

IEEE Standard for Risk-Informed Categorization and Treatment of Electrical and Electronic Equipment at Nuclear Power Generating Stations and Other Nuclear Facilities

IEEE Power and Energy Society

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Nuclear Power Engineering Committee

IEEE Standard for Risk-Informed Categorization and Treatment of Electrical and Electronic Equipment at Nuclear Power Generating Stations and Other Nuclear Facilities

Sponsor

**Nuclear Power Engineering Committee
of the
IEEE Power and Energy Society**

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Abstract: Risk-informed methods have been established to appropriately categorize components as either safety significant or low safety significant. Application of these methods has been shown to be safety-beneficial for existing nuclear power generating stations and nuclear facilities. No standardized approach currently exists for the detailed application of these methods to electrical and electronic components. The results of the categorization process are not easily integrated with traditional Class 1E/non-Class 1E classifications or the resulting treatment for these components. In this standard, methods are provided to categorize electrical and electronic components using a risk-informed process and identify how the categorization results relate to Class 1E/non-Class 1E classifications. Also provided in this standard is a standardized and accepted method for alternate treatment of categorized components commensurate with their safety significance.

Keywords: categorization, IEEE 1819™, risk-informed, safety significance, treatment

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Introduction

This introduction is not part of IEEE Std 1819-2016, IEEE Standard for Risk-Informed Categorization and Treatment of Electrical and Electronic Equipment at Nuclear Power Generating Stations and Other Nuclear Facilities.

This standard provides risk-informed methods to appropriately categorize components as either safety significant or low safety significant. Application of these methods has been shown to be safety-beneficial for existing nuclear power generating stations and nuclear facilities. No standardized approach currently exists for the detailed application of these methods to electrical and electronic components. The results of the categorization process are not easily integrated with traditional Class 1E/non-Class 1E classifications or the resulting treatment for these components. This standard provides methods to categorize electrical and electronic components using a risk-informed process and identifies how the categorization results relate to Class 1E/non-Class 1E classifications. This standard also provides a standardized and accepted method for alternate treatment of categorized components commensurate with their safety significance.

History

At the Nuclear Power Engineering Committee (NPEC) meeting in mid-2004, the 2005-2006 NPEC Goals were approved. Goal five was to Incorporate Risk-Informed Methodologies into IEEE Standards. Some risk-informed criteria had already been incorporated into IEEE Std 338™, which provided for risk-informed test intervals. NPEC asked the subcommittee to make a recommendation as to how to incorporate risk into other standards in accordance with goal five. A position paper on integration of “Risk-Informed Methodology” into IEEE standards was written with three options. After discussions within the subcommittee and working groups, a determination was made that the best option was a new standard that would complement existing standards. This option was approved by NPEC in mid-2006. The need for this standard to address the categorization and treatment of equipment by safety significance was also presented and approved.

This document is intended to provide guidance for establishing a methodology for the categorization of electrical and electronic systems and components (EESCs) for nuclear power plant licensees/operators that choose to adopt regulations that provide for risk analysis and categorization of electrical and electronic components and appropriate treatment or that choose to establish facility prioritization, effectiveness, or optimization processes supporting risk-informed decision-making. An example of such regulation is U.S. 10 CFR 50.69, Risk-Informed Categorization and Treatment of Structures, Systems and Components for Nuclear Power Reactors. This methodology may also be used for other purposes, such as gaining a better understanding of the risk significance of EESCs and applying resources and effort in a manner commensurate with that risk significance, while still meeting the applicable regulatory requirements. The approach detailed here utilizes risk insights that are obtained from Probabilistic Risk Assessment (PRA) models in combination with deterministic evaluations performed by plant-knowledgeable personnel. These insights are applied to selected plant systems in a systematic manner that evaluates the risk significance of EESCs. System functions and their associated components are categorized as safety significant or low safety significant, based on their risk contribution to preventing or mitigating a core damage event or a large early radioactivity release.

This standard allows the reduction of special treatment requirements for Class 1E EESCs that have been categorized as low safety significant in accordance with an approved methodology. Conversely, EESCs that are non-Class 1E but categorized as safety significant are required to be evaluated for additional controls to provide increased confidence that they can perform their safety significant functions. Thus, increased focus and resources can be applied to safety significant EESCs while allowing increased flexibility for items with low safety significance. The expected result of applying this methodology is that nuclear safety is increased while improving the reliable and cost-effective operation of the power plant.

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IEEE Standard for Risk-Informed Categorization and Treatment of Electrical and Electronic Equipment at Nuclear Power Generating Stations and Other Nuclear Facilities

1. Overview

1.1 Scope

This standard identifies and discusses criteria for risk-informed categorization and treatment of electrical and electronic components that are designated by the user to be placed into safety significant categories at nuclear power generating stations and other nuclear facilities.

1.2 Purpose

This standard provides methods to categorize electrical and electronic components using a risk-informed process and provides the recommended treatment of categorized components commensurate with their safety significance.

1.3 Applicability

This standard addresses electrical and electronic systems and components (EESC) only. EESCs are categorized into four Risk-Informed Safety Classifications (RISC), as shown in [Figure 1](#).

For RISC-1 EESCs, the current IEEE standards, recommended practices and guides will continue to be applied.

For RISC-2 EESCs, IEEE nuclear standards generally do not apply. However, based on their safety significance, RISC-2 EESCs shall be evaluated by considering IEEE Nuclear Power Engineering Committee standards, recommended practices, and guides for the purpose of determining what enhanced treatment may need to be applied to these EESCs.

For RISC-3 EESCs, based on their low safety significance, some special treatment requirements contained in IEEE nuclear standards, recommended practices and guides may no longer apply. RISC-3 EESCs can be evaluated for alternate treatment that is less stringent than the previously applied IEEE nuclear standards, although certain aspects of these standards should be considered as recommended practice.