



Evaluation of “Safety Related” and “Important to Safety” terminology for safety classification of nuclear installation items in Brazil

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1. Introduction

In general terms, safety demonstration of nuclear installations is carried out through an assessment of compliance with design criteria and safety requirements established in national and international codes and standards applicable to each type of installation. In addition, a safety analysis consisting of installation behavior study during its useful lifetime, shall be developed considering normal operating conditions, transients, and postulated accidents, to determine safety margins and verify the adequacy of items designed to prevent accidents or mitigate their consequences. Also, design requirements applicable to each installation item depend on its classification with respect to safety. Thus, safety classification of structures, systems, and components (SSCs) must be performed based on adequate methods and clear and consistent criteria to ensure that an overall safety level expected for the installation is achieved. It is worth emphasizing the importance of the terminology adopted and the understanding of concepts definitions used in a safety classification process. In this work, this subject is raised to demonstrate that divergent definitions and misinterpretations of concepts may result in inconsistencies in SSCs safety classification. Thus, this article presents a review of the application of “safety-related item” and “item important to safety” terminology, evaluating definitions and interpretations given by the International Atomic Energy Agency (IAEA), the United States Nuclear Regulatory Commission (U.S.NRC) and the National Nuclear Energy Commission (CNEN) of Brazil.

2. Methodology

Initially, a comparative analysis was performed to verify the correlation among the definitions of “Safety Related Item” and “Item Important to Safety” presented in IAEA safety standards, U.S.NRC codes and regulatory guides and CNEN standards. Then, considering possible identified inconsistencies, an assessment of the impact of this issue regarding consistency of SSCs safety classification was carried out. According to the IAEA Safety Glossary [1], “safety related items” are a subgroup of “items important to safety”, considering the following definitions:

“Safety related item. An item important to safety that is not part of a safety system.”

“Item important to safety. An item that is part of a safety group and/or whose malfunction or failure could lead to radiation exposure of the site personnel or members of the public.

Items important to safety include:

- Those structures, systems and components whose malfunction or failure could lead to undue radiation exposure of site personnel or members of the public;

- *Those structures, systems and components that prevent anticipated operational occurrences from leading to accident conditions;*
- *Safety features (for design extension conditions);*
- *Those features that are provided to mitigate the consequences of malfunction or failure of structures, systems and components.*”

Concerning the U.S.NRC, the definition of “safety-related” SSCs presented in 10 CFR 50.2 [2] is:

*“**Safety-related structures, systems and components means those structures, systems and components that are relied upon to remain functional during and following design basis events to assure:***

- (1) The integrity of the reactor coolant pressure boundary;*
- (2) The capability to shut down the reactor and maintain it in a safe shutdown condition; or*
- (3) The capability to prevent or mitigate the consequences of accidents which could result in potential offsite exposures comparable to the applicable guideline exposures set forth in § 50.34(a)(1) or §100.11 of this chapter, as applicable.”*

Although the term “important to safety” is not included in the definitions of 10 CFR 50.2 [2], the following interpretation is given in the introduction of Appendix A of 10 CFR 50 [3]:

*“The principal design criteria establish the necessary design, fabrication, construction, testing, and performance requirements **for structures, systems, and components important to safety; that is, structures, systems, and components that provide reasonable assurance that the facility can be operated without undue risk to the health and safety of the public.**”*

On the other hand, the term “Safety Related” is not used in Appendix A of 10 CFR 50, raising the hypothesis that, in this Appendix A, the term “Important to Safety” has been used as equivalent to “Safety Related”, as shown, for example, in [4] and [5]. Thus, the lack of a clear definition of the correlation between the terms “Important to Safety” and “Safety Related” generated a series of communications between license applicants and the U.S.NRC staff. In these documents, difficulties and inconsistencies are pointed out and necessary clarifications are requested to establish proper distinction between these terms. As presented in [4], there is a letter from the U.S.NRC in response to an applicant, confirming inconsistency in the use of “Safety Related” and “Important to Safety” and explaining that these terms are not equivalents. Moreover, the concept of “Safety Related” should be understood as a subgroup of “Important to Safety”. In SECY-86-164 [6], the category “Important to Safety” is subdivided into “Safety Related” and “Nonsafety Related”, in line with [4] and explained in [7]. However, the term “Nonsafety Related” (NSR) is not clearly defined in the U.S.NRC regulations, as shown in [8] and [9]. In these documents, a table of equivalence of terms is presented, which does not include a designation for SSCs “Important to Safety” that are not part of the “Safety Related” category. In [9], it is suggested that the “Nonsafety Related” category defined by the IEEE should be equivalent to and limited to the IAEA “Not Important to Safety” category. However, in [5], license applicants had difficulties to determine which “Nonsafety Related” SSCs should be categorized as “Important to Safety”, inducing to the conclusion that “Nonsafety Related” SSCs are not contained in the “Not Important to Safety” category, but may be classified as “Important to Safety”. In [10], a correlation is established in which “Nonsafety Related” SSCs permeate both categories, “Important to Safety” and “Not Important to Safety”. In [11], the terms “Safety Related” and “Nonsafety Related” are considered as well as their respective correlations with other references used in the U.S.NRC regulatory framework, in addition to the following excerpt:

“Items that are not relied upon to achieve these basic safety-related functions and whose failure would not prevent the accomplishment of these basic safety-related functions are NSR.”

Regarding CNEN standards, such terms may vary depending on the standard used. The CNEN glossary [12] contains a definition for “Item Important to Safety” which, except for minor variations, is maintained in most of its standards:

*“**Item important to safety** - Item that includes or is included in:*

- a) structures, systems and components whose failure or malfunction may result in undue radiation exposure to facility personnel or members of the public;*

b) structures, systems and components that prevent anticipated operational occurrences from resulting in accident conditions;

c) features necessary to mitigate the consequences of failure or malfunction of structures, systems and components mentioned in "a" and "b" above."

The CNEN glossary [12] does not contain the definition of the term “Safety Related Item”, but in its standards, except for CNEN NE 1.11 [13], the following definition is presented:

"Safety Related Item - Important safety item that does not contain radioactive material."

The following step of the methodology adopted in this study is the evaluation of possible implications that inconsistencies and conflicts identified in terminology and in concepts definitions may have in the safety classification scheme of nuclear installations SSCs. Thus, lack of clarity and consistency in defining these terms may interfere with safety classification of SSCs and, consequently, attribute quality requirements non compatible to their safety importance. Ultimately, adopting a necessary and sufficient set of design requirements ensures not only meeting criteria and safety requirements defined by the regulatory authority, but also projects feasibility. Furthermore, highly conservative results, originated from erroneous epistemic perceptions, can consume excessive financial resources, without necessarily increasing installation safety level.

3. Results and Discussion

The definitions for “Important to Safety” presented by the IAEA, U.S.NRC and CNEN are equivalent. On the other hand, IAEA definition for “Safety Related” is equivalent to U.S.NRC definition for “Nonsafety Related”, which can cause confusion and misunderstanding, as they are denominations that configure opposition. “Safety Related” definition proposed by the U.S.NRC is equivalent to the IAEA definition for “Safety Systems”. It should be noted that "Nonsafety Related" SSCs permeate both "Important to Safety" and "Not Important to Safety" categories, according to the U.S.NRC definitions. In this sense, it is worth discussing which “Nonsafety Related” SSCs should be categorized as “Important to Safety”. There is not a direct equivalence of CNEN definition for “Safety Related Item” with those presented by the IAEA and U.S.NRC, nor the correlation of this definition with other terms used by these organizations. In Table I, a correlation among IAEA, U.S.NRC and CNEN terminologies is proposed, according to the references used in the elaboration of this work.

Table I: Correlation among IAEA, U.S.NRC and CNEN terminologies.

IAEA	Important to Safety		Not Important to Safety
	Safety	Safety Related	
U.S.NRC	Important to Safety		Not Important to Safety
	Safety Related	Nonsafety Related	
CNEN	Important to Safety		Not Important to Safety
	a		

^a – CNEN definition for “Safety Related Item” does not allow an adequate scope to be attributed to this classification and, consequently, it is not possible to make a clear proposition of its correlation with analogous terms defined by IAEA and U.S.NRC. In addition, the definition for “Nonsafety Related Item” is not used in CNEN standards.

Regarding the proposition presented in Table I, it can be noted that, for CNEN, the terminology “Item Important to Safety” is used in a clear contrast to SSCs that do not depend on nuclear licensing, as established in item 6.1.2 of CNEN NE 1.04 Standard [14]. Thus, particularities and possible distinctions between the categories “Safety Related” and “Nonsafety Related” (the latter not defined in CNEN standards) are not used, evidenced, or even established. According to [15], in which a comparison of acquisition costs is presented, it can be observed that, for example, "Safety Related" valves (Gate Valve 3" SS) may cost 50 times more than similar “Nonsafety Related” ones. Thus, it can be concluded that using “Nonsafety Related” SSCs instead of “Safety Related”, considering a classification scheme with consistent criteria and clearly defined concepts, may reduce purchasing cost of nuclear facilities items by millions of dollars.

4. Conclusions

The correlation between “Safety Related Item” and “Item Important to Safety” terminologies is not straightforward in the IAEA safety guides, U.S.NRC codes and regulatory guides and CNEN standards. Within the regulatory framework of the U.S.NRC, the definition, correlation and understanding of these terminologies may present inconsistencies, especially when “Nonsafety Related” definition is considered. Therefore, it may be concluded that acquisition of "Nonsafety Related" items that meet all safety and regulatory requirements may exempt the use of "Safety Related" items, avoiding additional costs to the project and undue impact on its schedule. Finally, a clear and consistent terminology and its correct understanding in safety classification process allows not only to assign appropriate design requirements to nuclear facility items, but also to perform an adequate allocation of financial resources.

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