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Project 717

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U.S. Nuclear Regulatory Commission
Document Control Desk
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Attention: Amy E. Cabbage, ESBWR Project Manager
Division of Regulatory Improvement Programs

Subject: **Errata and Addenda No. 1 to Licensing Topical Report, NEDO-33175, Revision 1, "Classification of ESBWR Abnormal Events and Determination of Their Safety Analysis Acceptance Criteria," February 2005**

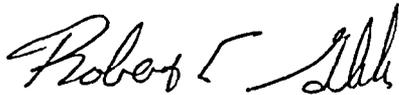
Enclosure 1 contains the subject Errata and Addenda (E&A). Please replace the applicable pages of the subject licensing topical report (LTR) with the attached corrected pages.

For your convenience, a copy of the LTR with the corrections incorporated also is attached.

If you have any questions, please contact Kurt Schaefer at (408) 925-2426 or Kathy Sedney at (408) 925-5232. Please let us know if we can provide any additional information to assist in your review.

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Sincerely,



Robert E. Gamble
Manager, ESBWR

Enclosure:

1. MFN 05-015 – Errata and Addenda No. 1 to Licensing Topical Report, NEDO-33175, Revision 1, *Classification of ESBWR Abnormal Events and Determination of Their Safety Analysis Acceptance Criteria*, February 2005

cc: WD Beckner USNRC (w/o enclosures)
MB Fields USNRC (with enclosures)
GB Stramback GE (with enclosures)
eDRF-0000-0028-0502

MFN 05-015
Enclosure 1

ENCLOSURE 1

MFN 05-015

Errata and Addenda No. 1 to Licensing topical Report,
NEDO-33175, Revision 1
*Classification of ESBWR Abnormal Events
and Determination of Their Safety Analysis Acceptance Criteria*
February 2005



Errata and Addenda Sheet

GE Nuclear Energy
175 Curtner Avenue
San Jose, CA 95125

Applicable to: ESBWR
Publication No. NEDO-33175, Rev. 1
Title: Classification of ESBWR Abnormal
Events And Determination of Their
Safety Analysis Acceptance Criteria

E&A No. 1
Date: February 2005

Note: Correct all copies of the
applicable publication as
specified below.

Issue Date: February 2005

<i>Item</i>	<i>References</i> (Section, Page Paragraph, Line)	<i>Instructions</i> (Corrections and additions are supplied as replacement pages)
1	Section 3, page 22, 2 nd paragraph, last sentence.	Revise "should be" to "should not be."
2	Section 3.1, page 23, 1st paragraph.	Reorder items "i," "j" and "k" as "a," "b" and "c."
3	Section 3.1, page 23, last paragraph.	Change "(e)" to "(d)."
4	Section 4.4, page 28	Grammatically clarified the 1 st sentence.
5	Table 3, page 34.	Reformat note "****" to start on a new line.

3. DETERMINATION OF EVENT CLASSIFICATIONS

Because

- the 10 CFR regulations have authority over all other document types,
- the non-accident abnormal event classifications within the SRP are inconsistently used,
- the non-accident abnormal event classifications within RG 1.70 are inconsistently used,
- the classifications of non-accident abnormal event classifications between the SRP and RG 1.70 are inconsistent,
- both sets of non-accident abnormal event classifications in the SRP and RG 1.70 are not consistent with the abnormal event classifications in the 10 CFR regulations,
- all versions of abnormal event categories are not clearly defined in the SRP and RG 1.70,
- the 10 CFR regulations do specifically define an AOO, LOCA, ATWS, normal operation, design basis events, and a number of associated terms, and
- the use of terms is more consistent within the 10 CFR regulations than in the SRP or RG 1.70

the classification of events should primarily be based on the classifications and terms used in the 10 CFR regulations.

The *design basis events (DBEs)* in the 10 CFR regulations assume an initiating event (and any resultant failures) with or without a single active component failure or operator error. The postulating of design basis events that assume a failure beyond the SFC or a common-mode failure is not specifically required by the 10 CFR regulations. However, the 10 CFR regulations do require evaluations of three specific event scenarios, i.e., Safe Shutdown Fire, Station Blackout (SBO) and ATWS, and some of these event scenarios do assume failures beyond the single failure criterion (SFC) and/or common-mode failures. Therefore, these events should not be classified as *DBEs*, however, their safety analyses should be included in a DCD or FSAR.

Based on Table 3-1 of ANSI/ANS-52.1-1983 (Reference 6), *DBEs* should have annual probabilities $\geq 10^{-6}$. Therefore, any event with an annual probability of $< 10^{-6}$ is not considered credible and should not be classified as a *DBE*.

The 10CFR regulations, SRP and RG 1.70 postulate events that (for the ESBWR with its advanced design features and additional redundancy) require failures beyond the SFC and/or require common-mode failures. Those events shall be included in the ESBWR DCD, but not as *DBEs*.

Per the 10 CFR regulations, AOOs are expected to occur once in a plant's lifetime, while accidents are low probability events that are not expected to occur during a plant's lifetime. Because the ESBWR has a design life is 60 years, any abnormal event that has an annual probability of occurrence $\geq 1/60$ could be classified as an AOO. However, historically, a value of $> 1/100$ has been used.

Based on the 10 CFR regulations, the SRP or an NRC reviewed Licensing Topical Report (LTR), the safety analysis acceptance criteria for each of the *special events* should be developed on an event-specific basis.

The 10 CFR regulations consistently refer to any failure of a fission product barrier that results in an offsite radiological consequence as an accident.

3.1 Approach For Determining Event Classifications

- (1) Per the 10 CFR regulations, the 10 CFR 50 App. A definitions, GDC, the 10 CFR 50.49 *design basis event* definition, SRP 6.1.1, SRP 15.0.1, RG 1.183 and guidance from events addressed in the SRP;
 - a. divide the types of events as *DBEs*, and by exclusion, all other events as *special events*;
 - b. determine if AOOs should be treated as accidents; and
 - c. generate the criterion for determining which type of accidents shall be classified as *design basis accidents (DBAs)*, and by exclusion, all other accidents are not *DBAs*.
- (2) Per the regulatory definition of an AOO (event probability), historical information and guidance from the SRP determine specific criteria for classifying events as AOOs.
- (3) Based on (a) the 10 CFR regulations associating accidents with radiological consequences, (b) application of SFC, (c) SRP and RG 1.70 guidance for the types of events that should be addressed in Chapter 15, (d) SRP acceptance criteria for transient/AOO events that result in fuel failure, and (e) historical consistently used terms, generate a classification term and criteria for determining non-AOO and non-DBA events, which (a) should be treated as *design basis events* and (b) result from an initiating event with or without assuming a single active component failure or single operator error. Include this new *DBE* term in the *DBE* classifications.
- (4) Based on (a) reviewing the 10 CFR regulations that have added other abnormal events (e.g., ATWS, SBO, Safe Shutdown Fire), (b) that *DBEs* do not include common-mode failures and/or additional failure(s) beyond the SFC, (c) reviewing the SRP events that include common-mode failures and/or failure(s) beyond the SFC, and (d) historically evaluated *non-DBE* events and used associated classification terms, generate a classification term for *non-DBEs* that should be addressed in a DCD Chapter 15.

3.2 Results of Event Classification Determinations

Table 3 provides the results of the event classifications in the form of a determination criteria vs. event classification matrix. Table 3 is based on the results from the following evaluation.

- (1) a. Per 10 CFR 50.49, and the fact that the SRP treats all postulated abnormal initiating events with or without assuming a single active component failure or single operator error as if they are all *design basis events*, the following are classified as *design basis events*:
 - *normal operation*, including AOOs;
 - *accidents*, see (3) for additional details;
 - *design basis accidents*;
 - *external events*; and
 - *natural phenomena*.

RG 1.70 classifies accidents as "limiting faults," which can be correlated to different service levels or design conditions in the applicable industry code, e.g., ASME Code Service Level C or D. To ensure conservatism and minimize the number of acceptance condition options, for DBAs, reactor coolant pressure boundary components shall be limited to ASME Code Service Level C limits.

If a DBA results in a discharge to the containment, then containment stresses (i.e., pressures and temperatures) must remain within their design limits.

GDC 19 is the only regulatory basis for the acceptance criterion on control room doses for DBAs.

The set of acceptance criteria for *DBA* safety analyses are provided in Table 8.

Because radiological acceptance criteria vary for the different accident scenarios, for each accident scenario applicable to an ESBWR, Table 9 provides the accident classification (*accident* or *DBA*) and its radiological acceptance criteria.

4.4 Special Events

As discussed in Section 3, the acceptance criteria for each *special event* safety analysis are developed on an event-specific basis, based on the coping, mitigation or acceptance criteria specified in the 10 CFR regulations, the SRP or an NRC reviewed LTR.

4.4.1 Overpressure Protection Analysis

For every fuel cycle an Overpressure Protection Analysis is performed. With respect to the reactor coolant pressure boundary (RCPB) pressure response, the event scenario is specifically chosen to bound all of the *design basis events*. The event requires/assumes

- (1) an operator error, multiple equipment failures or a common mode failure cause(s) the MSIVs in all four main steamlines (MSLs) to simultaneously close;
- (2) the two MSIV position switch circuits on three to six MSIVs fail, which causes the MSIV position scram function to fail; and
- (3) the reactor is shutdown by a high neutron flux scram trip.

The Overpressure Protection Analysis demonstrates that the SRVs have adequate pressure relief capacity to prevent the RCPB ASME Code Service Level B pressure limit(s) and the Reactor Coolant System Pressure Safety Limit in the Technical Specifications from being exceeded. Therefore, this event only needs/has the following acceptance criteria.

- Pressures in the reactor coolant and main steam systems shall be maintained below 110% of their design values (i.e., not exceed ASME Code Service Level B).
- The reactor steam dome pressure shall be maintained less than or equal to the Reactor Coolant System Pressure Safety Limit in the Technical Specifications.

Table 3
Chapter 15 Abnormal Event Classification Determination Matrix

Determination Criteria vs. Event Classification	Annual Probability $\geq 10^{-2}$	Thermal Hydraulic Basis	Radiological Analysis Basis		Assumes An Additional SACF or SOE		Event Not Included As A Design Basis Event in 10 CFR 50.49(b)(1)(ii) <u>and</u>		
			10 CFR 20	10 CFR 50.34(a)(1) & GDC 19	Yes	No	Is Postulated In A Regulation	Assumes Common-Mode Failure(s)	Assumes Failures, Beyond SFC
AOO	X	SLMCPR	(Not needed)			X			
		Maintain 100% Core Coverage	X		X				
Accident (non-DBA)		Maintain 100% Core Coverage	X*	X*	X*	X*			
DBA		10 CFR 50.46		X	X				
Special Event **		X*		X***			X**	X**	X**

* Specific event dependent.

** Does not include severe accidents and other events that are only evaluated as part of the plant PRA.

*** If applicable to a specific Special Event.

+ Or any combination of these conditions.