OECD/NEA Source Convergence Benchmark 1: Checkerboard storage of assemblies

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Overview

The model comprises a notional 24x3 LWR fuel storage rack with fuel elements stored in alternate locations. The fuel elements are ~5.0% enriched-by-weight fuel elements located within fully water-flooded steel storage racks surrounded by a close-fitting full concrete reflection on three sides, water on the remaining side and water on the top and bottom. The fuel elements are formed from a 15x15 lattice of Zr-clad UO_2.

Specifications

Material data

The material compositions are as follows (in atoms/barn.cm):

Fuel			Concrete		
	U238	2.2380E-02		H	5.5437E-03
	O	4.6054E-02		C	6.9793E-03
	U235	8.2213E-04		SI	7.7106E-03
				CA	8.9591E-03
				O	4.3383E-02
Water			Iron		
	H	6.6706E-02		FE	8.3770E-02
	O	3.3353E-02			
Zirconium					
	ZR	4.2910E-02			

Geometry data

The following figure describes the problem geometry. The fuel elements are numbered as in a conventional matrix, so that the lowest left-hand fuel element in the figure below is in position (1,1) and the top right-hand fuel element is in position (23,3).

Required calculations

Calculations should be performed using 500 scored generations Four sets of calculations are required using each of the following starting source distributions:

- Uniform over the 36 fuel elements
- All starting source points in location (1,1)
- All starting source points in location (23,3)
- All starting source points in location (12,2)

For each starting source distribution, three different numbers of skipped generations should be employed: 20, 40 and 100. In addition, for each source/skipped generations combination, three difference numbers of starting source points per iteration will be used: 1000, 2000, 5000.

Thirty-six calculations are therefore required as follows:

Case	Starting Source	Skipped Generations	Starting source points
1	Uniform	20	1000
2	Uniform	40	1000
3	Uniform	100	1000
4	Location (1,1)	20	1000
5	Location (1,1)	40	1000
6	Location (1,1)	100	1000
7	Location (23,3)	20	1000
8	Location (23,3)	40	1000
9	Location (23,3)	100	1000
10	Location (12,2)	20	1000
11	Location (12,2)	40	1000
12	Location (12,2)	100	1000
13	Uniform	20	2000
14	Uniform	40	2000
15	Uniform	100	2000
16	Location (1,1)	20	2000
17	Location (1,1)	40	2000
18	Location (1,1)	100	2000
19	Location (23,3)	20	2000
20	Location (23,3)	40	2000
21	Location (23,3)	100	2000
22	Location (12,2)	20	2000
23	Location (12,2)	40	2000
24	Location (12,2)	100	2000
25	Uniform	20	5000
26	Uniform	40	5000
27	Uniform	100	5000
28	Location (1,1)	20	5000
29	Location (1,1)	40	5000
30	Location (1,1)	100	5000
31	Location (23,3)	20	5000
32	Location (23,3)	40	5000
33	Location (23,3)	100	5000
34	Location (12,2)	20	5000
35	Location (12,2)	40	5000
36	Location (12,2)	100	5000

Required output

The following information is required. The proposed submission format is intended to make the analysis phase easier. MS Excel spreadsheets may be used to enter the data. However, when a simple text file is used, numerical data separator should be "," without blanks and the word NODATA is to be inserted if a field is empty.
 ("

Line	Required information
1:	Date
2:	Institution
3:	Contact Person
4:	e-mail address
5:	Voice phone number
6:	FAX Phone Number
7:	Problem name, e.g., "Benchmark 1: Checkerboard storage"
8:	Case name, e.g., 1
9:	Code name
10:	Code type, e.g., Monte Carlo, SN
11:	Cross section library source, e.g., JEF-2.2
12:	Starting source
13:	nskip = number of generations skipped before beginning tallies or before convergence:
14:	ngen = number of generations tallied
15:	nhist = number of histories per generation
16:	ngensh = number of generations per superhistory
17:	final k-eff estimate
18:	final k-eff estimate uncertainty (one standard deviation)
19:	k-eff estimate for first supergeneration
20:	individual k-eff estimate for second supergeneration
18+ngen:	individual k-eff estimate for last supergeneration

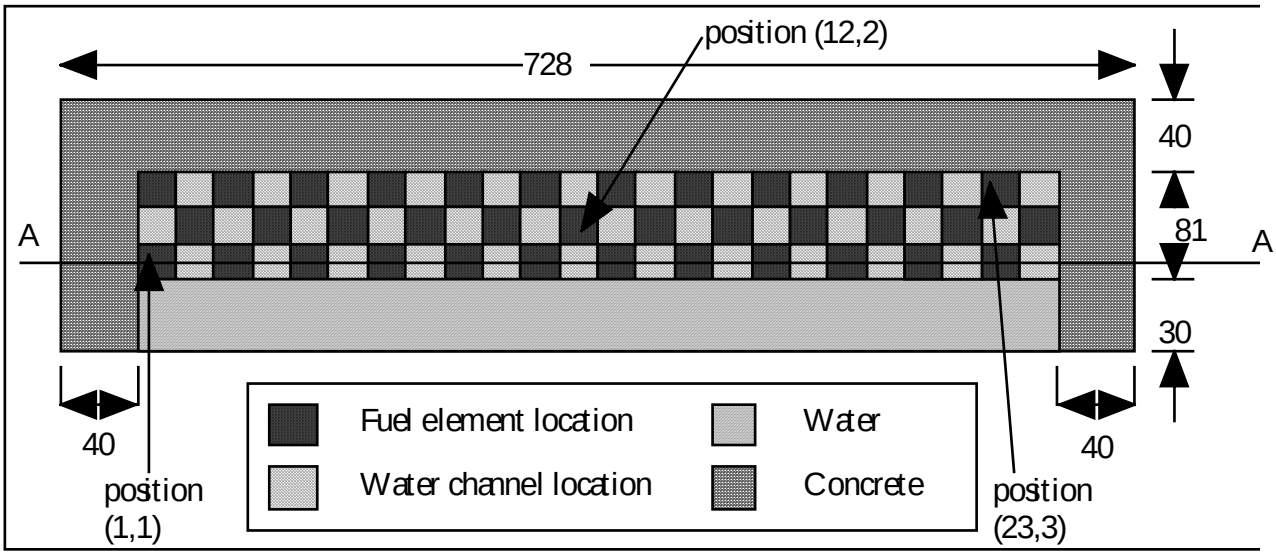
Cumulative fission fractions " ff(i,g)" in fissionable region "i" in generation g, is also an important output. As all computer codes do not have the capability of printing this information for any generation, participants may choose between the following alternatives.

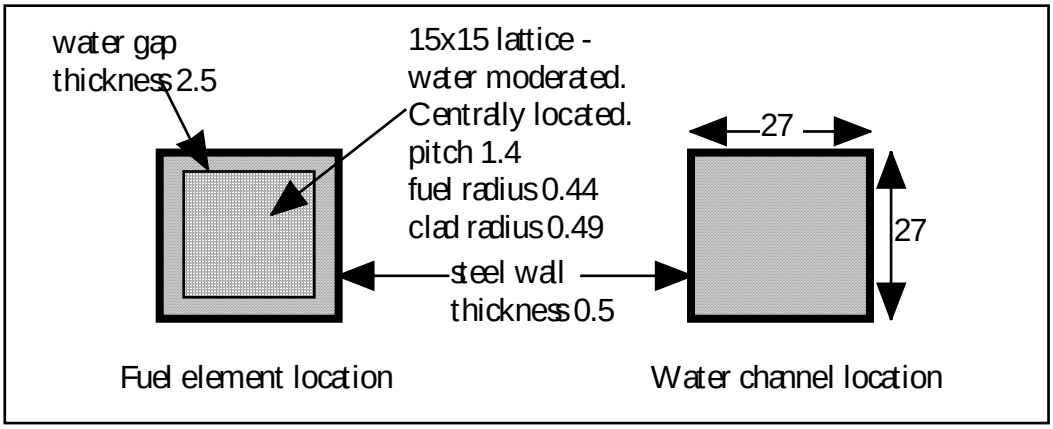
1) Fission fractions are given as average over all generations

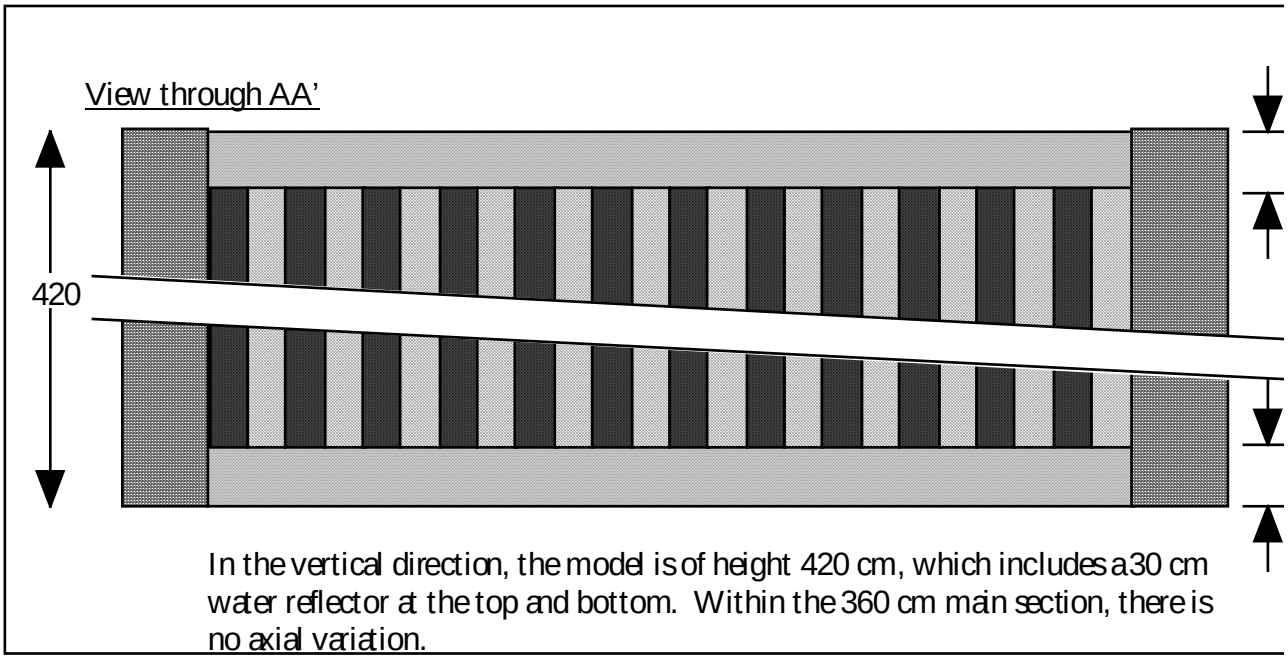
2) Fission fractions are given as average over all active generations

3) Fission fractions are given at different generation sequences

All dimensions in cm







In the vertical direction, the model is of height 420 cm, which includes a 30 cm water reflector at the top and bottom. Within the 360 cm main section, there is no axial variation.