

## Sensitivity Analysis

A wide spectrum of sensitivity analyses were completed by requesting that the licensee calculate CCDP values which corresponded to various combinations of HEPs. The analysts determined that the calculated increase in CDF for Fire Zone 99-M was most likely in the range of 7E-6 to 2E-5. The analyst qualitatively determined that an additional increase in the CDF was warranted due the existence of additional fire zones at the facility which also credited the use of operator recovery actions.

The licensee's human reliability analysis (HRA) was completed for non-fire conditions. The dominate recovery actions for a fire in Zone 99-M involved the establishment of emergency feedwater (EFW), the restoration of electrical power, and the establishment of feed and bleed capability. The associated non-fire human error probabilities for these recovery actions were 1.86E-1 for EFW, 1.0E-1 for electrical power, and 6E-3 for feed and bleed. The revised HRA estimate from the licensee included HEP values of 2.6E-1 for EFW, 1E-1 for electric power, and 3.2E-1 for feed and bleed.

The NRC analysts' completed a simplified HRA screening analysis using INEEL/EXT-99-0041, "Revision of the 1994 ASP HRA Methodology (Draft)," January 1999. The HEP values using the assumption that procedures were available, but poor were 1.0 for EFW, 7.5E-1 for electric power, and 7.5E-1 for feed and bleed. The HEP values using the assumption that procedures were adequate were 6E-1 for EFW, 5.5E-1 for electric power, and 5.5E-1 for feed and bleed.

The delta CDF non-fire results were obtained by subtracting the associated recovery term from the NON-FIRE NOMINAL VALUE. The delta CDF revised HRA results (SPAR and Licensee) were obtained by subtracting the associated recovery term from the associated REVISED HRA NOMINAL VALUE.

FIRE ZONE 99M - SEVERITY FACTOR NOT APPLIED				
RECOVERY TERM	CDF	DELTA CDF NON FIRE HRA	DELTA CDF REVISED HRA (SPAR)	DELTA CDF REVISED HRA (LICENSEE)
NON-FIRE NOMINAL VALUE	5.37E-07	N/A	N/A	N/A
REVISED HRA NOMINAL VALUE (SPAR)	2.23E-5	N/A	N/A	N/A
REVISED HRA NOMINAL VALUE ESTIMATE (LICENSEE)	2.28E-6	N/A	N/A	N/A
ELECTRIC POWER 0.3, EFW 0.3, FEED AND BLEED 6E-3	1.21E-06	6.73E-07	N/A	N/A
ELECTRIC POWER 0.3, EFW 0.6, FEED AND BLEED 6E-3	6.05E-06	5.51E-06	N/A	3.77E-6
ELECTRIC POWER 0.6, EFW 0.6, FEED AND BLEED 6E-3	7.73E-06	7.19E-06	N/A	5.45E-6
ELECTRIC POWER 0.3, EFW 0.6, FEED AND BLEED 0.1	8.46E-06	7.92E-06	N/A	6.18E-6
ELECTRIC POWER 0.3, EFW 0.6, FEED AND BLEED 0.3	1.52E-05	1.47E-05	N/A	1.29E-5
ELECTRIC POWER 0.55, EFW 0.6, AND FEED AND BLEED 0.55	2.23E-5	2.18E-5	N/A	2.00E-5
ELECTRIC POWER 0.1, EFW 1.0, FEED AND BLEED 6E-3	2.28E-05	2.23E-05	5.00E-7	2.05E-5
ELECTRIC POWER 1.0, EFW 1.0, FEED AND BLEED 6E-3	2.44E-05	2.39E-05	2.10E-6	2.21E-5
ELECTRIC POWER 0.75, EFW 1.0, FEED AND BLEED 0.75	1.07E-04	1.06E-04	8.47E-5	1.05E-4

2003-358

R17

FIRE ZONE 99M WITH SEVERITY FACTOR APPLIED				
RECOVERY TERM	CDF	DELTA CDF NON FIRE HRA	DELTA CDF REVISED HRA (SPAR)	DELTA CDF REVISED HRA (LICENSEE)
NON-FIRE NOMINAL VALUE	3.15E-07	N/A	N/A	N/A
REVISED HRA NOMINAL VALUE (SPAR)	1.31E-5	N/A	N/A	N/A
REVISED HRA NOMINAL VALUE ESTIMATE (LICENSEE)	1.43E-6	N/A	N/A	N/A
ELECTRIC POWER 0.3, EFW 0.3, FEED AND BLEED 6E-3	7.13E-07	3.98E-07	N/A	N/A
ELECTRIC POWER 0.3, EFW 0.6, FEED AND BLEED 6E-3	3.55E-06	3.24E-06	N/A	2.21E-6
ELECTRIC POWER 0.3, EFW 0.6, FEED AND BLEED 0.1	4.97E-06	4.66E-06	N/A	3.63E-6
ELECTRIC POWER 0.3, EFW 0.6, FEED AND BLEED 0.3	8.94E-06	8.63E-06	N/A	7.6E-6
ELECTRIC POWER 0.6, EFW 0.6, FEED AND BLEED 6E-3	9.74E-06	9.43E-06	N/A	8.40E-6
ELECTRIC POWER 0.55, EFW 0.6, FEED AND BLEED 0.55	1.31E-5	1.28E-5	N/A	1.18E-7
ELECTRIC POWER 0.1, EFW 1.0, FEED AND BLEED 6E-3	1.34E-05	1.31E-05	3.00E-7	1.21E-5
ELECTRIC POWER 1.0, EFW 1.0, FEED AND BLEED 6E-3	1.43E-05	1.40E-05	1.20E-6	1.30E-5
ELECTRIC POWER 0.75, EFW 1.0, FEED AND BLEED 0.75	6.31E-05	6.28E-05	5.00E-5	6.18E-5

## Sensitivity Analysis

A wide spectrum of sensitivity analyses were completed by requesting that the licensee calculate CCDP values which corresponded to various combinations of HEPs. The analysts determined that the calculated increase in CDF for Fire Zone 99-M was most likely in the range of 7E-6 to 2E-5. The analyst qualitatively determined that an additional increase in the CDF was warranted due the existence of additional fire zones at the facility which also credited the use of operator recovery actions.

The licensee's human reliability analysis (HRA) was completed for non-fire conditions. The dominate recovery actions for a fire in Zone 99-M involved the establishment of emergency feedwater (EFW), the restoration of electrical power, and the establishment of feed and bleed capability. The associated non-fire human error probabilities for these recovery actions were 1.86E-1 for EFW, 1.0E-1 for electrical power, and 6E-3 for feed and bleed. The revised HRA estimate from the licensee included HEP values of 2.6E-2 for EFW, 1E-1 for electric power, and 3.2E-1 for feed and bleed.

The NRC analysts' completed a simplified HRA screening analysis using INEEL/EXT-99-0041, "Revision of the 1994 ASP HRA Methodology (Draft)," January 1999. The HEP values using the assumption that procedures were available, but poor were 1.0 for EFW, 7.5E-1 for electric power, and 7.5E-1 for feed and bleed. The HEP values using the assumption that procedures were adequate were 6E-1 for EFW, 5.5E-1 for electric power, and 5.5E-1 for feed and bleed.

The delta CDF non-fire results were obtained by subtracting the associated recovery term from the NON-FIRE NOMINAL VALUE. The delta CDF revised HRA results were obtained by subtracting the associated recovery term from the associated REVISED HRA NOMINAL VALUE.

FIRE ZONE 99M - SEVERITY FACTOR NOT APPLIED				
RECOVERY TERM	CDF	DELTA CDF NON FIRE HRA	DELTA CDF REVISED HRA (SPAR)	DELTA CDF REVISED HRA (LICENSEE)
NON-FIRE NOMINAL VALUE	5.37E-07	N/A	N/A	N/A
REVISED HRA NOMINAL VALUE (SPAR)	2.23E-5	N/A	N/A	N/A
REVISED HRA NOMINAL VALUE ESTIMATE (LICENSEE)	2.28E-6	N/A	N/A	N/A
ELECTRIC POWER 0.3, EFW 0.3, FEED AND BLEED 6E-3	1.21E-06	6.73E-07	N/A	N/A
ELECTRIC POWER 0.3, EFW 0.6, FEED AND BLEED 6E-3	6.05E-06	5.51E-06	N/A	3.77E-6
ELECTRIC POWER 0.6, EFW 0.6, FEED AND BLEED 6E-3	7.73E-06	7.19E-06	N/A	5.45E-6
ELECTRIC POWER 0.3, EFW 0.6, FEED AND BLEED 0.1	8.46E-06	7.92E-06	N/A	6.18E-6
ELECTRIC POWER 0.3, EFW 0.6, FEED AND BLEED 0.3	1.52E-05	1.47E-05	N/A	1.29E-5
ELECTRIC POWER 0.55, EFW 0.6, AND FEED AND BLEED 0.55	2.23E-5	2.18E-5	N/A	2.00E-5
ELECTRIC POWER 0.1, EFW 1.0, FEED AND BLEED 6E-3	2.28E-05	2.23E-05	5.00E-7	2.05E-5
ELECTRIC POWER 1.0, EFW 1.0, FEED AND BLEED 6E-3	2.44E-05	2.39E-05	2.10E-6	2.21E-5
ELECTRIC POWER 0.75, EFW 1.0, FEED AND BLEED 0.75	1.07E-04	1.06E-04	8.47E-5	1.05E-4

FIRE ZONE 99M WITH SEVERITY FACTOR APPLIED				
RECOVERY TERM	CDF	DELTA CDF NON FIRE HRA	DELTA CDF REVISED HRA (SPAR)	DELTA CDF REVISED HRA (LICENSEE)
NON-FIRE NOMINAL VALUE	3.15E-07	N/A	N/A	N/A
REVISED HRA NOMINAL VALUE (SPAR)	1.31E-5	N/A	N/A	N/A
REVISED HRA NOMINAL VALUE ESTIMATE (LICENSEE)	1.43E-6	N/A	N/A	N/A
ELECTRIC POWER 0.3, EFW 0.3, FEED AND BLEED 6E-3	7.13E-07	3.98E-07	N/A	N/A
ELECTRIC POWER 0.3, EFW 0.6, FEED AND BLEED 6E-3	3.55E-06	3.24E-06	N/A	2.21E-6
ELECTRIC POWER 0.3, EFW 0.6, FEED AND BLEED 0.1	4.97E-06	4.66E-06	N/A	3.63E-6
ELECTRIC POWER 0.3, EFW 0.6, FEED AND BLEED 0.3	8.94E-06	8.63E-06	N/A	7.6E-6
ELECTRIC POWER 0.6, EFW 0.6, FEED AND BLEED 6E-3	9.74E-06	9.43E-06	N/A	8.40E-6
ELECTRIC POWER 0.55, EFW 0.6, FEED AND BLEED 0.55	1.31E-5	1.28E-5	N/A	1.18E-7
ELECTRIC POWER 0.1, EFW 1.0, FEED AND BLEED 6E-3	1.34E-05	1.31E-05	3.00E-7	1.21E-5
ELECTRIC POWER 1.0, EFW 1.0, FEED AND BLEED 6E-3	1.43E-05	1.40E-05	1.20E-6	1.30E-5
ELECTRIC POWER 0.75, EFW 1.0, FEED AND BLEED 0.75	6.31E-05	6.28E-05	5.00E-5	6.18E-5

A qualitative analysis of similarly affected fire zones in Unit 1 and Unit 2 was completed. The analyst compared the remaining 15 fire zones in Unit 1 which required manual actions for safe shutdown to Calculation 85-E-0053-47, "Individual Plant Examination of External Events/Fire," Revision 2, to determine which fire zones were unscreened as part of the FIVE analysis. The following fire zones were unscreened.

Fire Zone	Description	Ignition Frequency	Automatic Suppression	Multiple Redundant Trains
197-X	Turbine Building (A1/A2 Failed)	7.31E-3	Partial	No
149-E	Upper North Electrical Penetration	2.66E-3	Yes	Yes
100-N	South Switchgear Room	1.13E-3	No	Yes
104-S	Electrical Equipment Room	3.71E-3	No	Yes
105-T	Lower South Electrical Penetration Room	3.07E-4	Yes	No
73-W	Bowling Alley	1.06E-3	Partial	Yes
76-W	Compressor Room	3.86E-3	No	Yes
34-Y	Auxiliary Building Piping Area	5.91E-4	No	Yes

The analyst compared the 21 fire zones in Unit 2 which required manual actions for safe shutdown to Calculation 85-E-0053-48, "Individual Plant Examination of External Events/Fire," Revision 2, to determine which fire zones were unscreened as part of the FIVE analysis. The following fire zones were unscreened:

Fire Zone	Description	Ignition Frequency	Automatic Suppression	Multiple Redundant Trains
2200-MM	Turbine Building A1/A2 Failed	1.8E-2	Partial	No
2200-MM	Turbine Building A1/A2 Not Failed	1.18E-3	Partial	No
2100-Z	4160 Volt Switchgear Room A4	1.13E-3	No	Yes
2096-M	MCC (2B63)	1.25E-3	No	Yes
2101-AA	4160 Volt Switchgear Room A3	1.08E-3	No	No
2108-S	Electrical Equipment Room 368	6.3E-4	No	Yes
2109-U	EDG Access Corridor	2.01E-3	Partial	Yes
OO	Intake Structure	1.78E-3	Partial	Yes

Fire Zone	Description	Ignition Frequency	Automatic Suppression	Multiple Redundant Trains
B3SC	Super Compartment for Auxiliary Building (Area of concern is 2091-BB)	9.28E-3	No	Yes
2055SC	Super Compartment for Lower South Electrical and Piping Penetration Room	6.62E-4	2084-DD No 2111-T Yes	2084-DD Yes 2111-T No
2040-JJ	Auxiliary Building Elevation 335	7.92E-3	No	Yes
2063SC	Super Compartment for Auxiliary Building Elevation 354	5.94E-3	Partial	Yes

The analysts' quantitative analysis determined that Fire Zone 98-J was of low safety significance due to the availability of automatic suppression capability and Fire Zone 99-M had either low to moderate or substantial safety significance due to not having automatic suppression capability.

The analysts determined that Fire Zones 98-J and 99-M had ignition frequencies between 2E-3 and 4E-3 and that both fire zones included multiple redundant trains of safe shut down equipment. The analysts determined the significance of a fire in a particular fire zone would be reduced if multiple redundant trains of equipment were "not" affected or if the fire zone had a relatively low ignition frequency (less than 1E-3). Accordingly, the analysts qualitatively removed fire zones from further consideration if any of the following conditions existed: the ignition frequency was less than 1E-3, the affected area had automatic suppression capability, or multiple redundant trains of safe shutdown equipment were "not" affected by a postulated fire.

The following fire zones required an additional assessment of the affected trains of redundant equipment:

Unit 1	Unit 2
100-N	2100-Z
104-S	2096-M
76-W	2091-BB
	2040-JJ

The analysts qualitatively compared the safety functions affected in Fire Zone 99-M to the safety functions affected by a fire in the above unscreened fire zones.

Safety Function	Unit 1 Fire Zone				Unit 2 Fire Zone			
	99-M White or Yellow	100-N White	104-S White or Yellow	78-W Green	2100-Z White	2096-M White	2091-BB White	2040-JJ White
Main Feedwater	1/1 <sup>(1)</sup>	1/1	1/1	0/1	1/1	1/1	1/1	0/1
High Pressure Injection	2/3	2/3	3/3	2/3	1/3	1/3	0/3	3/3
Low Pressure Injection	1/2	1/2	2/2	1/2	1/2	0/2	0/3	1/2
Service Water	1/2	1/2	2/2	1/2	1/3	0/3	0/3	1/3
Diesel Generator	2/2	2/2	2/2	1/2	2/2	1/2	1/2	1/2
Emergency Feedwater Flow-paths	4/4	3/4	4/4	3/4	0/2	2/2	2/2	1/2

1. X/X: Number of failed trains/Number of available trains



A qualitative analysis of similarly affected fire zones in Unit 1 and Unit 2 was completed. The analyst compared the remaining 15 fire zones in Unit 1 which required manual actions for safe shutdown to Calculation 85-E-0053-47, "Individual Plant Examination of External Events/Fire," Revision 2, to determine which fire zones were unscreened as part of the FIVE analysis. The following fire zones were unscreened.

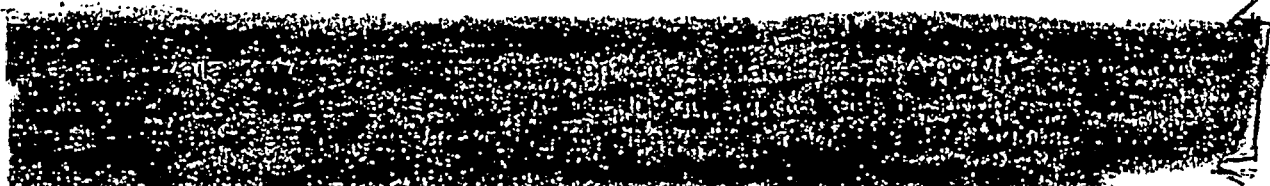
Fire Zone	Description	Ignition Frequency	Automatic Suppression	Multiple Redundant Trains
197-X	Turbine Building (A1/A2 Failed)	7.31E-3	Partial	No
149-E	Upper North Electrical Penetration	2.66E-3	Yes	Yes
100-N	South Switchgear Room	1.13E-3	No	Yes
104-S	Electrical Equipment Room	3.71E-3	No	Yes
105-T	Lower South Electrical Penetration Room	3.07E-4	Yes	No
73-W	Bowling Alley	1.06E-3	Partial	Yes
76-W	Compressor Room	3.86E-3	No	Yes
34-Y	Auxiliary Building Piping Area	5.91E-4	No	Yes

The analyst compared the 21 fire zones in Unit 2 which required manual actions for safe shutdown to Calculation 85-E-0053-48, "Individual Plant Examination of External Events/Fire," Revision 2, to determine which fire zones were unscreened as part of the FIVE analysis. The following fire zones were unscreened:

Fire Zone	Description	Ignition Frequency	Automatic Suppression	Multiple Redundant Trains
2200-MM	Turbine Building A1/A2 Failed	1.8E-2	Partial	No
2200-MM	Turbine Building A1/A2 Not Failed	1.18E-3	Partial	No
2100-Z	4160 Volt Switchgear Room A4	1.13E-3	No	Yes
2096-M	MCC (2B63)	1.25E-3	No	Yes
2101-AA	4160 Volt Switchgear Room A3	1.08E-3	No	No
2108-S	Electrical Equipment Room 368	6.3E-4	No	Yes
2109-U	EDG Access Corridor	2.01E-3	Partial	Yes
OO	Intake Structure	1.78E-3	Partial	Yes



Fire Zone	Description	Ignition Frequency	Automatic Suppression	Multiple Redundant Trains
B3SC	Super Compartment for Auxiliary Building (Area of concern is 2091-BB)	9.28E-3	No	Yes
2055SC	Super Compartment for Lower South Electrical and Piping Penetration Room	6.62E-4	2084-DD No 2111-T Yes	2084-DD Yes 2111-T No
2040-JJ	Auxiliary Building Elevation 335	7.92E-3	No	Yes
2063SC	Super Compartment for Auxiliary Building Elevation 354	5.94E-3	Partial	Yes



7A

Accordingly, the analysts removed the fire zones from consideration if any of the following conditions existed: the ignition frequency was less than 1E-3, the affected area had automatic suppression capability, or multiple redundant trains of safe shutdown equipment were not affected by a postulated fire.

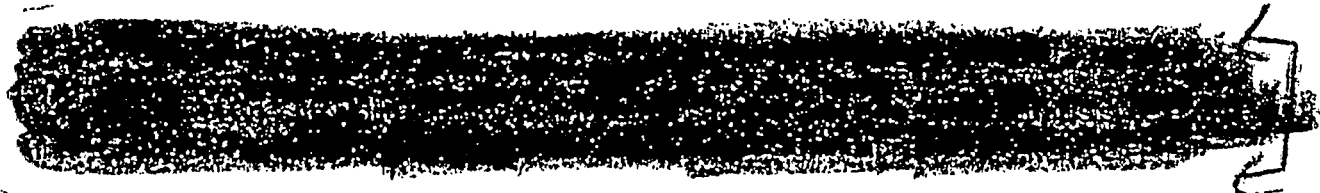
The following fire zones required an additional assessment of the affected trains of redundant equipment:

- |        |         |
|--------|---------|
| Unit 1 | Unit 2  |
| 100-N  | 2100-Z  |
| 104-S  | 2096-M  |
| 76-W   | 2091-BB |
|        | 2040-JJ |

The analysts qualitatively compared the safety functions affected in Fire Zone 99-M to the safety functions affected by a fire in the above unscreened fire zones.

Safety Function	Unit 1 Fire Zone				Unit 2 Fire Zone			
	99-M White or Yellow	100-N White	104-S White or Yellow	76-W Green	2100-Z White	2096-M White	2091-BB White	2040-JJ White
Main Feedwater	1/1 <sup>(1)</sup>	1/1	1/1	0/1	1/1	1/1	1/1	0/1
High Pressure Injection	2/3	2/3	3/3	2/3	1/3	1/3	0/3	3/3
Low Pressure Injection	1/2	1/2	2/2	1/2	1/2	0/2	0/3	1/2
Service Water	1/2	1/2	2/2	1/2	1/3	0/3	0/3	1/3
Diesel Generator	2/2	2/2	2/2	1/2	2/2	1/2	1/2	1/2
Emergency Feedwater Flow-paths	4/4	3/4	4/4	3/4	0/2	2/2	2/2	1/2

1. X/X: Number of failed trains/Number of available trains



7A