THE MUSA PROJECT

The overall objective of the Management and Uncertainties of Severe Accident (MUSA) project was to assess the capability of Severe Accident (SA) codes when modelling reactor and SFP (Spent Fuel Pool) accident scenarios of Gen II and III Nuclear Power Plants (NPP).

To do so, UQ (Uncertainty Quantification) methods have been employed, with emphasis on the effect of already-set and innovative accident management (AM) measures on accident unfolding, particularly those related to ST (Source Term) mitigation.

The MUSA project proposed an innovative research agenda to move forward the predictive capability of SA analysis codes. It led to outstanding challenges: identification and quantification of uncertainty sources in SA analyses; review and adaptation of UQ methods; and testing such methods against reactor and SFP accident analyses, including AM.

Given the focus of Figures of Merit (FOM) related to ST, the project has identified variables with a major impact on ST uncertainties. However, it has been highlighted that governing uncertainties might be scenario-dependent and to settle such an observation would require a systematic application of BEPU on risk-dominating sequences.

A special attention has been given to educational and training aspects, disseminating the acquired knowledge also towards the young generation of researchers.

The project ended in May 2023.

THE MAIN OUTCOMES

Over the course of the project, MUSA has produced some major outcomes:

- **An extensive database on input parameters uncertainties.** A set of more than 400 uncertain parameters have been characterized by their lower and upper bounds and probability density functions (pdf), and most importantly, supporting references are provided.
- **A vastly diverse and tested range of methods & tools.** Several integral SA codes and uncertainty quantification analytical tools have been coupled, often being assisted by in-house phython scripts providing further flexibility in data post-processing and analysis.
- **A large variety of reactor & scenarios UQ database.** A large number of in-reactor scenarios have been addressed, some including AM, with different codes and UQ tools. The uncertainty propagation bases has been diverse on key aspects, like number of parameter which uncertainties are propagated, treatment of run crashes, bifurcation and/or outliers, sensitivity analysis techniques. Such a diversity is fundamental to consolidate a systematic approach.
- **A “first-of-a-kind” UQ SFP application.** Application of UASA to SFP accidents has provided insights into how different uncertainties could be with respect to in-reactor scenarios and identified specific challenges.
- **A “still growing” dossier of open references.** MUSA has been present in major events (i.e., SNETP Forum, FISA conference, CSARP workshop, etc.) and has published about six joint open journal papers, to which individual organizations might add more than a dozen papers. This will channel the MUSA impact in the SA community.

Over these specific outcomes, there is an intangible outcome that stands out: **a broad, trained and capable community of using the UaSA approach in the severe accident analysis domain.**

For more information visit: **https://musa-h2020.eu/results**

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AN INTERNATIONAL PROJECT:

The MUSA Consortium comprises 30 partners, spread across 3 continents. It involves the most experienced organisations in the scientific domain of SA.

PARTNERS:

CIEMAT / BEL V / CEA / CNPRI / CNSC / ENEA / LLC ENERGORISK / EPRI / FRAMATOME GMBH / GRS / INRNE / IRSN / JAEA / JRC / KAERI / KIT / LEI / LGI / NINE SRL / PSI / SSTC NRS / TRACTEBEL / TUS / UNIPI / UNIRM1 / VMU / VTT / JACOBS / ENSO / USNRC

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MUSA H2020 EUROPEAN PROJECT

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