Entergy

Entergy Operations, Inc.
P. O. Box 756
Port Gibson, MS 39150
Tel 601 437 6409
Fax 601 437 2795

William A. Eaton
Vice President,
Operations
Grand Gulf Nuclear Station

GNRO-2002/00012

February 20, 2002

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

SUBJECT: Grand Gulf Nuclear Station, Unit 1
Docket No. 50-416
Supplement to Amendment Request Concerning
Control Rod Scram Time Testing Frequency

REFERENCES: GNRO-2001/0002, Control Rod Scram Time Testing Frequency
Proposed Amendment to the Operating License, LDC 2001-001,
dated January 25, 2001

Dear Sir or Madam:

By letter GNRO-2001/00002, Control Rod Scram Time Testing Frequency, Proposed Amendment to the Operating License, dated January 25, 2001, Entergy Operations, Inc. (Entergy) proposed a change to the Grand Gulf Nuclear Station, Unit 1 (GGNS) Technical Specifications (TSs) to extend scram time testing intervals.

In December, 2001, Entergy and members of your staff held several phone calls to discuss questions concerning our proposed changes to the control rod scram time testing interval from 120 to 200 days of full power operation. As a result of the call, three questions were determined to require formal response. Entergy's response is contained in Attachment 1.

There are no Technical Specification changes proposed by this supplement. The original no significant hazards considerations included in the reference is still valid and is not affected by any information contained in the supplement. There are no new commitments contained in this letter, although certain changes to the Technical Specifications Bases will be made as described in this letter with adoption of the proposed change.

If you have any questions or require additional information, please contact Bill Brice at 601-368-5076.

A001

I declare under penalty of perjury that the foregoing is true and correct. Executed on February 20, 2002 .

Sincerely,

William A Eaton

WAE/WBB

Attachments:
1. Response to Request For Additional Information
2. Revised Markup of Technical Specification Bases Pages

cc: Mr. Ellis W. Merschoff
Regional Administrator
U. S. Nuclear Regulatory Commission
Region IV
611 Ryan Plaza Drive, Suite 400
Arlington, TX 76011-8064

Mr. S. P. Sekerak
Project Manager Region IV
U. S. Nuclear Regulatory Commission
NRR/DLPM, Mail Stop 07D1 (w/2)
Washington, DC 20555-0001

Mr. T. L. Hoeg, GGNS Senior Resident
Mr. D. E. Levanway (Wise Carter)
Mr. L. J. Smith (Wise Carter)
Mr. N. S. Reynolds
Mr. H. L. Thomas

Dr. E. F. Thompson (w/a)
State Health Officer
State Board of Health
P.O. Box 1700
Jackson, Mississippi 39205

Attachment 1

To

GNRO-2002/00012

Response to Request for Additional Information

Response to Request for Additional Information Related to Scram Time Testing Intervals

Question:

If the representative sample of 20 rods is tested every 200 operating days to determine the failure rate, what is the probability that TS LCO 3.1.4 will not be met? In other words calculate the assurance that if more than 14 rods in the entire core (out of 193) are slow, this situation would be detected by the sampling process.

Response:

The sampling frequency as well as the determination of what constitutes a "representative sample" is based on operating experience and on the additional testing done at more frequent intervals as required by Limiting Condition for Operation (LCO) 3.1.3 "Control Rod Operability" and LCO 3.1.5, "Control Rod Scram Accumulators." This is discussed in the current basis for Surveillance Requirement (SR) 3.1.4.2. The basis goes on to explain that "The sample remains 'representative' if no more than 20% of the control rods in the tested sample are determined to be 'slow.'" Additional testing is required if this limit is exceeded. We do however, understand your concerns and desire to compensate for the uncertainties inherent to this type of basis. We therefore propose to change the basis for this Surveillance Requirement to help account for some of the uncertainties. We will change the 20% acceptance criteria to 7.5%. This aligns with the 7.5% of the total control rods allowed to have scram times that exceed the specified limit. Having no more than 7.5% of the total number of control rods allowed to be "slow" ensures that the scram reactivity assumed in the Design Basis Accident (DBA) and transient analysis is met. This is true even with a single stuck control rod, as is allowed by LCO 3.1.3, "Control Rod Operability", concurrent with another control rod failing to scram, in order to meet single failure criteria. We believe that this provides sufficient conservatism and provides additional statistical basis for our proposed change.

Question:

Reference, Page 2, last paragraph, first sentence: "A calculation was performed to calculate the historic probability of..."

a) Describe/state the data base used for the "historic probability."

Response:

The data utilized included all scram time tests used to satisfy the surveillance requirement from October 22, 1982 through December 8, 1999 on control rod drive mechanisms installed in the plant as of that date with the following two exclusions:

1. Data from November 1993 through June 3, 1994. During RF06, GGNS replaced the SCRAM solenoid pilot valve (SSPV) tophead subassemblies. Subsequently, early Cycle 7 rod insertion data demonstrated poor performance and multiple slow rods. This continued until a physical modification of the plant was made. The problem was confined to a certain vintage of SSPV tophead subassemblies. Replacement of these

subassemblies ended the problem. The 918 tests included in this period were an anomaly and are not a good representation of normal performance of the equipment. These tests were therefore, excluded from the data used to calculate the historic probability.

2. Data from test results that were considered to be too fast to be credible. The test procedure includes a provision to disallow data with insertion times to notch 43 of less than 0.2 seconds. Another rod would be selected to complete the sample. Although this provision was added to address a known problem with manual operation of the test switches, an investigation to determine cause and appropriate corrective actions would be initiated for any of these "fast" rods. It should be noted that the test switches only affect scram times during testing and do not affect "actual" scram times.

Question:

3. **Reference, Page 2, last paragraph, second sentence. "An evaluation of the historic average times and standard deviation in time..."**

a) **How was the standard deviation calculated?**

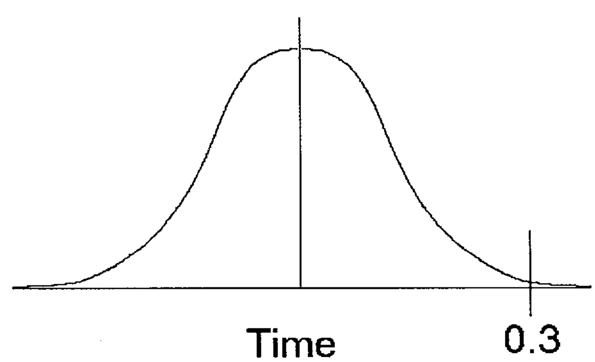
Response:

The standard deviation of scram times was calculated by applying the standard deviation function in Excel to the measured scram times of the database population.

b) **Was the standard deviation added or subtracted from the historic success rate, or was a confidence limit calculated?**

Response:

The relevant data is the times from notch 48 (fully withdrawn) to notch 43, since times to notch 29 (further into the core) have a much higher success rate, and since historically any test that failed at notch 29 had already failed at notch 43. The historic success rate is 0.99841 based on 12 failures per 7,524 tests in the database. This was done using straight division with no confidence level or standard deviation applied. This number does not make use of the large amount of data provided in the total test times, i.e., it doesn't recognize that most tests pass with a comfortable margin. If we think of the test times distribution as a bell curve, the vast majority lie under 0.3 seconds (the specified acceptance criteria). Relying on only the 12 points above the 0.3 seconds time is making use of only a small amount of the available information.



Our approach was to try to determine the bell curve based on the actual timing results and standard deviation. If we had an infinite number of tests and the distribution was a perfect curve, then 3 times

the standard deviation σ would encompass 99.73% of the data. Since we have only 7,524 tests in the database, we use 3.077 times σ. The value of 3.077 is based on 100 degrees of freedom on a student t chart. It is conservative to use 100 degrees rather than n - 1 = 7,523 where n = number of data points.

The average test time is 0.2384 seconds with a standard deviation of 0.142 seconds. 0.2384 + 3.077 * 0.0142 is close to, but less than 0.3 seconds. We expect only 0.27% of results to lie outside of the 3σ range evenly split between faster and slower times. So we believe only 0.135% will exceed the 0.3 second time criterion.

We then use the 7,512 successes/12 recorded failures as a second check. We would have expected 0.99865 of the results to be less than 0.3 seconds, and we found 0.99841. This further supports our results.

The 12 failures out of 7,524 trials are data from the extreme tail of a probability distribution. It is less accurate than use of all 7,524 data points. The fact that we had 12 failures while predicting 10.2 failures is a chance variation. This is to be expected given that the 10.2 prediction is a mathematical "expectation" that does not take into account the inherent uncertainties that are demonstrated by the actual failure rate of 12.

c) Why wasn't the standard deviation calculated for the GGNS estimate of the success rate?

Response:

The standard deviation was calculated for the values used in the analysis. As described above, we calculated a value of 0.99865. That number is a best estimate of the fraction of tests that will result in a less than 0.3 second value. Being a best estimate, it is true the actual value for future tests may be 0.99841 (the historic success rate) or even a little less. The reason that the argument for extended testing frequency is sound is not that we are highly confident that the calculated value will always be the result, but rather with a best estimate of 0.99865, we are highly confident that very few rods will fail. In fact, we used the more conservative number of 0.9984 to make this point. We could have used an even lower number (say 0.9968, which doubles the failure rate from the witnessed .0016 to .0032) and still shown no impact in reducing the test frequency.

Attachment 2

To

GNRO-2002/00012

Revised Markup of Technical Specification Bases Pages

BASES (continued)

SURVEILLANCE REQUIREMENTS

The four SRs of this LCO are modified by a Note stating that during a single control rod scram time surveillance, the CRD pumps shall be isolated from the associated scram accumulator. With the CRD pump isolated (i.e., charging valve closed), the influence of the CRD pump head does not affect the single control rod scram times. During a full core scram, the CRD pump head would be seen by all control rods and would have a negligible effect on the scram insertion times.

SR 3.1.4.1

The scram reactivity used in DBA and transient analyses is based on assumed control rod scram time. Measurement of the scram times with reactor steam dome pressure ≥ 950 psig demonstrates acceptable scram times for the analyzed transients.

Scram insertion times increase with increasing reactor pressure because of the competing effects of reactor steam dome pressure and stored accumulator energy. Therefore, demonstration of adequate scram times at reactor steam dome pressure greater than 950 psig ensures that the scram times will be within the specified limits at higher pressures. Limits are specified as a function of reactor pressure to account for the sensitivity of the scram insertion times with pressure and to allow a range of pressures over which scram time testing can be performed. To ensure scram time testing is performed within a reasonable time following a refueling or after a shutdown ≥ 120 days, all control rods are required to be tested before exceeding 40% RTP. This Frequency is acceptable, considering the additional surveillances performed for control rod OPERABILITY, the frequent verification of adequate accumulator pressure, and the required testing of control rods affected by work on control rods or the CRD System.

SR 3.1.4.2

Additional testing of a sample of control rods is required to verify the continued performance of the scram function during the cycle. A representative sample contains at least 10% of the control rods. The sample remains "representative" if no more than 20% of the control rods in

7 1/2

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.1.4.2 (continued)

the tested sample are determined to be "slow." If more than ~~20%~~ 7½ % of the sample is declared to be "slow" per the criteria in Table 3.1.4-1, additional control rods are tested until this ~~20%~~ 7½ criterion (e.g., ~~20%~~ 7½ of the entire sample size) is satisfied, or until the total number of "slow" control rods (throughout the core, from all surveillances) exceeds the LCO limit. For planned testing, the control rods selected for the sample should be different for each test. Data from inadvertent scrams should be used whenever possible to avoid unnecessary testing at power, even if the control rods with data were previously tested in a sample. The ~~120~~ 200 day Frequency is intended to allow consistency with control rod sequence exchanges and is based on operating experience that has shown control rod scram times do not significantly change over an operating cycle. This Frequency is also reasonable, based on the additional Surveillances done on the CRDs at more frequent intervals in accordance with LCO 3.1.3 and LCO 3.1.5, "Control Rod Scram Accumulators." The 7½ % of sample size criteria is intended to align with the 7½ % of the total control rods allowed to have scram times that exceed the specified limit

SR 3.1.4.3

When work that could affect the scram insertion time is performed on a control rod or the CRD System, testing must be done to demonstrate that each affected control rod retains adequate scram performance over the range of applicable reactor pressures from zero to the maximum permissible pressure. The scram testing must be performed once before declaring the control rod OPERABLE. The required scram time testing must demonstrate that the affected control rod is still within acceptable limits. The limits for reactor pressures < 950 psig are established based on a high probability of meeting the acceptance criteria at reactor pressures ≥ 950 psig. Limits for ≥ 950 psig are found in Table 3.1.4-1. If testing demonstrates the affected control rod does not meet these limits, but is within the 7 second limit of Table 3.1.4-1 Note 2, the control rod can be declared OPERABLE and "slow."

Specific examples of work that could affect the scram times include (but are not limited to) the following: removal of any CRD for maintenance or modification; replacement of a control rod; and maintenance or modification of a scram solenoid pilot valve, scram valve, accumulator isolation valve, or check valves in the piping required for scram.

(continued)