FAQ 17-01
Grand Gulf June 2016 Power Change (Final NRC 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?

Question 2 Supporting Questions:

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 issues, faults or discrete events 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 transient that initiates 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 discrete events occurred during this transient that are indicative of plant performance and should be considered inputs into the unplanned power change PI.

The first 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 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 event 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 began 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.