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## **#5-14 Improvements of gamma radiotracer measurements and modelization on the Colentec loop in Cadarache for the quantified analysis of the clogging phenomena in Steam Generators**

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The Tube Support Plate blockage, also named clogging, is a complex phenomenon that can occur in the steam generator of Pressurized Water Reactors. This deposit of iron oxides, that can reduce the coolant flux and constraint the primary tubes, could have significant consequences on heat exchanges and the integrity of the primary tubes. Since 2014, the representative dedicated equipment, named COLENTEC loop at Cadarache had already provide a large number of results on the physico-chemical properties of the deposit formed in specifics thermohydraulic and chemical stable conditions. A major improvement was the switch to an active configuration in 2017 allowing the injection of a gamma radiotracer  $^{59}\text{Fe}$  inside the circuit. Using dedicated gamma measurement stations specifically designed by our laboratory, coupled with post-processing numerical modelling, we became able to determine on-line and then to quantify the influence on clogging of the following parameters such as the chemistry, the temperature, the pressure without waiting for the opening and the dismounting of the test section. The knowledge acquired over four active campaigns now gives us an overall view of the test section and the experimental configurations required for a pertinent analysis of the phenomena. This experience feedback is also now sufficient to enable us to make our modeling more reliable, with a view to advanced quantitative analysis.

Based on previous results and limitations, this paper first presents the specific experimental equipment recently set up on the loop on a dedicated location, in order to obtain measurements that are more representative of the phenomena involved.

The experience gained from previous campaigns has also given us a better understanding of the loop's peculiarities. As a result, the previous partial models previously developed individually for each campaign have been reviewed and optimized. The new model presented here now takes into account the entire test section. The code's architecture, its modularity, its iterative conception now makes it simple and efficient to take into account any changes in detector, geometry, emission source, etc.

The document presented here, on the improvements made to both measurement and modeling, now makes it possible to envisage more relevant acquisitions and even more precise quantifications. It therefore improves the understanding of clogging and could lead to better management of the maintenance of steam generators in power plants.

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