

$$w_j = \frac{f_j}{\sum_j f_j}; \quad j = 1, 2, \quad (5.8a)$$

$$\Phi_j = w_j \sum_{n=1}^{NP} \sum_{i \in R_n}^I F(D_i^{small}), \quad (5.8b)$$

$$\hat{\Phi} = \sum_j \Phi_j. \quad (5.8c)$$

5.5 Δ LERF frequency

Because the STP RCFC are independent of the concerns raised in GSI-191, and because their design can remove decay and maintain contamination RCB limits within design, concerns raised in GSI-191 would not result in containment failure. The RCFC design allows for simplification of LERF. That is, for the STP design, the change in early release frequency could be assumed directly proportional to the change in core damage frequency:

$$\Delta LERF = LERF_{MOR} \left(\frac{\Delta CDF}{CDF_{MOR}} \right) \quad (5.9)$$

Because all the scenarios in the risk-informed category are LLOCA, only the LLOCA frequency for LERF from the STP PRA model of record contributes to LERF in ROVERD. The LLOCA LERF for the arithmetic mean quantification is $1.73E-10yr^{-1}$. The geometric mean for LLOCA LERF is $3.1E-11yr^{-1}$.

5.6 Results

STP has two Cases (Case 1 and Case 2) other than the condition tested (AREVA, 2008) that are bounding for fine fiber amounts. The tested deterministic case assumed two of the three STP ECCS strainers in operation (single failure criterion). Case 1 is the most likely case when all three strainers are in operation. In this case, far less fiber will accumulate on each strainer than for the tested case. Therefore, Case 1 is bounded by the tested case.

However, Case 2 corresponds to a case where only one train of the three STP ECCS strainers are in operation. Although this case is beyond design basis, it needs to be considered in the risk analysis since at least twice as much fiber would accumulate on the single strainer than when two or more strainers are in operation. In this case, only 1/2 the tested amount of fine fiber can be assumed to be tolerated.

Table 5.2: Case 1 and Case 2 results for geometric (GM) and arithmetic (AM) aggregations of Tregoning et al. (2008, Tables 7.11 and 7.19) data. Frequencies are in events/yr. Also shown are the results for a DEGB-only model for the locations that go to failure.

Continuum Break Model						
Quantile	Case 1 GM	Case 1 AM	Case 2 GM	Case 2 AM	$\hat{\Phi}$ (GM)	$\hat{\Phi}$ (AM)
5 th	2.64E-10	6.47E-09	3.68E-09	2.36E-08	3.08E-10	6.69E-09
50 th	7.50E-09	1.68E-07	8.30E-08	4.92E-07	8.47E-09	1.72E-07
95 th	3.43E-07	4.79E-06	1.81E-06	1.24E-05	3.62E-07	4.89E-06
Mean	1.17E-07	1.56E-06	5.10E-07	3.93E-06	1.22E-07	1.59E-06
DEGB-Only Model						
5 th	9.83E-11	8.18E-09	1.14E-09	1.66E-08	1.12E-10	8.29E-09
50 th	2.86E-09	2.07E-07	2.64E-08	3.90E-07	3.16E-09	2.09E-07
95 th	1.47E-07	7.06E-06	6.85E-07	1.21E-05	1.54E-07	7.13E-06
Mean	5.12E-08	2.06E-06	2.03E-07	3.61E-06	5.32E-08	2.08E-06

Table 5.3: Δ LERF evaluation for geometric and arithmetic means of the Continuum and DEG-only models.

Model	Δ LERF using $\hat{\Phi}$ (GM)	Δ LERF using $\hat{\Phi}$ (AM)
Contiuum break model	4.11E-13	2.99E-11
DEGB-only model	1.79E-13	3.91E-11

5.7 Δ CDF results

When all cases are considered using (5.8), a slightly higher Δ CDF is estimated than when only one strainer is in operation. Table 5.2 summarizes the Δ CDF estimate for geometric and arithmetic averages from Tregoning et al. (2008). The frequencies for the bounding cases are $f_2 = 3.32E - 6yr^{-1}$ (Case 1) and $f_1 = 4.34E - 8yr^{-1}$ (Case 2). As shown, the median Δ CDF is within Region III of the Regulatory Guide 1.174 evaluation ($\ll 1.0E - 06$). Interpolation of Table 5.1 is done using the linear-linear method, (5.2).

As shown in Table 5.2, only the mean and 95th percentile of the arithmetic mean estimate exceed the Region III criterion in (NRC, 2011). As described in the letter to the NRC dated May 22, 2014 (ML14149A434), the geometric method of aggregation is the most appropriate estimator of LOCA frequency from (Tregoning et al., 2008).

5.8 Δ LERF results

Using (5.9), Δ LERF values were calculated using Δ CDF for geometric and arithmetic means using baseline CDF. LERF values for geometric and arithmetic quantifications for LLOCA were used for the baseline LERF values. The results are summarized in Table 5.3.