

Regulatory Guide 1.53 Rev 1 Single Failure Criterion

Presentation to
Committee to Review Generic Requirements
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Single Failure Criterion

- Draft RG DG-1118 was issued in 2002 for public comment.
- Received 4 comment letters.
- Made few minor changes in the implementation section:
 - Backfitting is not intended for current operating nuclear power plants

Single Failure Criterion

- Draft DG-1118:

Licensees of Operating Nuclear Power Plants will have the option to use for safety system modifications.

1. The June 1973 issue of RG 1.53 and be subjected by the staff on a case-by-case basis; or
2. This revision 1

Single Failure Criterion

- Final RG:

It will also be used to evaluate the submittals from the operating reactor licensees who voluntarily propose to initiate safety system (or protection system) modifications, if there is a clear nexus between the proposed modifications and this guidance for applying single failure criterion.

Single Failure Criterion

- What is a “Single Failure?”

The safety systems shall perform all required safety functions for a DBE in the presence of:

- Any single detectable failure within the safety systems.
- All failures caused by the single failure.
- All failures that cause or are caused by the DBE requiring the safety function.

Single Failure Criterion

- Single Failure:
 - The single failure could occur prior to, or at any time during, the DBE for which the safety system is required to function.

Single Failure Criterion

- Single-Failure analysis in designs using digital computers:

Reference to another IEEE Std was added (IEEE Std 7-4.3.2 – 1993).

Single Failure Criterion

- Shared Systems:

Single-Failure Criterion is:

- The safety systems of all units be capable of performing their required safety functions with a single failure assumed within the shared systems or within the auxiliary supporting features or other systems with which the shared systems interface.

Single Failure Criterion

- The safety systems of each unit shall be capable of performing their required safety functions, with a single failure initiated concurrently in each unit within the systems that are not shared.
- Provisions shall be included in the design to ensure that single failures within one unit will not adversely affect (propagate to) the other unit, thereby preventing the shared systems from performing the required safety functions.

Single Failure Criterion

Design Analysis for Single Failure

Procedure:

For each design basis event, the following steps shall apply:

- The safety function for which the analysis is to be performed shall be determined.
- The protective actions at the system level that are available to accomplish the safety function shall be determined.

Single Failure Criterion

- The safety groups that will sufficiently satisfy the required safety functions shall be determined.
- The independence of the safety groups that were established above shall be verified.
- For systems or parts where independence cannot be established, a systematic investigation of potential failures shall be conducted to assure that the single-failure criterion is not violated.

Single Failure Criterion

- Probabilistic Assessment
 - A probabilistic assessment shall not be used in lieu of the single failure analysis.
 - A failure can be excluded from the Single-Failure Analysis based on:
 - Reliability Analysis
 - Probability Assessment
 - Operational Experience
 - Engineering Judgement
 - Any Combination

Single Failure Criterion

- Sensing Lines

Lines connecting sensors to the process systems shall be included in the Single-Failure Analysis.