

IEEE Standard Application of the Single-Failure Criterion to Nuclear Power Generating Station Safety Systems

Sponsor

**Nuclear Power Engineering Committee
of the
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Abstract: The application of the single-failure criterion to the electrical power, instrumentation, and control portions of nuclear power generating station safety systems is covered. Conformance with the requirements of IEEE Std 603-1991 and the single-failure criterion as stated in that document is established. Interpretation and guidance in the application of the single-failure criterion, a discussion of the failures, and an acceptable method of single-failure analysis are presented.

Keywords: nuclear power, nuclear power generating station, safety systems, single-failure criterion

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Introduction

(This introduction is not part of IEEE Std 379-1994, IEEE Standard Application of the Single-Failure Criterion to Nuclear Power Generating Station Safety Systems.)

The requirement for nuclear power generating station safety systems to meet a single-failure criterion is found in many documents, including IEEE standards, American Nuclear Society (ANS) standards, and federal regulations. It is the intention of this document to

- Conform specifically with the requirements of IEEE Std 603-1991, IEEE Standard Criteria for Safety Systems for Nuclear Power Generating Stations^a
- Interpret the single-failure criterion as stated in IEEE Std 603-1991
- Provide guidance in the application of the single-failure criterion as stated in IEEE Std 603-1991

It is recognized that the single-failure criterion is applicable to the aggregate of electrical and mechanical systems. However, the criterion statement, as found in this document, has been developed for electrical systems. Where the interface with mechanical systems is unavoidable (for example, sensing lines), the mechanical portions are considered to be part of the electrical system with which they interface. It should be noted that the systems include the actuation and protection systems as well as the electrical power system.

The purpose of this revision is to

- Clarify that the safety systems shall be capable of performing their safety functions with the single-failure occurring prior to or during the design basis event
- Revise the definitions to agree with IEEE Std 603-1991
- Update the references cited in the text

Several areas addressed by, but not completely developed within, this standard are as follows:

- *Relationships with other guides and standards:* Other guides and standards should be incorporated in any good design in order to produce an acceptable and reliable system. The relationship of the single-failure criterion to these other guides and standards, documentation requirements, reliability and probability studies, testing, and operation is not within the scope of this standard.
- *Shared systems:* This standard, in the present revision, describes the manner in which the single-failure criterion should be applied to shared systems. The intent is to neither endorse nor forbid the use of shared systems, but rather to provide minimum requirements to assure that shared systems will be analyzed as rigorously for the effects of component failures as they would be if sharing were not used.
- *Single operator error:* Operator actions should be considered but are beyond the scope of this document.
- *Common cause failures:* Common cause failures not subject to single-failure analysis include those that can result from external environmental effects, design deficiencies, manufacturing errors, maintenance errors, and operator errors. Common cause failures are of concern in assessing plant safety.

Common cause failure should be addressed using reliability and probability tools, and should consider the consequences of the loss of safety function.

Common cause failures are also addressed by IAEA 50-P-1, Application of the Single Failure Criterion.

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^aInformation on references can be found in clause 2.

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