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Introduction

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Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/ Figure/Table/Note	Type of comment	Comment (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	



DRAFT International Standard

ISO/DIS 17838-1

Reactor technology - Design and performance evaluation of the emergency core cooling system strainer in pressurized water reactor nuclear power plants —

Part 1: General principles

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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This document was prepared by Technical Committee ISO/TC 85, *Nuclear energy, nuclear technologies, and radiological protection*, Subcommittee SC 6, *Reactor technology*.

A list of all parts in the ISO 17838 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The purpose of this document is to provide guidance for the design and performance evaluation of the Emergency Core Cooling System (ECCS) strainer in pressurized water reactor (PWR) nuclear power plants (NPPs). While there are many types of PWRs, this standard will focus on those that rely on ECCS pumps, which present enough similarities to allow a common approach. For other technologies, this document may be used selectively, depending on the specific design characteristics of their plants.

In the event of an accident at a PWR NPP, nuclear safety is ensured by maintaining the integrity of the defense-in-depth barriers. Although the specific barriers may vary from country to country, the basic principle is to keep as many of these barriers intact as possible throughout the accident.

Two main categories of accidents can be identified:

- Design Basis Accidents (DBAs): accidents that are addressed in the safety case of the plant; and
- Severe Accidents (SAs): accidents that are beyond the plant safety case. Usually, these accidents involve a loss of core integrity and initiation of core melt.

In both DBAs and SAs scenarios, it is imperative to maintain cooling recirculation through the safety systems. This includes safety injections into the core by Emergency Core Cooling System (ECCS), or containment cooling, via Containment Heat Removal System (CHRS), exemplified by the Containment Spray System (CSS), or reactor vessel cavity cooling via Cavity Injection System (CIS), or core melt cooling via the Core Catcher or other features.

All the above-mentioned cooling functions need to be achieved by water supplies, pumps, and filtration equipment to ensure the effectiveness of cooling water. The water can be obtained from locations such as the containment sump at the lower part of the containment or the In-Containment Refueling Water Storage Tank (IRWST). The functional requirements for the various components within these systems are derived from their safety claims.

DBAs and SAs are typically initiated by a high-energy line break (HELB). In the event of a HELB within the containment, the insulation and paint coatings surrounding the break can be damaged by high-energy blowdown fluids, possibly resulting in the generation of debris. The debris, together with the blowdown fluids from the pipe break and the water from the CSS, can flow and be directed towards the lower parts of the containment. As this occurs, although some of the debris may be caught by barriers such as compartments, thresholds, and steel gratings, but the other debris will continue to be transported by the water flow and will eventually accumulate in the containment sump or in the IRWST or in other water storage facilities. This accumulation of debris could render water unavailable to nuclear safety systems, thereby affecting their normal operation.

To ensure compliance with the operational requirements of the safety systems for water effectiveness, a set of strainers may be installed at the upstream inlet of the water supply pipe to filter out debris such as fibre and particles. In PWR NPPs, this strainer is commonly referred to as the Emergency Core Cooling System (ECCS) strainer. Depending on the (some) specific safety case (requirements), strainer may also be used for Design Extended Conditions (DEC), where specific safety features are considered.

Accidents may disrupt the normal operation of various equipment, posing significant risks to plant safety. For example, as mentioned above, the accumulation of debris on the ECCS strainer following an accident could result in the strainer being blocked. Such accumulation can increase the head loss across the strainer, which in turn reduces the available Net Positive Suction Head (NPSHa) to the safety system pumps. If the NPSHa falls below the required Net Positive Suction Head (NPSHr) of the pumps, cavitation can occur, resulting in a reduction in pump flow rate and potentially rendering the safety functions of the system ineffective. Furthermore, the ECCS strainer can allow the passage of fine fibre and particles, which can clog and erode downstream equipment such as heat exchangers, valves, CSS spray nozzles and orifices, and can also increase the head loss across the reactor core, impairing the core heat transfer efficiency and potentially damaging the fuel cladding. Additionally, fibre, paint particles and chemical debris can adhere to the fuel rod cladding, further degrading heat removal conditions.

