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NATIONAL STANDARD OF THE PEOPLE'S REPUBLIC OF CHINA

GB/T 43062-2023

Nuclear energy - Determination of neutron fluence and displacement per atom(dpa) in reactor vessel and internals

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Foreword

This document complies with the provisions of GB/T 1.1-2020 "Standardization Work Guidelines Part 1.Structure and Drafting Rules of Standardization Documents"

Drafting.

This document is modified to adopt ISO 19226.2017 "Nuclear energy reactor pressure vessels and internal components Neutron fluence and atomic dislocation times

(dpa) determination".

Compared with ISO 19226.2017, this document has made the following structural adjustments.

---Chapter 8 adds 8.1 to avoid the appearance of suspended sections, 8.2 corresponds to 8.1 in ISO 19226.2017, and 8.3 corresponds to ISO 19226.

8.2 in.2017.

The technical differences between this document and ISO 19226.2017 and their reasons are as follows.

---Replaced ANSI/ANS19.10 and ASTME170-16a (see Chapter 2) with normatively quoted GB/T 4960.2 to suit

In response to my country's technical conditions, the operability is increased.

The following editorial changes have been made to this document.

---Adjusted the notes in the scope and placed them at the end of this chapter;

--- Added enumeration instructions for the two types of nuclear databases "China CENDL" and "Russian BROND" (see 4.2.1) to improve example explanations

Integrity of knowledge;

---Added references ANSI/ANS19.10 and ASTME170-16a (see references [1] and [2]);

---Deleted references [1]~[6], [21]~[29] (see references in ISO 19226.2017).

Please note that some content in this document may be subject to patents. The publisher of this document assumes no responsibility for identifying patents.

Introduction

This document is intended for use in the following situations.

a) Involves the determination of exposure parameters used to predict radiation damage to reactor pressure vessels and reactor internals. The irradiation parameter can be neutron injection

Amount and/or number of atomic dislocations (dpa).

b) Involves the determination of material properties of reactor pressure vessels and reactor internals exposed to neutron irradiation.

c) Licensing procedures involving regulatory agencies, such as the preparation of regulatory guidelines and analysis of pressure vessels and reactors irradiated by neutrons;

Reports on the integrity and material properties of reactor internal components should be made.

Nuclear power reactor pressure vessels and internals

Determination of neutron fluence and number of atomic dislocations (dpa)

1 Scope

This document specifies a procedure for the assessment of irradiation of components between the reactor core and the containment vessel based on a given core neutron source.

The amount of irradiation can be expressed by neutron fluence, number of atomic dislocations (dpa) or helium nuclide production. The evaluation of irradiation may use neutron fluence rate as appropriate.

calculations or measurements from dosimeters in the pressure vessel and reactor cavity.

This document applies to different reactor types such as pressurized water reactors (PWRs), boiling water reactors (BWRs) and pressurized heavy water reactors (PHWRs).

Determination of neutron fluence and atomic dislocation number (dpa) of the reactor pressure vessel and internal components.

This document also establishes a method for evaluating the neutron damage characteristics of reactor pressure vessels and internal components of PWRs, BWRs, and PHWRs.

process. Damage mainly refers to direct damage due to the number of atomic dislocations caused by collision with neutrons, and indirect damage caused by gas production.

Receive damage. The extent of both types of damage depends strongly on the neutron energy spectrum. Therefore, for a given neutron fluence and neutron energy spectrum, the total cumulative original

The calculation of the number of ion ionization times is an important data for reactor life management.

Note. The "neutron source" in this document refers to the distribution of fission neutron sources in the reactor core.

2 Normative reference documents

The contents of the following documents constitute essential provisions of this document through normative references in the text. Among them, the dated quotations

For undated referenced documents, only the version corresponding to that date applies to this document; for undated referenced documents, the latest version (including all amendments) applies to

this document.

GB/T 4960.2 Nuclear scientific and technical terminology fission reactor

3 Terms and definitions

The terms and definitions defined in GB/T 4960.2 and the following apply to this document.

3.1

accuracyofameasured/calculatedvalue

The difference between a measured/calculated value and the true value, usually due to systematic errors caused by the measurement or calculation process.

3.2

benchmarkexperimentbenchmarkexperiment

A well-defined set of physical experiments whose results are judged to be sufficiently accurate to be used as a reference point for calculations.

Note. This judgment is made by a group of experts in the field.

3.3

The most accurate neutron based on all available measurements, calculations and adjustments based on bias estimates, least squares analysis and engineering judgment

fluence value.

3.4

Mathematical equations, approximations, assumptions, relevant parameters, and computational procedures that produce computational results.