NUCLEAR ENERGY INSTITUTE

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November 2, 1999

Mr. Richard F. Dudley
Project Manager
U.S. Nuclear Regulatory Commission
Mail Stop11 D19
Washington, DC 20555-0001

PROJECT NUMBER: 689

Dear Mr. Dudley:

On July 15-16, 1999, the NRC held a workshop on spent fuel accidents at decommissioning plants. During the course of the workshop, presentations by the NRC and the industry concluded that spent fuel pools possess substantial capability beyond their design basis to withstand seismic events, but that variations in seismic capacity existed due to plant-specific designs and locations.

As a follow up to the NRC staff's evaluation on October 21, 1999, Ms. Diane Jackson made a request for EPRI seismic data. Attached are a table and three charts. The table contains both the LLNL and EPRI estimates for spent fuel pool (SFP) failure frequency based on Dr. Kennedy's approximate approach.

The approximation approach to estimate SFP failure frequency is as follows: at each site, calculate the annual probability of exceeding 1.824g based on the 10 hz, 5 hz, and 2.5 hz hazard curves. Determine the maximum of these three values and multiply this value by 0.5 to estimate SFP failure.

Key to the table is as follows:
The Table contains 10 columns,
Column 1 contains the site numbers.
Column 2 contains the annual probability of exceeding 1.824g based on the LLNL 2.5 hz hazard curve for each site.
Column 3 contains the annual probability of exceeding 1.824g based on the LLNL 5 hz hazard curve for each site.

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Column 4 contains the annual probability of exceeding 1.824g based on the LLNL 10 hz hazard curve for each site.
Column 5 contains the maximum value from columns 2, 3, and 4 for each site.
Column 6 is column 5 * 0.5.
Column 7 contains the EPRI results, based on Kennedy's methodology, for each site.
Column 8 contains the arithmetic average of the LLNL and EPRI results (columns 6 and 7) for each site.
Column 9 contains the geometric average of the LLNL and EPRI results (columns 6 & 7) for each site.

Column 10 is only used for plotting purposes.

Key to Charts and Notes
Chart 1 contains the LLNL results based on the 1993 LLNL seismic hazard results (column 6).
Chart 2 contains both the LLNL and EPRI results (columns 6 and 7).
Chart 3 contains the geometric average of the LLNL (column 6) and EPRI (column7) results.
The geometric average is used for two reasons - the first is that the hazard curves are lognormally distributed, the second is that the geometric average gives equal weight to both studies, which are equally valid.

Please contact me at (202) 739-8110 or by e-mail (apn@.nei.org) if you have any questions.

Sincerely,

Alan Nelson

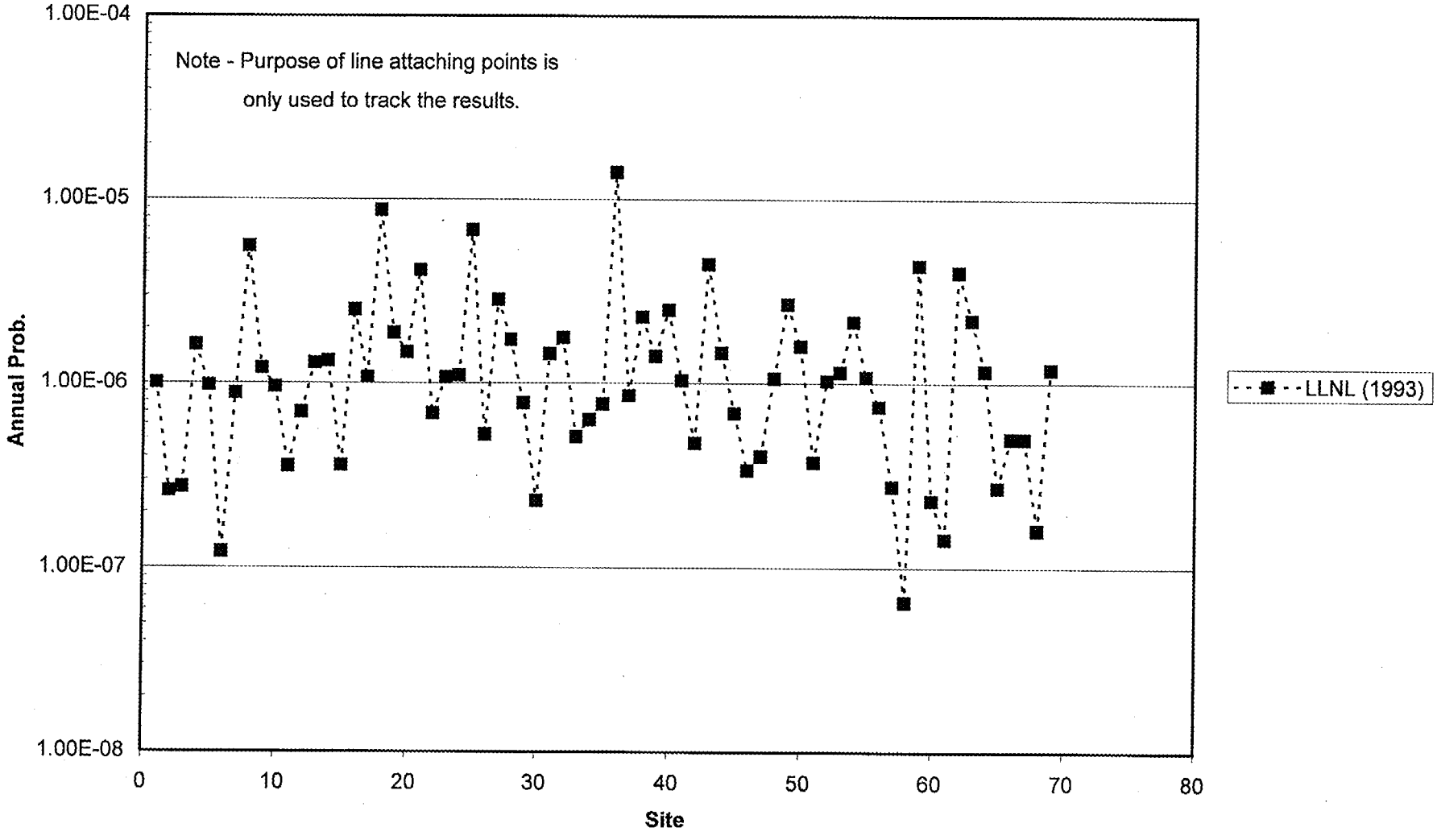
APN:lrh

Enclosure

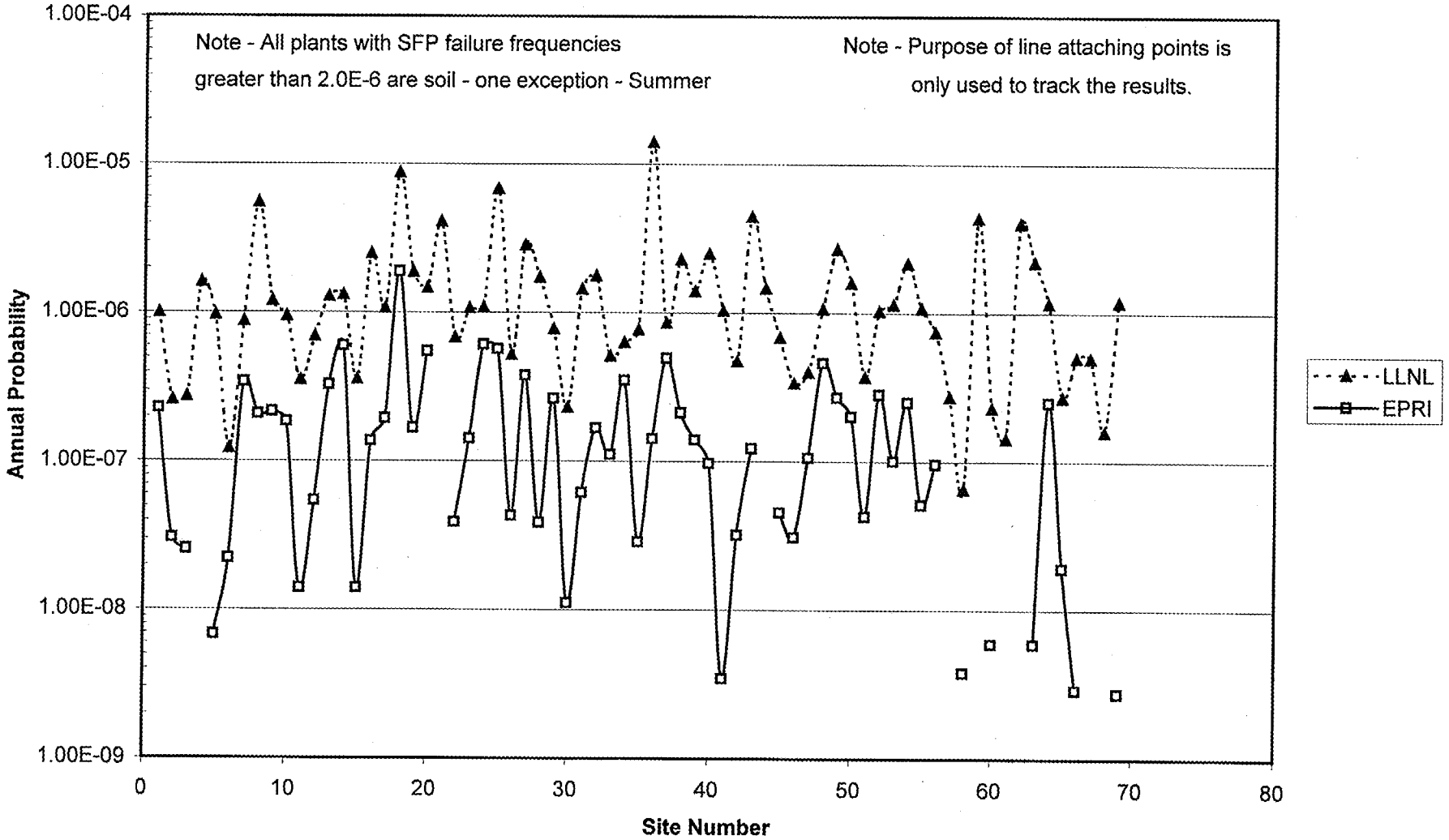
Site #	LLNL 2.5hz	LLNL 5hz	LLNL 10hz	LLNL Max (2.5, 5, 10)	LLNL Max*0.5	EPRI	L+E Avg.	L+E Geometric	
1	1.56E-06	2.00E-06	1.04E-06	2.00E-06	1.00E-06	2.27E-07	6.14E-07	3.73E-07	1.50E-06
2	4.23E-07	5.18E-07	2.44E-07	5.18E-07	2.59E-07	3.03E-08	1.45E-07	6.62E-08	1.50E-06
3	4.04E-07	5.45E-07	2.69E-07	5.45E-07	2.72E-07	2.55E-08	1.49E-07	6.16E-08	1.50E-06
4	2.33E-06	3.22E-06	1.96E-06	3.22E-06	1.61E-06		8.06E-07	8.06E-07	1.50E-06
5	1.94E-06	1.40E-06	4.35E-07	1.94E-06	9.68E-07	6.80E-09	4.88E-07	5.76E-08	1.50E-06
6	2.02E-07	2.44E-07	1.16E-07	2.44E-07	1.22E-07	2.22E-08	7.20E-08	4.00E-08	1.50E-06
7	1.36E-06	1.76E-06	9.54E-07	1.76E-06	8.79E-07	3.42E-07	6.11E-07	4.57E-07	1.50E-06
8	1.11E-05	9.02E-06	2.43E-06	1.11E-05	5.54E-06	2.08E-07	2.87E-06	7.73E-07	1.50E-06
9	1.71E-06	2.41E-06	1.34E-06	2.41E-06	1.21E-06	2.16E-07	7.11E-07	3.92E-07	1.50E-06
10	1.39E-06	1.90E-06	1.10E-06	1.90E-06	9.50E-07	1.85E-07	5.68E-07	3.24E-07	1.50E-06
11	5.24E-07	7.07E-07	3.63E-07	7.07E-07	3.53E-07	1.40E-08	1.84E-07	5.07E-08	1.50E-06
12	1.01E-06	1.39E-06	7.70E-07	1.39E-06	6.95E-07	5.41E-08	3.75E-07	1.42E-07	1.50E-06
13	1.84E-06	2.57E-06	1.42E-06	2.57E-06	1.29E-06	3.27E-07	8.07E-07	5.14E-07	1.50E-06
14	1.88E-06	2.63E-06	1.41E-06	2.63E-06	1.32E-06	5.99E-07	9.58E-07	7.58E-07	1.50E-06
15	5.28E-07	7.14E-07	3.68E-07	7.14E-07	3.57E-07	1.40E-08	1.86E-07	5.10E-08	1.50E-06
16	5.02E-06	3.41E-06	1.00E-06	5.02E-06	2.51E-06	1.37E-07	1.32E-06	4.26E-07	1.50E-06
17	1.65E-06	2.15E-06	1.09E-06	2.15E-06	1.08E-06	1.94E-07	6.35E-07	3.51E-07	1.50E-06
18	9.05E-06	1.75E-05	1.08E-05	1.75E-05	8.74E-06	1.89E-06	5.32E-06	3.17E-06	1.50E-06
19	3.75E-06	2.23E-06	1.05E-06	3.75E-06	1.88E-06	1.68E-07	1.02E-06	4.14E-07	1.50E-06
20	2.28E-06	2.94E-06	1.67E-06	2.94E-06	1.47E-06	5.50E-07	1.01E-06	7.46E-07	1.50E-06
21	6.36E-06	8.23E-06	1.87E-06	8.23E-06	4.11E-06		2.06E-06	2.06E-06	1.50E-06
22	1.13E-06	1.36E-06	7.00E-07	1.36E-06	6.82E-07	3.89E-08	3.61E-07	1.18E-07	1.50E-06
23	1.63E-06	2.14E-06	1.10E-06	2.14E-06	1.07E-06	1.42E-07	6.07E-07	2.94E-07	1.50E-06
24	1.59E-06	2.19E-06	1.25E-06	2.19E-06	1.10E-06	6.11E-07	8.54E-07	7.22E-07	1.50E-06
25	1.21E-05	1.37E-05	4.41E-06	1.37E-05	6.83E-06	5.71E-07	3.70E-06	1.45E-06	1.50E-06
26	8.32E-07	1.05E-06	5.11E-07	1.05E-06	5.24E-07	4.29E-08	2.84E-07	1.10E-07	1.50E-06
27	2.30E-06	5.33E-06	5.70E-06	5.70E-06	2.85E-06	3.78E-07	1.61E-06	7.81E-07	1.50E-06
28	3.46E-06	2.43E-06	8.62E-07	3.46E-06	1.73E-06	3.86E-08	8.83E-07	1.85E-07	1.50E-06
29	1.17E-06	1.56E-06	9.36E-07	1.56E-06	7.78E-07	2.65E-07	5.21E-07	3.72E-07	1.50E-06
30	3.20E-07	4.59E-07	2.61E-07	4.59E-07	2.30E-07	1.11E-08	1.20E-07	3.66E-08	1.50E-06
31	1.79E-06	2.89E-06	5.35E-07	2.89E-06	1.45E-06	6.15E-08	7.53E-07	2.15E-07	1.50E-06
32	3.54E-06	2.31E-06	1.06E-06	3.54E-06	1.77E-06	1.68E-07	9.70E-07	4.04E-07	1.50E-06
33	8.50E-07	1.02E-06	5.15E-07	1.02E-06	5.10E-07	1.11E-07	3.11E-07	1.86E-07	1.50E-06
34	1.02E-06	1.27E-06	6.24E-07	1.27E-06	6.33E-07	3.52E-07	4.92E-07	4.16E-07	1.50E-06
35	1.13E-06	1.54E-06	8.11E-07	1.54E-06	7.69E-07	2.86E-08	3.99E-07	1.07E-07	1.50E-06

36	2.32E-05	2.81E-05	4.67E-06	2.81E-05	1.41E-05	1.42E-07	7.10E-06	1.00E-06	1.50E-06
37	1.33E-06	1.71E-06	9.13E-07	1.71E-06	8.56E-07	4.95E-07	6.75E-07	5.78E-07	1.50E-06
38	3.42E-06	4.59E-06	2.35E-06	4.59E-06	2.29E-06	2.13E-07	1.25E-06	5.17E-07	1.50E-06
39	2.79E-06	1.84E-06	9.73E-07	2.79E-06	1.40E-06	1.40E-07	7.68E-07	3.28E-07	1.50E-06
40	1.25E-06	5.01E-06	2.83E-06	5.01E-06	2.50E-06	9.71E-08	1.30E-06	3.55E-07	1.50E-06
41	1.02E-06	1.32E-06	2.07E-06	2.07E-06	1.03E-06	3.45E-09	5.19E-07	4.23E-08	1.50E-06
42	7.60E-07	9.45E-07	4.85E-07	9.45E-07	4.73E-07	3.20E-08	2.52E-07	8.98E-08	1.50E-06
43	5.49E-06	8.90E-06	1.87E-06	8.90E-06	4.45E-06	1.23E-07	2.29E-06	5.30E-07	1.50E-06
44	2.65E-06	2.79E-06	2.93E-06	2.93E-06	1.46E-06		7.32E-07	7.32E-07	1.50E-06
45	1.08E-06	1.37E-06	6.85E-07	1.37E-06	6.85E-07	4.53E-08	3.65E-07	1.29E-07	1.50E-06
46	5.07E-07	6.74E-07	3.29E-07	6.74E-07	3.37E-07	3.08E-08	1.84E-07	7.53E-08	1.50E-06
47	6.17E-07	8.00E-07	4.18E-07	8.00E-07	4.00E-07	1.06E-07	2.53E-07	1.64E-07	1.50E-06
48	6.36E-07	2.13E-06	1.16E-06	2.13E-06	1.06E-06	4.61E-07	7.62E-07	5.93E-07	1.50E-06
49	4.55E-06	5.39E-06	2.91E-06	5.39E-06	2.70E-06	2.71E-07	1.48E-06	6.34E-07	1.50E-06
50	1.84E-06	3.17E-06	1.25E-06	3.17E-06	1.59E-06	2.01E-07	8.94E-07	4.24E-07	1.50E-06
51	5.71E-07	7.41E-07	3.88E-07	7.41E-07	3.71E-07	4.26E-08	2.07E-07	9.38E-08	1.50E-06
52	6.09E-07	2.06E-06	1.16E-06	2.06E-06	1.03E-06	2.83E-07	6.57E-07	4.31E-07	1.50E-06
53	1.14E-06	2.29E-06	1.12E-06	2.29E-06	1.14E-06	1.01E-07	6.22E-07	2.51E-07	1.50E-06
54	2.37E-06	4.32E-06	2.64E-06	4.32E-06	2.16E-06	2.51E-07	1.21E-06	5.50E-07	1.50E-06
55	1.69E-06	2.15E-06	9.83E-07	2.15E-06	1.08E-06	5.13E-08	5.64E-07	1.70E-07	1.50E-06
56	1.18E-06	1.49E-06	7.93E-07	1.49E-06	7.43E-07	9.62E-08	4.20E-07	2.01E-07	1.50E-06
57	4.80E-07	5.48E-07	2.49E-07	5.48E-07	2.74E-07		1.37E-07	1.37E-07	1.50E-06
58	9.12E-08	1.30E-07	7.10E-08	1.30E-07	6.51E-08	3.80E-09	3.45E-08	1.14E-08	1.50E-06
59	1.73E-06	8.73E-06	4.59E-06	8.73E-06	4.37E-06		2.18E-06	2.18E-06	1.50E-06
60	3.48E-07	4.61E-07	2.51E-07	4.61E-07	2.30E-07	5.96E-09	1.18E-07	2.65E-08	1.50E-06
61	2.22E-07	2.86E-07	1.61E-07	2.86E-07	1.43E-07		7.15E-08	7.15E-08	1.50E-06
62	4.25E-06	7.43E-06	8.03E-06	8.03E-06	4.02E-06		2.01E-06	2.01E-06	1.50E-06
63	4.41E-06	2.75E-06	4.70E-07	4.41E-06	2.20E-06	5.91E-09	1.10E-06	8.08E-08	1.50E-06
64	6.10E-07	2.33E-06	1.75E-06	2.33E-06	1.16E-06	2.50E-07	7.07E-07	4.20E-07	1.50E-06
65	3.96E-07	5.41E-07	2.41E-07	5.41E-07	2.70E-07	1.91E-08	1.45E-07	5.26E-08	1.50E-06
66	9.98E-07	7.16E-07	1.93E-07	9.98E-07	4.99E-07	2.90E-09	2.51E-07	2.70E-08	1.50E-06
67	9.94E-07	9.40E-07	1.68E-07	9.94E-07	4.97E-07		2.49E-07	2.49E-07	1.50E-06
68	2.34E-07	3.19E-07	1.81E-07	3.19E-07	1.59E-07		7.97E-08	7.97E-08	1.50E-06
69	2.38E-06	1.37E-06	3.73E-07	2.38E-06	1.19E-06	2.75E-09	5.96E-07	4.05E-08	1.50E-06

LLNL SFP Failure Frequency
Based on Kennedy Methodology



SFP Failure Frequency (LLNL-93 and EPRI-89)
Kennedy Methodology



Geometric Mean (LLNL & EPRI)
Kennedy Methodology