2.5 x 10^{-6}/ry to 2.0 x 10^{-5}/ry. This gives a total LERF estimate for the staffs analysis as:

LERF from additional CDF	=	2.85 x 10^{-5}/ry
LERF from "high/dry" base CDF	=	2.5 x 10^{-6}/ry to 2.0 x 10^{-5}/ry
total LERF	=	3.10 x 10^{-5}/ry to 4.85 x 10^{-5}/ry

This result is well above the "red/yellow" threshold value of 1 x 10^{-5}/ry threshold used in the significance determination process.

Sensitivity Study

As a sensitivity study, the staff also analyzed a case crediting the licensee's distinction between LERF and non-LERF sequences. Using the licensees conditional LERF probabilities, these results become:

for SGTR >225 gpm:

0.33/yr x 7.75 x 10^{-5} x 0.13 = 3.32 x 10^{-6}/ry

for SGTR between 75 and 225 gpm:

0.67/yr x 1.60 x 10^{-6} = 1.07 x 10^{-6}/ry

for MSLB with SGTR >225 gpm:

0.001/yr x 0.33 x 0.25 x 1 x 10^{-2} = 8.25 x 10^{-7}/ry

for MSLB with SGTR between 75 and 225 gpm:

0.001/ry x 0.67 x 0.25 x 1.0 x 10^{-3} = 1.67 x 10^{-7}/ry

5.38 x 10^{-6}/ry LERF from CDF crediting licensee's reduction factors

So, if the staff also credits the licensee's basis for considering 83% of the CDF from spontaneous ruptures to create releases too low to be in the LERF category, then the sum of the LERF contributions for all sequences considered by the licensee would be below 1 x 10^{-5}/ry. However, as discussed above, the licensee did not include any consideration of the additional LERF that would result from steam generator depressurization-induced tube ruptures during other core damage accidents, such as those caused by SBO events. In the staff's base case analysis, above, that contribution was estimated in the range of 2.5 x 10^{-6}/ry to 2 x 10^{-5}/ry. Including that contribution, the corresponding sensitivity case LERF results is:

LERF from additional CDF	=	5.38 x 10^{-6}/ry
LERF from "high/dry" base CDF	=	2.5 x 10^{-6}/ry to 2.0 x 10^{-5}/ry

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low sensitivity study total LERF = 7.88×10^{-6}/ry to 2.54×10^{-5}/ry

Thus, the range of results for the sensitivity case include the numerical threshold for the " red/yellow" determination, with the larger portion of the range on the "red" side. From this sensitivity case, the staff concludes that the question about the reduction in radiological releases created by a functioning steam line safety valve could be important when a plant is known to have a low "high/dry" component of its base CDF plus a high probability of maintaining the degraded steam generator secondary in a pressurized condition until the RCS fails inside the containment. However, the licensee did not address those factors in its response to the staff's initial risk assessment. Therefore, on the basis of the information available, the staff concludes that it is most probable that a LERF contribution above 1×10^{-5}/ry will occur for a year during which a steam generator is degrading severely enough to allow a tube to rupture during normal operation.

Staff Conclusion

The foregoing staff review and analysis has estimated that, when all contributions to LERF are considered, the condition being assessed is most likely to remain in the "red" category, with its LERF increment above the 1×10^{-5} threshold. This is true even when considerable credit is given for reduced human error probabilities for the smaller break size events and the licensee's rational is credited for taking much of the spontaneous rupture CDF contribution out of the LERF category. On this basis, the staff concludes that the result of its final risk evaluation is best quantified as a "red" result.

Although the range of the sensitivity study results does cross the "red/yellow" numerical threshold, the staff does not consider that to be an appropriate basis for a "yellow" finding for several reasons. Foremost is the fact that the LERF reduction effect that was the subject of the sensitivity case has not been credited in any previous staff risk assessment and has not been studied by the staff to verify the magnitude of the effect. In addition, when that effect is credited, the larger portion of the range of the results remains on the "red" side of the numerical threshold. Finally, that range results from the staff's treatment of factors that the licensee left out of their response to the staff's initial risk assessment. Because the staff's conclusions are intended to serve as a guide for the staff's future oversight activities, it is most appropriate to base them on the staff's own best estimate of the risk, as modified after careful consideration of the material presented by the licensee. It would be inappropriate to require such analyses to meet some more difficult "burden of proof" before oversight activities are permitted or to create a benefit for licensees to maintain uncertainty for staff analysts.

The staff acknowledges that it is the nature of risk analyses that their numerical results are very uncertain. Although not expected, it is possible that knowledge gained in the future would alter this analysis sufficiently to change the conclusion regarding the "color" determination for a similar future inspection finding. However, for the purpose of assigning a color to past licensee performance, the staff believes that the performance should be judged on the basis of the risk perceptions at the time of the performance and finding. In that regard, the staff notes that current PRAs show steam generator tube ruptures to be a dominant contributor to public heath consequences from nuclear accidents. The IPE for Indian Point unit 2 has a conditional core damage probability of 7.75×10^{-5} and a conditional large release probability of 1×10^{-5} for a

steam generator tube rupture. Additionally, though the IPE does not treat the induced tube rupture probabilities, these issues were been known from treatments in NUREGs 0844, 1150, 1477 and 1570. Also, tube support plate flow-slot hour-glassing and the associated tube U-bend apex cracking have been known phenomena that the Indian Point unit 2 technical specifications specifically addressed. Tube ruptures due to these phenomena had occurred prior to 1997. Therefore, it is the staff's position that these risk perspectives at the time of the licensee's actions would warrant a "red" determination, and that mitigating knowledge developed after the fact is not relevant to judging the adequacy of the licensee's performance at a time when that additional knowledge did not serve as a basis for their actions.

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