UNPLANNED SCRAMS WITH COMPLICATIONS (USWC)

Purpose

This indicator monitors that subset of unplanned automatic and manual scrams that require additional operator actions beyond that of ~~the~~a "normal" scram. 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.

* When determining Main Feedwater (MFW) unavailability or non-recoverability using approved plant procedures the focus is not on whether MFW was used (i.e., actually required additional operator actions), but whether MFW was available to be used to perform its intended function.

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Indicator Definition

The USwC indicator is defined as the number of unplanned scrams while critical, both manual and automatic, during the previous 4 quarters that require additional operator actions as defined by the applicable flowchart (Figure 2) and the associated flowchart questions.

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Data Reporting Elements

The following data are required to be reported for each reactor unit.

The number of unplanned automatic and manual scrams while critical in the previous quarter that required additional operator response as determined by the flowchart criteria.

Calculation

The indicator is determined using the values reported for the previous 4 quarters as follows:

value = total unplanned scrams while critical in the previous 4 quarters that required additional operator response as defined by the applicable flowchart and the associated flowchart questions.

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Definition of Terms

Scram means the shutdown of the reactor by the rapid addition of negative reactivity by any means, e.g., insertion of control rods, boron, use of diverse scram switches, or opening reactor trip breakers

Normal Scram means any scram that is not determined to be complicated in accordance with the guidance provided in the Unplanned Scrams with Complications indicator. A normal scram is synonymous with an uncomplicated scram.

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.

Scram Response refers to the period of time which starts with the onset of the initiating event and concludes when operators have performed and verified post scram actions in accordance with the applicable EOP(s) and determined that the plant has achieved a stabilized condition in accordance with criteria in approved plant procedures and analyses.

Clarifying Notes

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PWR FLOWCHART QUESTIONS (See Figure 2)

Did two or more control rods fail to fully insert?

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Did the turbine fail to trip?

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Was power lost to any ESF bus?

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Was a Safety Injection signal received?

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Was ~~Main Feedwater~~(MFW) unavailable or not recoverable using approved plant procedures following the scram?

If operating prior to the scram, did ~~Main Feedwater~~MFW cease to operate and was it unable to be restarted during the reactor scram response? The consideration for this question is whether ~~Main Feedwater~~MFW could be used to feed the steam generators if necessary. The qualifier of "not recoverable using approved plant procedures" will allow a licensee to answer "No" to this question if there is no physical equipment restraint to prevent the operations staff from starting the necessary equipment, aligning the required systems, or satisfying required logic using plant procedures approved for use and in place prior to the reactor scram occurring.

The operations staff must be able to start and operate the required equipment using normal alignments and approved normal and off-normal operating procedures to feed the minimum number of steam generators required by the EOPs to satisfy the heat sink criteria. Manual operation of controllers/equipment, even if normally automatic, is

allowed if addressed by procedure. Situations that require maintenance activities or non-proceduralized operating alignments require an answer of "Yes." Additionally, the restoration of MFW must be capable of feeding the Steam Generators in a reasonable period of time. Operations should be able to start a ~~Main Feedwater~~MFW pump and start feeding Steam Generators with the ~~Main Feedwater~~MFW system within about 30 minutes~~.~~ after a scram. Additionally, if MFW is initially available post scram and then becomes unavailable, the 30 minute estimate could be used as a reasonable period of time it would take to recover MFW. Again, this 30 minute time period is just an estimate used to quantify what a reasonable period of time would be to start or recover MFW under normal conditions. During startup conditions where ~~Main Feedwater~~MFW was not placed in service prior to the scram this question would not be considered and should be skipped. If design features or procedural prohibitions prevent restarting ~~Main Feedwater~~MFW under certain plant conditions, and MFW is free from damage or failure and available for use, the MFW system is not considered unavailable and this question should be answered as "No."

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Was the scram response procedure unable to be completed without entering another EOP?

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BWR FLOWCHART QUESTIONS (See Figure 2)

Did an RPS actuation fail to indicate / establish a shutdown rod pattern for a cold clean core?

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Was pressure control unable to be established following the initial transient?

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Was power lost to any Class 1E Emergency / ESF bus?

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Was a Level 1 Injection signal received?

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Was ~~Main Feedwater~~MFW not available or not recoverable using approved plant procedures?

If operating prior to the scram, did ~~Main Feedwater~~MFW cease to operate and was it unable to

be restarted during the reactor scram response? The consideration for this question is whether ~~Main Feedwater~~MFW could be used to feed the reactor vessel if necessary. The qualifier of "not recoverable using approved plant procedures" will allow a licensee to answer "NO" to this question if there is no physical equipment restraint to prevent the operations staff from starting the necessary equipment, aligning the required systems, or satisfying required logic circuitry using plant procedures approved for use that were in place prior to the scram occurring.

The operations staff must be able to start and operate the required equipment using normal alignments and approved normal and off-normal operating procedures. Manual operation of controllers/equipment, even if normally automatic, is allowed if addressed by procedure. Situations that require maintenance activities or non-proceduralized operating alignments will not satisfy this question. Additionally, the restoration of ~~Main~~MFW must be capable of being restored to provide feedwater (FW) to the reactor vessel in ~~Feedwater must be capable of being restored to provide feedwater to the reactor vessel in~~ a reasonable period of time. Operations should be able to start a ~~Main Feedwater~~MFW pump and start feeding the reactor vessel with the ~~Main Feedwater System~~MFW system within about 30 minutes~~.~~ after a scram. Additionally, if MFW is initially available post scram and then becomes unavailable, the 30 minute estimate could be used as a reasonable period of time it would take to recover MFW. Again, this 30 minute time period is just an estimate used to quantify what a reasonable period of time would be to start or recover MFW under normal conditions. During startup conditions where ~~Main Feedwater~~MFW was not placed in service prior to the scram, this question would not be considered, and should be skipped. If design features or procedural prohibitions prevent restarting MFW under certain plant conditions, and MFW is free from damage or failure and is available for use, the MFW system is not considered unavailable and this question should be answered as "No."

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

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APPENDIX H

USwC Basis Document

The USwC PI will monitor the following six conditions that complicate the operators' scram response ~~recovery~~ actions.

1. Reactivity Control
2. Pressure Control (BWRs)/Turbine Trip (PWRs)
3. Power available to Emergency Busses
4. Need to actuate emergency injection sources
5. Availability of Main Feedwater (MFW)
6. Utilization of scram recovery Emergency Operating Procedures (EOPs)

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H 1 PWR Flowchart Basis Discussion

H 1.1 Did two or more control rods fail to fully insert?

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H 1.2 Did the turbine fail to trip?

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H 1.3 Was power lost to any ESF bus?

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H 1.4 Was a Safety Injection signal received?

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H 1.5 Was ~~Main Feedwater~~MFW unavailable or not recoverable using approved plant procedures following the scram?

This section of the indicator is a holdover from the Scrams with Loss of Normal Heat Removal indicator which the USwC indicator is replacing. Since all PWR designs have an emergency ~~Feedwater~~FW system that operates if necessary, the availability of the normal or main ~~main Feedwater~~FW systems ~~is~~, as a backup in emergency situations, can be important for managing risk following a reactor scram. This portion of the indicator ~~-~~is designed to measure that backup availability directed by ~~the~~ approved plant procedures (e.g., EOPs) on a loss of all emergency ~~Feedwater~~FW. Licensees should rely on the material condition availability of the equipment to reach the decision for this question.

It is not necessary for the ~~main Feedwater~~MFW system to continue operating following a reactor trip. ~~The~~Some plants have design features in place to prevent MFW from continued operation or from allowing it to be restarted unless certain criteria are met. Although these design features are in place to protect the plant, the MFW system must be free from damage or failure that would prohibit restart of the system if necessary. ~~Since~~For example, some plant designs do not include electric driven ~~main Feedwater~~MFW pumps (steam driven pumps only) and it may not be possible to restart ~~main Feedwater~~MFW pumps without a critical reactor. ~~Those plants should answer this question as"No" and move on. Some~~ Additionally, some other plant designs have interlocks and signals in place to prevent feeding the steam generators with ~~main Feedwater~~MFW unless reactor coolant temperature is greater than the no-load average temperature. These plants ~~should also answer~~may be justified in answering this question as "No"~~and move on,~~ if the design feature is active and the MFW system is otherwise free from damage or failure and available to perform its intended function.

~~Licensees should rely on the material condition availability of the equipment to reach the decision for this question. Condenser vacuum, cooling water, steam pressure values should be evaluated based on the requirements to operate the pumps may be lower than normal if procedures allow pump operation at that lower value.these support systems are able to be restarted (if not running) to support main feedwater restart within them 30 minute timeframe they can be considered as available. These requirements apply until the completion or exit of the scram response procedure.~~

~~The availability of steam dumps to the condenser does NOT enter into this indicator at all Use of atmospheric steam dumps following the reactor trip is acceptable for any duration.~~

~~Loss of one feed pump does not cause a loss of main feedwater. Only one is needed to remove residual heat after a trip. As long as at least one pump~~As long as the minimum number of pump(s) and valve(s) can still operate and provide ~~Feedwater~~FW to the minimum number of steam generators required by the EOPs to satisfy the heat sink criteria, ~~main feedwater~~MFW should be considered available.

~~The failure in a closed position of a feedwater isolation valve to a steam generator is a loss of feed to that one steam generator. As long as the main feedwater system is able to feed the minimum number of steam generators required by the EOPs to satisfy the heat sink criteria, the loss of ability to feed other steam generators should not be considered a loss of feedwater. Isolation of the feedwater regulating or isolation valves does not constitute a loss of feedwater if nothing prevents them from being reopened in accordance with procedures.~~

~~A Steam Generator Isolation Signal or Feedwater Isolation Signal does not constitute a loss of main feedwater as long as it can be cleared and feedwater restarted. If the isolation signal was caused by a high steam generator level, the estimate time frame should start once the high level isolation signal has cleared.~~

~~The 30 minute time frame for restart of main Feedwater~~The 30 minutes time frame for restart of MFW was chosen based on restarting from a hot and filled condition. Since this time frame will not be measured directly it should be an estimation developed based on ~~the material condition of~~

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~~the plants systems following the reactor trip~~specific plant design and plant operating experience. If no abnormal material conditions exist the 30 minutes should normally be met. If actions to restart MFW as directed by plant procedures and design would ~~require more~~take longer than 30 minutes to complete (even if all systems were hot and the material condition of the plants systems following the reactor trip ~~were~~was normal~~,~~) that routine time should be used in the evaluation of this question, provided SG dry-out cannot occur on an uncomplicated trip ~~if the time is~~lasting longer than 30 minutes. The ~~opinion~~professional judgment of the on-shift licensed SRO during the reactor trip should be ~~accepted~~used in determining if this timeframe was met.

H 1.6 Was the scram response procedure unable to be completed without entering another EOP?

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H 3 BWR Flowchart Basis Discussion

H 3.1 Did an RPS actuation fail to indicate / establish a shutdown rod pattern for a cold clean core?

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H 3.2 Was pressure control unable to be established following the initial transient?

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H 3.3 Was power lost to any Class 1E Emergency / ESF bus?

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H 3.4 Was a Level 1 Injection signal received?

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H 3.5 Was Main Feedwater not available or not recoverable using approved plant procedures?

If operating prior to the scram, did ~~Main Feedwater~~MFW cease to operate and was it unable to be restarted during the reactor scram response? The consideration for this question is whether ~~Main Feedwater~~MFW could be used to feed the reactor vessel if necessary. The qualifier of "not recoverable using approved plant procedures" will allow a licensee to answer "NO" to this question if there is no physical equipment restraint to prevent the operations staff from starting the necessary equipment, aligning the required systems, or satisfying required logic circuitry using plant procedures approved for use that were in place prior to the scram occurring.

The operations staff must be able to start and operate the required equipment using Normal alignments and approved normal and off-normal operating procedures. Manual

operation of controllers/equipment, even if normally automatic, is allowed if addressed by procedure. Situations that require maintenance activities or non-proceduralized operating alignments will not satisfy this question. Additionally, the restoration of ~~Main Feedwater~~MFW must be capable of being restored to provide feedwater (FW) to the reactor vessel in a reasonable period of time. Operations should be able to start a ~~Main Feedwater~~MFW pump and start feeding the reactor vessel with the ~~Main Feedwater System~~MFW system within about 30 minutes~~.~~ after a scram. Additionally, if MFW is initially available post scram and then becomes unavailable, the 30 minute estimate could be used as a reasonable period of time it would take to recover MFW. Again, this 30 minute time period is just an estimate used to quantify what a reasonable period of time would be to start or recover MFW under normal conditions. During startup conditions where ~~Main Feedwater~~MFW was not placed in service prior to the scram, this question would not be considered, and should be skipped. If design features or procedural prohibitions prevent restarting MFW under certain plant conditions, and MFW is free from damage or failure and available for use, the MFW system is not considered unavailable and this question should be answered as "No."

H 3.6 Following initial transient, did stabilization of reactor pressure/level and drywell pressure meet the entry conditions for EOPs?

Since BWR designs have an emergency high pressure system that operates automatically between a vessel-high and vessel-low level, it is not necessary for the ~~Main Feedwater~~MFW ~~System~~system to continue operating following a reactor trip. ~~However,~~Although these design features are in place to protect the plant, the MFW system must be available (i.e., free from damage or failure that would prohibit restart of the ~~Main Feedwater System~~system if necessary). Therefore, failure of the MFW system to be available is considered to be risk significant enough to require a "Yes" response for this PI~~.To be considered available, the system must be free from damage or failure that would The system must be free from damage or failure that would prohibit restart of the system if necessaryTherefore, there is some~~. Therefore, there is significant reliance on the material condition or availability of the equipment to reach the decision for this question. Condenser vacuum, cooling water, and steam pressure values should be evaluated based on the requirements to operate the pumps, and may be lower than normal if procedures allow pump operation at that lower value.

The 30 minute time frame for restart of ~~Main Feedwater~~MFW was chosen based on restarting from a hot condition with adequate reactor water level. Since this time frame will not be measured directly~~,~~ it should be an estimation developed based on ~~the material condition of the plants systems following the reactor trip~~specific plant design and plant operating experience. If no abnormal material conditions exist~~,~~ the 30 minutes should normally be ~~capable of being~~ met. If plant procedures and design would require more than 30 minutes~~,~~ (even if all systems were hot and the material condition of the plants systems following the reactor trip were normal~~, a~~) that routine time should be used in the evaluation of this question. The ~~considered opinion~~professional judgment of ~~an~~ the on-shift licensed SRO during the reactor trip should be used in ~~meeting~~determining if this ~~time frame is acceptable.~~timeframe was met.

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