THỬ NGHIỆM ĐÁNH GIÁ NHIỆT ĐỘ CAO NHẤT CỦA BỀ MẶT BÓ NHIÊN LIỆU CHO LÒ PHẢN ỨNG HẠT NHÂN NGHIÊN CỨU WWR-SM TASHKENT BẰNG CHƯƠNG TRÌNH TÍNH TOÁN RELAP5/MOD3.3

MAXIMUM CLADDING TEMPERATURE PREDICTION FOR NUCLEAR RESEARCH REACTOR WWR-SM TASHKENT USING BEST-ESTIMATE CODE RELAP5/MOD3.3

Truong Hoang Tuan[1], Cao Thanh Long[1]
[1] *Center for Nuclear Technologies, 217 Nguyen Trai, Nguyen Cu Trinh ward, district 1, Ho Chi Minh city, Vietnam*
Email: truong.hoang.tuan@cenutech.vn

WWR-SM and its primary cooling system

WWR-SM Tashkent research reactor of the Republic of Uzbekistan, with a similar operational 10MW as the research reactor proposed by RCNEST project, is a light water moderated and cooled reactor.

The primary cooling system drives downward forced convection to remove the heat generated by the core. The water enters the central tank via an inlet pipe, flows upward then turns toward the centre to move downward through the core, ultimately exits the central tank through an outlet.

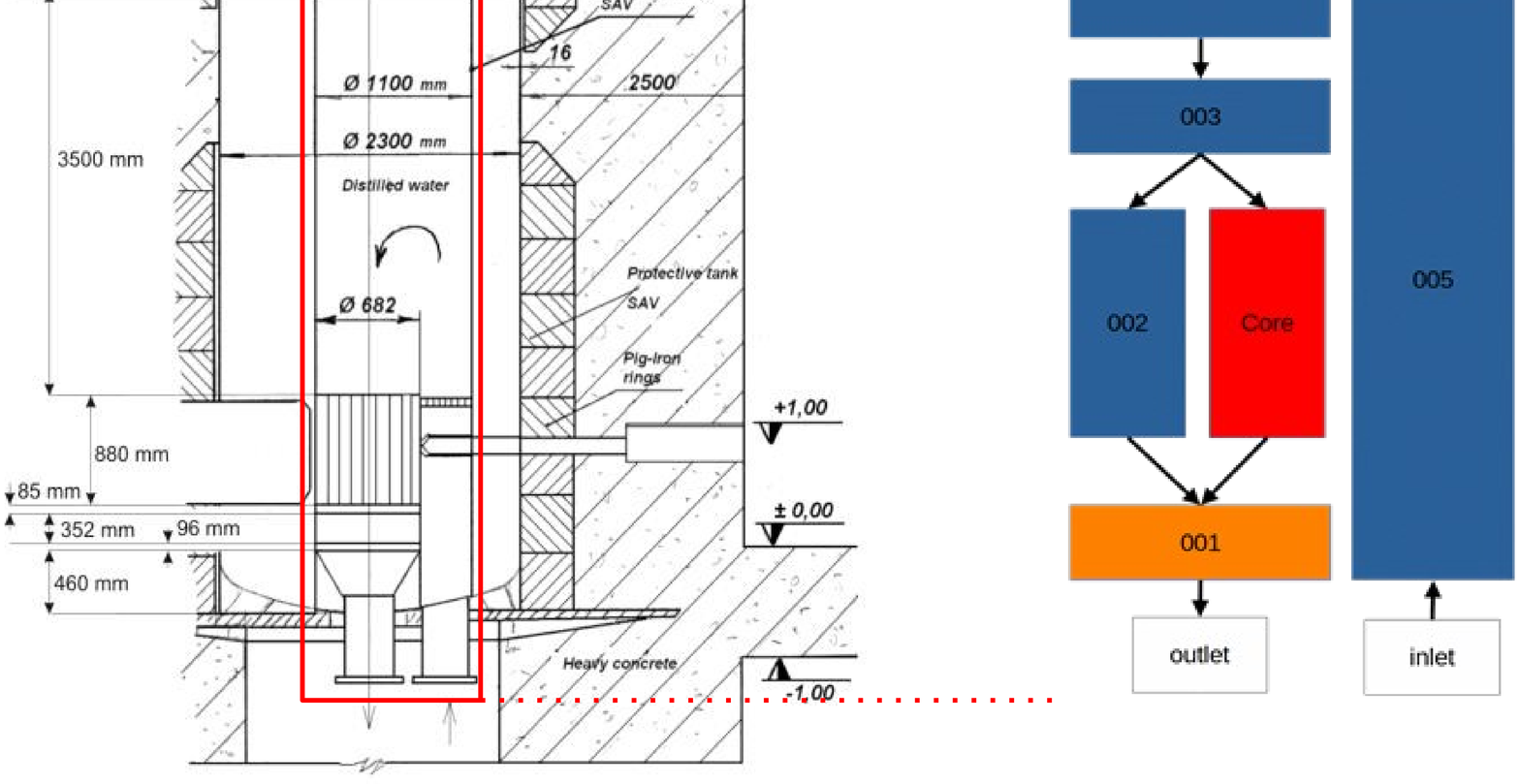


Fig 1. Elevation view of WWR-SM and RELAP5 model of the central tank

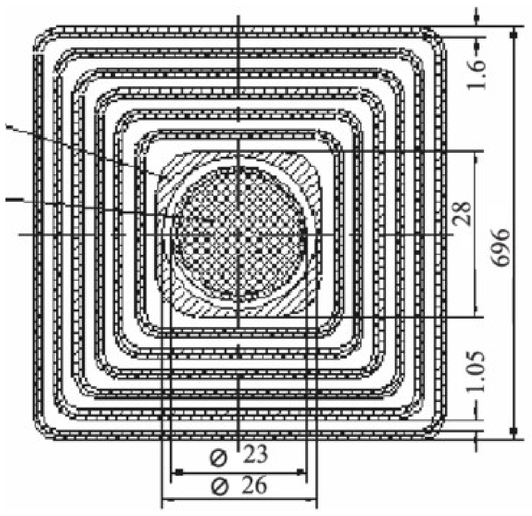
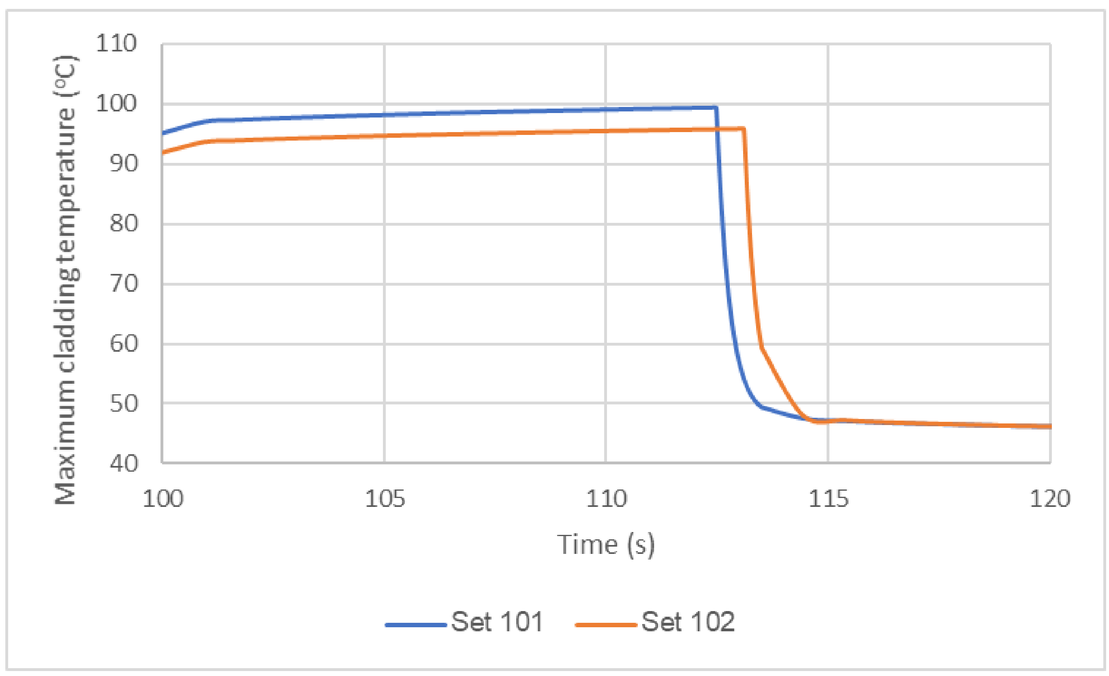


Fig 2. Cross section of 6-tube IRT-4M

Accidental reactivity increase by in-pile experiemtal devices

The whole system achieved steady state at 11 MW critically then was inserted 0.04$ instantly. This “sudden” event was taken to be a time period of 0.05 s. The delayed scram signal due to 10s limit of reactor period was ignored. Without information about control rod drop time, the scram event was modelled as an instant -13.42$ insertion.



RELAP5 simulation and results

The model was simulated using two different geometry sets embedded in the software (set 101 – parallel plates and 102 – narrow rectangle channels).

There was a temperature spike because the insertion reactivity caused a prompt jump in the reactor power. The temperature, then, gradually increased until the reactor power reached 12 MW which caused a scram.

At peak power, the default set, number 101, predicted the maximum cladding temperature of 99.35 degree C while that estimated by the set 102 was 95.82 degree C.

Comparing to the reference, the estimated peak cladding temperature was 98.6 C.

Conclusion

Two different hydraulic geometry sets were used to predict maximum cladding temperature and the results were not in agreement. Since the correlations provided by the sets did not specifically target the IRT-4M design so it was hard to determine which was more suitable. Experiments are required to achieve a more accurate predicted solution.