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MFN 07-064, Supplement 2

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Subject: **Response to Portion of NRC Request for Additional Information Letter No. 214 Related to ESBWR Design Certification Application ESBWR RAI Number 19.1-13 S02**

The purpose of this letter is to submit the GE Hitachi Nuclear Energy (GEH) response to the U.S. Nuclear Regulatory Commission (NRC) Request for Additional Information (RAI) dated June 25, 2008 (Reference 1).

Verified DCD changes associated with this RAI response are identified in the enclosed DCD markups by enclosing the text within a black box. The marked-up pages may contain unverified changes in addition to the verified changes resulting from this RAI response. Other changes shown in the markup(s) may not be fully developed and approved for inclusion in the DCD. The previous RAIs and responses to RAI 19.1-13 S02 are in references 2 through 5.

The GEH response to RAI Number 19.1-13 S02 is in Enclosure 1.

If you have any questions or require additional information, please contact me.

Sincerely,

Richard E. Kingston

Richard E. Kingston
Vice President, ESBWR Licensing

D063
NRO

References:

1. MFN 08-552, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, GEH, *Request For Additional Information Letter No. 214 Related To ESBWR Design Certification Application*, dated June 25, 2008.

2. MFN 06-222, Letter from U.S. Nuclear Regulatory Commission to David H. Hinds, GEH, *Request For Additional Information Letter No. 40 Related To ESBWR Design Certification Application, dated July 5, 2006.*

3. MFN 07-064, *Response to Portion of NRC Request for Additional Information Letter No. 40 Related to ESBWR Design Certification Application ESBWR Probabilistic Risk Assessment RAI Numbers 19.1-13 and 19.2-27,* dated February 2, 2007.

4. MFN 07-064, Supplement 1, *Response to Portion of NRC Request for Additional Information Letter No. 40 Related to ESBWR Design Certification Application ESBWR Probabilistic Risk Assessment RAI Number 19.1-13(amended)* dated November 15, 2007.

5. MFN 07-658 Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, GEH, *REQUEST FOR ADDITIONAL INFORMATION LETTER NO. 121 RELATED TO ESBWR DESIGN CERTIFICATION APPLICATION, dated* December 5, 2007.

Enclosure:

1. Response to Portion of NRC Request for Additional Information Letter No. 214 Related to ESBWR Design Certification Application Probabilistic Risk Assessment RAI Numbers 19.1-13 S02

cc:	AE Cubbage	USNRC (with enclosure)
	RE Brown	GEH/Wilmington (with enclosure)
	eDRF Section	0000-0089-2930

Enclosure 1

MFN 07-064, Supplement 2

Response to Portion of NRC Request for Additional Information Letter No. 214 Related to ESBWR Design Certification Application ESBWR Probabilistic Risk Assessment RAI Number 19.1-13 S02

***Original Responses previously submitted are included without DCD updates to provide historical continuity during review.**

NRC RAI 19.1-13

Provide a discussion on possible changes to the various Release Category source term magnitudes that could result for external events and shutdown severe accidents, as compared to the values calculated for the full power internal event accidents. Provide bounding levels for the core damage frequency (CDF) and containment failure frequencies for external events and shutdown operation accidents.

GE Response (original)

Provide a discussion on possible changes to the various Release Category source term magnitudes that could result for external events and shutdown severe accidents, as compared to the values calculated for the full power internal event accidents

The release category source term "magnitudes" are unlikely to be affected by external events and shutdown. The external events do not impact the phenomena included in the analyses, and there is no direct impact on the probability of containment failure. However, the external events create scenarios that change the Level 1 accident class frequencies, and also may cause failures of support systems for systems credited in the Level 2 model.

The consequence analysis models multiple radionuclide release categories. Source terms are defined based on ESBWR thermal hydraulic analysis. Bounding consequence analyses are performed, showing that the ESBWR design meets NRC safety goals with sufficient margin (NEDO 33201 Rev. 1 Section 1.3.1). The source term evaluation was performed with the MAAP computer code, which produces the distribution of radionuclides released to the environment as a function of time. Each release category is represented by a severe accident sequence that was selected and modeled to represent the group of potential severe accidents that could be associated with that release category. The selection is based on several factors, including the frequency of the various sequences that lead to the end state and the spectrum of response for the various sequences. The selected sequence provides a conservative basis for the source term quantification.

The following systems are considered in the Level 2 model Containment Systems Event Tree (CSET)

- Containment Isolation System (CIS)
- Vapor Suppression System (VB) - vacuum breaker function
- Short term containment heat Removal (W1) - suppression pool cooling mode of the FAPCS
- Long-term containment heat removal (W2) - PCCS is designed with adequate water in the PCCS pools to mitigate a design basis event for 24 hours after event initiation.
- Containment Vent (VT) – suppression chamber vent path.

As stated earlier, the external events are unlikely to change the accident progression and source term magnitude for the following reasons:

a) Most of the Level 2 major components are either inside the containment, or submerged in the pools (i.e. no impact from floods, high winds, or fires) and are thus unaffected by external events as noted below. Divisional failures of power or instrumentation caused by external events do not greatly impact the reliability of these systems due to the high degree of redundancy of these systems.

- The deluge mode of GDCS operation provides flow through the BiMAC to flood the lower drywell when the temperature in the lower drywell increases enough to be indicative of RPV failure and core debris in the lower drywell. The GDCS deluge system is activated by thermal-sensors embedded in the lower drywell floor.
- The BiMAC provides additional assurance of debris bed cooling by providing an engineered pathway for water flow through the debris bed.
- Vacuum breakers are inside containment and respond to changes in differential pressure

b) The primary systems credited for isolation (i.e. the MSIVs) fail closed on loss of power, loss of instrument, loss of feedwater, or actuation signal failures.

c) Drywell spray system is not credited in this analysis

d) The isolation condensers do not condense a significant amount of steam after RPV depressurization and thus, provide little mitigation of a severe accident after RPV depressurization. For conservatism, the ICS was not credited in the severe accident sequence evaluation.

e) Overpressure of the containment due to failure of long-term decay heat removal tends to occur gradually and there is time for recovery. In general, recovery of failed systems was not credited in the severe accident analysis. However, a sensitivity study (Section 11 of NEDO 33201 Rev. 1) was performed for long-term decay removal scenarios that credited some recoveries.

f) The ESBWR seismic assessment is a seismic margins analysis. The analysis demonstrates the ESBWR plant and equipment can withstand an earthquake with a magnitude at least two times the safe shutdown earthquake.

Provide bounding levels for the core damage frequency (CDF) and containment failure frequencies for external events and shutdown operation accidents.

The frequency distribution for the Release Categories is likely to change primarily due to impacts on systems credited in the Level 1 PRA. The effect of external events on the Level 1 systems impacts the frequency estimates of accident classes that are inputs and propagate through the Level 2 analyses. In addition, there may be some impact on the availability of support systems credited in the Level 2 CSETs that caused by external events.

The Core Damage Frequencies for full power, fire, and flood events are listed below and are compared by accident classes to the internal events PRA results. The impacts to the

corresponding release categories for these events have been evaluated since they are the dominant core damage frequency scenarios.

Comparison of CDF Internal Event vs. Full Power Fire and Flooding PRA results

Accident Class (1)	CDF (/yr)	CDF (/yr)	CDF (yr)
	Internal Events PRA (2)	Power Fire PRA	Power Flood
Class I	2.86E-08	9.88E-09	3.68E-09
Class III	4.11E-10	4.50E-10	9.8E-14
Class IV	1.83E-10	4.79E-12	
Class V	4.27E-12		1.19E-12
Total	2.92E-08	1.03E-08	3.68E-9

1 Excludes Class II contribution (see 72 hr sensitivity Section 11)
2 NEDO-33201 Table 7.2-2

Comparison of CSET and CPET Release Category Frequencies for Internal Events vs. Full Power Fire and Flood PRA results

Release Category	Frequency (yr)	Frequency (yr)	Frequency (yr)
	Internal PRA (1,2)	Power Fire PRA	Power Flood
TSL	2.84E-08	1.02E-08	3.64E-09
FR	2.33E-10	2.32E-11	<1E-12
BYP	1.00E-12	6.86E-12	<1E-12
OPVB	<1E-12	<1E-12	<1E-12
OPW1	<1E-12	<1E-12	<1E-12
OPW2	1.40E-11	1.40E-12	<1E-12
CCIW	2.90E-10	1.03E-10	3.67E-11
CCID	2.90E-11	1.03E-11	3.68E-12
EVE	2.50E-10		
EVE (CCIW*)			
DCH	<1E-12	4.50E-13	<1E-12
BOC	4.00E-12		1.19E-12
Total	2.92E-08	1.03E-08	3.68E-09

1 Reference – NEDO 332101 rev. 1 Table 8.2-2
2 Reference – NEDO 33201 rev. 1,Table 9-1

The core damage frequency for tornadoes is several orders of magnitude lower and only a reference to the detailed core damage assessment is provided at the end of this response.

Finally, the contribution to core damage for shutdown event can be found in Revision 1 of NEDO 33201. The analyses conservatively assume that these core damage scenarios result in large releases since the containment is open during most of the shutdown windows. The core damage frequencies for dominant shutdown events are listed below:

Shutdown Events (all modes)	CDF (/yr)
Internal Events	5.56E-9
Fire	2.32E-8
Flood	1.64E-09

The results of the shutdown-fire analyses primarily involve scenarios where fire in one division propagates to another division due to fire damper failure. The shutdown fire analyses are conservative. These evaluations assumed that a fire in a division damages all equipment in the division and the fire results in an inadvertently stuck open relief valve (IORV).
A detailed breakdown of the core damage frequencies for the external events and shutdown scenarios can be found in the following tables of NEDO 33201 Rev. 1

- Table 12-15 Full Power Core Damage Frequency Due to Internal Fires
- Table 12-16 Shutdown Core Damage Frequencies Due to Internal Fires
- Table 13-5 CDF Contribution of At-Power Flooding Scenarios
- Table 13-6 CDF Contribution of Shutdown Flooding Scenarios
- Table 14-2 Tornado-Induced CDF (At Power and Shutdown)
- Tables 15-13 and 15-14. No accident sequence has a HCLPF lower than 0.60 g (i.e., 2 x SSE).
- Table 16.6-1 Shutdown CDF by Initiating Event and by Mode of Operation

In summary, the external events and shutdowns do not impact the accident progression or source term magnitude. However, the impact of these events on equipment credited by the Level 1, or Level 2, models does impact the frequency, and potentially the frequency distribution of the accident classes that are used as input to the Level 2 mode event trees.

DCD Impact

There are no DCD Revisions resulting from the response to this RAI.

GEH Response (amended)

Provide a discussion on possible changes to the various Release Category source term magnitudes that could result for external events and shutdown severe accidents, as compared to the values calculated for the full power internal event accidents

The release category source term "magnitudes" are unlikely to be affected by external events and shutdown. The external events do not impact the phenomena included in the analyses, and there is no direct impact on the probability of containment failure. However, the external events create scenarios that change the Level 1 accident class frequencies, and also may cause failures of support systems for systems credited in the Level 2 model.

The consequence analysis models multiple radionuclide release categories. Source terms are defined based on ESBWR thermal hydraulic analysis. Bounding consequence analyses are performed, showing that the ESBWR design meets NRC safety goals with sufficient margin (NEDO 33201 Rev. 2 Section 1.1). The source term evaluation was performed with the MAAP computer code, which produces the distribution of radionuclides released to the environment as a function of time. Each release category is represented by a severe accident sequence that was selected and modeled to represent the group of potential severe accidents that could be associated with that release category. The selection is based on several factors, including the frequency of the various sequences that lead to the end state and the spectrum of response for the various sequences. The selected sequence provides a conservative basis for the source term quantification.

The following systems are considered in the Level 2 model Containment Event Trees (CETs):

- Containment Isolation System (CIS)
- Vapor Suppression System (VB) - vacuum breaker steam suppression function
- Short term containment heat Removal (W1) – performed by the suppression pool cooling (SPC) mode of the Fuel and Auxiliary Pools Cooling system (FAPCS) or Passive Containment Cooling System (PCCS)
- Long-term containment heat removal (W2) - PCCS is designed with adequate water in the PCCS pools to mitigate a design basis event for 24 hours after event initiation; successfully W2 requires PCCS pool make-up. The SPC mode of FAPCS can also perform long-term containment heat removal.
- Containment Vent (VT) – suppression chamber vent path.
- Lower Drywell Debris Bed Cooling (BI_SP) – The GDCS deluge system injects water to the BiMAC after the RPV has failed and the core relocates to the LDW.

As stated earlier, the external events and are unlikely to change the accident progression and source term magnitude for the following reasons:

a) Most of the Level 2 major components are either inside the containment, or submerged in the pools (i.e. no impact from floods, high winds, or fires) and are thus unaffected by

external events as noted below. Divisional failures of power or instrumentation caused by external events do not greatly impact the reliability of these systems due to the high degree of redundancy of these systems.

- The deluge mode of the Gravity-Driven Cooling System (GDCS) operation provides flow through the BiMAC to flood the lower drywell when the temperature in the lower drywell increases enough to be indicative of RPV failure and core debris in the lower drywell. The GDCS deluge system is activated by thermal-sensors embedded in the lower drywell floor and airspace. Deluge is controlled by a stand-alone electrical system that operates independently of all other plant systems.
- The BiMAC provides additional assurance of debris bed cooling by providing an engineered pathway for water flow through the debris bed.
- Vacuum breakers are passive components inside containment and respond to changes in differential pressure

b) The primary systems credited for isolation (i.e. the MSIVs) fail closed on loss of power, loss of instrument, loss of feedwater, or actuation signal failures. Redundant check valves isolate Feedwater lines.

c) Drywell sprays are not used as an accident mitigation system

d) The isolation condensers do not condense a significant amount of steam after RPV depressurization and thus, provide little mitigation of a severe accident after RPV depressurization. In high-pressure core damage scenarios, ICS has already failed in the Level 1 accident sequence; logically, the ICS is not included in the Level 2 analysis.

e) Overpressure of the containment due to failure of long-term decay heat removal tends to occur gradually and there is time for recovery. Recovery of failed systems was not credited in the severe accident analysis.

f) The ESBWR seismic assessment is a seismic margins analysis. The analysis demonstrates the ESBWR plant and equipment can withstand an earthquake with a magnitude at least 1.67 times the safe shutdown earthquake.

Provide bounding levels for the core damage frequency (CDF) and containment failure frequencies for external events and shutdown operation accidents.

The frequency distribution for the Release Categories is likely to change primarily due to impacts on systems credited in the Level 1 PRA. The effect of external events on the Level 1 systems impacts the frequency estimates of accident classes that are inputs and propagate through the Level 2 analyses. In addition, external events may impact the availability of support systems credited in the Level 2 CETs.

The Core Damage Frequencies for full power, fire, flood, and high wind events are listed below and are compared by accident class to the internal events PRA results. The impacts to the corresponding release categories for these events have been evaluated since they are the dominant core damage frequency scenarios.

Comparison of CDF Internal Event vs. Full Power Fire and Flooding PRA results

Accident Class	CDF (/yr)	CDF (/yr)	CDF (yr)	CDF (yr)
	Internal Events PRA (1)	Power Fire PRA	Power Flood	Power High Winds
Class I	5.63E-09	1.74E-09	4.11E-10	5.18E-10
Class II-a	4.2E-11	6.8E-11	6.5E-11	ε
Class II-b	ε (2)	ε	ε	ε
Class III	4.52E-09	3.25E-09	8.31E-10	8.04E-10
Class IV	1.87E-09	2.99E-09	3.12E-10	1.5E-11
Class V	1.47E-10	8E-12	0.00	4E-12
Total	1.22E-08	8.06E-09	1.62E-09	1.34E-09

1 – NEDO-33201 Table 7.2-2
2 – Calculated frequencies <1E-12/yr are reported as "ε"

Comparison of CET Release Category Frequencies for Internal Events vs. Full Power Fire, Flood, and High Winds PRA results

Release Category	Frequency (yr)	Frequency (yr)	Frequency (yr)	Frequency (yr)
	Internal Events PRA (1)	Power Fire PRA	Power Flood	Power High Winds
TSL	1.12E-08	7.58E-09	1.41E-09	1.33E-09
FR	ε	ε	ε	ε
BYP	5.6E-11	2.63E-10	1.29E-10	1.2E-11
OPVB	1.6E-11	1E-12	ε	ε
OPW1	3.2E-11	6.5E-11	6.4E-11	ε
OPW2	ε	4E-12	1E-12	ε
CCIW	9.9E-11	7.2E-11	0.00	1.3E-11
CCID	1E-12	7.1E-11	0.00	ε
EVE	6.10E-10	0.00	0.00	0.00
DCH	PU (2)	PU	PU	PU
BOC	1.47E-10	8E-12	0.00	4E-12
Total	1.22E-08	8.06E-09	1.62E-09	1.34E-09

1 Reference – NEDO 33201 rev. 2 Table 8.2-2
2 Reference – Physically Unreasonable (see NEDO-33201 Section 21.3.1)

Finally, the contribution to core damage for shutdown event can be found in Revision 2 of NEDO 33201 Section 16. The analyses conservatively assume that these core damage scenarios result in large releases since the containment is open during most of the shutdown windows. The core damage frequencies for dominant shutdown events are listed below:

Shutdown Events (all modes)	CDF (/yr)
Internal Events	9.37E-09
Fire	2.71E-08
Flood	5.24E-09

Fires scenarios in the Turbine Building general area and the Service Water building dominate the shutdown fire results. Each of these cases causes a loss of instrument air and subsequent loss of shutdown cooling because of containment isolation valve closure. These shutdown fire scenarios are conservative as discussed in NEDO-33201 Revision 2 Sections 12.8.4.1 and 12.8.4.2.

A detailed breakdown of the core damage frequencies for the external events and shutdown scenarios can be found in the following tables of NEDO 33201 Rev. 2.

- Table 12.9-1 Full Power Core Damage Frequency Due to Internal Fires
- Table 12.9-3 Shutdown Core Damage Frequencies Due to Internal Fires
- Table 13-3 At Power Flooding Frequencies, # Failed Components and CDF
- Table 13-5 CDF Contribution of Shutdown Flooding Scenarios
- Table 14-2 High Wind-Induced CDF (At Power and Shutdown)
- Tables 15-9, 15-10a, and 15-10b HCLPF Derivation for ESBWR Seismic Event Trees (Full Power and Shutdown)
- Table 16.6-1 Shutdown CDF by Initiating Event and by Mode of Operation

In summary, the external events and shutdowns do not impact the accident progression or source term magnitude. However, the impact of these events on equipment credited by the Level 1 and Level 2 models does impact the core damage frequency and the frequency distribution of the accident classes that are used as input to the Level 2 mode event trees.

DCD/NEDO-33201 Impact

There are no DCD or NEDO-33201 Revisions resulting from the response to this RAI.

NRC RAI 19.1-13, Supplement 1

Please update the response to NRC RAI 19.1-13 to be current with Revision 2 of the Probabilistic Risk Assessment (PRA). In addition, please provide a discussion on possible changes to the various release category source term magnitudes that could result from external events and shutdown severe accidents, as compared to the values calculated for the full power internal event accidents.

GE Response

None provided. In an email from Mr. Rocky Foster, USNRC, dated 2/14/08 and quoted below, the Staff noted that:

"After review of the amended response to RAI 19.1-13, the staff has determined GEH's amended response submitted on November 15, 2007 adequately addresses the requested information in RAI 19.1-13 S01, dated December 5, 2007 and therefore additional information is not required from GEH at this time concerning this matter. RAIs 19.1-13 and 19.1-13 S01 are considered resolved by the staff."

DCD Impact

There are no DCD Revisions resulting from the response to this RAI.

NRC RAI 19.1-13 Supplement 2

Question Summary

Update the response to NRC RAI 19.1-13 to include Level 3 results.

NRC Full Text:

Please provide Level 3 PRA results for external events and shutdown events, extending the Level 2 results reported in your response to RAI 19.1-13 Supplement 01. Similar to what is reported in Section 10.2.4 of the PRA, please also compare these results to the safety goals.

GEH Response

Rev 4 of NEDO-33201 will incorporate Level 3 PRA results for external events and shutdown events based on updated source terms and sequence information.

A sensitivity study, (see below), based on currently available data, has been performed for the Level 3 PRA results for external events and shutdown events and compared with the safety goals. Based on the sensitivity study, it is expected that the conclusions in Chapter 19 of the DCD, regarding offsite consequences, will not be changed.

DCD/NEDO-033201 Impact

DCD Impact – There is no impact as a result of this RAI response.

NEDO-33201 Impact – Revision 4 of NEDO-33201 will incorporate Level 3 PRA results for external events and shutdown events.

Relevant DCD Chapter 19 sections will be evaluated after Level 3 PRA results are incorporated into Rev 4 of NEDO-33201.

Sensitivity Study

Based on currently available data, a sensitivity study for the Level 3 PRA results for external events and shutdown events are reported in the following tables and compared with the safety goals.

The overall methodology used in this study of assessing the external and shutdown events is the same as used in sections 9 and 10 of NEDO-33201 for assessing the internal events offsite consequences.

Section 22.9 and 22.10 of NEDO-33201, Rev 3, reviewed the latest impacts on section 9 and 10 since Rev 2 of NEDO-33201. Similar to the approach of Section 22 of Rev 3, NEDO-33201, this study is performed to assess the impact of the external and shutdown events with the currently available relevant data, for instance, release frequencies and sequences selections.

Sequence Selection ---

The representative sequences for each of the external events release categories are chosen based on current internal events Level 3 (Section 22.9 of NEDO-33201) source term representative sequences. Current external events are modeled with the same events trees as used for the internal events. It is judged that the internal events release sequences serve reasonable representation of the external events source terms distribution and contribution to offsite consequences.

As described in NEDO-33201, section 16.3.1, the shutdown PRA analysis assumed all core damage sequences contribute directly to large release frequency, i.e., all core damage events contribute to a bypass release. The internal event containment bypass sequences, described in Section 9 of NEDO-33201 Rev 3, are used to represent the shutdown events in this analysis. The bypass release category of the internal events assumed that the failure of the Containment Isolation System function leads to a direct release path to the environment, bypassing the containment.

The at-power model accounts for reactor modes 1 through 4. The shutdown model covers modes 5 and 6. The representative cases used for the at-power model assumed the containment was bypassed. The shutdown model conservatively assumed the containment was open for the entire shutdown. Since the cases used in the at-power internal events model bypassed the containment altogether, the same cases can be a reasonably applied to shutdown sequences that assumed the containment was open. Using this approach does not credit source term decay throughout shutdown.

It was evaluated in Section 22.9 and 22.10 of NEDO-33201, Rev 3, that the offsite consequences are more sensitive to the release category frequencies rather than the source terms derived from particular representative sequences.

However, it is recognized that under a certain shutdown condition, certain isotopes, such as Ru may become more volatile than during at-power. To account for this potential impact, the Ru

content is increased by an order of magnitude from E-2 to E-1 for shutdown fire scenarios. The sensitivity result of the Ru activity increase is presented in Table J.

The process and methodology along with the latest available sequence and frequency data will be incorporated into NEDO-33201, Rev 4, Section 9 and 10.

Mitigative Measures ---

In response to an external or shutdown event, no credit was taken from any potential operational or ERO procedures that could mitigate the offsite consequences as part of the Level 3 analysis.

Source Terms ---

Results from Section 9 of NEDO-33201 Rev 3 and the long-term source term sensitivity study of Section 22.9 are used for source terms in this study. As described in Section 22.9 of NEDO-33201 Rev 3, some of the source terms took into account the post 72 hours continuous release plume rise. Source term 4, High-Pressure Containment Bypass (BYP), has been re-quantified to account for additional plume rise beyond 72 hours. Source terms will be updated in Rev 4 of NEDO-33201.

Release Category Frequency ---

The release category frequency of each of the external events was derived based on individual external event core damage cutset quantifications. These frequencies will be revised in Rev 4 of NEDO-33201.

Stated in the shutdown PRA study (Section 16 of NEDO-33201), over 90% of the CDF associated with shutdown can be mitigated by closing the lower drywell hatch. The impact of lowering the screening values can be seen in sensitivity Case 2 in the shutdown PRA (Section 16.6.2.3 of NEDO-33201). In this case the HRA probability associated with closure of the lower drywell hatch along with other HRA values are reduced. This reduction leads to a reduction in shutdown CDF to 7.78E-10/yr from the baseline shutdown risk of 9.37E-9/yr of core damage. Table J shows the risk measures associated with this sensitivity study.

As shown in Table K, shutdown fire has the highest relative offsite consequence risk. This result is partially due to the way the shutdown fire sequences were modeled. Conservative estimates were made in an attempt to bound the fire analysis due to lack of complete design detail. The results in Section 12.2.5 of NEDO-33201 are very conservative due to the nature of the evaluation.

For instance, over 67% of the shutdown fire CDF was contributed from fire area F4100, Turbine Building General Area. As recognized in Section 22.12 of NEDO-33201 Rev 3, the fire modeling in the Turbine Building General Area is conservatively treated, the model assumed a fire in any part of this general area would cause damage to all the components in this area. The Turbine Building General Area consisted of multiple floors and each floor consisted of large areas. Further, no credit was taken for fire suppression systems in this area.

Similar to the shutdown fire modeling in the Turbine Building General Area, the shutdown fire propagation scenario for the two RWCU/SDC pump rooms with a screened fire initiating frequency of 6.5E-3/yr (fire area F1152/F1162, section 12.8.4.4, NEDO-33201), is also conservative since a fire has to pass through multiple normally closed non-fire doors, two access tunnels, two corridor areas and the fire door separating the two areas.

Scenarios like these contributed to the very conservative shutdown fire core damage frequency. It is reasonable to expect that the quantified shutdown fire risk will decrease as more detailed modeling becomes available. For instance, in Section 22.12 of NEDO-33201 Rev 3, it stated that based on the latest design information, fire area modeling of F7300, the Service Water and Water Treatment building, would be re-remodeled in the shutdown fire modeling in Rev 4 of NEDO-33201. Revision of this fire area in the current shutdown fire model will reduce the current baseline shutdown fire CDF by 27% (see Table J for a sensitivity of this shutdown fire CDF reduction).

Modeling Codes ---

The following codes are used for accident progression and consequence analysis. Parameters used in the analysis, such as meteorological data, are identical to those in Section 10 and 22 of NEDO-33201, Rev 3.

MAAP – Modular Accident Analysis Program
MACCS2 – MELCOR Accident Consequence Code System

Emergency Preparedness Actions ---

No credit is taken for Emergency Response Organization actions.

Consequence Case Selection ---

For this study and consistent with section 22.10 of NEDO-33201, an enveloping case of elevated release with plume and buoyant effect was studied. As shown in the following tables, even with these conservative frequency and release category assumptions, the off site risk measures of each of these external and shutdown events are still within the limits of the Risk Goals.

Results ---

The result of this study was compared against Chapter 19 of DCD. The conclusion of DCD Chapter 19 that the offsite consequences of external and shutdown events, including sensitivity studies, are less than the defined risk goals, are un-changed.

External and shutdown events Level 3 study will be incorporated into Rev 4 of NEDO-33201. As a result of Rev 4 of NEDO-33201, relevant insights of Chapter 19 of the DCD will again be re-considered.

Summary of Tables ---

Table A	Release Category Frequencies
Table B	Radionuclide Source Terms
Table C	Fire Consequences
Table D	Flood Consequences
Table E	High Wind Consequences
Table F	Shutdown Internal Consequences
Table G	Shutdown Fire Consequences
Table H	Shutdown Flood Consequences
Table I	Shutdown High Wind Consequences
Table J	Shutdown Internal and Fire Consequences - Sensitivity
Table K	Risk Measures

Table A
Release Category Frequencies

Source Term	Release Category	MAAP Case	Description	Release Frequency (/yr)									
				Internal[1]	Fire	Flood[2]	High Wind	SD (Internal)	SD (Internal Sensitivity)	SD (Fire)	SD (Fire Sensitivity)	SD (Flood)	SD (High Wind)
1	BOC	BOCsd_nIN_R1	Break Outside Containment	4.97E-11	8.06E-12	0.0E+00	4.41E-12						
2		BOCdr_nIN_R1											
3	BYP	T_nIN_BYP_R1	Containment Bypass	4.54E-11	2.63E-10	1.34E-10	1.50E-11	9.37E-09	7.78E-10	2.71E-08	1.98E-08	5.24E-09	1.19E-09
4		T_nDP_nIN_BYP_R1											
5	CCID	T_nIN_nD_CCID_R1	Core-Concrete Interaction Dry	9.76E-13	7.09E-11	0.0E+00	1.55E-13						
6		T_nDP_nIN_nD_CCID_R1											
7	CCIW	T_nIN_CCIW_R1	Core-Concrete Interaction Wet	9.94E-11	7.18E-11	1.22E-11	1.30E-11						
8		T_nDP_nIN_CCIW_R1											
9	EVE	T_nIN-nD_EVE_R1	Ex-vessel Steam Explosion	6.04E-10	0.0E+00	0.0E+00	0.0E+00						
10	FR	T_AT_nIN_nCHR_FR_R1	Filtered Release	6.02E-11	1.49E-13	8.09E-14	1.29E-14						
11	OPVB	T_nIN_VB_R1	Overpressure Vacuum Breaker	1.00E-15	6.58E-13	3.25E-13	2.20E-14						
12		T_nIN_VB_R1											
13	OPW1	T_nDP_nIN_nCHR_W1_R1	Overpressure Early Containment Heat Removal Loss	1.00E-15	6.49E-11	6.40E-11	1.07E-13						
14	OPW2	T_nDP_nIN_nCHR_W2_R1	Overpressure Late Containment Heat Removal Loss	2.42IE-13	3.91E-12	1.11E-12	8.76E-13						
15	TSL	T_AT_nIN_TSL2x_R1	Tech Spec Leakage	1.12E-08	7.57E-09	1.41E-09	1.33E-09						

[1] Internal event was not asked for in this RAI, listed here for info and comparison purpose (Section 22.8 of NEDO-33201).
[2] The BYP release includes one day of CDF contribution to account for de-inerted containment as discussed in section 8.1.4. However, this was not accounted for in Table 13.7-1 of NEDO-33201, and will be included in Rev 4 of NEDO-33201.

Table B

Radionuclide Source Terms[1]

(Release Fraction 72 and longer hours after onset of core damage)

Source Term	Xe/Kr	CsI	TeO_2	SrO	MoO_2	CsOH	BaO	La_2O_3	CeO_2	Sb	Te_2	UO_2	Time (hr)[2]
1	9.8E-01	7.0E-01	4.6E-01	1.3E-02	1.7E-01	3.7E-01	3.1E-02	2.5E-04	1.2E-03	5.0E-01	6.5E-04	3.0E-06	72
2	2.6E-01	1.3E-01	1.2E-01	4.5E-04	1.6E-02	3.6E-02	2.0E-03	3.1E-05	1.4E-04	6.0E-02	1.3E-06	1.0E-06	72
3	9.71E-01	5.37E-01	1.68E-01	4.49E-03	7.14E-02	3.22E-01	1.43E-02	1.82E-04	8.54E-04	3.11E-01	8.25E-05	5.20E-06	138.89
4	1.00E+00	1.14E-01	6.05E-02	4.08E-02	2.29E-02	6.22E-02	3.95E-02	4.08E-02	4.10E-02	2.06E-01	3.84E-04	3.93E-06	128.11
5	9.04E-01	1.69E-01	1.52E-01	2.18E-07	3.12E-07	2.45E-01	4.71E-06	1.59E-08	1.71E-08	2.77E-01	8.32E-07	9.94E-08	138.89
6	9.6E-01	3.5E-01	7.7E-02	8.1E-07	4.0E-07	6.2E-02	1.1E-05	3.6E-07	4.7E-07	1.4E-01	1.3E-07	2.0E-07	72
7	9.96E-01	9.09E-03	7.51E-05	7.08E-08	2.20E-07	1.27E-02	1.06E-06	9.96E-09	1.39E-08	3.88E-01	9.75E-07	1.45E-08	277.78
8	9.96E-01	3.06E-01	4.04E-02	2.71E-06	2.23E-06	9.73E-02	4.02E-06	2.60E-06	2.62E-06	1.15E-01	5.28E-07	1.55E-08	277.78
9	8.3E-01	1.5E-01	1.5E-01	1.7E-03	6.5E-05	2.3E-01	7.5E-04	4.9E-05	6.6E-04	2.8E-01	4.9E-04	3.4E-06	72
10	1.0E+00	6.1E-03	2.6E-04	7.1E-09	3.3E-08	4.0E-03	3.5E-08	5.1E-10	2.2E-09	1.6E-01	2.3E-05	1.5E-11	72
11	9.97E-01	6.64E-01	4.86E-02	5.58E-04	1.93E-06	1.17E-01	2.93E-04	4.57E-06	1.08E-04	4.07E-01	5.32E-03	8.72E-07	277.78
12	9.97E-01	2.66E-01	7.90E-03	1.00E-06	3.04E-07	1.19E-01	4.92E-07	1.01E-07	6.90E-07	3.85E-01	1.13E-05	6.49E-09	277.78
13	1.00E+00	6.42E-01	1.90E-01	9.07E-04	2.49E-07	2.00E-01	4.15E-04	3.20E-06	1.27E-04	1.34E-01	1.72E-07	6.22E-07	224.56
14	9.92E-01	7.03E-01	1.29E-01	9.65E-04	2.54E-07	1.72E-01	4.82E-04	3.14E-06	1.30E-04	2.71E-01	8.13E-08	6.32E-07	277.78
15	2.7E-03	1.6E-04	9.9E-05	2.6E-06	6.2E-05	5.9E-05	1.3E-05	1.1E-07	3.7E-07	1.7E-04	7.6E-10	3.3E-10	72

[1] For reference, see Table 22.9-2 of NEDO-33201, Rev 3. For this study, source term 4 also reflects an extended plume rise.
[2] The longer time past 72 hrs took into account the continuous plume rise after 72 hrs.

Table C

Fire Consequences

Source Term	Release Category	MAAP CASE	Release Frequency (/yr)	Individual Risk (0-1 mile)	Weighted Individual Risk (/yr)	Weighted Individual Risk Contribution	Societal Risk (0-10 miles)	Weighted Societal Risk (/yr)	Weighted Societal Risk Contribution	Prob.of Dose > .2 Sv(0-0.5 mile)	Weighted Prob of Exceedance (/yr)	Weighted Dose Contribution
1	BOC	BOCsd_nIN_R1	8.06E-12	1.15E-01	4.63E-13	0.93%	1.42E-02	5.72E-14	0.35%	1.00E+00	4.03E-12	0.72%
2		BOCdr_nIN_R1	8.06E-12	8.46E-02	3.41E-13	0.68%	1.22E-02	4.92E-14	0.30%	1.00E+00	4.03E-12	0.72%
3	BYP	T_nIN_BYP_R1	2.63E-10	1.12E-01	8.84E-14	0.18%	1.59E-02	1.25E-14	0.08%	1.00E+00	7.89E-13	0.14%
4		T_nDP_nIN_BYP_R1	2.63E-10	1.07E-01	2.81E-11	56.29%	5.11E-02	1.34E-11	82.43%	1.00E+00	2.62E-10	47.14%
5	CCID	T_nIN_nD_CCID_R1	7.09E-11	1.04E-01	4.11E-12	8.25%	1.24E-02	4.91E-13	3.02%	1.00E+00	3.96E-11	7.11%
6		T_nDP_nIN_nD_CCID_R1	7.09E-11	7.39E-02	2.32E-12	4.65%	9.50E-03	2.98E-13	1.83%	1.00E+00	3.13E-11	5.63%
7	CCIW	T_nIN_CCIW_R1	7.18E-11	1.04E-01	5.15E-12	10.34%	1.11E-02	5.50E-13	3.38%	1.00E+00	4.95E-11	8.91%
8		T_nDP_nIN_CCIW_R1	7.18E-11	9.37E-02	2.09E-12	4.18%	1.07E-02	2.38E-13	1.47%	1.00E+00	2.23E-11	4.00%
9	EVE	T_nIN_nD_EVE_R1	0.00E+00	1.07E-01	0.00E+00	0.00%	1.36E-02	0.00E+00	0.00%	1.00E+00	0.00E+00	0.00%
10	FR	T-AT_nIN_nCHR_FR	1.49E-13	7.85E-02	1.17E-14	0.02%	6.85E-03	1.02E-15	0.01%	9.95E-01	1.48E-13	0.03%
11	OPVB	T_nDP_nIN_VB_R1	6.58E-13	1.12E-01	3.68E-15	0.01%	1.28E-02	4.21E-16	0.00%	1.00E+00	3.29E-14	0.01%
12		T_nIN_VB_R1	6.58E-13	9.11E-02	5.69E-14	0.11%	8.94E-03	5.59E-15	0.03%	1.00E+00	6.25E-13	0.11%
13	OPW1	T_nDP_nIN_nCHR_W1_R1	6.49E-11	1.04E-01	6.75E-12	13.54%	1.38E-02	8.96E-13	5.51%	1.00E+00	6.49E-11	11.67%
14	OPW2	T_nDP_nIN_nCHR_W2_R1	3.91E-12	1.04E-01	4.07E-13	0.82%	1.37E-02	5.36E-14	0.33%	1.00E+00	3.91E-12	0.70%
15	TSL	T_AT_nIN_TSL2x_R1	7.57E-09	0.00E+00	0.00E+00	0.00%	2.71E-05	2.05E-13	1.26%	9.63E-03	7.29E-11	13.10%
Total				--	4.98E-11		--	1.63E-11		--	5.56E-10	

Table D

Flood Consequences

Source Term	Release Category	MAAP CASE	Release Frequency (yr)	Individual Risk (0-1 mile)	Weighted Individual Risk (/yr)	Weighted Individual Risk Contribution	Societal Risk (0-10 miles)	Weighted Societal Risk (/yr)	Weighted Societal Risk Contribution	Prob.of Dose > .2 Sv(0-0.5 mile)	Weighted Prob of Exceedance (/yr)	Weighted Dose Contribution
1	BOC	BOCsd_nIN_R1	0.00E+00	1.15E-01	0.00E+00	0.00%	1.42E-02	0.00E+00	0.00%	1.00E+00	0.00E+00	0.00%
2		BOCdr_nIN_R1	0.00E+00	8.46E-02	0.00E+00	0.00%	1.22E-02	0.00E+00	0.00%	1.00E+00	0.00E+00	0.00%
3	BYP	T_nIN_BYP_R1	1.34E-10	1.12E-01	4.50E-14	0.20%	1.59E-02	6.39E-15	0.08%	1.00E+00	4.02E-13	0.18%
4		T_nDP_nIN_BYP_R1	1.34E-10	1.07E-01	1.43E-11	63.90%	5.11E-02	6.83E-12	86.34%	1.00E+00	1.34E-10	59.31%
5	CCID	T_nIN_nD_CCID_R1	0.00E+00	1.04E-01	0.00E+00	0.00%	1.24E-02	0.00E+00	0.00%	1.00E+00	0.00E+00	0.00%
6		T_nDP_nIN_nD_CCID_R1	0.00E+00	7.39E-02	0.00E+00	0.00%	9.50E-03	0.00E+00	0.00%	1.00E+00	0.00E+00	0.00%
7	CCIW	T_nIN_CCIW_R1	1.22E-11	1.04E-01	8.72E-13	3.90%	1.11E-02	9.31E-14	1.18%	1.00E+00	8.38E-12	3.72%
8		T_nDP_nIN_CCIW_R1	1.22E-11	9.37E-02	3.53E-13	1.58%	1.07E-02	4.03E-14	0.51%	1.00E+00	3.77E-12	1.67%
9	EVE	T_nIN_nD_EVE_R1	0.00E+00	1.07E-01	0.00E+00	0.00%	1.36E-02	0.00E+00	0.00%	1.00E+00	0.00E+00	0.00%
10	FR	T-AT_nIN_nCHR_FR	8.09E-14	7.85E-02	6.35E-15	0.03%	6.85E-03	5.54E-16	0.01%	9.95E-01	8.05E-14	0.04%
11	OPVB	T_nDP_nIN_VB_R1	3.25E-13	1.12E-01	1.82E-15	0.01%	1.28E-02	2.08E-16	0.00%	1.00E+00	1.63E-14	0.01%
12		T_nIN_VB_R1	3.25E-13	9.11E-02	2.81E-14	0.13%	8.94E-03	2.76E-15	0.03%	1.00E+00	3.09E-13	0.14%
13	OPW1	T_nDP_nIN_nCHR_W1_R1	6.40E-11	1.04E-01	6.66E-12	29.75%	1.38E-02	8.83E-13	11.17%	1.00E+00	6.40E-11	28.41%
14	OPW2	T_nDP_nIN_nCHR_W2_R1	1.11E-12	1.04E-01	1.15E-13	0.52%	1.37E-02	1.52E-14	0.19%	1.00E+00	1.11E-12	0.49%
15	TSL	T_AT_nIN_TSL2x_R1	1.41E-09	0.00E+00	0.00E+00	0.00%	2.71E-05	3.82E-14	0.48%	9.63E-03	1.36E-11	6.03%
Total	--			--	2.24E-11		--	7.91E-12		--	2.25E-10	

Table E

High Wind Consequences

Source Term	Release Category	MAAP CASE	Release Frequency (/yr)	Individual Risk (0-1 mile)	Weighted Individual Risk (/yr)	Weighted Individual Risk Contribution	Societal Risk (0-10 miles)	Weighted Societal Risk (/yr)	Weighted Societal Risk Contribution	Prob.of Dose > .2 Sv(0-0.5 mile)	Weighted Prob of Exceedance (/yr)	Weighted Dose Contribution
1	BOC	BOCsd_nIN_R1	4.41E-12	1.15E-01	2.54E-13	7.30%	1.42E-02	3.13E-14	3.08%	1.00E+00	2.21E-12	4.75%
2		BOCdr_nIN_R1	4.41E-12	8.46E-02	1.87E-13	5.37%	1.22E-02	2.69E-14	2.64%	1.00E+00	2.21E-12	4.75%
3	BYP	T_nIN_BYP_R1	1.50E-11	1.12E-01	5.04E-15	0.15%	1.59E-02	7.16E-16	0.07%	1.00E+00	4.50E-14	0.10%
4		T_nDP_nIN_BYP_R1	1.50E-11	1.07E-01	1.60E-12	46.06%	5.11E-02	7.64E-13	75.13%	1.00E+00	1.50E-11	32.24%
5	CCID	T_nIN_nD_CCID_R1	1.55E-13	1.04E-01	8.99E-15	0.26%	1.24E-02	1.07E-15	0.11%	1.00E+00	8.65E-14	0.19%
6		T_nDP_nIN_nD_CCID_R1	1.55E-13	7.39E-02	5.06E-15	0.15%	9.50E-03	6.51E-16	0.06%	1.00E+00	6.85E-14	0.15%
7	CCIW	T_nIN_CCIW_R1	1.30E-11	1.04E-01	9.33E-13	26.85%	1.11E-02	9.96E-14	9.79%	1.00E+00	8.97E-12	19.34%
8		T_nDP_nIN_CCIW_R1	1.30E-11	9.37E-02	3.78E-13	10.87%	1.07E-02	4.31E-14	4.24%	1.00E+00	4.03E-12	8.69%
9	EVE	T_nIN_nD_EVE_R1	0.00E+00	1.07E-01	0.00E+00	0.00%	1.36E-02	0.00E+00	0.00%	1.00E+00	0.00E+00	0.00%
10	FR	T-AT_nIN_nCHR_FR	1.29E-14	7.85E-02	1.01E-15	0.03%	6.85E-03	8.84E-17	0.01%	9.95E-01	1.28E-14	0.03%
11	OPVB	T_nDP_nIN_VB_R1	2.20E-14	1.12E-01	1.23E-16	0.00%	1.28E-02	1.41E-17	0.00%	1.00E+00	1.10E-15	0.00%
12		T_nIN_VB_R1	2.20E-14	9.11E-02	1.90E-15	0.05%	8.94E-03	1.87E-16	0.02%	1.00E+00	2.09E-14	0.05%
13	OPW1	T_nDP_nIN_nCHR_W1_R1	1.07E-13	1.04E-01	1.11E-14	0.32%	1.38E-02	1.48E-15	0.15%	1.00E+00	1.07E-13	0.23%
14	OPW2	T_nDP_nIN_nCHR_W2_R1	8.76E-13	1.04E-01	9.11E-14	2.62%	1.37E-02	1.20E-14	1.18%	1.00E+00	8.76E-13	1.89%
15	TSL	T_AT_nIN_TSL2x_R1	1.33E-09	0.00E+00	0.00E+00	0.00%	2.71E-05	3.60E-14	3.54%	9.63E-03	1.28E-11	27.61%
Total	--			--	3.48E-12		--	1.02E-12		--	4.64E-11	

Table F

Shutdown Internal Consequences

Source Term	Release Category	MAAP CASE	Release Frequency (/yr)	Individual Risk (0-1 mile)	Weighted Individual Risk (/yr)	Weighted Individual Risk Contribution	Societal Risk (0-10 miles)	Weighted Societal Risk (/yr)	Weighted Societal Risk Contribution	Prob.of Dose > .2 Sv(0-0.5 mile)	Weighted Prob of Exceedance (/yr)	Weighted Dose Contribution
3	BYP	T_nIN_BYP_R1	9.37E-09	1.12E-01	3.15E-12	0.31%	1.59E-02	4.47E-13	0.09%	1.00E+00	2.81E-11	0.30%
4		T_nDP_nIN_BYP_R1	9.37E-09	1.07E-01	1.00E-09	99.69%	5.11E-02	4.77E-10	99.91%	1.00E+00	9.34E-09	99.70%
Total	--			--	1.00E-09		--	4.78E-10		--	9.37E-09	

Table G

Shutdown Fire Consequences

Source Term	Release Category	MAAP CASE	Release Frequency (/yr)	Individual Risk (0-1 mile)	Weighted Individual Risk (/yr)	Weighted Individual Risk Contribution	Societal Risk (0-10 miles)	Weighted Societal Risk (/yr)	Weighted Societal Risk Contribution	Prob.of Dose > .2 Sv(0-0.5 mile)	Weighted Prob of Exceedance (/yr)	Weighted Dose Contribution
3	BYP	T_nIN_BYP_R1	2.71E-08	1.12E-01	9.11E-12	0.31%	1.59E-02	1.29E-12	0.09%	1.00E+00	8.13E-11	0.30%
4		T_nDP_nIN_BYP_R1	2.71E-08	1.07E-01	2.89E-09	99.69%	5.11E-02	1.38E-09	99.91%	1.00E+00	2.70E-08	99.70%
Total	--			--	2.90E-09		--	1.38E-09		--	2.71E-08	

Table H

Shutdown Flood Consequences

Source Term	Release Category	MAAP CASE	Release Frequency (/yr)	Individual Risk (0-1 mile)	Weighted Individual Risk (/yr)	Weighted Individual Risk Contribution	Societal Risk (0-10 miles)	Weighted Societal Risk (/yr)	Weighted Societal Risk Contribution	Prob.of Dose > .2 Sv(0-0.5 mile)	Weighted Prob of Exceedance (/yr)	Weighted Dose Contribution
3	BYP	T_nIN_BYP_R1	5.24E-09	1.12E-01	1.76E-12	0.31%	1.59E-02	2.50E-13	0.09%	1.00E+00	1.57E-11	0.30%
4		T_nDP_nIN_BYP_R1	5.24E-09	1.07E-01	5.59E-10	99.69%	5.11E-02	2.67E-10	99.91%	1.00E+00	5.22E-09	99.70%
Total	--			--	5.61E-10		--	2.67E-10		--	5.24E-09	

Table I

Shutdown High Wind Consequences

Source Term	Release Category	MAAP CASE	Release Frequency (/yr)	Individual Risk (0-1 mile)	Weighted Individual Risk (/yr)	Weighted Individual Risk Contribution	Societal Risk (0-10 miles)	Weighted Societal Risk (/yr)	Weighted Societal Risk Contribution	Prob.of Dose > .2 Sv(0-0.5 mile)	Weighted Prob of Exceedance (/yr)	Weighted Dose Contribution
3	BYP	T_nIN_BYP_R1	1.19E-09	1.12E-01	4.00E-13	0.31%	1.59E-02	5.68E-14	0.09%	1.00E+00	3.57E-12	0.30%
4		T_nDP_nIN_BYP_R1	1.19E-09	1.07E-01	1.27E-10	99.69%	5.11E-02	6.06E-11	99.91%	1.00E+00	1.19E-09	99.70%
Total	--			--	1.27E-10		--	6.07E-11		--	1.19E-09	

Table J

Shutdown Internal Consequences – HEP Value Sensitivity

Source Term	Release Category	MAAP CASE	Release Frequency (/yr)	Individual Risk (0-1 mile)	Weighted Individual Risk (/yr)	Weighted Individual Risk Contribution	Societal Risk (0-10 miles)	Weighted Societal Risk (/yr)	Weighted Societal Risk Contribution	Prob.of Dose > 0.2 Sv (0-0.5 mile)	Weighted Prob of Exceedance (/yr)	Weighted Dose Contribution
3	BYP	T_nIN_BYP_R1	7.78E-10	1.12E-01	2.61E-13	0.31%	1.59E-02	3.71E-14	0.09%	1.00E+00	2.33E-12	0.30%
4		T_nDP_nIN_BYP_R1	7.78E-10	1.07E-01	8.30E-11	99.69%	5.11E-02	3.96E-11	99.91%	1.00E+00	7.76E-10	99.70%
Total	--			--	8.33E-11		--	3.97E-11		--	7.78E-10	
Shutdown Fire Consequences – Fire Area F7300 Sensitivity												
3	BYP	T_nIN_BYP_R1	1.98E-08	1.12E-01	6.65E-12	0.31%	1.59E-02	9.44E-13	0.09%	1.00E+00	5.93E-11	0.30%
4		T_nDP_nIN_BYP_R1	1.98E-08	1.07E-01	2.11E-09	99.69%	5.11E-02	1.01E-09	99.91%	1.00E+00	1.97E-08	99.70%
Total	--			--	2.12E-09		--	1.01E-09		--	1.98E-08	
Shutdown Fire Consequences – Ru Sensitivity												
3	BYP	T_nIN_BYP_R1	2.71E-08	1.16E-01	9.43E-12	0.32%	3.24E-02	2.63E-12	0.17%	1.00E+00	8.13E-11	0.30%
4		T_nDP_nIN_BYP_R1	2.71E-08	1.10E-01	2.97E-09	99.68%	5.60E-02	1.51E-09	99.83%	1.00E+00	2.70E-08	99.70%
Total	--			--	2.98E-09		--	1.52E-09		--	2.71E-08	

Table K

Risk Measures

Cases	Description	Weighted Individual Risk (/yr)	Weighted Societal Risk (/yr)	Weighted Probability of Exceedance (/yr)
1	Internal*	8.94E-11	1.41E-11	1.09E-09
2	Fire	4.98E-11	1.63E-11	5.56E-10
3	Flood	2.24E-11	7.91E-12	2.25E-10
4	High Wind	3.48E-12	1.02E-12	4.64E-11
5	Shutdown (Internal)	1.00E-09	4.78E-10	9.37E-09
6	Shutdown (Fire)	2.90E-09	1.38E-09	2.71E-08
7	Shutdown (Flood)	5.61E-10	2.67E-10	5.24E-09
8	Shutdown (High Wind)	1.27E-10	6.07E-11	1.19E-09
9	Shutdown (Internal) Sensitivity	8.33E-11	3.97E-11	7.78E-10
10	Shutdown (Fire) Sensitivity	2.12E-09	1.01E-09	1.98E-08
11	Shutdown (Ru) Sensitivity	2.98E-09	1.52E-09	2.71E-08
	NRC Risk Goals	< 3.9E-7	< 1.7E-6	< 10E-6

* Internal events are not asked for in this RAI, listed here for info and comparison purpose