SCALE6.2 ORIGEN library produced from JENDL/AD-2017

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Symposium on Nuclear Data 2020, 26-27 November 2020, RIKEN Wako Campus

Introduction and objective

- ORNL released the SCALE6.2 code in 2016.
- The ORIGEN code in SCALE6.2 is easier to use and more precise than the ORIGEN-S code.
  - ORIGEN uses one group cross section data generated from a specified neutron spectrum and a multigroup activation library with the COUPLE code, not three group cross section data for ORIGEN-S.
- We expect that ORIGEN in SCALE6.2 will be mainly used for activation calculations in nuclear facility decommissioning.
- Thus we produced a SCALE6.2 ORIGEN library from JENDL Activation Cross Section File for Nuclear Decommissioning 2017 (JENDL/AD-2017) in order to popularize JENDL/AD-2017.

Processing Method -(1)

- Code : AMPX-6 in SCALE6.2.2
- Condition :
  - Group structure : 200 groups (the same as one of libraries attached in SCALE6.2)
    - ✓ Assume transport calculations with MATXSLIB-J40 (199 groups)
    - ✓ The 200 group structure is the same as the 199 group structure except for its first group.
  - Temperature : 300 K
    - ✓ Assume activation calculations for bio-shield concrete
  - Weighting function : Maxwellian - 1/E - fission spectrum - 1/E (above 10 MeV)
  - Infinite dilution

Processing Method -(2)

❑ AMPX-6 processing :

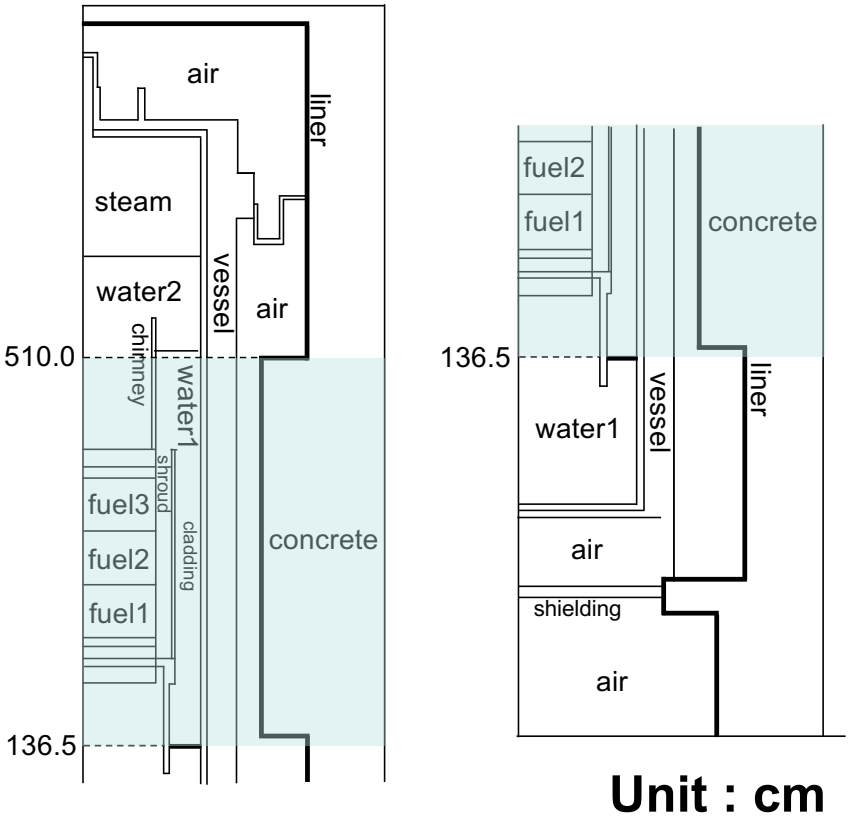
- **ExSite code in AMPX-6 package produces a template input file for AMPX-6.**
- **We produce an ORIGEN library from each file of JENDL/AD-2017 with AMPX-6 and a modified template input and combine all the ORIGEN libraries to one ORIGEN library with AMPX-6.**

❑ Remarks on JENDL/AD-2017 :

- **Use 0K MF10 version because 0K MF9 version is not processed.**
- **Modify a metastable state level based on the decay data of SCALE6.2 (Ex. ^{134m}Cs level : 3 in JENDL/AD-2017, 1 in decay data of SCALE6.2)**
- **Remove unnecessary resonance data because AMPX-6 considers them**

Test with JPDR activation calculation -(1)

- We calculate **radioactive inventories in bio-shield concrete** of JAEA **JPDR** (Japan Power Demonstration Reactor).
- **Neutron spectra** inside the concrete are calculated with the Sn **DORT** code, a 199 group library including up-scattering data from **MATXSLIB-J40** and a simplified JPDR model.

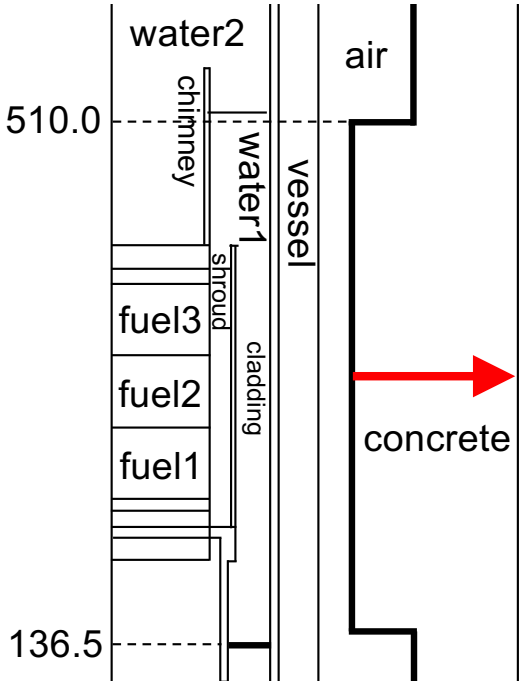


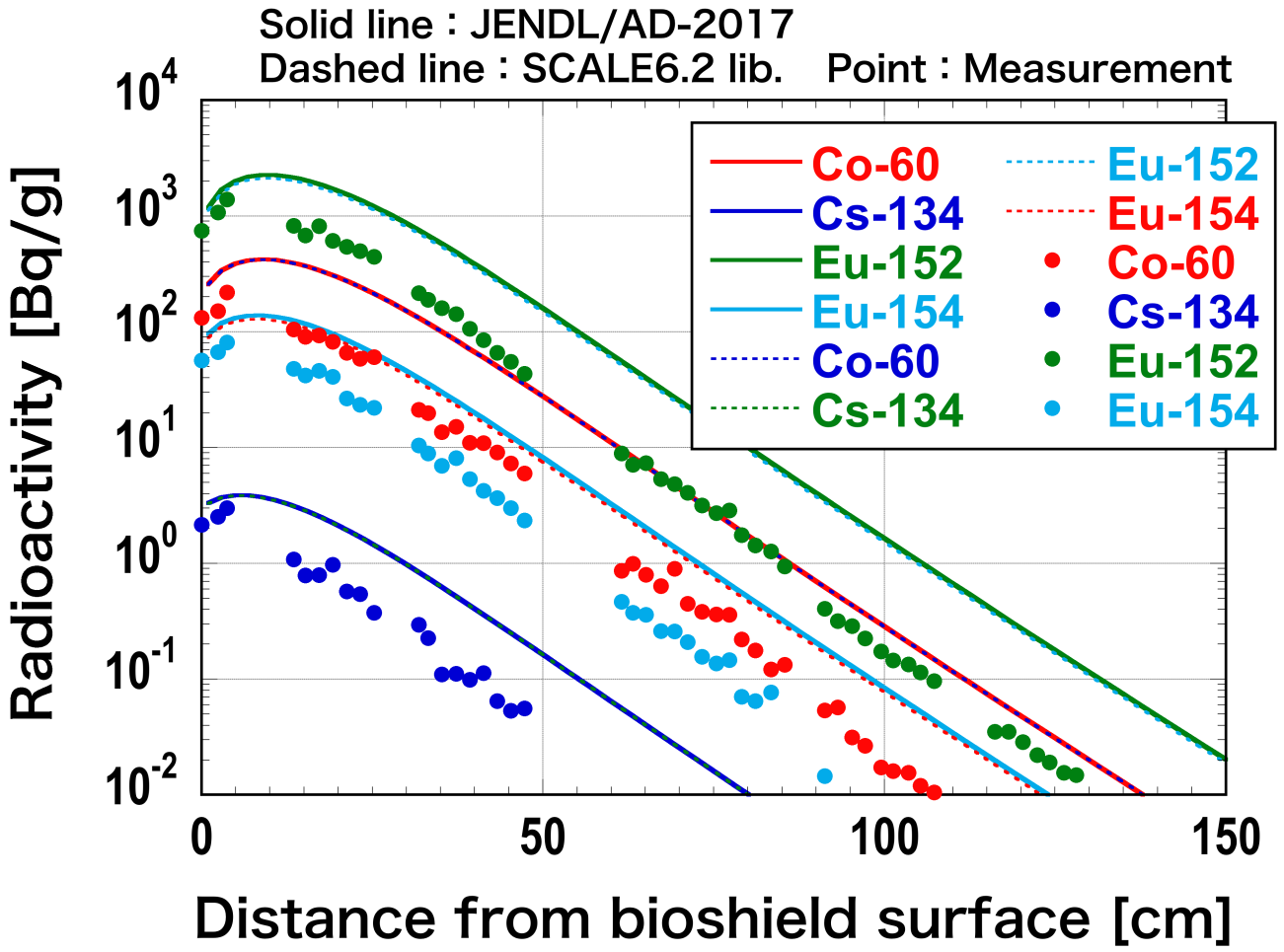
Region of from 136.5 cm to 510 cm (vertical) is modeled in DORT.

Test with JPDR activation calculation -(2)

- We calculate radioactive inventories in the concrete with COUPLE and ORIGEN in SCALE6.2.2 and calculated neutron spectra.
- Activation libraries :
  - the 200 group library produced from JENDL/AD-2017
  - the 200 group library attached in SCALE6.2 (produced from JEFF-3.1/A by ORNL)
- 0.0 is added before 199 group neutron spectra because 200 group structure is the same as 199 group structure except for its first group.
- Time of 161 ORIGEN and COUPLE calculations is 4 minutes (cf. 2.5 minutes for ORIGEN-S).

Test with JPDR activation calculation -(3)





Radioactivity distribution at Z=340cm (cooling : 15 years)

Calculation results with two libraries are almost the same.

→ The library from JENDL/AD-2017 has no problem!

Summary

- We produced a 200 group SCALE6.2 ORIGEN library from JENDL/AD-2017 with AMPX-6.
- Radioactive inventories in bio-shield concrete of JAEA JPDR were calculated with ORIGEN in SCALE6.2.2 for testing the library.
  - the 200 group library produced from JENDL/AD-2017
  - the 200 group library attached in SCALE6.2 (produced from JEFF-3.1/A by ORNL)

    → Almost the same results

    → The produced library has no problem.
- We will release the produced library.