

FAQ 17-02 (Final NRC Response)
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
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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 () No

FAQ to become effective () 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:

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“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.

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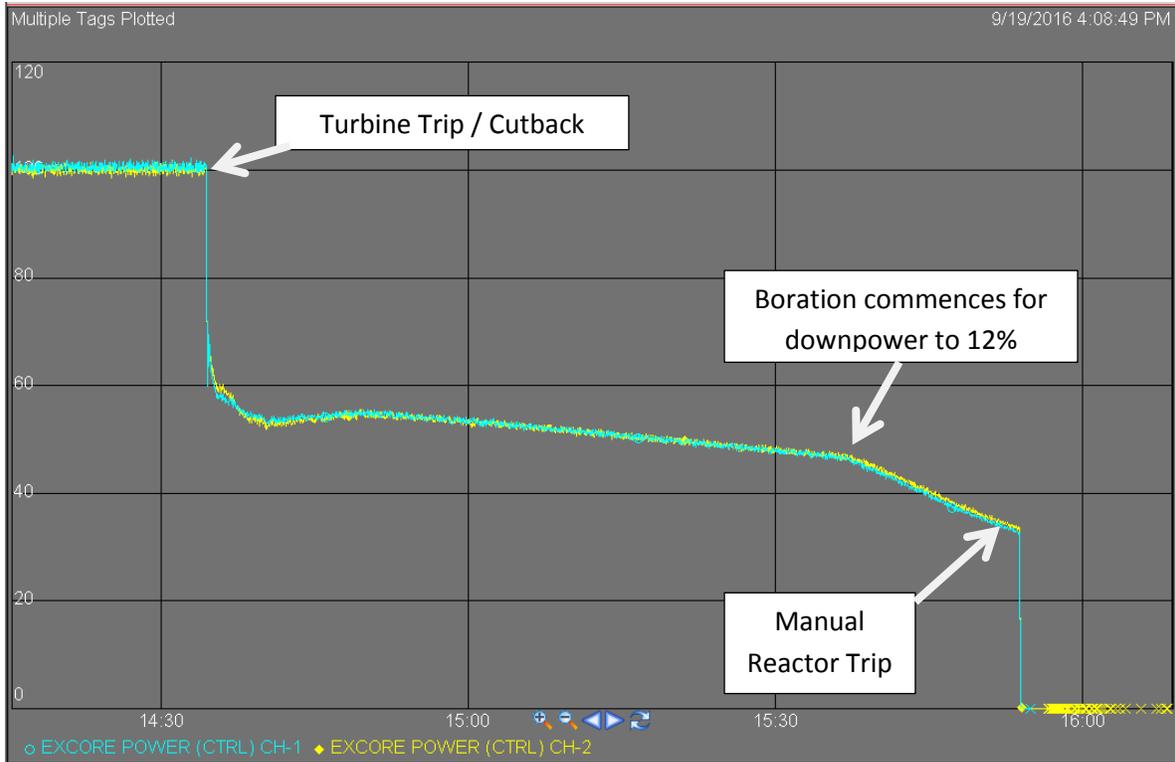


Figure 1: Reactor Power during the Event

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.

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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 change 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

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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:

None

PRA update required to implement this FAQ? No

MSPI Basis Document update required to implement this FAQ? No

NRC Response

The staff reviewed the procedure used by the licensee for the transient response and eventual plant trip (40AO-9ZZ08 Rev. 31), and discussed the event with the licensee and resident inspectors. The most pertinent parts of NEI 99-02 as pointed out by the licensee involve the definition of unplanned scram and when not to count a downpower that proceeds an unplanned scram. In this event, the initial downpower was caused by an unknown fault on the turbine control system. The decision to trip the reactor was predicated by that initial event. As such, the downpower and scram are subject to the criteria in Section 2.1 of NEI 99-02, Revision 7 (page 17, lines 1-2): "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."

This event should count as one unplanned scram and no unplanned power changes. No change to NEI 99-02 is required as a result of this FAQ.