NURETH-21 21st International Topical Meeting on Nuclear Reactor Thermal Hydraulics | August 31 (Sun) - September 5 (Fri), 2025 BEXCO · Busan, Korea www.nureth-21.org

Simulation and Analysis of Containment Behavior during Selected Severe Accident Transients in a Generic Konvoi-type PWR using COCOSYS

Miriam Müer, Marco K. Koch
Plant Simulation and Safety Group (PSS), Ruhr-Universität Bochum (RUB)
44780 Bochum, Germany
miriam.mueer@pss.rub.de; marco.koch@pss.rub.de

Michael Klauck, Stephan Kelm
Institute of Energy Technologies – Electrochemical Process Engineering (IET-4)
Forschungszentrum Jülich GmbH
52425 Jülich, Germany
m.klauck@fz-juelich.de; s.kelm@fz-juelich.de

ABSTRACT

In case of a severe accident in a PWR-type nuclear power plant, maintaining the structural integrity of the containment building – representing the last barrier against the release of radioactive material into the surrounding environment – is of utmost importance. Therefore, addressing the various challenges that the containment may be facing during an accident is a crucial part of reactor safety research. Reliable prediction of thermal hydraulic processes and phenomena inside the containment are key to optimizing accident management measures, such as e.g., the hydrogen mitigation strategy or filtered venting systems.

In a collaborative effort of Ruhr-Universität Bochum (RUB PSS) and Forschungszentrum Jülich GmbH (FZJ), multiple simulations of postulated accident sequences in a generic Konvoi-type PWR (1,300 MW_{el} / 70,000 m^3 free containment volume) with a simplified nodalization and junction structure were carried out using the lumped parameter Containment Code System (COCOSYS) developed by GRS gGmbH. Both, a loss-of-coolant accident (LOCA) and a station blackout (SBO) scenario were investigated. Unmitigated reference calculations are used for comparative assessment with the respective mitigated cases putting special emphasis on the development of the gas composition inside the containment aiming at enhancing the general understanding of the H_2/CO combustion risk, particularly in the late phase of a severe accident.

This paper gives a detailed overview of the simulations performed and includes a comprehensive discussion of the results. The work presented here was conducted within the framework of the European AMHYCO project (Euratom 20192020, GA No 945057).

KEYWORDS
Severe Accidents, Containment analysis, Accident mitigation measures, COCOSYS

1. INTRODUCTION

Since combustion events during a severe accident (SA) in a nuclear power plant (NPP) can lead to dynamic loads on the containment, possibly even threatening its structural integrity, it is essential to develop a comprehensive understanding of the distribution of combustible gases within the containment in order to assess and evaluate potential consequences. The European AMHYCO project [1] aims to