

# Monte Carlo technics for reliable radiological inventories

## Activation and contamination on large scale models

Providing the most accurate and reliable radiological inventories on large scale models (conceptual design, decommissioning studies) to anticipate costs savings.

### Challenge

The radiological inventory of structures around the reactor drives its dismantling cost. It can be done through measurements and calculations.

The radiological inventory is also an input for waste classification assessment and doses evaluation.

These data are used to define decommissioning scenarios, schedules and related safety analyses.

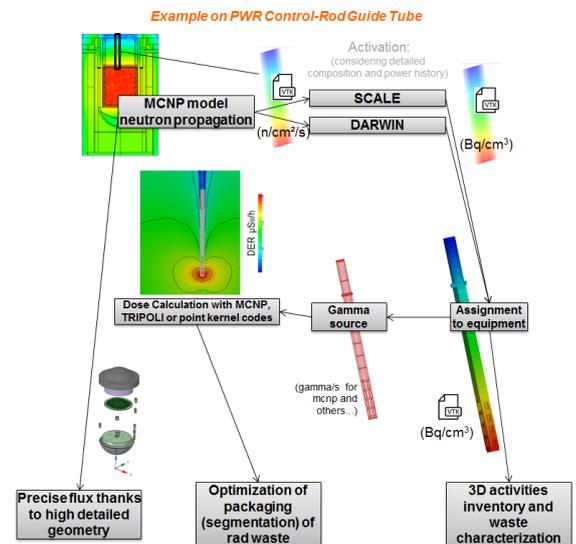
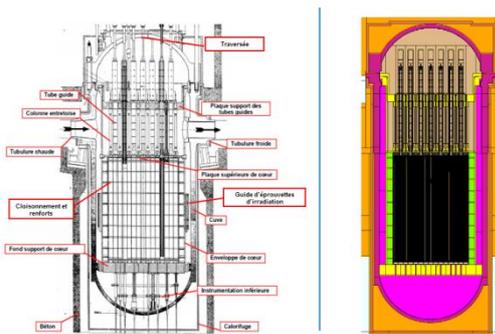
### Solution

Framatome's methodology offers efficient and reliable activated and contaminated waste evaluations on large scale model.

It is based on Monte Carlo state of the art calculations and involves:

1. A precise modelling
  - With the help of internal tools and advanced technics for source and geometry modeling,
  - With the integration of Computer-Aided Design file.
2. Acceleration methods for Monte Carlo N-Particle
  - Transport (MCNP) calculations
  - On 3D meshes,
  - With continuous energy with latest cross section libraries.
3. The coupling of depletion calculation codes

Framatome's methodology produces 3D radiological inventory mock-up. Those models are then used to optimize the waste packaging. It is versatile and applicable to all type of reactors and waste regulations.



### Customer benefits

Framatome's Monte Carlo technics for reliable waste evaluations

- Integrated product : 3D model + neutron flux calculations + activation calculations + waste streams + dose equivalent rates (DER) everywhere in the model, without discontinuity
- Increases reliability and accuracy of activated waste evaluations with state of the art methodology → conservatism and costs are reduced
- Optimizes the segmentation of activated waste and packaging, generating costs savings
- Optimizes the ALARA (As Low As Reasonably Achievable) approach of personal exposure
- Reduces time with faster methodology compared to a classical approach
- Parametrical product which can be adapted to customers
- Linkability to Virtual Reality

**Your performance is our everyday commitment**

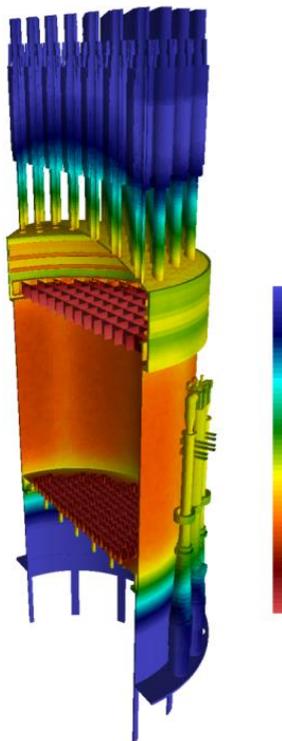
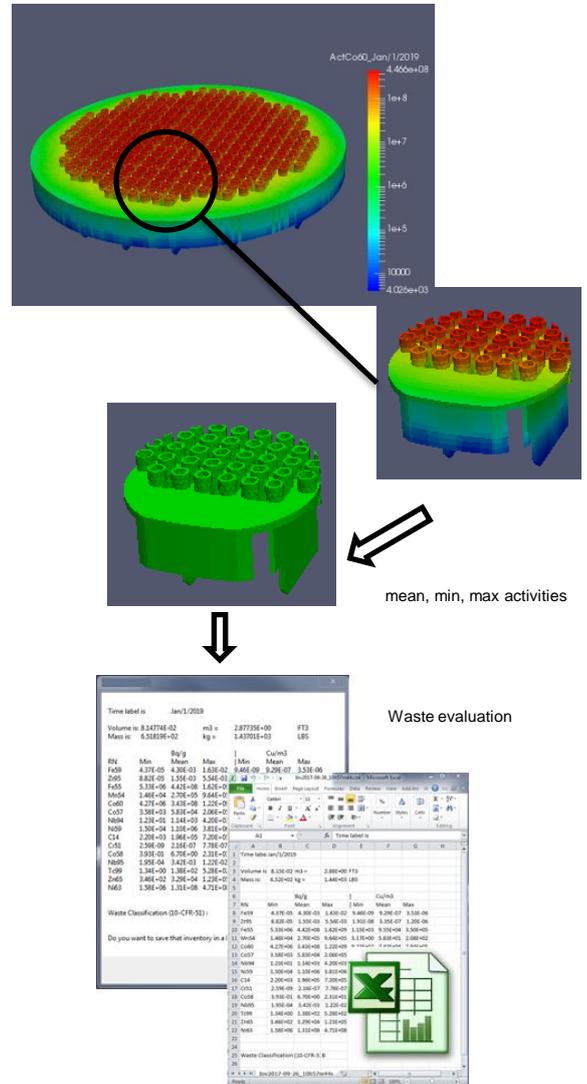
## Technical information

- Framatome's methodology can be used as an « à la carte » calculation scheme.
- According to the need, each step can be purchased separately (from a fine modelling task to a waste classification).
- The radiological model can be used then to assist the dismantling studies (dose rates calculation for different radiological states or dismantling project steps, assist in dose measure campaign).

S. Janski, "Validation of Numerical Simulations of Activation by Neutron Flux - 15038", in WM2015, Phoenix, Arizona, USA (2015)

M. Culioli, "State of the art of Monte Carlo technics for reliable activated waste evaluations", PREDEC, Lyon (2016)

N. Chapoutier, "AREVA Developments for an Efficient and Reliable use of Monte Carlo codes for Radiation Transport Applications", ICRS13 RPSD 2016, Paris (2016)



## Key figures

- Since **2012**, Framatome has assisted EDF and CEA in the waste assessment for conceptual designs and also for French shutdown reactors.
- 10 reactors** inventories were evaluated, with very accurate result when compared to characterization sample.
- Those studies allowed Framatome and EDF DP2D to set up a state of the art calculation scheme regarding waste assessment and Monte Carlo technics.

## References



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