

3.2 Classification of Structures, Systems, and Components

GDC 1 requires that structures, systems, and components (SSCs) important to safety be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety functions to be performed. GDC 1 also requires that a quality assurance program be established to provide adequate assurance that these SSCs will satisfactorily perform their safety functions, and that appropriate records of the design, fabrication, erection, and testing of these SSCs be maintained for the life of the plant. To fulfill these requirements, the U.S. EPR SSCs are classified according to nuclear safety function, seismic design category, quality group, quality standards, and applicability of the 10 CFR Part 50, Appendix B quality assurance program. This section describes the methodology used for classifying the U.S. EPR SSCs. Seismic classification is addressed in Section 3.2.1 and quality group classification is addressed in Section 3.2.2.

10 CFR 50.2 defines safety-related SSCs as the “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...”

The U.S. EPR SSCs are classified based on their functions and the 10 CFR 50.2 definition of safety-related. A function that does not address one of the three objectives listed above is non-safety related.

The U.S. EPR safety classification methodology makes a distinction between primary design functions and secondary design functions. A primary design function is a principal function for which an SSC must be included in the plant design. A secondary design function is a function that the SSC must be capable of fulfilling because of the location of that SSC within the plant design. Both primary and secondary design functions can be, but need not be, safety related.

Safety classification of systems considers only their primary design functions. Thus, systems are safety related if any one of their primary design functions is safety related.

Safety classification of structures and components considers both their primary and secondary design functions. Thus, structures and components are safety related if at least one of their primary or secondary design functions is safety related.

As a result, application of the U.S. EPR safety classification methodology logically allows both the identification of safety-related systems that include non-safety-related components, and the identification of non-safety-related systems that include safety-related components.

In addition to safety related and non-safety related, the U.S. EPR safety classification methodology has a third classification which includes SSCs that are by definition non-safety related, but to which a “significant licensing requirement or commitment” applies. A “significant licensing requirement or commitment” is a practice that is based on an NRC regulation or licensing guidance that applies to SSCs that do not meet the 10 CFR 50.2 definition of safety-related, but which are deemed to be “important to safety” by NRC staff. These SSCs are classified as supplemented grade.

The U.S. EPR safety classification methodology uses the following designations:

- Safety-related: S.
- Non-safety related: NS.
- Supplemented Grade: NS-AQ.

U.S. EPR SSCs that are classified as safety related are subject to the quality assurance program requirements of 10 CFR 50, Appendix B. Non-safety-related SSCs are not included in the 10 CFR 50, Appendix B quality assurance program. However, those non-safety-related SSCs that are classified as supplemented grade will be included in the 10 CFR 50, Appendix B quality assurance program if inclusion is explicitly invoked by the relevant “significant licensing requirement or commitment.”

Table 3.2.2-1—Classification Summary lists the safety classification of U.S. EPR SSCs.

Classification of fire protection systems in accordance with RG 1.189 is described in Section 9.5.1.

3.2.1 Seismic Classification

GDC 2 requires in part that “structures, systems, and components important to safety shall be designed to withstand the effects of natural phenomena such as earthquakes...without loss of capability to perform their safety functions.” In addition, 10 CFR 50.34(a)(12) requires that—in order to comply with the earthquake provisions of GDC 2—the U.S. EPR comply with the earthquake engineering criteria of 10 CFR Part 50, Appendix S. 10 CFR Part 50, Appendix S defines the safe shutdown earthquake (SSE) as the “vibratory ground motion for which certain structures, systems, and components must be designed to remain functional.”

10 CFR Part 50, Appendix S states “the structures, systems, and components required to withstand the effects of the Safe Shutdown Earthquake Ground Motion or surface deformation are those necessary 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 that could result in potential offsite exposures comparable to the guideline exposures of §50.34(a)(1).”

To meet the requirements of both GDC 2 and 10 CFR Part 50, Appendix S with regard to the design for earthquakes, U.S. EPR SSCs are seismically classified in accordance with RG 1.29.

Radioactive waste management SSCs are explicitly excluded from the seismic classification requirements of RG 1.29. However, they meet the seismic design criteria specified in RG 1.143 (refer to Sections 11.2, 11.3, and 11.4) and GDC 61 as it relates to the design of radioactive waste systems and other systems that may contain radioactivity. Safety-related instrument sensing lines meet the seismic design requirements specified in RG 1.151.

The seismic classification of U.S. EPR SSCs uses the following categories: Seismic Category I, Seismic Category II, radwaste seismic, conventional seismic, and non-seismic.

Table 3.2.2-1 lists the seismic classification of U.S. EPR SSCs. A COL applicant that references the U.S. EPR design certification will identify the seismic classification of applicable site-specific SSCs that are not identified in Table 3.2.2-1.

The piping and instrumentation diagrams (P&IDs) of U.S. EPR systems indicate the Seismic Category I boundaries when portions of a system are not Seismic Category I. A list of U.S. EPR piping and instrumentation diagrams is provided in Section 1.7.

3.2.1.1 Seismic Category I

U.S. EPR SSCs that are classified as safety related are also designed to be capable of performing their safety functions during and following an SSE. Therefore, these safety-related SSCs, including their foundations and supports, are classified as Seismic Category I. Additionally, certain SSCs explicitly identified in RG 1.29, such as fuel storage racks in the spent fuel storage structure and Class 1E electrical systems, are classified as Seismic Category I.

Seismic Category I SSCs are designed to withstand the seismic loads associated with the SSE, in combination with other designated loads, without loss of function or pressure integrity. SSE seismic design loads are addressed in Section 3.7. The design of Seismic Category I structures is addressed in Section 3.8. The seismic design of mechanical systems and components is addressed in Section 3.9. The seismic qualification of mechanical and electrical equipment, including their supports, is addressed in Section 3.10.

Seismic Category I SSCs are subject to the quality assurance program requirements of 10 CFR Part 50, Appendix B.

3.2.1.2 Seismic Category II

Per RG 1.29, some U.S. EPR SSCs that perform no safety-related function could, if they failed under seismic loading, prevent or reduce the functional capability of a Seismic Category I SSC, or cause incapacitating injury to main control room occupants during or following an SSE. These non-safety-related SSCs are classified as Seismic Category II.

U.S. EPR SSCs classified as Seismic Category II are designed to withstand SSE seismic loads without incurring a structural failure that permits deleterious interaction with any Seismic Category I SSC or that could result in injury to main control room occupants. The seismic design criteria that apply to Seismic Category II SSCs are addressed in Section 3.7.

Seismic Category II SSCs are subject to the pertinent quality assurance program requirements of 10 CFR Part 50, Appendix B.

3.2.1.3 Radwaste Seismic

Radioactive waste management SSCs that are classified as RW-IIa per RG 1.143 are subject to the relevant seismic design requirements tabulated in that RG. These SSCs are designed to withstand seismic loads up to $\frac{1}{2}$ SSE and are seismically categorized as radwaste seismic (RS).

3.2.1.4 Conventional Seismic

Some non-safety-related U.S. EPR SSCs do not fall within the criteria for classification as Seismic Category I or II, but may still be subject to seismic design criteria that are incorporated in, or invoked by, an applicable commercial or industry code. These SSCs are classified as conventional seismic (CS). SSCs that are classified as CS, based solely on applicable commercial or industry codes, are not considered part of the licensing basis for the U.S. EPR since this classification is not prescribed in NRC regulations or guidance documents.

Some supplemented grade U.S. EPR SSCs do not fall within the criteria for classification as Seismic Category I or II, but may be subject to “significant licensing requirements or commitments” that specify consideration of seismic design criteria that are less demanding than either a full or ½ SSE. Those SSCs that are classified as RW-IIb or RW-IIc per RG 1.143 are included in this group. These SSCs are also seismically categorized as CS.

3.2.1.5 Non-Seismic

The U.S. EPR SSCs that do not fall within the RG 1.29 criteria for classification as Seismic Category I or II, do not fall within the RG 1.143 criteria for RW-IIa, RW-IIb, or RW-IIc, and are not subject to any seismic design criteria invoked by the applicable commercial or industrial codes and standards, are classified as non-seismic (NSC).