPV Water Level. Use of the ECs to control pressure is allowed per N1-EOP-2 and N1-SOP-1, with allowance to cooldown using the ECs if the main condenser is not available. Response to a Lo-Lo RPV Water Level condition is part of N1-OP- 43C which has guidance to reset and restore from this condition in conjunction with the normal scram recovery and cooldown procedure sections. Therefore, the answerto this statement is "No."

*"Following the initial transient, maintaining reactor and drywell pressures below the Emergency Procedure entry values while ensuring reactor water level is above the Emergency Procedure entry values allows answering "No."*

NMP Response:

The EOP entry condition associated with Lo RPV Water Level is expected and occurs as part of the normal plant response to a scram. Lo Lo RPV Water Level is not an entry condition in any EOP procedure. RPV Water Level was restored as expected using HPCI. Operators established pressure control in accordance with N1-EOP-2 by manually initiating EC 11 during the initial transient (as shown in Attachment 1) and maintained reactor pressure below any further EOP entry conditions. Pressure control was maintained using EC 11 and then TBVs following restoration of the MSIVs. Following the initial transient, reactor pressure and drywell pressures remained below EOP entry conditions. The highest RPV pressure following the transient was

1005 psig which is well below the entry condition of 1080 psig. No other EOP entry conditions were met during the scram response. Therefore, the answer to this statement is "No."

*"The requirement to remain in the EOPs because of reactor pressure/water level and drywell pressure following the initial transient indicates complications beyond the typical reactor scram."*

NMP Response:

The initial Lo RPV Water Level, post scram, was the only EOP entry condition setpoint met during or after the transient. The Lo RPV water level recovered to within normal operating band without Operator Actions as expected. No reactor or drywell pressure EOP entry conditions occurred during or after the transient. The highest pressure in the reactor during the transient was 1005 psig, well below the EOP entry condition of 1080 psig. No conditions or equipment issues existed during the duration of the scram response requiring re-entry or extended operation in the EOP. Therefore, the answer to this statement is "No."

"*Additionally, reactor water level scram signal(s) during the scram response indicate level could not be stabilized and require this question be answered "Yes".”*

NMP Response:

Once reactor water level recovered from the initial transient, reactor water level remained stable throughout the scram response. Therefore, the answer is "No”.

Additional Clarifying Information Regarding use of Alternate Pressure Control System:

The NRC indicated that the NMP1 Operators used an "alternate pressure control system" as defined in N1-EOP-2 by using the ECs. The term "alternate pressure control system" is terminology used in N1-EOP-2. The plant responded as expected to an RPV Lo-Lo Level containment isolation. Operator's use of ECs with reactor vessel isolated is a procedural step in N1-EOP-2 and N1-SOP-1.

Note, in FAQ 18-01, SRVs are considered acceptable to momentarily lift during the initial transient, without being considered a scram with complications. Unlike SRVs, ECs are part of acceptable manual pressure control when MSIVs close. ECs are clearly referenced as part of the pressure control system in NEI 99-02, Question #2 of the BWR flowchart, while SRVs are not.

The relevant portion of NEI 99-02, Question 2 of the BWR flowchart, is provided below for clarity of the pressure control system components.

*"The failure of the pressure control system (i.e., turbine valves / turbine bypass valves / HPCI / RCIC/isolation condenser) to maintain the reactor pressure or a failed open SRV(s) counts in this indicator as a complication beyond the normal reactor trip response and would result in a ‘Yes’ response."*

**CONCLUSION:**

In conclusion, the use of ECs as an "alternate Pressure Control System," as identified in N1-EOP-2, is a normal reactor trip response. As a result of a low RPV water level scram, at no time during the initial transient and during the scram response did the pressure control system, as described in N1-EOP-2, fail. No additional EOP entries were met after the expected initial entry on Lo RPV Water Level. There was no delay in exiting the EOP and SOP procedures due to the use of EC 11. Therefore, NMP maintains that question #6 is a "No" response.

If licensee and NRC resident/region do not agree on the facts and circumstances, explain:
The licensee and NRC concur on the facts and circumstances surrounding the event.

Potentially relevant FAQs:

FAQ 18-01 – "Definition of Initial Transient"

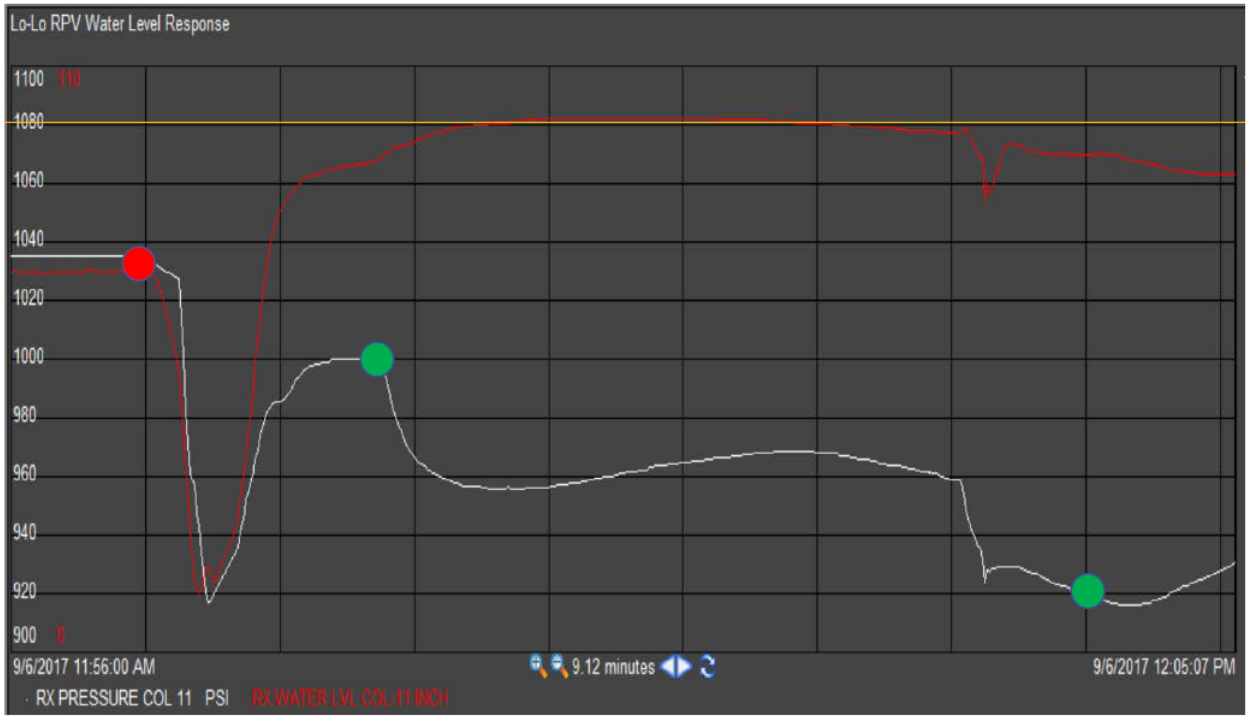
**Response Section:**

Proposed Resolution of FAQ:
N/A

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

PRA update required to implement this FAQ?
No.

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




NMP1 Scram 9/6/17 Lo Reactor Water Level

~1157 – 13 Feedwater Flow Control Valve rapidly closed

11:57:15.401 – Reactor automatically scrams on low RPV level, HPCI initiation signal received

11:57:21 – 11 and 12 Feedwater Pumps start

11:57:34.003 – Lo-Lo RPV Water Level reached, vessel and containment isolation signals received

11:57:35.503 – All MSIVs shut

11:58:45 – 11 Emergency Condenser placed into service for RPV pressure control

12:03:31 – MSIVs reopened, Main Condenser re-established for RPV pressure control

12:04:14 – 11 Emergency Condenser removed from service

*Line denotes N1-EOP-2 entry condition for RPV Pressure (1080 psig)

**Proposed NRC Response:**

The NRC staff completed the evaluation of this FAQ by reviewing the details of the event provided in this FAQ, the event details included in the Post Transient Review and the guidance provided in NEI 99-02, Revision 7. The evaluation took into consideration the review by resident inspectors, operator licensing staff, and other headquarters staff.

The purpose of the IE04, "Unplanned Scrams with Complications," performance indicator, as stated in NEI 99-02, Revision 7, is to monitor "that subset of unplanned automatic and manual scrams that either require additional operator actions beyond that of the "normal" scram or involve the unavailability of or inability to recover main feedwater. Such events or conditions have the potential to present additional challenges to the plant operations staff and therefore, may be more risk-significant than uncomplicated scrams." Further clarifying guidance on what is considered an unplanned scram with complications is included in NEI 99-02, Revision 7. Specifically, NEI 99-02 includes six questions applicable to BWR scrams – if any of the questions are answered 'yes' then the scram counts as a complicated scram.

1. Did an RPS actuation fail to indicate / establish a shutdown rod pattern for a cold clean core?
2. Was pressure control unable to be established following the initial transient?
3. Was power lost to any Class 1E Emergency / ESF bus?
4. Was a Level 1 Injection signal received?
5. Was Main Feedwater not available or not recoverable using approved plant procedures during the scram response?
6. Following initial transient, did stabilization of reactor pressure/level and drywell pressure meet the entry conditions for EOPs?

The review of this FAQ will focus on clarifying question #6 for this event:

> Following initial transient, did stabilization of reactor pressure/level and drywell pressure meet the entry conditions for EOPs?

On September 6, 2017, NMP Unit 1 experienced an automatic reactor scram due to reactor vessel low water level that resulted from the spurious closure of a feedwater pump flow control valve. Following the automatic scram, the feedwater system's HPCI mode of operation was automatically initiated. As part of the initial transient, RPV level lowered until a low-low level signal occurred (the setpoint is 5"), which resulted, in part, in automatic closure of the MSIVs. This caused the turbine bypass valves to be unavailable to control pressure forcing the operators to use an alternate pressure control system, in this case the emergency condensers. Plant parameter data submitted by the licensee in conjunction with the FAQ indicates that RPV water level dropped below 53", but that RPV pressure did not exceed 1080 psig.

N1-EOP- 2 contains, in part, entry criteria of RPV water level below 53" and/or RPV pressure above 1080 psig. The plant parameters indicate that N1-EOP- 2 entry was warranted based upon conditions of RPV level but not on conditions of RPV pressure. As the licensee stated in this FAQ, and as staff confirmed with operator licensing staff, once any entry criteria for a given EOP is met, BWR EOP usage practices require that all legs of that EOP (e.g. both the level and pressure legs of N1-EOP- 2) be performed concurrently. Additionally, entry into N1-SOP-1, "Reactor Scram," was also warranted based upon the occurrence of a reactor scram.

Subsequent actions taken by the crew within N1-EOP-2 included placing an Emergency Condenser into service for RPV pressure control. Both the pressure control leg of N1-EOP- 2 and N1-SOP-1 include direction for controlling RPV pressure by using OP-13 to place Emergency Condensers in service if the Main Condenser is not available. The documentation supplied in conjunction with this review indicates that SRVs were not operated (either automatically or manually) to control RPV pressure during this event. Crew action was subsequently taken to reopen MSIVs and restore normal feedwater system operations.

For this event, the use of the emergency condenser (i.e. an alternate pressure control system) did not require additional time for the operators to control pressure. The use of emergency condensers as a pressure control system is clearly identified in N1-EOP- 2 and N1-SOP-1, in the same place the turbine bypass valves are mentioned as the primary option to maintain pressure control. Also, the design basis for the emergency condensers is described in the Technical Specifications and the UFSAR as a system that provides redundant backup to provide decay heat removal in the event that the reactor feedwater capability is lost, and the main condenser is not available.

The procedures used during this event (N1-EOP- 2 and N1-SOP-1) are the procedures used for a normal scram response, the only difference was that the operators used the emergency condensers (allowed by the procedures) to control pressure because the turbine bypass valves were not available. The operators did not enter any additional EOPs and no other conditions or equipment issues existed that necessitated extended time in EOPs.

We also reviewed the guidance provided within FAQ 18-01: Definition of Initial Transient (ADAMS Accession No. ML18144A961) to verify the applicability for this event. Given that FAQ 18-01 became effective after the event in question, the specific guidance within was not used as part of the staff review of this FAQ.

Based on the information provided and reviewed, the staff concludes that the event described in this FAQ does not count as a complicated scram. The scram continues to count as an unplanned scram per the IE01 PI. The staff arrived at this position based on the specific circumstances of this particular event. This conclusion is case-specific and should not be interpreted as applicable to other events that might necessitate use of the emergency condenser. The staff believes review of circumstances such as these are best done on a case-by-case basis and did not identify any necessary revisions to NEI 99-02, Revision 7.