Functional analysis of the fuel treatment unit of the MSFR

Introduction

The SAMOSAFER project, supported by the European Community through an H2020 grant, recently started (Oct 2019) with a 4-years program aiming at "develop and demonstrate new safety barriers for more controlled behaviour of Molten Salt Reactors in severe accidents to ensure that the MSR can comply with all expected regulations in 30 years' time" [1].

In SAMOSAFER WP1 "Safety requirements and Risk identification", the application of risk analysis methods (successfully applied to the fuel circuit in the framework of the previous SAMOFAR project [2]) is foreseen for the analysis of the fuel treatment unit. The fuel treatment unit main aims are:

- the continuous extraction of fission products from the fuel salt, in order to ensure the reactor operation and avoid shut-down for refueling,
- the control of the Redox potential of the salt to keep it in the right range and thus reduce corrosion.

The operation of this unit involves various processes, with a different level of details in the current stage of the design. Therefore, a functional analysis of the identification of potential risks is identified as a suitable approach in order to guide the sequent steps of the design process.

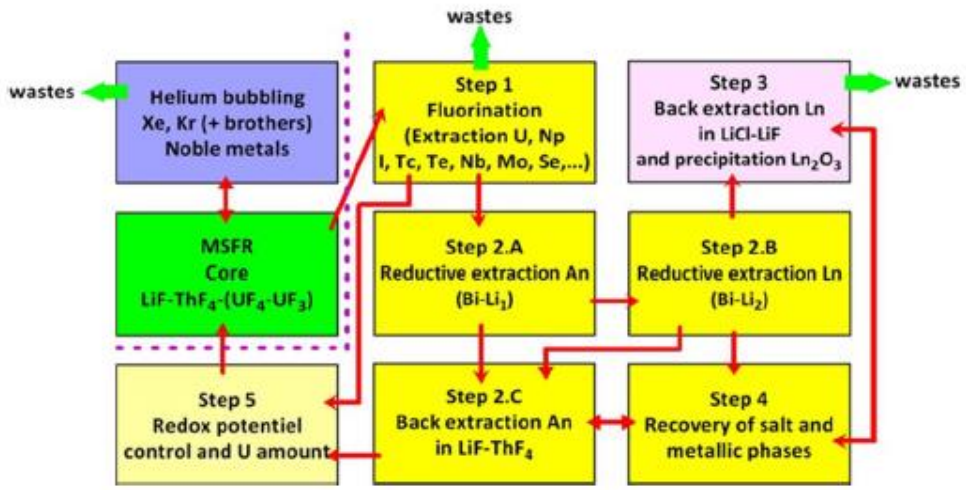

Figure 1: Schematic overview of the fuel processing stages in the fuel treatment unit [1].

Aim of the work

The work proposed for this thesis project is subdivided into the following steps:

- analysis of previous experiences gained in the application of functional analysis for the fuel circuit of the MSFR [2]
- Application of the FFMEA methodology to the processes carried out in the fuel treatment unit, in order to identify the main Postulated Initiating Events (PIEs) leading to a loss of functionality of the unit
- A (preliminary) categorization of the identified PIEs in terms of severity of the consequences and, possibily, frequency of occurrence.

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References

[1] SAMOSAFER Website, https://samosafer.eu/.

[2] D. Gérardin, A. C. Uggenti, S. Beils, A. Carpignano, S. Dulla, E. Merle, D. Heuer, A. Laureau, M. Allibert, A methodology for the identification of the postulated initiating events of the Molten Salt Fast Reactor, *Nuclear Engineering and Technology*, **51**(4), 1024-1031, 2019.