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Design requirements for the prevention and control of water intake blockage in nuclear power plants

核电厂取水堵塞物防控设计要求

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63 Design requirements for preventing blockages in nuclear power plant intake water Released on April 30, 2026 Implemented on 2026-11-

01 State Administration for Market Regulation The State Administration for Standardization issued a statement.

1.Scope This document specifies the design requirements for preventing water intake blockages caused by marine organisms and floating debris in seawater direct-current cooling nuclear power plants. This document applies to the design for preventing blockages in the intake water of nuclear power plants using seawater direct-flow cooling. (Intake water blockages in circulating water nuclear power plants) For reference in prevention and control design.

4.1 General Requirements

4.1.1 The design should meet the requirements of safety and reliability, technical feasibility, environmental friendliness, resource protection, economic rationality and convenient operation and maintenance.

4.1.2 The prevention and control of water intake blockages should adhere to a combination of technical and human measures, as well as a combination of proactive avoidance and interception measures, addressing the root causes of the blockages. Systematic prevention and control measures should be taken in terms of determination, water intake project design, monitoring and early warning, relocation and disposal, interception and cleanup, and operational requirements. Mechanical methods are recommended. Mechanized, automated, and information-based prevention and control measures are used to ensure the safe and stable operation of nuclear power plants.

4.1.3 Through design and operation and maintenance management, under the influence of external events determined by the design basis in the site hazard assessment, important [activities] should be ensured. Ensure the safety of the plant's water intake system; shut down the circulating water pumps if necessary.

4.1.4 Nuclear power plants constructed with multiple reactors should, in conjunction with the requirements of the regional power grid, develop a comprehensive plan for unit response and control in the event of a blockage outbreak. This is to ensure the stability of the power system operation and maintain the normal levels of grid frequency and voltage.

4.1.5 A comprehensive technical and economic comparison should be conducted, taking into account factors such as site characteristics, sources of clogging, overall layout, filtration system and equipment configuration. Eliminate common water intake failure caused by blockage intrusion in multiple units.

4.1.6 Nuclear power plants with multiple reactors should adopt proactive, advance, and unit-specific emergency response measures, and promptly implement manual intervention and reduce circulating water levels. Measures such as reducing the load on generating units in an orderly manner are taken to avoid short-term passive shutdowns of multiple units due to blockages.

4.1.7 The design intrusion intensity of the blockage should be determined comprehensively based on the blockage investigation, historical extreme value amplification, and the load-bearing capacity of the filtration facilities in the pump room. This will be determined and used as the basis for system and equipment configuration.

4.1.8 Water intake projects should have the ability to actively avoid blockages and reduce the entrapment effect of blockages.

4.1.9 The monitoring and early warning design should reflect the principle of early detection and early intervention, and should preferably have forecasting and early warning functions to support nuclear power plant operation and maintenance management decisions. Provide evidence promptly.

4.1.10 DC cooling water supply systems should be equipped with circulating water monitoring and pre-filtration facilities; each independent water intake and open intake channel should be equipped with corresponding monitoring and pre-filtration facilities. Corresponding circulating water monitoring and pre-filtration facilities.

4.1.11 The configuration of circulating water monitoring and pre-filtration facilities and circulating water filtration facilities should be mutually compatible, and the marine interception facilities and... The target functions and interception targets of each land-based interception facility.

4.1.12 The overall layout of the nuclear power plant, the impact on cooling water intake for the nuclear island and conventional island, differences in system and equipment configuration, and investment impact should be considered. Based on factors such as impact, the configuration scheme of the filtration system for the circulating water system and the plant water system should be reasonably determined.

4.1.13 The classification of buildings, systems and equipment related to the prevention and control of water intake blockages should be reasonably determined.

4.2 Requirements for collecting basic data

4.2.1 Hydrological Data When taking water samples from the coast or tidal estuaries, the following information should be collected.

a) Hydrological conditions of the marine and terrestrial areas near the nuclear power plant;

b) Marine hydrological characteristics, including tidal features, current velocity, direction and movement patterns, tidal range and duration of rise and fall tides, and typical tidal levels. Process line;

c) Tsunami and storm surge conditions;

d) The patterns of sediment erosion and deposition in the project area, and the stability of the shoreline;

e) Sediment movement characteristics, including source, quantity, direction of movement, and extent of drifting zones; vertical distribution of sediment content and particle size distribution curves. Bedload analysis, wind and wave-driven sand lifting and rapid sediment deposition;

f) Wave data, including wave heights at different periods at the intake and various engineering points, wave rose diagrams, wave break zone extent, and 100-year wave data. When encountering waves, such as the maximum possible typhoon waves, the corresponding wave rise should be analyzed and explained.

g) Highest tide level, average tide level, lowest tide level, design benchmark high and low water levels, and once-in-a-century high and low water levels, etc.

h) Salinity characteristics, including salinity and the distribution of salinity along water depth at a specified cross section;

i) Water temperature characteristics determined from nuclear power plant site data, including monthly maximum water temperature, average water temperature, minimum water temperature, and specified intervals. The distribution of surface water temperature along water depth, design baseline natural water temperature, historical extreme maximum water temperature, historical extreme minimum water temperature, and global... Predicted increases in water temperature due to global warming, etc.

j) Abnormalities and pollution of seawater quality;

k) Ice formations, ice conditions, and characteristic values, including freezing period, ice thickness, width, ice flow size and corresponding flow velocity, direction, deposition location, and height. Degree, etc.;

l) Current status and planning of the marine environment, etc.

4.2.2 Meteorological Data

4.2.2.1 The following meteorological data and the times of extreme values should be collected.

a) Annual average temperature, extreme maximum temperature, and extreme minimum temperature;

b) Annual average wind speed and maximum wind speed;

c) Wind rose diagram showing the frequency of winds in each direction throughout the year and in each of the four seasons, as well as the frequency of calm winds.

4.2.2.2 The climate characteristics, historical meteorological disasters, typhoons, etc. of the meteorological stations and the area where the factory site is located should be collected and verified.