

# Investigating decommissioning scenarios of EPR nuclear power plants through MCNP models

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## New Nuclear Power in the UK

For the first time in 30 years **two new nuclear power plants** are opening in the UK **Hinkley C & Sizewell C**. The UK government recently announced a **£14.2 billion** investment into Sizewell C. The reactor design is based on the **European Pressurised Water Reactors**. Each Site will be equipped with **2 EPRs** with a Combined Output of **3.2 GW** of electricity.

## UK Decommissioning Landscape

- The NDA oversees the strategic clean-up of the UK's nuclear legacy estate.
- **17 nuclear sites** are now under decommissioning.
- Annual budget: **£4+ billion**, with long-term liabilities totalling **~£124 billion** over 120+ years.
- Many UK sites were never designed with decommissioning in mind.
- **The Nuclear Liabilities Fund** ensures that new reactors, are financially equipped for eventual decommissioning.
- **~60 Years** – Expected operational lifetime of new EPRs before decommissioning begins.
- **1,000–2,500 Million €** – Average cost to decommission a single US PWR reactor.

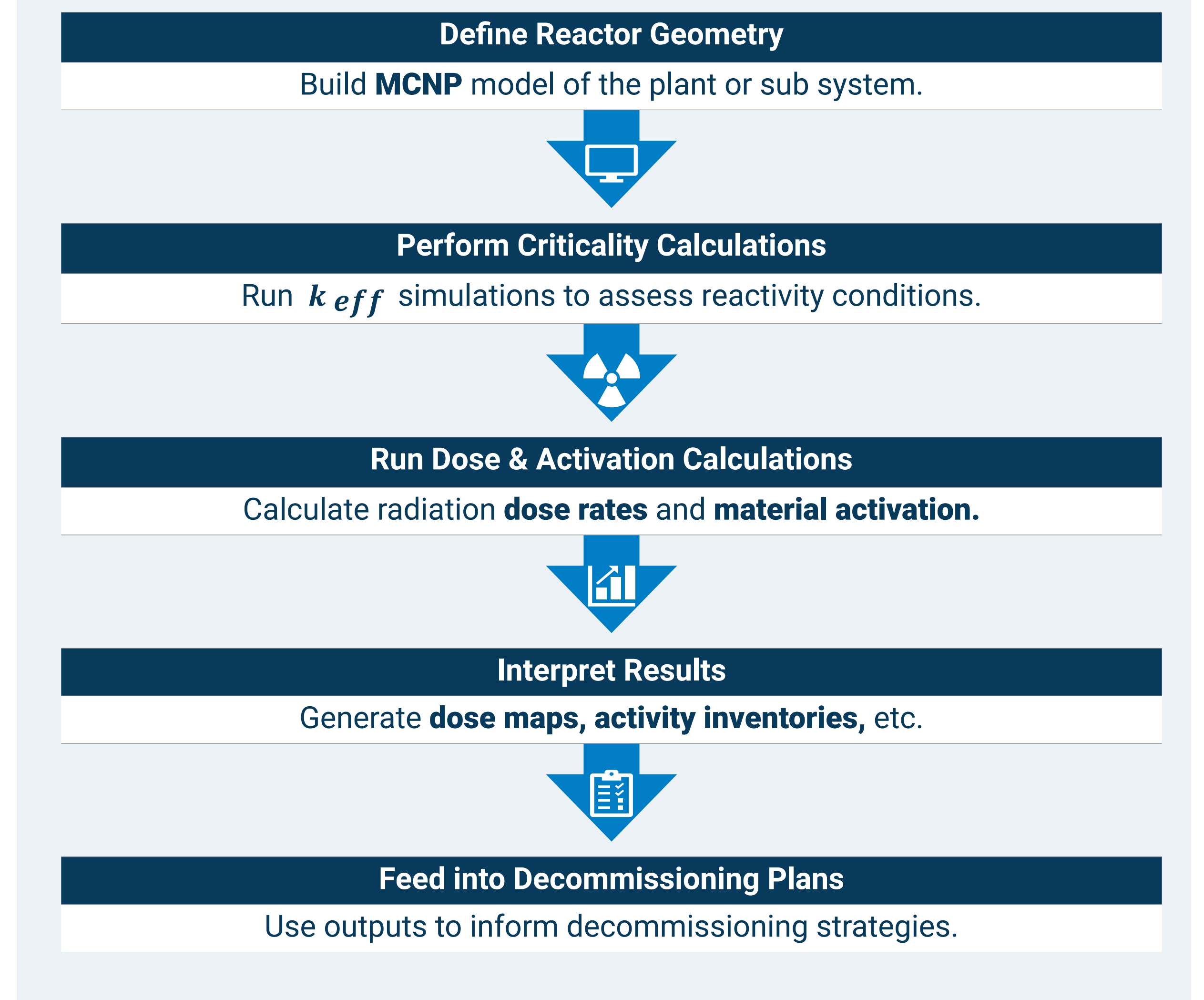


Figure 1: NDA owned nuclear sites in the UK [1].

## Sizewell C Decommissioning Process



## MCNP Reactor Design



## Decommissioning in the Digital Age

- **Virtual reactors before real dismantling** – Digital models simulate the entire process years ahead.
- **Radiation before demolition** – MCNP predicts radiation hotspots.
- **Workflow visualisation** – Digital Mock-Ups optimise dismantling plans.
- **Safer preparation** – Virtual environments reduce worker exposure.
- **Single source of truth** – All data is captured in unified digital models.

## Existing Reactor Modelling using MCNP

**Established Use** – MCNP has been widely used to model neutron flux, activation, and dose fields in operational and decommissioning reactors.

### Beznau PWR Case Study:

- Full-core MCNP modelling supported activation assessments and waste packaging design.
- Demonstrated how spatial flux data informs safe dismantling and shielding strategies.

### Relevance to This Work:

- Provides a validated framework for applying MCNP to **new reactor types**, like the EPR at Sizewell C.
- Shows how dose-informed modelling supports early planning before physical decommissioning begins.

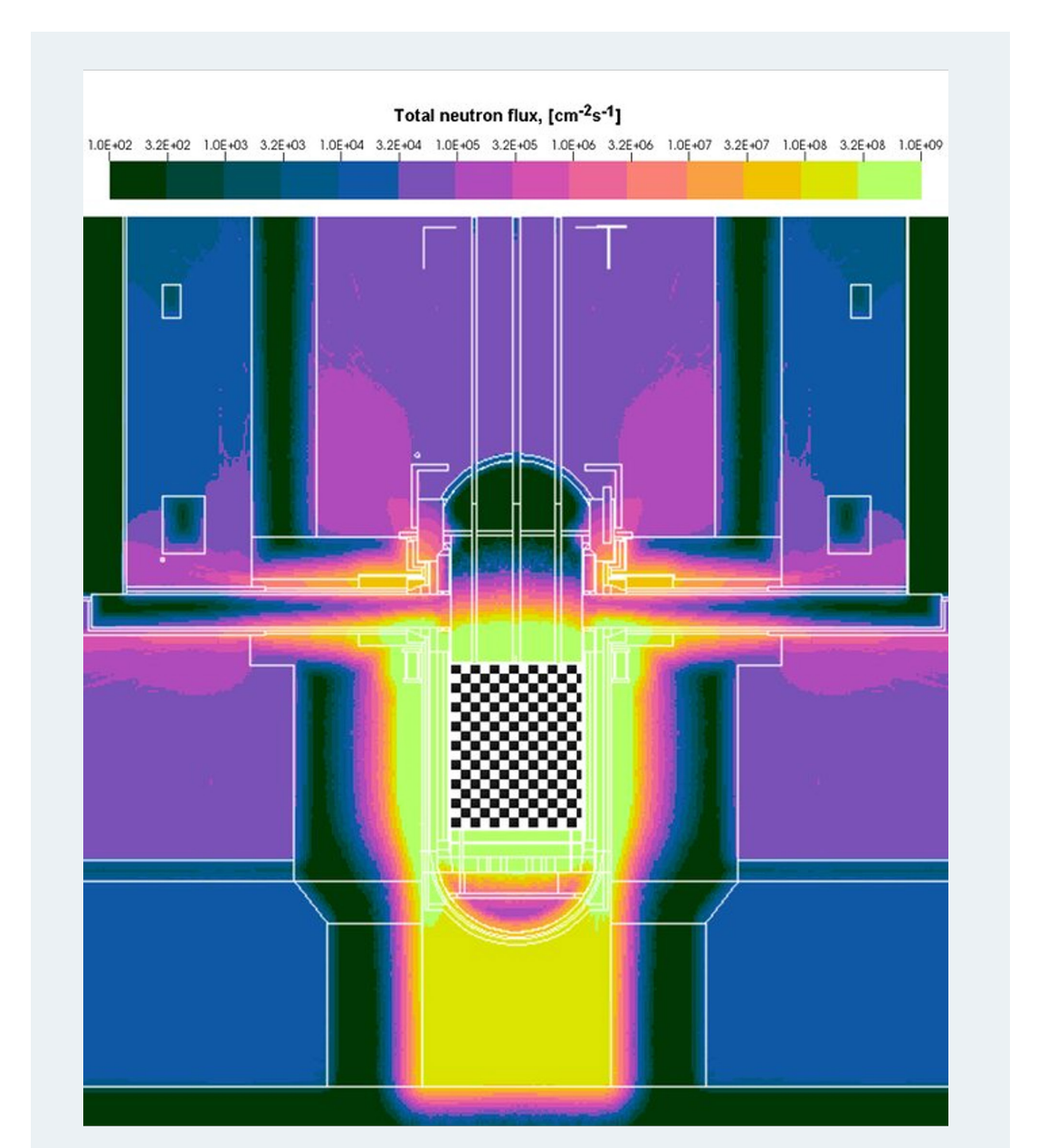


Figure 2: Spatial neutron flux distribution across the reactor pressure vessel and bioshield at the Beznau PWR [2].

## References & Acknowledgements

1. GOV.UK, Aug. 22, 2013. <https://www.gov.uk/government/organisations/nuclear-decommissioning-authority/about>
2. Pisano, Paolo Giunio. (2018). Application and Validation of the Nagra Activation Calculation Methodology to the Beznau NPP and Development of a Packaging Concept for RPV and Internals. 10.13140/RG.2.2.24275.53288.

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