SGTI SDP
INDUSTRY Comments

SG SDP Questions and Comments

- An explanation of how the SDP criteria are to be applied needs to be developed. The paper attached to the draft SDP provides a basis for the SDP, but does not serve as an explanation of how to interpret and use it.
    - Expand on the basis for the conditions associated with each of the color bands.
    - The White Paper needs to be updated to reflect the current version of 0612 (Group 1, 2, 3 questions for example).

Meeting Result: The draft SDP included a "White Paper" that explained the background of the tube integrity concern and the severe accident considerations. It was not intended as a procedure explaining use of the SDP. The NRC intends to develop a procedure for the SDP similar to those prepared for other SDPs. This procedure will correct the references to older versions of 0612. The NRC plans to complete the procedure prior to our next meeting in December.

- Performance of SG inspections involves judgments and uncertainties (technique and sampling). Provide a specific definition of performance deficiency as it pertains to SG inspections; give examples.

Meeting Result: The NRC will consider adding examples of performance deficiencies. The following examples were discussed during the meting:

- Acceptance of excessive noise in NDE data
- Acceptance of bad data
- Operator error
- Error in plugging list resulting in a missed plugging or repair

One example offered by Emmett during the meeting would be especially helpful. Emmett stated that missing an indication does not necessarily result in a performance deficiency since SG inspections are not without uncertainty. The inspector must determine whether the analyst's oversight is part of a pattern of substandard performance. In addition the "obviousness" of the indication and the subsequent behavior of the tube would also be relevant.

On the other hand, the staff stated that a performance deficiency be involved, even if a licensee followed the guidelines, if a situation occurs that should have been avoided. Appendix B obligates us to identify conditions adverse to quality in a timely manner.

- Provide specific explanations of what are minor issues in the area of SG performance.
    - Should appendix E to 0612 be revised to include these examples?

Meeting Result: The NRC intends to add this information in the next version of the SDP.

- The criteria used to determine the color bands make sense in a relative manner, but what specific color should be assigned to a limit does not have a clear basis. For example:

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- The 3 NOΔP criterion is based on the original guidance contained in RG 1.121 to ensure an adequate margin existed for operation of the SGs. RG 1.121 was originally issued on the mid 1970's. In the 1990's the 3NOΔP was used a surrogate the provide assurances that operation for beyond design basis accidents was acceptable. However, as discussed in Section VIII of the proposed SG SDP and in NUREG-1740, this position does not have a solid basis. Consequently, the use of the 3NOΔP criterion is, in essence, grandfathering historic guidance into a significance determination process without a solid basis.

- 3NOΔP is a deterministic parameter defined for design basis purposes; it has no relation to probabilistic conditions. Since 3NOΔP does not relate achievable pressure event, it cannot be given a frequency of occurrence or the frequency is zero. If the frequency of occurrence is zero, the risk is zero. We need to perform a risk assessment for each event using some standard methodology to see where the events really stack up.

- 3NOΔP is a convenient "line in the sand", but it is nor necessarily a significant issue. For example, if a plant has two tubes that test at 3.01 ΔP there is no finding. However, if the tubes test at 2.99 ΔP, the plant is in the yellow band. The difference is insignificant.

Meeting Result: The NRC stated that significance of 3ΔP from a risk perspective is based on the following:

- Severe accident analysis results are unclear as to whether the hot leg, pressurizer surge line, or SG tubing will fail first under the "high and dry" scenario. In addition, the ability of the tubes to withstand severe conditions is highly dependent on tube degradation. Preliminary evaluation indicates that if a tube does not burst under 3ΔP pressure differentials, then it will also be able to withstand severe accident conditions. The industry asked the NRC for a summary of their evaluation that showed this result.
- The risk of exceeding 3ΔP may be zero, but if a tube is not strong enough to hold 3ΔP, it has a larger probability of failing at lower pressures accompanied by the higher temperatures that exist during operation.

- White is defined as low to moderate safety significance. If margin exists to ΔP MSLB then this criterion is met. Specifically, failure to met 3NOΔP does not mean that there is no margin remaining to tube failure.

  - Failure to meet ΔP MSLB does indicate a loss of margin. It does not make sense to group the $3x\Delta P_{NO}$ conditions with the ΔP MSLB condition in the yellow band. The ΔP_{NO} conditions should be a white condition.

  - Further, multiple tubes not meeting ΔP_{NO} conditions indicates a programmatic breakdown with the SG inspection that should call for focused inspections addressing the SG program. This is consistent with a white finding. If the $3x\Delta P_{NO}$ conditions were yellow, the called for inspections would be too broad for

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this specific issue.

Meeting Result: The industry pointed out that risk is not the only determinant of what conditions ought to be captured in an SDP's color bands. In cases where the risk is not well defined, other SDPs have based the color of certain conditions on the appropriateness of the NRC inspection effort associated with a finding in the area. With this in mind, the industry offered a variation on the ">1 tube that does not meet $3x\Delta P_{NO}$ integrity criterion" condition that would split it into two:

1. >1 tube that does not meet $3x\Delta P_{NO}$ integrity criterion, all cases due to a common cause
2. >1 tube that does not meet $3x\Delta P_{NO}$ integrity criterion due to more than one causes

The latter is a programmatic concern and should be treated with a broader perspective – a yellow finding is appropriate.

The former may be due to a one time condition and more focused attention is called for – a white finding is appropriate.

The NRC pointed out that due to multiple tube rupture concerns, the first condition proposed by the industry carries a higher risk and should be limited to a maximum number of tubes. The NRC stated that they would consider our proposal.

A better link between risk and tube condition should be established. One option could be to consider a simplistic best estimate PRA evaluation of the risk significance of the various limits used in the SDP and relating their ΔLERF results to the appropriate color.

Meeting Result: The NRC volunteered to prepare an explanation of their evaluation that relates the different conditions to the ΔLERF values in the SDP, but this will not be a detailed PRA analysis. The industry decided to drop the request for a detailed analysis implied by the comment for the following reasons:

- The SDP is intended to be used as an initial assessment. If its result is appealed by the licensee or otherwise questionable, a Phase 3 evaluation is performed which involves a rigorous PRA analysis using plant specific information and the actual conditions encountered.
- The Phase 2 SDP guidance is intended to be conservative, typically by an order of magnitude.
- PRA evaluations of SG tube integrity challenges are dependent on the outcome of research being performed to address the questions raised by Hoppenfeld's DPO. It is premature to push a detailed PRA evaluation of the SG SDP conditions.

- The SDP uses the term "$3X\Delta P_{NO}$". The performance criterion uses the term "normal steady state full power operations". The agreed upon performance criteria term should be used.

Meeting Result: The NRC intended for this condition to be consistent with the performance criterion. The wording will be corrected in the next version of the SDP.

- Why use the term "rupture" when the industry and NRC have agreed to the definition of burst? The term "tube rupture" needs to be defined and related to tube burst.

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- The definition of "susceptible to rupture" will be difficult to apply. Tubes are not subject to the type of testing during inspections that can determine if rupture would have occurred.

Meeting Result: The NRC will consider adding a definition of rupture to the next version of the SDP. However, because of concerns with licensee's interpretation of whether burst has occurred in cases where testing has been terminated prior to reaching 3ΔP, and because of the risk significance of a tube that is degraded to the point where it would fail during normal operations, they are inclined to keep the "susceptible to rupture" condition as a red finding.

The industry agreed with the concept that a tube degraded to this point is a significant safety concern, but vigorously opposed the creation of a new term – "susceptible to rupture" – to characterize this condition. We suggested that the condition be revised to apply to a tube that bursts prior to achieving 1xΔP. In this case ΔP would be determined in a manner consistent with the structural integrity performance criteria - the largest differential pressure occurring over the full range of normal operating conditions including startup, operation in the power range, hot standby, and cooldown and all anticipated transients included in the design specification.

The NRC will consider our proposal.

- Assigning a red color to a tube rupture is not consistent with the ROP process. A tube rupture is an event – events are covered by management directive 8.3 (which determines what level of immediate response NRC provides for the event). Later inspection may result in performance deficiencies which will then be assessed using the SDP.

Meeting Result: The NRC agreed with our point and will revise this wording in the next version of the SDP if they are more than minor.

- Explain how the four conditions listed on page J-7 of the SDP (NDE technology, noise, in situ screening criteria, and benchmarking CM/OA) relate to the SDP color bands and inspection effort. These seem to be inconsistent with the "Minor Finding" questions on page J-14.

Meeting Result: This information was not intended to apply specifically to any of the color bands in the SDP, but to apply to the NRC's ISI Inspection Procedure (71111.08), indicating conditions where additional attention is appropriate. The NRC did state that conditions such as these may result in a "green" finding if the condition is "greater than minor" as determined by 0612 Appendix B, section C.

- Explain the distinction made between B&W and U-tube plants with respect to risk significance if a tube degrades such that it cannot sustain a MSLB (page J-1). The B&W plants are treated more severely on the basis that a MSLB or similar high delta-P event is more likely to occur at a B&W plant. (The differences in SG design are already included in the loads that are considered when determining whether the tube can sustain a MSLB.) A MSLB event is not inherently more or less likely on a B&W plant.

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High primary-to-secondary differential pressure events are assigned a frequency of 1E-2 for B&W plants and 1E-3 for U-tube plants (see page J-11). This is based on several secondary-side depressurization events in the B&WOG operating experience where high differential tube pressures were reached. These events should not be included in the calculation of this frequency because corrective actions have since been taken at the B&WOG plants to eliminate the design feature that was the cause of these events. Specifically, there was a problem with MSSVs sticking open due to manual lift levers sticking. The manual lift levers have now been removed from the MSSVs at all but one of the B&WOG plants (for one plant they are required by the State code). Other improvements have also been made over the years at the B&WOG plants to minimize the probability of a large differential tube pressure event. In the high differential pressure events that did occur at the B&WOG plants, there were operational actions that could have minimized the differential pressure that were not taken, because plant owners at the time were not sensitive to the risk.

Meeting Result: The NRC stated that the difference is due to several actual events and operating experience, not only to the event discussed in the second paragraph of the comment.

- LERF calculation (see page J-11 - The staff assumes that 100% of the delta-CDF is also delta-LERF. This assumption fails to consider factors that may reduce the fraction of the CDF that goes to LERF. This includes availability of feedwater, availability of SG isolation, and whether or not core damage involved early or late failure of ECCS. The status of these systems affects both the timing of core damage (allowing time for evacuation of the close-in population) and reduction or scrubbing of the release. In addition, once core damage has begun, Severe Accident Management Guidance will be invoked. Fundamental to this guidance is quenching and cooling overheated core material, protecting remaining fission product boundaries, restoring compromised fission product boundaries and minimizing fission product releases. The staff's calculation does not recognize the contribution of these systems and the operators for minimizing potential off site releases during SG tube rupture related severe accidents.

Meeting Result: The comment brings up a valid point, but the issue is a long standing concern that needs to be addressed in the general context of PRA application. For the present, it is standard PRA practice to assume that $\Delta CDF = \Delta LERF$.

- The probability assigned for the operator failure to stop the sequence prior to core damage (0.01 on page J-11) appears to be an order of magnitude higher than the similar quantification used in NUREG-0844. Given the long time to core damage for the highest frequency sequences and the availability of the TSC/EOF for support, the higher failure probability seems unjustified.

Meeting Result: The operator failure probability was obtained from NUREG 1570 which states that the probability of human error varies between 10^{-1} and 10^{-3}.