Using open SMR datasets E-SMR and LDR lite for research and training purposes

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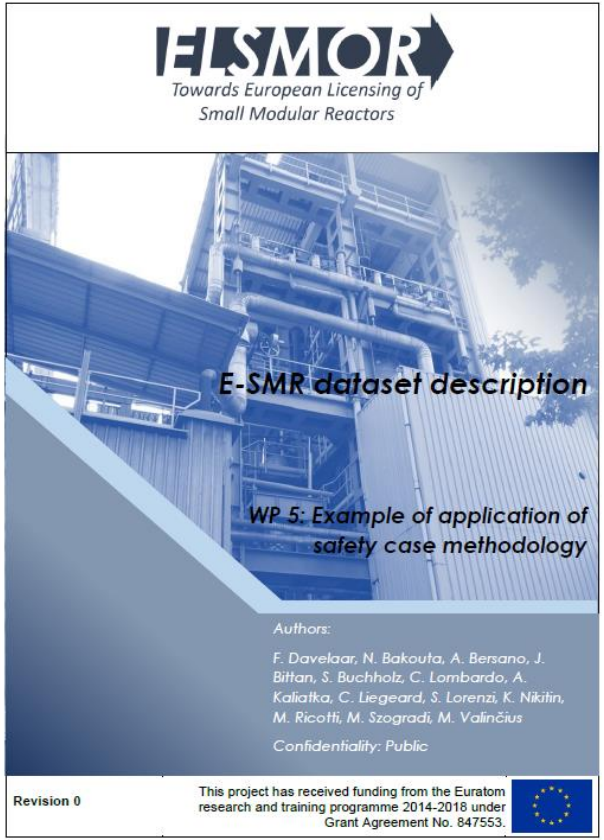
Introduction

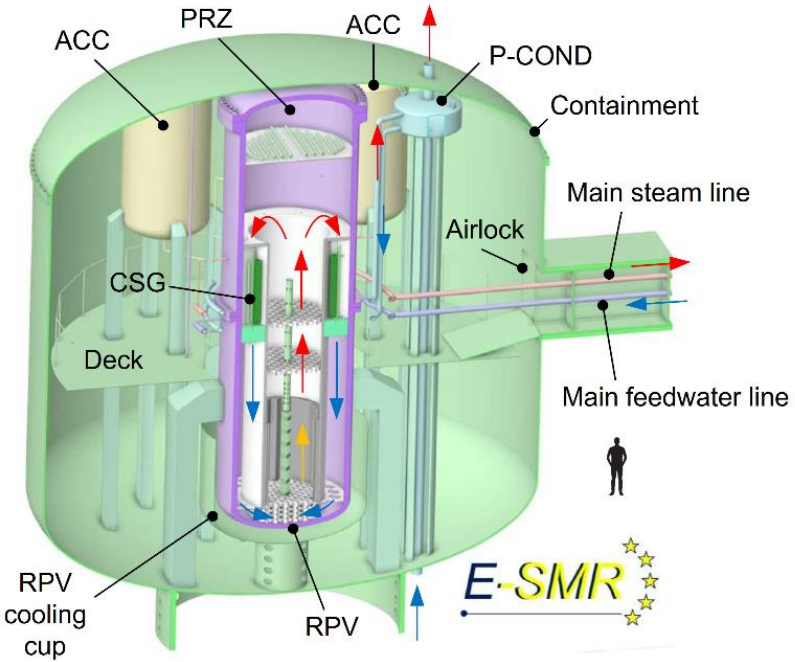
- Various SMR designs are being developed
  - Information on the safety approach is not necessarily yet available
- Having access to open datasets allows for famialiarazation with the designs, education, and testing of simulation models
- This presentation introduces two open datasets describing light water SMRs
  - E-SMR and LDR lite

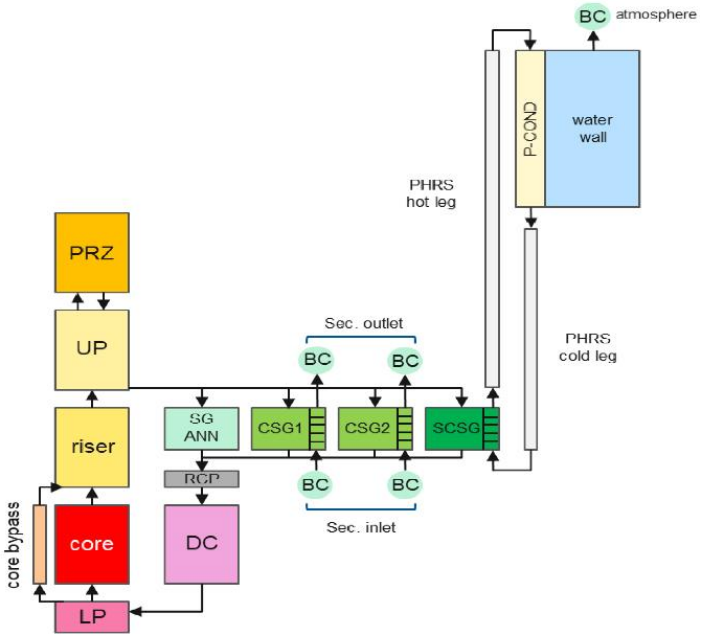
E-SMR

- E-SMR dataset was created in EURATOM-funded ELSMOR (towards European Licensing of Small Modular Reactors) project to demonstrate a safety philosophy similar to PWR-type SMRs.
  - Based on public information on French SMR design at the time (2022) and engineering judgement
  - Joint effort by multiple organizations
- The dataset was published under the CC-BY-NC 4.0 license
  - https://doi.org/10.23729/474d23cf-60a7-4f78-9d6e-1e2d8633db4b

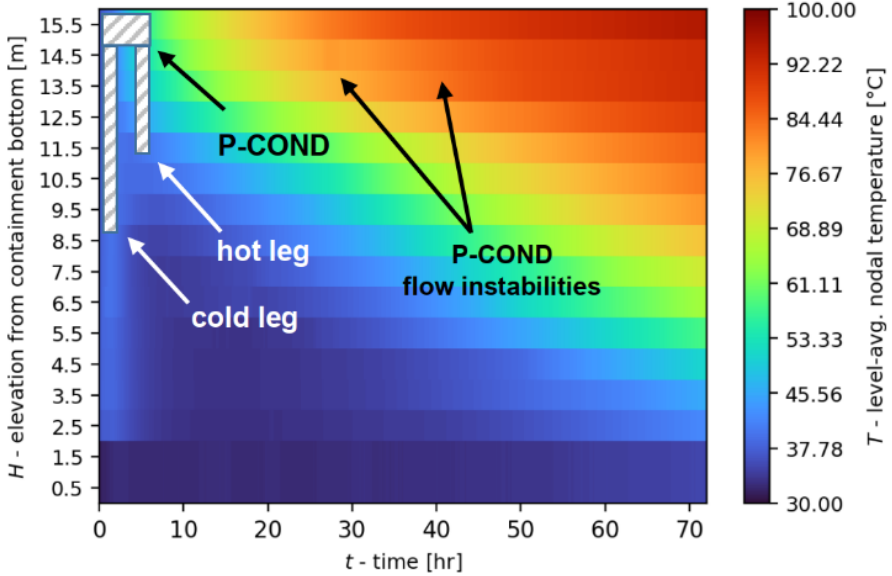


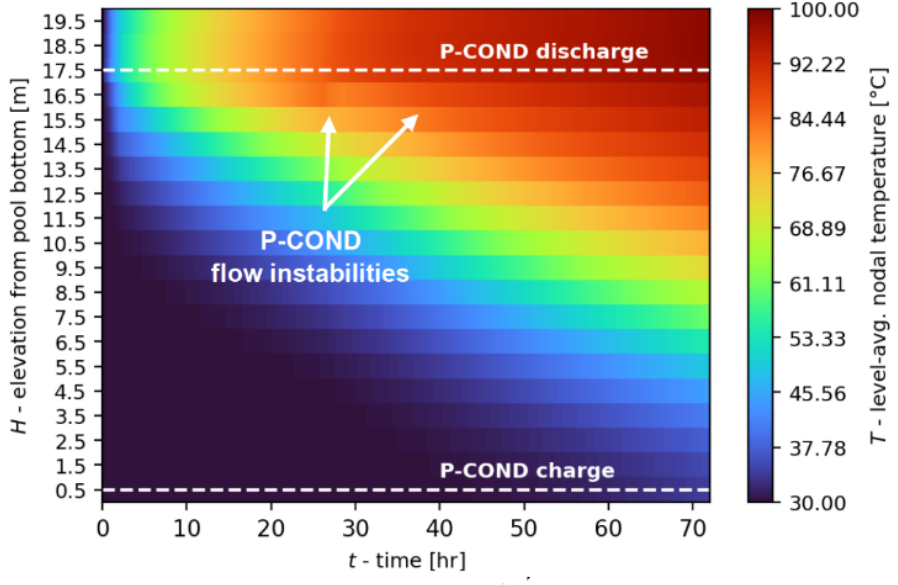
Schematic of E-SMR





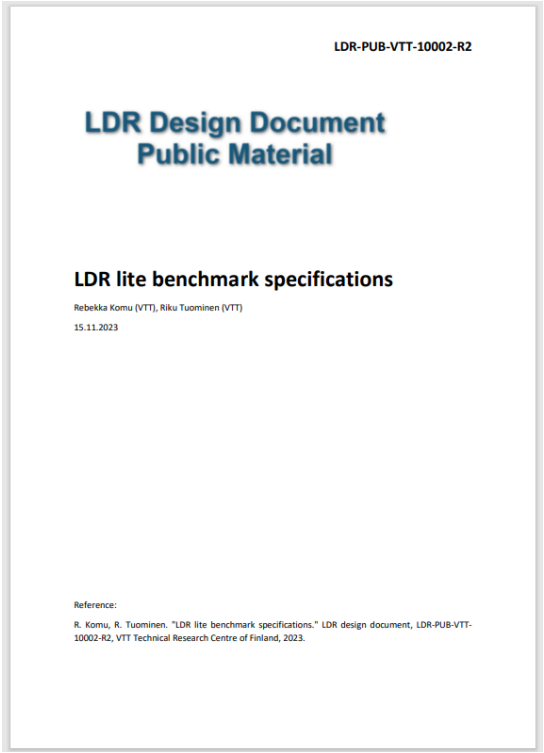
APROS simulation results of containment cooling during station blackout





LDR lite

- The LDR lite dataset is a public version of the Low-temperature District heating Reactor (LDR-50), intended for academic research.
  - LDR-50 is suitable for district heating and other low-temperature applications, which influenced the design of the reactor to include different innovative passive safety system designs and approaches.
  - Benchmark specifications at https://www.ldr-reactor.fi/en/ldr-lite-benchmark/
- Currently LDR-50 is being commercialized by Steady Energy



LDR-PUB-VTT-10002-R2

LDR Design Document
Public Material

LDR lite benchmark specifications

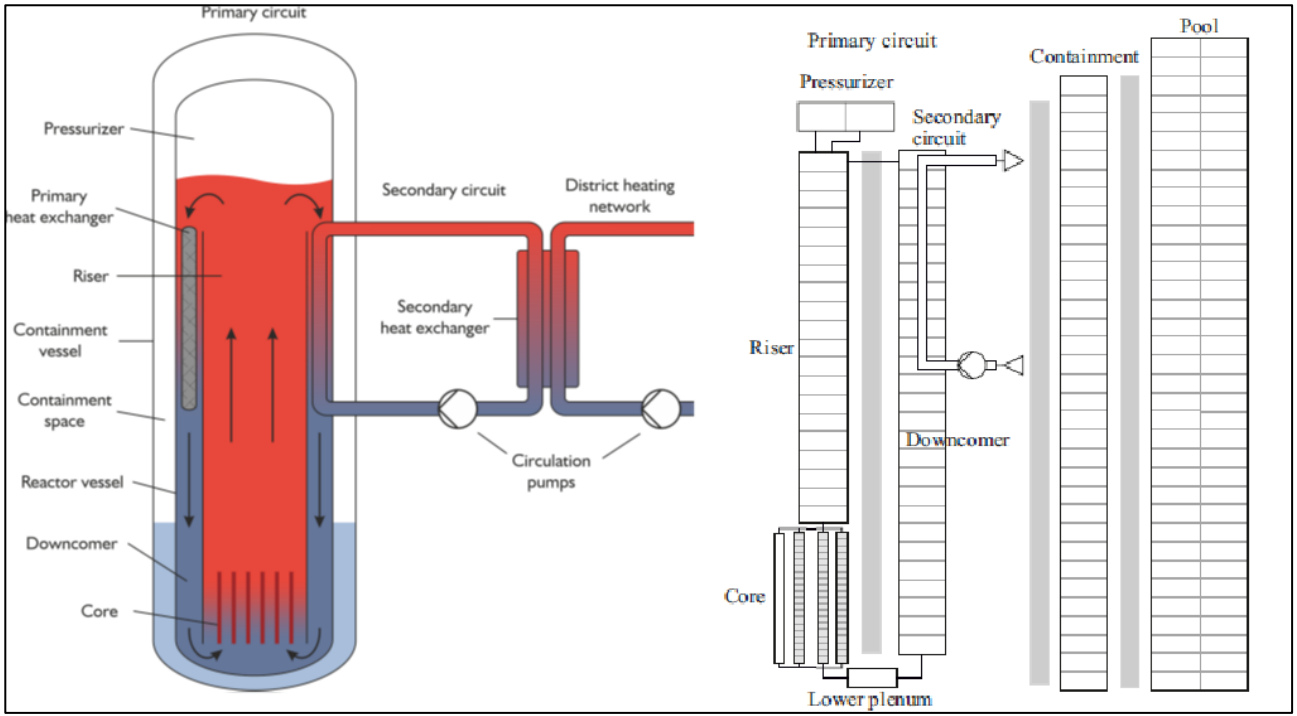
Rebekka Komu (VTT), Riku Tuominen (VTT)

15.11.2023

Reference:

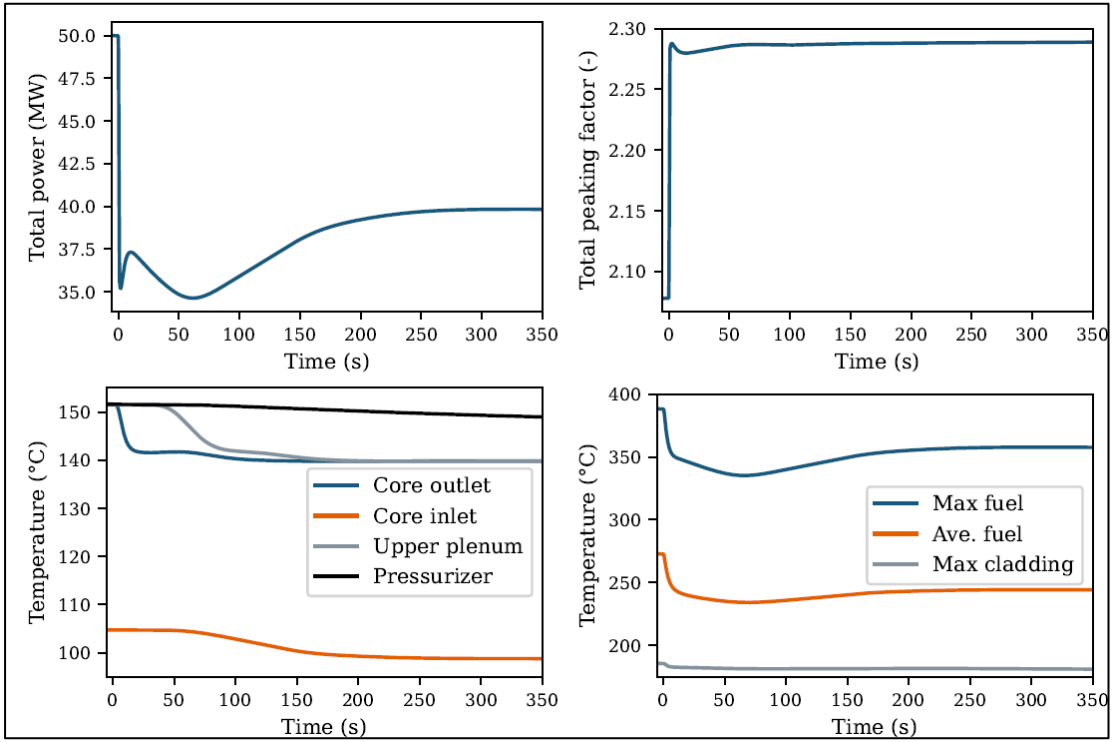
R. Komu, R. Tuominen. "LDR lite benchmark specifications." LDR design document, LDR-PUB-VTT-10002-R2, VTT Technical Research Centre of Finland, 2023.

Schematic overview of LDR lite



Example of benchmark simulation

- Example result of a control rod drop simulation
  - Was originally presented at PHYSOR2024
- Demonstrates dynamic coupling between reactor physics and thermal hydraulics



Conclusions

- Two open datasets presented are already in active use in several joint research projects
  - E.g. E-SMR has been used in EU-funded TANDEM project; LDR lite will be used in EU-funded projects EASI-SMR and SANE for benchmarks and code comparisons
- However,
  - Constructing ”close enough” models requires effort
  - The designs may change drastically reducing the impact of the models
- Case in point: Nuward redesign announced this summer
  - C’est la vie

beyond

the obvious

Thank you!

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