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WCAP-16125-NP, Rev. 2 (Non-Proprietary)
Project No. 694

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U. S. Nuclear Regulatory Commission
Washington, DC 20555-001

Subject: Pressurized Water Reactor Owners Group
Responses to the NRC Request for Additional Information (RAI) on Topical Report (TR) WCAP-16125-NP, Revision 1, "Justification for Risk-Informed Modifications to Selected Technical Specifications For Conditions Leading to Exigent Plant Shutdown" (PA-LSC-0364 Revision 2)

References:

1. PWROG Letter, F. Schiffley to Document Control Desk, "Transmittal of WCAP-16125-NP, Revision 1, "Justification for Risk-Informed Modifications to Selected Technical Specifications For Conditions Leading to Exigent Plant Shutdown," OG-08-7, January 7, 2008.

2. NRC Letter, Holly D. Cruz of NRR to Mr. Anthony Nowinowski of the PWR Owners Group Program Management Office, "Request for Additional Information Re: Pressurized Water Reactor Owners Group (PWROG) Topical Report (TR) WCAP-16125-NP, Revision 1, "Justification for Risk-Informed Modifications to Selected Technical Specifications For Conditions Leading to Exigent Plant Shutdown", (TAC No. MD8138), January 27, 2009.

In January 2008, the Pressurized Water Reactor Owners Group (PWROG) submitted WCAP-16125-NP (Non-Proprietary), Rev. 1, "Justification for Risk-Informed Modifications to Selected Technical Specifications For Conditions Leading to Exigent Plant Shutdown," for review and approval (Reference 1). In January 2009, NRC staff provided a formal Request for Additional Information (RAI) (Reference 2) for WCAP-16125-NP Revision 1.

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Enclosure 1 to this letter (LTR-RAM-II-09-020-NP) provides the RAI responses to the 10 questions received in Reference 2. Enclosure 2 to this letter provides the primary changes and markups as indicated by revision bars in WCAP-16125-NP Revision 2.

These RAI responses are being provided to support issuance of the Safety Evaluation on WCAP-16125-NP, Revision 2.

Following receipt of the Safety Evaluation for WCAP-16125-NP Revision 2, this letter will be incorporated into the approved version and will be issued as WCAP-16125-NP-A, Revision 0.

If you have any questions concerning this matter, please feel free to call Chad Holderbaum at 412-374-6230.

Sincerely,

on behalf of Dennis Buschbaum

Dennis Buschbaum, Chairman
Pressurized Water Reactor Owners Group

DEB:CMH:rfn

Enclosures 2

cc: PWROG Management Committee
PWROG Licensing Subcommittee
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Response to Request for Additional Information Regarding

Topical Report (TR) WCAP-16125-NP, Revision 1

"Justification for Risk-Informed Modifications to Selected

Technical Specifications for Conditions Leading to Exigent

Plant Shutdown" (TAC No. MD8138)

1. The U. S. Nuclear Regulatory Commission (NRC) staff has determined that the Exclusion Area Boundary (EAB) thyroid dose values calculated with use of the more realistic χ/Q values (10^{-5} to 10^{-4}), and consideration of containment sprays operational, range between 10^{+4} to 10^{+6}. However, your assessment noted that these values range from 10^{+4} to 10^{+5}, resulting in an order of magnitude lower than the EAB thyroid dose values assessed by the NRC staff. Please justify your determination of the EAB thyroid dose values presented in Table 4.3-1 for large early release associated with quantitative health objective by TR WCAP-16125-NP, Revision 1. In addition, please provide detailed calculations showing the derivation of each of the release values (Curies) as shown in Table 4.3-1.

Response

Justify your determination of the EAB thyroid dose values presented in Table 4.3-1 for large early release.

The stated assumption in Table 4.3-1 of the TR is that sprays are assumed to be available for both the bounding χ/Q dose and the realistic range χ/Q dose cases. For the "Approximate 2 hour Ci release (only CSS operable)" entry in Table 4.3-1, the Ci release in Table 4.3-1 is given as a range of 2.5E6 to 30E6 Ci. The upper bound of this range is actually the value calculated for the Large Early Release (LER) <u>without</u> sprays operating (see Section 5.2.1). In an upper bound sense then (taking this release uncertainty into account), the dose could exceed that due to the expected release with sprays; i.e., 2.5E6 Ci of I-131 (see also Section 5.2.1). Therefore, for this case, the dose is calculated as follows:

Bounding χ/Q Dose with Sprays = Ci Release•χ/Q•Breathing Rate•Dose Conversion Factor > 2.5E6 Ci•1E-3 sec/m^3•3.5E-4 m^3/sec•1.1E6 rem/Ci > 1E6 rem thyroid

For the more realistic case, the release is assumed to be limited to that calculated for the case with sprays assumed to be available (2.5E6 Ci of I-131) such that the only uncertainty is in the assumed χ/Q:

Realistic Range χ/Q Dose with Sprays = Ci Release•χ/Q•Breathing Rate•Dose Conversion Factor = 2.5E6 Ci•(1E-5 to 1E-4 sec/m^3)•3.5E-4 m^3/sec•1.1E6 rem/Ci = 1E4 to 1E5 rem thyroid

Provide detailed calculations showing the derivation of each of the release values (Curies) as shown in Table 4.3-1.

1. Large Early Release

<u>Spray Credit</u>

A number of judgments and assumptions have been made in order to determine a representative activity release to the environment associated with a LER. Key to making that determination is the estimate of containment spray impact on the LER release. The spray impact is estimated to be approximately a factor of 12 reduction in the Ci of I-131 released from the containment as compared to the LER case without sprays.

In order to demonstrate that the estimated spray removal impact is not dependent specifically on the TID-14844/Regulatory Guide 1.4 methodology, the Alternative Source Term (AST) spray methodology is evaluated, as well.

Considering first the TID-14844/Regulatory Guide 1.4 methodology (since that is the principal methodology employed in Table 4.3-1), the spray removal rate for iodine is limited to 20 per hour by the applicable regulatory guidance. Usually, that rate is achievable. However, only 91% of the total iodine (the elemental fraction stipulated in Regulatory Guide 1.4) is assumed to be removed at this rate; organic iodine is not removed at all and particulate iodine is removed at a substantially lower rate. Therefore, the integrated iodine airborne (normalized to the release from the RCS so the units of the integral is "hours") over the first two hours may be estimated to be $0.09 \bullet 2 \text{ hours} + 0.91 \bullet (1-e^{-(20 /\text{hour} \bullet 2 \text{ hours})})/20 /\text{hour} = 0.18 \text{ hours} + 0.05 \text{ hours} = 0.23 \text{ hours}$. If the full release were airborne for two hours, the integrated iodine airborne (normalized to the release from the RCS) would be 2.0 hours. Therefore, the spray impact is about an order of magnitude reduction in what the two-hour release would be assuming a uniform fractional release rate from the containment over the two-hour dose period.

For the Alternative Source Term (AST), the results would be similar. Assuming a uniform rate of release from the RCS over ~ two hours as an approximation of the AST, the release rate (normalized to the release from the RCS) would be ~0.5 /hour. Spray removal rates are lower for the particulate-dominated AST than for the TID-14844 elemental iodine. One may estimate the particulate removal value to be between 5 and 10 per hour; an average of 7.5 per hour is used in the example below. In the example, 95% of the activity (the particulate iodine) is removed at 7.5 per hour and ~5% of the activity (the elemental iodine, 4.85% to be exact) is removed at 20 per hour.

Equilibrium is reached rapidly, so the steady-state expression $A = S/\lambda$ (where $S = \lambda A$ at steady state) is used for the spray case to characterize the fraction of the release that's airborne over the first two hours (A) in terms of the fractional release rate (S = 0.5 /hour) and the removal rate (λ = 7.5 /hour for particulate and 20 /hour for elemental iodine). The time-integrated result for the case with sprays is $A \bullet 2 \text{ hours} = 0.5 /\text{hour} \bullet (0.95/7.5 /\text{hour} + 0.05/20 /\text{hour}) \bullet 2 \text{ hours} = 0.13 \text{ hours}$ (normalized, as before, to the release from the RCS). This may be compared to the integrated A over the first two hours without sprays which would be 1.0 hours (again, normalized to the release from the RCS). However, for the first two hours after the release is complete (rather than the first two hours from the start of release), the result would be 2.0 hours without sprays, same as for TID-14844/Regulatory Guide 1.4. So here again, the spray impact is about an order of magnitude reduction in the average amount of activity airborne over the two-hour dose period (i.e., 0.13 hours with sprays vs. 1.0 to 2.0 hours without sprays).

Large Early Release Containment Leakage

Having estimated the I-131 activity in the containment over the first two hours (normalized by the activity release) both with and without sprays, one must estimate the LER uniform containment leak rate over that same period in order to obtain the integrated release to the environment. The fraction released to the environment is assumed to be 30% for the case without sprays and 2.5% for the case with sprays.

To justify these two estimates, consider, for example, a representative LER pathway consisting of a 6" diameter (0.2 ft^2) opening (e.g., a failed-open mini-purge flow path producing a pre-existing containment failure). Assuming a sonic velocity of ~1100 fps through this pathway, it would exhibit a leak rate of about 220 cfs, amounting to a fractional leak rate of ~6 /day or ~0.25 /hour for a typical containment free volume of 3.0E6 ft^3. This leak rate is small enough (relative to the spray removal rates of >7.5 per hour) to not significantly alter the impact of sprays, but large enough to result in substantial removal of containment activity in two hours (i.e., $1-e^{-0.25 /\text{hour} \bullet 2 \text{ hours}} = \sim 40\%$ release).

In the absence of sprays, some natural removal would be expected to occur, reducing the 40% release to an estimated 30% release over two hours for the given leak rate.

For a 24-hour release, the 0.25 per hour containment leak rate is not sustainable because of decreasing containment pressure. Under these conditions, natural removal would be expected to have an even greater impact on the amount released than that assumed for the two-hour release. However, no attempt has been made to estimate more closely what the potential 24-hour release would be except to indicate >30% for the 24-hour release in Table 4.3-1.

With sprays in operation, the average amount of activity airborne in the containment over the first two hours (and the amount leaked) would be reduced by nearly an order of magnitude as documented above. Since sprays also tend to reduce the containment pressure and leak rate (as well as the airborne activity), the overall spray impact has been estimated to be about a factor of 12 (20% greater than the estimated factor of ten impact of sprays on airborne activity alone), reducing the fraction of core inventory released over the first two hours from 30% to 2.5%. Importantly, the nature of sprays is to reduce releases beyond two hours even more dramatically than the two-hour releases. For this reason, the 24-hour release for the spray case is stated to be the same as the two-hour release in Table 4.3-1.

Large Early Release Activity Release

The conversion of percentages to Ci of I-131 has been done on the basis of 1E8 Ci of I-131 in the core (typical for a 4000 MWt core). Therefore, the 30% release is stated as 30E6 Ci of I-131 and the 2.5% release is stated as 2.5E6 Ci of I-131.

Note that the range of I-131 releases has been given as 2.5E6 to 30E6 Ci of I-131 for all five of the applicable entries in Table 4.3-1 for the Large Early Release. This is because of the uncertainties in the above estimates. For cases without sprays, one would expect the release to be near the upper end of the stated range. For cases with sprays, one would expect the release to be at the lower end of that range, particularly when "realistic" doses are being calculated.

Regarding the impact of the Iodine Cleanup System (ICS), the Shield Building Emergency Air Cleanup System (SBEACS), the Penetration Room Emergency Air Cleanup System (PREACS), and/or the ECCS Pump Room Emergency Air Cleanup System (ECCS-PREACS), it is doubtful these systems would be effective in reducing the activity released for a large, pre-existing opening, an Interfacing-system LOCA (ISLOCA) initiator, or an energetic containment failure. These are the containment failure modes typically considered in connection with a LER.

2. MHA Release

The MHA release is similar to that for the LER except the release from the core is reduced by about a factor of 2 to 2.5, the containment leak rate is reduced by a factor of 1200 (~6 per day to 0.005 per day), and natural removal would be expected to be somewhat more effective than the LER case because of greater residence time inside containment. These three effects are estimated to reduce the LER value without sprays (30E6 Ci I-131 leaked) by a factor in excess of 3000. The estimated release for the MHA without sprays (and no other mitigation system) is a value <1E4 Ci I-131.

For the MHA with some or all mitigation systems available, sources other than containment leakage (specifically, ESF leakage) are likely to become important. A sump volume of 500,000 gallons and an ESF leak rate of 2 gpm are assumed, leading to a fractional leak rate of 4E-6 per minute.

Assuming 50% of the core inventory of I-131 is in the sump (5E7 Ci), the ESF leakage release rate for I-131 (assuming 10% iodine re-evolution) is 20 Ci per minute or 2400 Ci over two hours. The order of magnitude reduction for sprays is taken into account reducing the containment leakage contribution to <1E3 Ci I-131 from <1E4 Ci I-131 without sprays. The sum of the containment leakage and the ESF leakage contributions is presented as <3.5E3 Ci I-131 if the Containment Spray System (CSS) is available, but no other mitigation systems are available.

For the case of CSS available as well as the ICS, the SBEACS, or the PREACS being available (but not all), an additional DF of 2 is applied to containment leakage I-131 release. This is based on virtually complete removal of the iodine in any of the containment leakage captured by these containment leakage collection systems, but the potential for as much as 50% bypass with not all systems being available. The DF of 2 is viewed as a minimum DF value. With the DF of 2 credit for the containment leakage contribution, the overall I-131 release is reduced from <3.5E3 Ci to <3.0E3 Ci.

If there is no secondary treatment of containment leakage (i.e., no ICS, SBEACS, or PREACS), but the ECCS-PREACS is available, the ESF leakage contribution is expected to be reduced by a factor of at least 20 (120 Ci of I-131 released) since there is little potential for bypass of systems designed to collect iodine released from ESF leakage. Since there is already conservatism in the <1E3 Ci of I-131 from containment leakage, the result for this combination (CSS + ECCS-PREACS) is stated as <1E3 Ci of I-131.

Finally, if all mitigation systems are available, a DF of 20 is assumed to be available for all containment and ESF leakage, reducing the <3.5E3 Ci I-131 released (sprays only) to <1.5E2 Ci I-131 released (recognizing the conservatism in the <3.5E3 Ci value).

3. DBA with Limited Fuel Damage

For the DBA with limited fuel damage case, two events were compared. One is a large LOCA with successful core cooling (estimated to involve a release from the fuel of less than 0.1% of the core inventory of I-131) and the second is a rod ejection accident. The second case (the rod ejection accident) was estimated to be more limiting.

The two-hour release without mitigation was estimated on the basis of 7% cladding failure and a gap fraction of 10%, leading to a total release from the core of 0.7% of the core inventory of I-131 or 7E5 Ci of I-131.

Both the steam generator release pathway and the containment release pathway were evaluated for the rod ejection accident with the containment release pathway being judged as more significant by about a factor of 40 (without mitigation). The two-hour, unmitigated release was estimated by assuming a containment leakrate of 0.005 per day (~0.00021 per hour) and a DF of 2 for plateout inside containment. Therefore, the unmitigated release is 7E5 Ci I-131•0.00021 per hour•2 hours•0.5 = 147 Ci of I-131. This value has been entered in Table 4.3-1 as <200 Ci of I-131.

Applying a DF of 10 for sprays reduces the release to <20 Ci of I-131.

For consideration of ICS, SBEACS, or PREACS, the same DF of 2 (considering the potential for bypass) has been applied as was applied for the MHA. This consideration reduces the release to <10 Ci I-131.

Because ESF leakage is not considered for the rod ejection accident, the ECCS-PREACS has no impact, and the release remains the same as sprays-only; i.e., <20 Ci of I-131, if only sprays and ECCS-PREACS are available.

With all mitigation systems available, the <20 Ci of I-131 could nominally be reduced to <1 Ci I-131. However, the potential for the steam generator release pathway precludes this reduction. If all of the activity were released via the steam generator pathway, the release to the environment would be ~10 Ci of I-131. With some of the activity released via each pathway, the result would be a release to the environment of <10 Ci I-131, but not <1 Ci I-131.

2. The TR proposes that the end states for some of the new Technical Specifications (TS) actions be Mode 4 instead of Mode 5. The NRC staff has previously approved for implementation TS Task Force Traveler (TSTF)-422-A which revises TS action end states. However, the proposed end states identified in Table 2-1 are not, in all cases, consistent with TSTF-422-A. Specifically, limiting conditions for operation (LCOs) 3.6.8 and 3.6.10 are not in the scope of TSTF-422-A, and should retain a Mode 5 end state. However, LCO 3.7.11 and 3.7.12 are in the scope of TSTF-422-A with a Mode 4 end state, this end state could be retained.

   Further, a licensee must implement TSTF-422-A to justify the revised end states of this TR for these new TS actions. If a licensee chose to request implementation of this TR without having applied for TSTF-422-A, then the existing end states (i.e., Mode 5) of its TS should be retained for consistency with the end state for the one inoperable train action requirement.

   The TR should be revised to: 1) make the end states consistent with the previously approved TSTF-422-A end states and 2) to identify the requirement to retain plant-specific consistency of the LCO action end states if TSTF-422-A has not been implemented.

Response

The request to modify end states has been removed. This has resulted in changes to Table 2-1, Sections 4.4 and 4.5, and discussions contained in Sections 5.2.1 and 5.2.2.

3. In Table 4.1-1 for the Low Pressure Safety Injection (LPSI) system and power-operated relief valve (PORV), the NRC staff requests the following clarifications:

   a) LPSI is identified as a backup mitigation function for small break Loss-of-Coolant Accidents (LOCAs) and Steam Generator Tube Ruptures (SGTR). Further details describing how the risk analyses credit this system for mitigation of these initiating events are requested.

   b) The pressurizer PORV is identified as not required for mitigation of a SGTR. Typically, a PORV is used for depressurization of the Reactor Coolant System (RCS) and termination of primary-to-secondary leakage.

Response

(a) The LPSI was not credited in the SGTR assessment. The footnote (d) will be changed to (b) "System/Component is not required to avert core damage for this event".

(b) Table 4.1-1 identified the PORV as not being required for mitigation of an SGTR. While the PORVs may be used for depressurization, CEN-152 (Combustion Engineering Owner's Group "Emergency Procedure Guidelines," (EPGs)) directs that they should only be used as a last resort in the unlikely event that main and auxiliary pressurizer spray are not available and it is necessary to lower pressurizer pressure. The EPGs directs a controlled cooldown while staying within post accident Pressure-Temperature limits and cooldown rates. Pressure control by a PORV requires close operator attention, because the resultant pressure decrease, when the PORV(s) is opened, can be dramatic. In addition, the operator must closely monitor RCS inventory control and pressure/temperature conditions in the RDT/containment while utilizing this method. As a result of the low likelihood of the use of the PORV for this event, component was identified with footnote b, "System/Component is not required to avert core damage for this event".

4. Table 4.3-2 identifies the probability of a system challenge during the proposed new action requirement of 24 hours. Please provide an explanation as to why this not then multiplied by the frequency of entering the new action requirement (i.e., 1-in-3 years or 1-in-5 years) as was done with the core damage mitigation systems in Table 4.1-3.

Response

The intent of the table was to demonstrate a bounding likelihood of the system being challenged within the AOT. The expected frequency of this challenge may be estimated by dividing the per entry challenge probability by a factor reflecting the frequency of condition entry (e.g., 1-in 3 years). This would effectively result in challenge frequencies between 4E-08 per year and 2.7 E-07 per year. With the exception of the containment spray, the systems identified in the subject table are cooling, ventilation and /or radiological cleanup systems that do not contribute to core damage frequency or large early release frequency. Thus, regardless of the system challenge frequency the CDF and LERF for these systems is zero. The CS spray CDF and LERF impacts are separately evaluated in Tables 4.1-3 and 4.2-1b respectively.

5. In all of the subparts of Section 5.1 for the core damage mitigating systems, the basis for the proposed change is not adequately described. Specifically, the Incremental Conditional Core Damage Probability (ICCDP) and Incremental Conditional Large Early Release Probability (ICLERP) are typically identified, but the TR in Section 4.0 (Page 9, third paragraph) had previously stated that Regulatory Guide (RG) 1.174 requirements for core damage frequency (ΔCDF) and large early release frequency (ΔLERF) were the applicable basis for these changes. Tables 4.1-3 and 4.2-1b present these metrics, although there is no comparison to the RG 1.174 guidance. The TR needs to clearly identify the basis for which the NRC staff is being requested to approve these changes.

Response

The appropriate subsections of 5.1 have been modified to specifically compare the incremental risks with both the RG 1.174 and RG 1.177 guidelines. The results of this comparison are summarized below and are captured in Section 4.2.5.

Comparison of Estimated Incremental Risks to RG 1.174 Guidelines for "Permanent" Change				
System	**Change in CDF (1/yr)**	**RG 1.174 Guideline Metric for "Small Change" in Mean CDF**	**Change in LERF**	**RG 1.174 "Small Change" in Mean LERF**
SIT	4.57E-09	1.00E-06	1.37E-11	1.00E-07
LPSI	4.11E-08	1.00E-06	1.23E-10	1.00E-07
CS (no CARC available)	1.67E-07	1.00E-06	2.81E-09	1.00E-07
PORV	1.53E-07	1.00E-06	1.11E-08	1.00E-07
Boration Systems	1.55E-08	1.00E-06	1.12E-09	1.00E-07
Pressurizer Heaters (once in 3 years)	1.00E-07	1.00E-06	3.76E-09	1.00E-07
Pressurizer Heaters (once in 5 years)	6.00E-08	1.00E-06	2.26E-09	1.00E-07

Comparison of Estimated Incremental Risks to RG 1.177 Guidelines for "TS Change"				
System	**ICCDP**	**RG 1.177 "Small Change" in Mean CDF**	**ICLERP**	**RG 1.177 "Small Change" in Mean LERF**
SIT	1.37E-08	5.0 E-07	4.11E-11	5.0 E-08
LPSI	1.23E-07	5.0 E-07	3.70E-10	5.0 E-08
CS (no CARC available)	5.02E-07	5.0 E-07	8.44E-09	5.0 E-08
PORV	4.60E-07	5.0 E-07	3.32E-08	5.0 E-08
Boration Systems	4.66E-08	5.0 E-07	3.36E-09	5.0 E-08
Pressurizer Heaters	3.01E-07	5.0 E-07	1.13E-08	5.0 E-08

For those systems where changes in the unavailability of the system have no direct impact on ICCDP or ICLERP and will not change the plant CDF or LERF (e.g., ECCS PREACS), the following was added to the Section 5 discussions.

"Since extending the AOT on these systems has no impact on the aforementioned risk metrics, the impact of the proposed modification to the TS for this system is below the RG 1.174 incremental risk guidelines and derivative RG 1.177 TS guidelines."

6. Section 5.1.3 for Tier 2 Restrictions refers to the Defense-in-Depth section, which states that the TS will include an action to confirm that LCO 3.7.5 is met. It is not clear to the NRC staff what this means (i.e., are all auxiliary feedwater pumps required to be operable?). In addition, LCO 3.7.5 is not always applicable in Mode 4 in the standard TS. It is not clear whether application of the new TS action in Mode 4 would therefore be acceptable. The TR needs to address these issues.

Response

The defense-in-depth considerations for Specification 3.4.11, PORVs, will require verification that LCO 3.7.5, "AFW System," is met. In Technical Specifications, the term "met" means that the LCO (which requires the AFW system to be Operable) is met. Therefore, all AFW trains must be Operable. LCO 3.4.11 is applicable in Modes 1, 2, and 3. LCO 3.7.5 is also applicable in Modes 1, 2, 3.

7. In Section 4.3.1.2, the TR states that availability of Containment Spray (CS) reduces the need for the additional fission product filtering afforded by the Shield Building Exhaust Air Cleanup System (SBEACS), Penetration Room Exhaust Air Cleanup System (PREACS), and Integrated Control System (ICS). However, in Sections 5.2.1 (SBEACS), 5.2.2 (ICS), and 5.2.6 (PREACS), the availability of the CS system is not discussed, nor is any Tier 2 or Tier 3 requirement identified. The availability of CS would seem to be an appropriate defense-in-depth consideration for these systems. The TR needs to address this concern.

Response

The TR states that the availability of containment sprays is a defense in depth consideration and adds the verification of an Operable train of containment spray to the Required Actions of the applicable Technical Specifications. (See "Defense in Depth" discussions in the associated Section 5 entries). As the system inoperability has no impact on CDF or LERF, this action does not meet the definition of Tier 2 or Tier 3 actions. In some cases, these defense in depth actions were inaccurately identified as being Tier 2 requirements. The TR has been corrected.

8. Section 5 identifies both Tier 2 restrictions and Tier 3 restrictions for each TS LCO. However, there are also recommendations found in other sections such as Defense-in-Depth, which are not reflected in either the Tier 2 or Tier 3 sections. This seems to establish a third layer of restrictions. It is not clear how the NRC staff is intended to consider these items in its Safety Evaluation (SE). Are these requirements for implementation? The TR needs to clarify its intent.

Response

Regulatory Guide 1.174 states that risk-informed changes to the Technical Specifications must be based on five principles, summarized as:

1. The proposed change meets the regulations.
2. The proposed change is consistent with the defense-in-depth philosophy.
3. The proposed change maintains sufficient safety margins
4. When proposed changes result in an increase in core damage frequency or risk, the increases should be small and consistent with the intent of the Commission's Safety Goal Policy Statement.
5. The impact of the proposed change should be monitored using performance measurement strategies.

Tier 2 and Tier 3 considerations fall under the fourth and fifth principle: the changes in risk should be small and should be monitored using performance measurement strategies (e.g., the program in place to satisfy 10 CFR 50.65, the Maintenance Rule).

Defense in depth actions meet the second principle, and therefore, represent a separate set of restrictions. In risk-informed changes that affect the AOT of a single train of a system, the defense-in-depth is provided by the remaining Operable train of the system. In the proposed change, the subject systems are inoperable and in some cases additional defense-in-depth requirements are identified. The TR takes the position that these defense-in-depth requirements are sufficiently important to include in the plant's Technical Specifications and are a condition on the use of the proposed AOTs.

Information on these principles has been added to Section 1.0 of the TR. Table 2-2 has been added to the TR to provide a summary of the actions to be included in plant documentation including administrative guidance, CRMP and Technical Specifications.

9. The subsections in Section 5.2 addressing the radiological control systems, the basis for the proposed changes are not clear. For example, in Section 5.2.1 for the SBEACS, the only basis for the new TS action is that there is no impact on ICCDP and ICLERP. All the other statements in this section are statements of fact about the system function. A clear basis must be established for acceptability of the proposed changes. This will involve not only the zero impact on severe accidents, but should also clearly identify the defense-in-depth afforded by the other operable systems (i.e., CS for the SBEACS), and the calculated frequency of having a "less-than-LERF" release meeting the RG 1.174 acceptance guidelines for LERF.

Response

Section 5.2 discussion of radiological control systems is requesting approval of these changes based on the low risk impact of the change as defined in RG 1.174 and RG 1.77, the defense in depth afforded by an Operable train of containment spray and the low frequency of potential "Less than LERF" releases. Furthermore, repair of these systems "at power" reduces the potential for any additional risks that may be associated with transitioning the plant to shutdown and returning the plant to power. The individual sections have been re-written accordingly.

10. The NRC staff review noted the following items during its review of the TR which may warrant some revisions to the document.

a) In Section 1.0, Page 1, and in other places throughout the TR, a distinction is drawn between Tier 2 actions and Tier 3 actions, based on the inclusion of Tier 2 actions in the TS action statement. The NRC staff notes that this is not consistent with RG 1.177, Tier 2 and Tier 3 considerations. RG 1.177 defines Tier 2 considerations as any restriction on equipment unavailability which is required to avoid high risk configurations. Tier 3 considerations involve the application of a configuration risk management program to assess emergent equipment unavailabilities. The redefinition of Tier 2 and Tier 3 in this TR may lead to confusion during implementation by licensees and will not be consistent with the NRC staff SE, which will use the RG 1.177 definitions.

Response

As discussed in the previous responses, Tier 2 considerations are not appropriate for inclusion in the Technical Specifications. Technical Specification Required Actions are added to various Specifications to address defense-in-depth. In some cases, the TR inappropriately attributed those actions to Tier 2 considerations. The TR has been corrected and additional explanation has been added to Section 1.0 to clarify the relationship between defense in depth, Tier 2, and Tier 3 considerations.

b) In Section 4.1.1, sentences five through seven ("In this bounding risk approach,...") and sentence 11 ("In general, it is assumed...") conflict, in that the sentences five through seven states that core damage is assumed based on unavailability of the systems, and sentence 11 says this is true only "in general."

Response

Text has been rewritten to remove this conflict.

c) In Section 4.1.2, a separate calculation of the ICCDP for a 23-hour period is provided. This is inconsistent with RG 1.177, which defines the ICCDP as the incremental risk over the entire action time, not just for the proposed increase in time.

Response

Calculations have been adjusted to consider the full AOT. This resulted in changes to Tables 4.1-2, 4.1-3, 4.2-3b, 4.2-2c, 4.2.5 and associated discussion in Sections 4 and 5.

d) In Section 4.2, Category 2 (severe accidents accompanied by loss of containment isolation) is identified as resulting in an early release (last sentence of first paragraph), then it is further clarified that Category 2 encompasses a range of events varying from early to late, and scrubbed and unscrubbed. These two sentences are inconsistent.

Response

While releases occurring during events with an unisolated containment can take many forms, all unisolated containment conditions were considered to be contributors to LERF. This is a conservative position and will increase the expected LERF contribution.

e) In Section 4.2.4, Page 28, under Final Comments, the term ΔLERP is assumed to be a typographical error, and should be ΔLERF.

Response

The term has been changed in the revised TR

f) In Section 4.3, Page 28, second paragraph after the bullet list of systems, it is not clear to what "containment iodine controlled atmospheric cleanup systems" refers, and it is also not clear why this and the control room emergency air temperature control system are specifically described in the second paragraph.

Response

The phrase has been revised to refer to all cleanup systems identified above. The revised phrase reads "atmospheric iodine cleanup systems". The CREATCS was called out in addition since it also controls environmental temperature.

g) In Section 5.0, Page 39, the paragraph after the list of subsections identifies that defense-in-depth is not maintained. The prior discussions which identify that there is significant redundancy of mitigation capability among the various systems being evaluated with regards to their impact on mitigation of offsite dose made a case that there is defense-in-depth maintained for achieving the dose mitigation function.

Response

The statement refers specifically to the fact that the TS is entered based on both trains of a system being inoperable. Other systems provide defense in depth capability. This is clarified in the revised TR as follows:

The TS changes being proposed generally are associated with the inoperability of an entire system (or unavailability of a given function). To address this loss of function, public safety is maintained by ensuring public risk is acceptably low, taking compensatory measures to provide defense in depth using alternate systems, and by providing an opportunity to repair the equipment during power operations thereby potentially avoiding the additional risk of plant transitions.

h) In Section 5.0, Page 39, the statement that the one hour plant shutdown (assumed to refer to TS 3.0.3 action requirement) is based on an inoperable containment being a violation of plant design is without basis.

Response

The TR has been reworded as follows: "The requirement for an immediate (1 hour) shutdown is usually based on the loss of an important safety function. The 1 hour time to initiate a plant shutdown was chosen to provide time to prepare for the plant evolution. The goal is to place the plant in a condition where the health and safety of the public could be better assured, but in a controlled manner."

i) In Section 5.1.2, Page 44, it is stated that the reactor vessel head vents may be cycled during a plant cooldown to eliminate steam voids which may have formed. The NRC staff considers this statement to be inaccurate since the purpose of the system is to vent non-condensable gasses only. Opening the head vents in a saturated RCS will only further increase voiding in the head.

Response

The sentence has been reworded to remove reference to head vents as follows:

"Also, while the unavailability of pressurizer heaters may complicate post-trip cooldowns, a successful cooldown is expected with a minimal impact on plant risk due to the ability to control pressure by adjusting the cooldown rate and/or adjusting RCS make-up flow rate."

j) In Section 5.1.5,Page 52, in the Basis for Proposed Change subsection, the third and fourth sentences regarding LPSI impact on SGTR events appear to be incomplete:

   i. The clause "as for many systems" needs further explanation as to what is intended to be conveyed.

Response

The associated text has been revised as follows:

"There is no significant impact of the unavailability of LPSI following SGTR events. A short term unavailability of the LPSI subsystems will result in a negligible incremental increase in the plant risk associated with large LOCA events."

References to the SDC function of LPSI are removed from the TR as no change is being requested to the SDC specification requirements.

   ii. The statement that LPSI is "required to be aligned to the SDC [shutdown cooling]" is not understood in the context of a justification for condition where neither train of LPSI is available.

Response

References to the SDC function of LPSI are removed from the TR as no change is being requested to the SDC specification requirements.

iii. The statement regarding the "risk impact of a plant shutdown with availability of SDCS [shutdown cooling system]" " is not understood since neither LPSI is available for shutdown cooling.

Response

References to the SDC function of LPSI are removed from the TR as no change is being requested to the SDC specification requirements.