

SFR-DC 70

Intermediate Coolant System

Proposed changes to address
public comments and implement
NRC identified editorial
improvements for consistency

Draft SFR-DC 70 as Published

(Sentence enumeration added.)

- 1 An intermediate cooling system shall be provided.
- 2 A single passive barrier shall separate intermediate coolant from primary coolant; at least a single passive barrier shall separate the energy conversion system coolant from intermediate coolant.
- 3 The intermediate coolant shall be chemically nonreactive with sodium.
- 4 A pressure differential shall be maintained across the primary to intermediate barrier such that any coolant barrier leakage would flow from the intermediate coolant system to the primary coolant system.

Draft SFR-DC 70 as Published (continued)

- 5 The intermediate coolant boundary shall be designed to permit the conduct of a surveillance program and inspection in areas where intermediate coolant leakage out of the intermediate coolant system, or energy conversion system coolant leakage into the intermediate coolant system, may hinder or prevent a structure, system, or component from performing any of its intended safety functions.

Draft SFR-DC 70 Rationale as Published

NRC considered the DOE's proposed SFR-DC 70 and made changes based on the "Response to NRC Staff Questions on the U.S. Department of Energy Report, "Guidance for Developing Principal Design Criteria for Advanced Non-Light Water Reactors" (ML15204A579) (pages 8-11)

NUREG-1368 (page 3-57) (ML063410561) Section 3.2.4.5 suggested the need for a separate criterion for the intermediate coolant system.

Also, separate criteria were included in NUREG-0968 (ML082381008) (Criterion 31—Design of Intermediate Cooling System and Criterion 33—Inspection of Intermediate Cooling System).

SFR-DC 70 Sentence by Sentence Markup

Sentence 1 → Sentence 1

If the primary coolant is not chemically compatible with the energy conversion system coolant, then ~~A~~-an intermediate coolant ~~cooling~~-system shall be provided.

SFR-DC 70 Sentence by Sentence Markup

Sentence 2 → Sentences 2 and 3

A passive boundary shall separate primary coolant from the working fluid of the intermediate coolant system provided that the primary coolant and the working fluid of the intermediate coolant system are chemically compatible such that postulated leakage between the two systems does not result in degradation of structures, systems, or components important to safety, or challenge the fuel design limits. ~~A single passive barrier shall separate intermediate coolant from primary coolant; at~~ At least a single passive boundary ~~barrier~~ shall separate the intermediate coolant from the energy conversion system coolant ~~from intermediate coolant.~~

SFR-DC 70 Sentence by Sentence Markup

Sentences 3 and 4 → Sentence 4

~~The intermediate coolant shall be chemically nonreactive with sodium.~~

A pressure differential shall be maintained across the primary to intermediate ~~barrier~~ coolant boundary such that any coolant ~~barrier~~ boundary leakage would flow from the intermediate coolant system to the primary coolant system.

Sentence 5 → Deleted

SFR-DC 70 Rationale Markup

~~NRC considered the DOE's proposed SFR-DC 70 and made changes based on the "Response to NRC Staff Questions on the U.S. Department of Energy Report, "Guidance for Developing Principal Design Criteria for Advanced Non-Light Water Reactors" (ML15204A579) (pages 8-11)~~

This SFR-DC has been worded to clarify that an intermediate coolant system must be used if the primary coolant is not chemically compatible with the energy conversion system coolant. NUREG-1368 (page 3-57) (ML063410561) Section 3.2.4.5 suggested the need for a separate criterion for the intermediate coolant system. Also, separate criteria were included in NUREG-0968 (ML082381008) (Criterion 31—Design of Intermediate Cooling System and Criterion 33—Inspection of Intermediate Cooling System).

SFR-DC 70 Rationale Markup (continued)

A passive boundary is adequate defense in depth when the intermediate coolant system is chemically compatible with the primary coolant such that postulated leakage between the two systems does not result in degradation of structures, systems, or components important to safety, or challenge the fuel design limits. An example is a heat removal system with liquid NaK:

A liquid sodium primary coolant system that is contaminated with NaK may have phase changes (solidification, boiling, etc.) at different temperatures, but the impact on the overall system may be negligible. The postulated leakage may be based upon a leak before break analysis or the ability to detect leakage between the primary and intermediate coolant systems.

SFR-DC 70 Rationale Markup (continued)

The higher pressure requirement is to ensure any leakage in the interface between the two systems does not result in a release of radioactive primary coolant to the non-radioactive part of the heat transport system.

Criteria related to the inspection of the intermediate coolant boundary were removed since they are included in SFR-DC 77.