

"Nuclear Reactor"

Description

This invention relates to an alternative structure of a nuclear reactor which minimizes the risks associated with a leakage.

Leakage of the heat exchanger is potential accident scenario in nuclear reactors. This could cause a positive reactivity in the core and possibly blockages in the flow path. Solutions proposed to increase the safety of nuclear reactors such as constructing doubled walled heat exchangers, using low-pressure oil as a secondary coolant or using the same coolant for both primary and secondary circuits proved to be more expensive and not inherently safe.

This invention proposes to place the heat exchanger in the up-flow coolant passage instead of the down-flow as in existing designs. This way, in case of a leakage the bubbles together or without slag flow upwards, in a direction away from the core, due to the lower density of the secondary with respect to the primary coolant. They are therefore driven to the gas plenum wherefrom they can be removed by known techniques. To further enhance safety, a non-return valve comprising of a passive flap is placed in the up-flow passage to prevent a back flow of primary coolant from the heat exchanger to the core. Additionally a grid and a comb-like stripper element are arranged to the entrance of the down-flow passage to prevent larger pieces of slag entering the passage and to direct bubbles to the gas plenum respectively. Calculations with a computational fluid dynamics code confirmed the coherence of the system. The most important advantage of this design is inherent safety. Furthermore, thermal stresses are reduced since the upper part of the reactor vessel wall will be considerably cooler during normal operation and accident events. In addition, due to the relocation of the heat exchanger, the down-flow passage can be made narrower resulting in a more compact design.

Areas of application

- Nuclear Energy Reactors

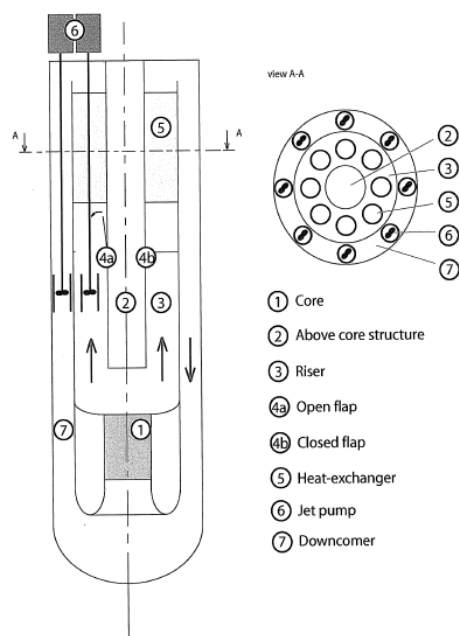
Stages of development

Patent Priority date: 28/07/2004

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Innovative aspects and main advantages

- Inherent safety
- Totally passive flaps
- Reduced thermal stresses
- More compact design



Scientific contact

Johan Carlsson - Institute for Energy
Joint Research Centre – European Commission
NL-1755 ZG Petten - The Netherlands
Tel: +31 22456 5341
E-mail: johan.carlsson@ec.europa.eu

Licensing contact

Intellectual Property and Scientific Collaboration Unit
JRC - European Commission
B-1049 Brussels, Belgium
Email: JRC-TechTransfer@ec.europa.eu

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