71-091211-CLN-01

TO: DISTRIBUTION
FROM: C NEUMEYER
SUBJECT: PROCEDURE TO UPDATE NSTX FAILURE MODES AND EFFECTS ANALYSIS (FMEA) DOCUMENT

References:

[1] NSTX Failure Modes and Effects Analysis (FMEA), NSTX-FMEA-61-4, 8/17/00
[2] NSTX General Requirements Document (GRD), NSTX_RQMT-GRD-018-011-02.doc, 12/8/98
[3] NSTX Center Stack Upgrade General Requirements Document, NSTX_CSU-RQMTS-GRD, 3/30/09
[4] NSTX Structural Design Criteria, NSTX_DesCrit_IZ_080103.doc, 8/1/3

The purpose of this memo is outline the procedure to update the NSTX FMEA [1] to reflect changes associated with the NSTX Center Stack and Neutral Beam Upgrade projects.

In addition to reflecting changes to the NSTX device and its operating envelope, additional columns in the FMEA shall be included to cover failure probability and consequence. These additions are needed to properly link the FMEA to the Structural Design Criteria [4].

General Design Guidelines

General Design Guidelines are given in Table 3.1-1 of the NSTX GRD [2] which is still in effect per the Center Stack Upgrade GRD [3]:

"Criteria given in the last revision of the GRD for the original NSTX Project shall still apply except where superceded by information contained herein".

Table 3.1-1 of the NSTX GRD is given below. Note that the same table appears in the Structural Design Criteria and traces its origin to DOE standards for non-reactor nuclear facilities[1].

[1] DOE/TIC-11603-Rev.1; BNL-51444-Rev.1, http://www.osti.gov/energycitations/product.biblio.jsp?osti_id=6780272

General Design Guidelines

Operating Condition	Description	P, Probability Of Occurrence In A Year	General Design Guidelines
Normal Events	Events that are planned to occur regularly in the course of facility operation	P=1	Provide safe and reliable operation
Anticipated Events	Events of moderate frequency which may occur once or more in the lifetime of a facility	$1>P\geq10^{-2}$	The facility should be capable of returning to operation without extensive corrective action or repair
Unlikely Events	Events which are not anticipated but which may occur during the lifetime of a facility	$10^{-2}>P\geq10^{-4}$	The facility should be capable of returning to operation following potentially extensive corrective actions or repairs, as necessary
Extremely Unlikely Events	Events which are limiting faults and are not expected to occur during the lifetime of a facility but are postulated because of their safety consequences	$10^{-4}>P\geq10^{-6}$	Facility damage may preclude returning to operation
Incredible Events	Events of extremely low probability of occurrence or of non-mechanistic origin	$P<10^{-6}$	Not considered in the design

Failure Probability

Failure probability definitions shall be based on the first three columns of the General Design Guidelines table. Entries in the FMEA table for failure probability shall be chosen from the following list:

- Normal
- Anticipated
- Unlikely
- Extremely Unlikely
- Incredible

Engineering judgement shall be used to choose the appropriate entry for each failure in the FMEA table; probabilistic analysis is not required.

Failure Consequence

Failure consequence definitions shall be based on the fourth column of the General Design Guidelines table. Entries in the FMEA table for failure consequence shall be chosen from the following list:

- Minimal
- Minor corrective action (to abbreviated as “Minor” in FMEA table)
- Major corrective action (to abbreviated as “Major” in FMEA table)

- Irreparable facility damage (to abbreviated as “Irreparable” in FMEA table)

Distinction between the above categories shall be as follows:

Consequence	**Criteria**
Minimal	Time to correct/repair < 1 week and Cost < $10K
Minor corrective action	Time or Cost greater than entry above, and Time to correct/repair < 1 month and Cost < $100K
Major corrective action	Time or Cost greater than entry above, and Time to correct/repair < 12 month and Cost < $5000K
Irreparable facility damage	Time or Cost greater than entry above or other factor preventing future use of facility

Engineering judgement shall be used to choose the appropriate entry for each failure in the FMEA table; detailed cost/schedule analysis is not required.

Table Format

Original FMEA table format will include the two additional columns (“Probability” and “Consequence” as follows:

Failure Mode	Effect	Detection	Recovery	Probability	Consequence

cc:

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