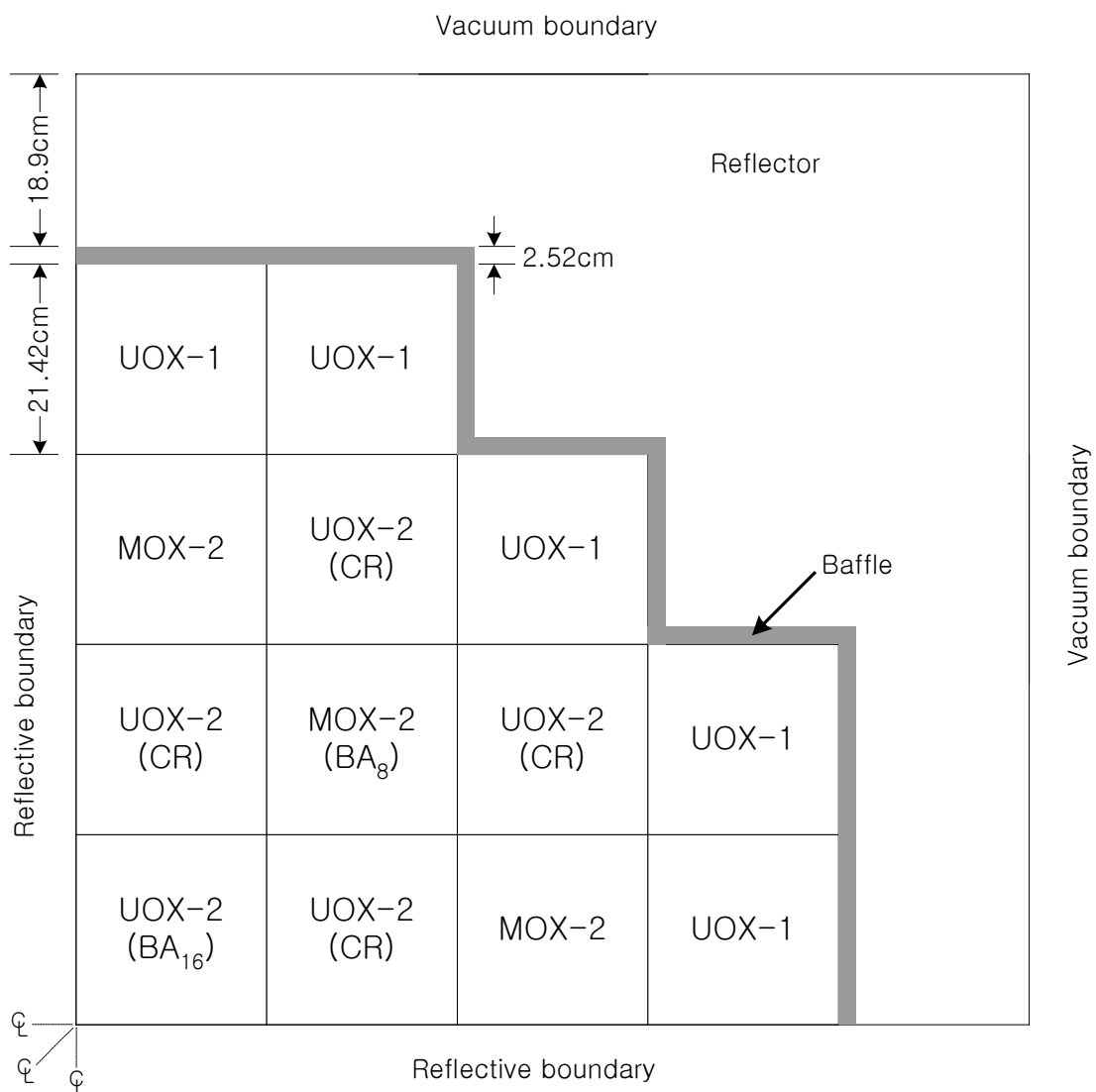


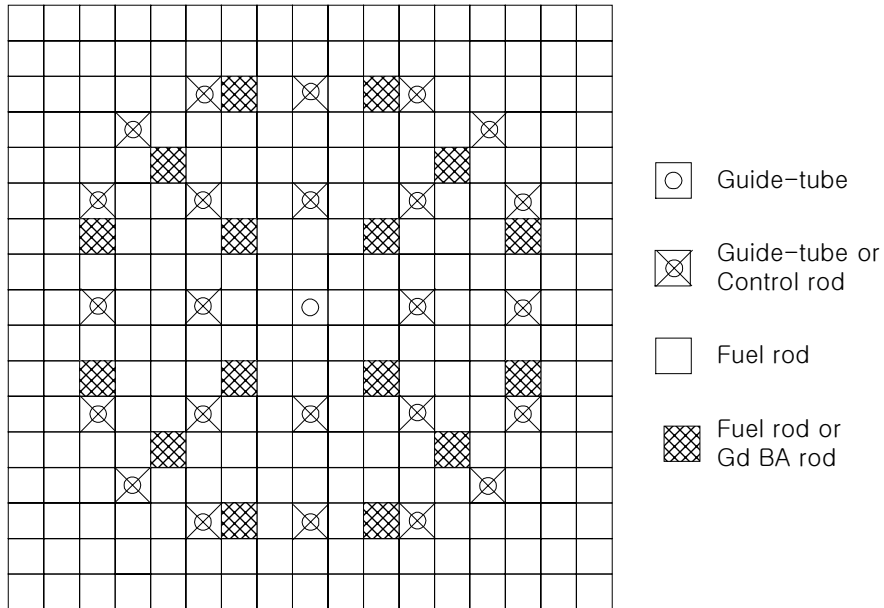
Benchmark Problem 3B : MOX Fuel-Loaded Small PWR Core
(MOX Fuel without Zoning)
(7 Group Homogenized Cells)

- 1) The problem is to calculate effective multiplication factor (k_{eff}) and power distribution.
- 2) Core Configuration (1/4 Core)

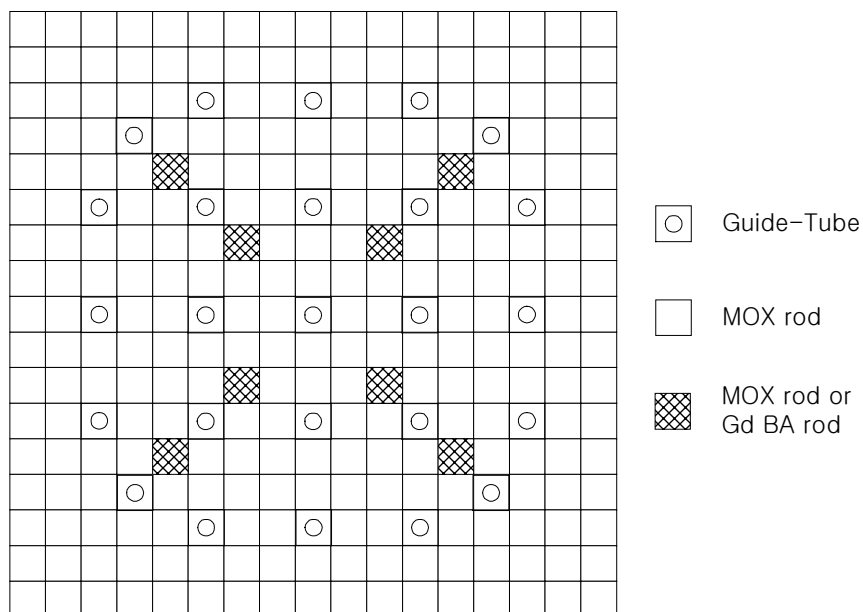


3) Fuel Assembly Configuration

- Lattice: 17 X 17	- Assembly pitch: 21.42 cm
- Number of fuel pins: 264	- Pin pitch: 1.26 cm
- Number of control rod guide tubes: 24	- Active fuel length: 365.76 cm
- Number of instrumentation guide tubes: 1	



<UOX Fuel Assembly>



<MOX-2 Fuel Assembly>

4) 7 Group Homogenized Cell Cross Sections (cm^{-1})

The 7 group homogenized cell cross sections were generated in the following way :

- i) The 7 group homogenized cross sections were generated by condensing the results of HELIOS 34 group runs as follows :

Fuel Materials	UO2 2.0 w/o, UO2 3.3 w/o, MOX 7.0 w/o	Single-cell calculations
Absorber Materials	Burnable absorber, Control rod	Single-assembly calculations
Other Materials	Clad, Gap, Coolant	UO2 3.3 w/o loaded single-cell calculation
	Baffle, Reflector	Two-assembly calculation (UOX-1 FA + Baffle/Reflector)

- ii) From these heterogeneous cross sections, the 7 group cell homogenized cross sections were generated by CRX heterogeneous calculations ; using either single-cell or single-assembly calculations depending on the pin type.
- iii) The scalar flux used in the cell homogenization was obtained by CRX using the 7 group transport-corrected cross sections defined in the following :

$$\sigma_{tr,g' \leftarrow g} = \sigma_{0,g' \leftarrow g} - \delta_{g'g} \sigma_{1g},$$

and

$$\sigma_g = \sigma_{ag} + \sigma_{0g} - \sigma_{1g},$$

where

$$\sigma_{0g} = \sum_{g'=1}^G \sigma_{0,g' \leftarrow g}, \quad \sigma_{1g} = \sum_{g'=1}^G \sigma_{1,g' \leftarrow g}.$$

- Download : [Bench3B_CX.txt](#) (text file format)
- Download : [Bench3B_CX.xls](#) (MS Excel file format)

a) MOX 7.0 w/o fuel cell (for MOX-2 FA)

	Total	Absorption	NuSigFiss	KappaSigFiss
Group 1	1.1163E-01	5.3075E-03	1.3445E-02	1.5809E-13
Group 2	2.8881E-01	2.4501E-03	2.2704E-03	2.6432E-14
Group 3	4.6268E-01	3.3573E-02	2.5089E-02	2.9590E-13
Group 4	5.5903E-01	1.0444E-01	2.7384E-02	3.2305E-13

Group 5	9.9936E-01	3.4240E-01	5.5081E-01	6.5068E-12
Group 6	1.2015E+00	2.7238E-01	4.5755E-01	5.3880E-12
Group 7	1.9380E+00	3.4884E-01	5.9002E-01	6.9434E-12

Scattering Cross Section [$\Sigma_{g' \rightarrow g}$]

P0 Scattering Cross Section

	$g = 1$	$g = 2$	$g = 3$	$g = 4$	$g = 5$	$g = 6$	$g = 7$
$g' = 1$	1.2233E-01	6.6619E-02	2.8760E-04	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
$g' = 2$	0.0000E+00	4.2958E-01	5.1670E-02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
$g' = 3$	0.0000E+00	0.0000E+00	7.4513E-01	4.8882E-02	6.8858E-03	1.2461E-03	7.6933E-04
$g' = 4$	0.0000E+00	0.0000E+00	0.0000E+00	5.6071E-01	2.0326E-01	2.8114E-02	1.2571E-02
$g' = 5$	0.0000E+00	0.0000E+00	0.0000E+00	5.8525E-03	7.0878E-01	2.2952E-01	7.2944E-02
$g' = 6$	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	1.5016E-01	8.4669E-01	2.7211E-01
$g' = 7$	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	6.4262E-02	4.4121E-01	1.4040E+00

P1 Scattering Cross Section

	$g = 1$	$g = 2$	$g = 3$	$g = 4$	$g = 5$	$g = 6$	$g = 7$
$g' = 1$	6.0649E-02	2.2266E-02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
$g' = 2$	0.0000E+00	1.7294E-01	2.1957E-02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
$g' = 3$	0.0000E+00	0.0000E+00	3.4999E-01	2.2345E-02	1.3483E-03	1.0537E-04	1.1381E-05
$g' = 4$	0.0000E+00	0.0000E+00	0.0000E+00	2.7503E-01	7.2163E-02	2.6278E-03	2.4510E-04
$g' = 5$	0.0000E+00	0.0000E+00	0.0000E+00	2.5520E-03	3.1792E-01	4.0625E-02	-9.6041E-04
$g' = 6$	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	3.0901E-02	2.9877E-01	1.0224E-02
$g' = 7$	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	2.2830E-03	2.6424E-02	2.9166E-01

Transport-Corrected Scattering Cross Section

	$g = 1$	$g = 2$	$g = 3$	$g = 4$	$g = 5$	$g = 6$	$g = 7$
$g' = 1$	3.9412E-02	6.6619E-02	2.8760E-04	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
$g' = 2$	0.0000E+00	2.3469E-01	5.1670E-02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
$g' = 3$	0.0000E+00	0.0000E+00	3.7133E-01	4.8882E-02	6.8858E-03	1.2461E-03	7.6933E-04
$g' = 4$	0.0000E+00	0.0000E+00	0.0000E+00	2.1065E-01	2.0326E-01	2.8114E-02	1.2571E-02
$g' = 5$	0.0000E+00	0.0000E+00	0.0000E+00	5.8525E-03	3.4864E-01	2.2952E-01	7.2944E-02
$g' = 6$	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	1.5016E-01	5.0680E-01	2.7211E-01
$g' = 7$	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	6.4262E-02	4.4121E-01	1.0837E+00

b) UO2 2.0 w/o fuel cell (for UOX-1 FA)

	Total	Absorption	NuSigFiss	KappaSigFiss
Group 1	1.1111E-01	4.7082E-03	1.1259E-02	1.3749E-13

Group 2	2.8863E-01	1.9361E-03	6.8735E-04	9.0606E-15
Group 3	4.5098E-01	2.3985E-02	7.7368E-03	1.0307E-13
Group 4	4.5889E-01	1.4122E-02	1.3847E-02	1.8447E-13
Group 5	6.6863E-01	4.3427E-02	6.0142E-02	8.0124E-13
Group 6	9.5402E-01	7.0252E-02	9.8688E-02	1.3148E-12
Group 7	1.6043E+00	1.3250E-01	1.8912E-01	2.5195E-12

Scattering Cross Section [$\Sigma_{g' \rightarrow g}$]

P0 Scattering Cross Section

	$g = 1$	$g = 2$	$g = 3$	$g = 4$	$g = 5$	$g = 6$	$g = 7$
$g' = 1$	1.2244E-01	6.7156E-02	2.8760E-04	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
$g' = 2$	0.0000E+00	4.3020E-01	5.1665E-02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
$g' = 3$	0.0000E+00	0.0000E+00	7.4201E-01	4.8857E-02	6.8659E-03	1.2425E-03	7.6711E-04
$g' = 4$	0.0000E+00	0.0000E+00	0.0000E+00	5.4649E-01	1.9899E-01	2.7304E-02	1.2209E-02
$g' = 5$	0.0000E+00	0.0000E+00	0.0000E+00	4.5242E-03	6.6623E-01	2.0922E-01	6.4648E-02
$g' = 6$	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	1.4040E-01	8.0301E-01	2.5200E-01
$g' = 7$	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	5.8083E-02	4.0400E-01	1.2990E+00

P1 Scattering Cross Section

	$g = 1$	$g = 2$	$g = 3$	$g = 4$	$g = 5$	$g = 6$	$g = 7$
$g' = 1$	6.1204E-02	2.2270E-02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
$g' = 2$	0.0000E+00	1.7321E-01	2.1953E-02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
$g' = 3$	0.0000E+00	0.0000E+00	3.4904E-01	2.2245E-02	1.3444E-03	1.0507E-04	1.1348E-05
$g' = 4$	0.0000E+00	0.0000E+00	0.0000E+00	2.6775E-01	6.9686E-02	2.5521E-03	2.3803E-04
$g' = 5$	0.0000E+00	0.0000E+00	0.0000E+00	2.3094E-03	2.8309E-01	3.4944E-02	-9.2361E-04
$g' = 6$	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	2.7756E-02	2.7495E-01	8.9424E-03
$g' = 7$	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	1.9464E-03	2.2808E-02	2.6456E-01

Transport-Corrected Scattering Cross Section

	$g = 1$	$g = 2$	$g = 3$	$g = 4$	$g = 5$	$g = 6$	$g = 7$
$g' = 1$	3.8963E-02	6.7156E-02	2.8760E-04	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
$g' = 2$	0.0000E+00	2.3503E-01	5.1665E-02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
$g' = 3$	0.0000E+00	0.0000E+00	3.6926E-01	4.8857E-02	6.8659E-03	1.2425E-03	7.6711E-04
$g' = 4$	0.0000E+00	0.0000E+00	0.0000E+00	2.0626E-01	1.9899E-01	2.7304E-02	1.2209E-02
$g' = 5$	0.0000E+00	0.0000E+00	0.0000E+00	4.5242E-03	3.4681E-01	2.0922E-01	6.4648E-02
$g' = 6$	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	1.4040E-01	4.9136E-01	2.5200E-01
$g' = 7$	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	5.8083E-02	4.0400E-01	1.0097E+00

c) UO2 3.3 w/o fuel cell (for UOX-2 FA)

	Total	Absorption	NuSigFiss	KappaSigFiss
Group 1	1.1113E-01	4.7825E-03	1.1458E-02	1.3977E-13
Group 2	2.8844E-01	2.0899E-03	1.0540E-03	1.3885E-14
Group 3	4.5382E-01	2.6690E-02	1.2300E-02	1.6387E-13
Group 4	4.6398E-01	1.8674E-02	2.2601E-02	3.0110E-13
Group 5	6.8795E-01	6.0669E-02	9.5993E-02	1.2789E-12
Group 6	9.8919E-01	9.8790E-02	1.5886E-01	2.1164E-12
Group 7	1.6809E+00	1.8302E-01	2.9556E-01	3.9375E-12

Scattering Cross Section [Sigma_g'->g]

P0 Scattering Cross Section

	g = 1	g = 2	g = 3	g = 4	g = 5	g = 6	g = 7
g' = 1	1.2239E-01	6.7130E-02	2.8760E-04	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
g' = 2	0.0000E+00	4.2992E-01	5.1656E-02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
g' = 3	0.0000E+00	0.0000E+00	7.4242E-01	4.8867E-02	6.8715E-03	1.2435E-03	7.6773E-04
g' = 4	0.0000E+00	0.0000E+00	0.0000E+00	5.4727E-01	1.9917E-01	2.7343E-02	1.2226E-02
g' = 5	0.0000E+00	0.0000E+00	0.0000E+00	4.7185E-03	6.6950E-01	2.0942E-01	6.5028E-02
g' = 6	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	1.4191E-01	8.0934E-01	2.5445E-01
g' = 7	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	5.9420E-02	4.1229E-01	1.3222E+00

P1 Scattering Cross Section

	g = 1	g = 2	g = 3	g = 4	g = 5	g = 6	g = 7
g' = 1	6.1194E-02	2.2266E-02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
g' = 2	0.0000E+00	1.7327E-01	2.1956E-02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
g' = 3	0.0000E+00	0.0000E+00	3.4931E-01	2.2272E-02	1.3455E-03	1.0515E-04	1.1357E-05
g' = 4	0.0000E+00	0.0000E+00	0.0000E+00	2.6810E-01	6.9809E-02	2.5557E-03	2.3837E-04
g' = 5	0.0000E+00	0.0000E+00	0.0000E+00	2.3089E-03	2.8469E-01	3.5303E-02	-9.1574E-04
g' = 6	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	2.8142E-02	2.7805E-01	9.1109E-03
g' = 7	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	2.0153E-03	2.3563E-02	2.7043E-01

Transport-Corrected Scattering Cross Section

	g = 1	g = 2	g = 3	g = 4	g = 5	g = 6	g = 7
g' = 1	3.8934E-02	6.7130E-02	2.8760E-04	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
g' = 2	0.0000E+00	2.3469E-01	5.1656E-02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
g' = 3	0.0000E+00	0.0000E+00	3.6938E-01	4.8867E-02	6.8715E-03	1.2435E-03	7.6773E-04
g' = 4	0.0000E+00	0.0000E+00	0.0000E+00	2.0656E-01	1.9917E-01	2.7343E-02	1.2226E-02
g' = 5	0.0000E+00	0.0000E+00	0.0000E+00	4.7185E-03	3.4811E-01	2.0942E-01	6.5028E-02

$g' = 6$	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	1.4191E-01	4.9404E-01	2.5445E-01
$g' = 7$	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	5.9420E-02	4.1229E-01	1.0262E+00

d) BA + 0.711 w/o UO2 fuel cell (for UOX-2 FA)

	Total	Absorption	NuSigFiss	KappaSigFiss
Group 1	1.1169E-01	4.0654E-03	9.4204E-03	1.1514E-13
Group 2	2.8800E-01	1.9608E-03	2.7952E-04	3.6915E-15
Group 3	4.6751E-01	3.8476E-02	2.4007E-03	3.1983E-14
Group 4	5.1798E-01	7.5614E-02	4.1753E-03	5.5625E-14
Group 5	1.1197E+00	4.4591E-01	1.0575E-02	1.4088E-13
Group 6	1.9228E+00	7.9017E-01	2.5478E-03	3.3943E-14
Group 7	2.7912E+00	7.9129E-01	1.1354E-03	1.5126E-14

Scattering Cross Section [$\Sigma_{g' \rightarrow g}$]

P0 Scattering Cross Section

	$g = 1$	$g = 2$	$g = 3$	$g = 4$	$g = 5$	$g = 6$	$g = 7$
$g' = 1$	1.2073E-01	6.7414E-02	2.9327E-04	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
$g' = 2$	0.0000E+00	4.2841E-01	5.2027E-02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
$g' = 3$	0.0000E+00	0.0000E+00	7.4576E-01	4.9128E-02	6.9059E-03	1.2497E-03	7.7157E-04
$g' = 4$	0.0000E+00	0.0000E+00	0.0000E+00	5.4667E-01	2.0345E-01	2.7968E-02	1.2506E-02
$g' = 5$	0.0000E+00	0.0000E+00	0.0000E+00	5.5070E-03	7.3120E-01	2.3885E-01	7.6688E-02
$g' = 6$	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	1.9120E-01	1.0426E+00	3.5787E-01
$g' = 7$	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	8.5355E-02	5.6700E-01	1.7744E+00

P1 Scattering Cross Section

	$g = 1$	$g = 2$	$g = 3$	$g = 4$	$g = 5$	$g = 6$	$g = 7$
$g' = 1$	5.8090E-02	2.2725E-02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
$g' = 2$	0.0000E+00	1.7230E-01	2.2108E-02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
$g' = 3$	0.0000E+00	0.0000E+00	3.5093E-01	2.2380E-02	1.3522E-03	1.0568E-04	1.1414E-05
$g' = 4$	0.0000E+00	0.0000E+00	0.0000E+00	2.7388E-01	7.1483E-02	2.6142E-03	2.4382E-04
$g' = 5$	0.0000E+00	0.0000E+00	0.0000E+00	2.7496E-03	3.3368E-01	4.3037E-02	-9.7540E-04
$g' = 6$	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	4.4162E-02	3.9942E-01	1.5533E-02
$g' = 7$	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	3.4960E-03	3.8809E-02	3.8455E-01

Transport-Corrected Scattering Cross Section

	$g = 1$	$g = 2$	$g = 3$	$g = 4$	$g = 5$	$g = 6$	$g = 7$
$g' = 1$	3.9915E-02	6.7414E-02	2.9327E-04	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
$g' = 2$	0.0000E+00	2.3401E-01	5.2027E-02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

$g' = 3$	0.0000E+00	0.0000E+00	3.7098E-01	4.9128E-02	6.9059E-03	1.2497E-03	7.7157E-04
$g' = 4$	0.0000E+00	0.0000E+00	0.0000E+00	1.9845E-01	2.0345E-01	2.7968E-02	1.2506E-02
$g' = 5$	0.0000E+00	0.0000E+00	0.0000E+00	5.5070E-03	3.5271E-01	2.3885E-01	7.6688E-02
$g' = 6$	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	1.9120E-01	5.8352E-01	3.5787E-01
$g' = 7$	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	8.5355E-02	5.6700E-01	1.3476E+00

e) BA + 0.711 w/o UO2 fuel cell (for MOX-2 FA)

	Total	Absorption	NuSigFiss	KappaSigFiss
Group 1	1.1128E-01	4.0454E-03	9.3838E-03	1.1444E-13
Group 2	2.8786E-01	1.9549E-03	2.7904E-04	3.6852E-15
Group 3	4.6747E-01	3.7986E-02	2.3682E-03	3.1550E-14
Group 4	5.2133E-01	7.9426E-02	3.8924E-03	5.1856E-14
Group 5	1.0548E+00	3.9091E-01	1.0777E-02	1.4358E-13
Group 6	1.9199E+00	7.8746E-01	2.5588E-03	3.4090E-14
Group 7	2.7859E+00	7.8574E-01	1.1276E-03	1.5022E-14

Scattering Cross Section [$\Sigma_{g' \rightarrow g}$]

P0 Scattering Cross Section

	$g = 1$	$g = 2$	$g = 3$	$g = 4$	$g = 5$	$g = 6$	$g = 7$
$g' = 1$	1.2050E-01	6.7407E-02	2.9492E-04	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
$g' = 2$	0.0000E+00	4.2843E-01	5.2094E-02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
$g' = 3$	0.0000E+00	0.0000E+00	7.4589E-01	4.9023E-02	6.8977E-03	1.2483E-03	7.7066E-04
$g' = 4$	0.0000E+00	0.0000E+00	0.0000E+00	5.4631E-01	2.0187E-01	2.7830E-02	1.2444E-02
$g' = 5$	0.0000E+00	0.0000E+00	0.0000E+00	5.9506E-03	7.1977E-01	2.3097E-01	7.4332E-02
$g' = 6$	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	1.9119E-01	1.0425E+00	3.5778E-01
$g' = 7$	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	8.5365E-02	5.6705E-01	1.7746E+00

P1 Scattering Cross Section

	$g = 1$	$g = 2$	$g = 3$	$g = 4$	$g = 5$	$g = 6$	$g = 7$
$g' = 1$	5.8100E-02	2.2870E-02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
$g' = 2$	0.0000E+00	1.7248E-01	2.2140E-02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
$g' = 3$	0.0000E+00	0.0000E+00	3.5051E-01	2.2367E-02	1.3506E-03	1.0556E-04	1.1400E-05
$g' = 4$	0.0000E+00	0.0000E+00	0.0000E+00	2.7243E-01	7.1269E-02	2.6013E-03	2.4262E-04
$g' = 5$	0.0000E+00	0.0000E+00	0.0000E+00	2.6147E-03	3.2370E-01	4.1797E-02	-9.3866E-04
$g' = 6$	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	4.4150E-02	3.9934E-01	1.5529E-02
$g' = 7$	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	3.4965E-03	3.8814E-02	3.8459E-01

Transport-Corrected Scattering Cross Section

	g = 1	g = 2	g = 3	g = 4	g = 5	g = 6	g = 7
g' = 1	3.9534E-02	6.7407E-02	2.9492E-04	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
g' = 2	0.0000E+00	2.3381E-01	5.2094E-02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
g' = 3	0.0000E+00	0.0000E+00	3.7155E-01	4.9023E-02	6.8977E-03	1.2483E-03	7.7066E-04
g' = 4	0.0000E+00	0.0000E+00	0.0000E+00	1.9976E-01	2.0187E-01	2.7830E-02	1.2444E-02
g' = 5	0.0000E+00	0.0000E+00	0.0000E+00	5.9506E-03	3.5260E-01	2.3097E-01	7.4332E-02
g' = 6	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	1.9119E-01	5.8345E-01	3.5778E-01
g' = 7	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	8.5365E-02	5.6705E-01	1.3477E+00

f) Control rod cell

	Total	Absorption	NuSigFiss	KappaSigFiss
Group 1	1.2417E-01	2.1420E-03	0.0000E+00	0.0000E+00
Group 2	2.9921E-01	7.3171E-03	0.0000E+00	0.0000E+00
Group 3	5.7997E-01	1.8247E-01	0.0000E+00	0.0000E+00
Group 4	1.0581E+00	6.2264E-01	0.0000E+00	0.0000E+00
Group 5	1.3203E+00	6.8385E-01	0.0000E+00	0.0000E+00
Group 6	1.6301E+00	6.9803E-01	0.0000E+00	0.0000E+00
Group 7	2.2847E+00	6.9590E-01	0.0000E+00	0.0000E+00

Scattering Cross Section [Sigma_g'->g]

P0 Scattering Cross Section

	g = 1	g = 2	g = 3	g = 4	g = 5	g = 6	g = 7
g' = 1	1.2334E-01	5.5605E-02	2.3375E-04	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
g' = 2	0.0000E+00	4.0420E-01	4.3422E-02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
g' = 3	0.0000E+00	0.0000E+00	6.6507E-01	4.1651E-02	5.8453E-03	1.0578E-03	6.5308E-04
g' = 4	0.0000E+00	0.0000E+00	0.0000E+00	5.4505E-01	2.1212E-01	2.9405E-02	1.3149E-02
g' = 5	0.0000E+00	0.0000E+00	0.0000E+00	4.3207E-03	6.8842E-01	2.2864E-01	7.2648E-02
g' = 6	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	1.4998E-01	8.5528E-01	2.7904E-01
g' = 7	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	6.4771E-02	4.3825E-01	1.4101E+00

P1 Scattering Cross Section

	g = 1	g = 2	g = 3	g = 4	g = 5	g = 6	g = 7
g' = 1	3.9049E-02	1.8100E-02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
g' = 2	0.0000E+00	1.3794E-01	1.7781E-02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
g' = 3	0.0000E+00	0.0000E+00	2.9646E-01	1.9069E-02	1.1445E-03	8.9451E-05	9.6610E-06
g' = 4	0.0000E+00	0.0000E+00	0.0000E+00	2.8530E-01	7.5961E-02	2.7485E-03	2.5635E-04
g' = 5	0.0000E+00	0.0000E+00	0.0000E+00	2.6796E-03	3.1521E-01	4.0593E-02	-8.9823E-04
g' = 6	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	3.3305E-02	3.0775E-01	1.1201E-02

$g' = 7$	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	2.6507E-03	2.8160E-02	2.9353E-01
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Transport-Corrected Scattering Cross Section

	$g = 1$	$g = 2$	$g = 3$	$g = 4$	$g = 5$	$g = 6$	$g = 7$
$g' = 1$	6.6192E-02	5.5605E-02	2.3375E-04	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
$g' = 2$	0.0000E+00	2.4847E-01	4.3422E-02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
$g' = 3$	0.0000E+00	0.0000E+00	3.4829E-01	4.1651E-02	5.8453E-03	1.0578E-03	6.5308E-04
$g' = 4$	0.0000E+00	0.0000E+00	0.0000E+00	1.8079E-01	2.1212E-01	2.9405E-02	1.3149E-02
$g' = 5$	0.0000E+00	0.0000E+00	0.0000E+00	4.3207E-03	3.3083E-01	2.2864E-01	7.2648E-02
$g' = 6$	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	1.4998E-01	5.0303E-01	2.7904E-01
$g' = 7$	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	6.4771E-02	4.3825E-01	1.0858E+00

g) Guide tube cell

	Total	Absorption	NuSigFiss	KappaSigFiss
Group 1	8.1018E-02	4.4990E-04	0.0000E+00	0.0000E+00
Group 2	2.5058E-01	8.3907E-05	0.0000E+00	0.0000E+00
Group 3	4.1241E-01	1.1136E-03	0.0000E+00	0.0000E+00
Group 4	5.0583E-01	5.0242E-03	0.0000E+00	0.0000E+00
Group 5	8.0002E-01	1.1831E-02	0.0000E+00	0.0000E+00
Group 6	1.2160E+00	1.9920E-02	0.0000E+00	0.0000E+00
Group 7	2.1192E+00	3.6782E-02	0.0000E+00	0.0000E+00

Scattering Cross Section [$\Sigma_{g' \rightarrow g}$]

P0 Scattering Cross Section

	$g = 1$	$g = 2$	$g = 3$	$g = 4$	$g = 5$	$g = 6$	$g = 7$
$g' = 1$	8.9536E-02	7.8066E-02	4.7175E-04	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
$g' = 2$	0.0000E+00	4.5621E-01	8.3663E-02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
$g' = 3$	0.0000E+00	0.0000E+00	9.2056E-01	7.8186E-02	1.1172E-02	2.0218E-03	1.2482E-03
$g' = 4$	0.0000E+00	0.0000E+00	0.0000E+00	6.7089E-01	3.1617E-01	4.4590E-02	1.9939E-02
$g' = 5$	0.0000E+00	0.0000E+00	0.0000E+00	5.1202E-03	8.7092E-01	3.2098E-01	1.0446E-01
$g' = 6$	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	2.0384E-01	1.1026E+00	3.8478E-01
$g' = 7$	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	8.9418E-02	5.9240E-01	1.8478E+00

P1 Scattering Cross Section

	$g = 1$	$g = 2$	$g = 3$	$g = 4$	$g = 5$	$g = 6$	$g = 7$
$g' = 1$	5.0082E-02	3.7424E-02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
$g' = 2$	0.0000E+00	2.5283E-01	3.6541E-02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
$g' = 3$	0.0000E+00	0.0000E+00	5.6291E-01	3.6598E-02	2.1876E-03	1.7097E-04	1.8465E-05

$g' = 4$	0.0000E+00	0.0000E+00	0.0000E+00	4.3040E-01	1.1584E-01	4.1679E-03	3.8873E-04
$g' = 5$	0.0000E+00	0.0000E+00	0.0000E+00	3.9540E-03	4.5112E-01	5.9500E-02	-1.2858E-03
$g' = 6$	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	4.7960E-02	4.3023E-01	1.6975E-02
$g' = 7$	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	3.6729E-03	4.0867E-02	4.0261E-01

Transport-Corrected Scattering Cross Section

	$g = 1$	$g = 2$	$g = 3$	$g = 4$	$g = 5$	$g = 6$	$g = 7$
$g' = 1$	2.0306E-03	7.8066E-02	4.7175E-04	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
$g' = 2$	0.0000E+00	1.6683E-01	8.3663E-02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
$g' = 3$	0.0000E+00	0.0000E+00	3.1867E-01	7.8186E-02	1.1172E-02	2.0218E-03	1.2482E-03
$g' = 4$	0.0000E+00	0.0000E+00	0.0000E+00	1.2010E-01	3.1617E-01	4.4590E-02	1.9939E-02
$g' = 5$	0.0000E+00	0.0000E+00	0.0000E+00	5.1202E-03	3.5763E-01	3.2098E-01	1.0446E-01
$g' = 6$	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	2.0384E-01	6.0743E-01	3.8478E-01
$g' = 7$	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	8.9418E-02	5.9240E-01	1.4006E+00

h) Baffle

	Total	Absorption	NuSigFiss	KappaSigFiss
Group 1	2.8203E-01	1.6422E-03	0.0000E+00	0.0000E+00
Group 2	4.0167E-01	6.7552E-04	0.0000E+00	0.0000E+00
Group 3	9.9137E-01	7.6252E-03	0.0000E+00	0.0000E+00
Group 4	8.9521E-01	3.4006E-02	0.0000E+00	0.0000E+00
Group 5	9.4509E-01	8.1811E-02	0.0000E+00	0.0000E+00
Group 6	1.0019E+00	1.3499E-01	0.0000E+00	0.0000E+00
Group 7	1.1187E+00	2.3782E-01	0.0000E+00	0.0000E+00

Scattering Cross Section [$\Sigma_{g' \rightarrow g}$]

P0 Scattering Cross Section

	$g = 1$	$g = 2$	$g = 3$	$g = 4$	$g = 5$	$g = 6$	$g = 7$
$g' = 1$	2.2896E-01	5.1421E-02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
$g' = 2$	0.0000E+00	3.9802E-01	2.9726E-03	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
$g' = 3$	0.0000E+00	0.0000E+00	9.8056E-01	3.1882E-03	0.0000E+00	0.0000E+00	0.0000E+00
$g' = 4$	0.0000E+00	0.0000E+00	0.0000E+00	8.3882E-01	2.2383E-02	0.0000E+00	0.0000E+00
$g' = 5$	0.0000E+00	0.0000E+00	0.0000E+00	6.0327E-03	7.9668E-01	6.0562E-02	0.0000E+00
$g' = 6$	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	5.4940E-02	7.4869E-01	6.3251E-02
$g' = 7$	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	1.1812E-01	7.6275E-01

P1 Scattering Cross Section

$g = 1$	$g = 2$	$g = 3$	$g = 4$	$g = 5$	$g = 6$	$g = 7$
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$g' = 1$	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
$g' = 2$	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
$g' = 3$	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
$g' = 4$	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
$g' = 5$	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
$g' = 6$	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
$g' = 7$	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

Transport-Corrected Scattering Cross Section

	$g = 1$	$g = 2$	$g = 3$	$g = 4$	$g = 5$	$g = 6$	$g = 7$
$g' = 1$	2.2896E-01	5.1421E-02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
$g' = 2$	0.0000E+00	3.9802E-01	2.9726E-03	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
$g' = 3$	0.0000E+00	0.0000E+00	9.8056E-01	3.1882E-03	0.0000E+00	0.0000E+00	0.0000E+00
$g' = 4$	0.0000E+00	0.0000E+00	0.0000E+00	8.3882E-01	2.2383E-02	0.0000E+00	0.0000E+00
$g' = 5$	0.0000E+00	0.0000E+00	0.0000E+00	6.0327E-03	7.9668E-01	6.0562E-02	0.0000E+00
$g' = 6$	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	5.4940E-02	7.4869E-01	6.3251E-02
$g' = 7$	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	1.1812E-01	7.6275E-01

i) Reflector

	Total	Absorption	NuSigFiss	KappaSigFiss
Group 1	7.5384E-02	4.9929E-04	0.0000E+00	0.0000E+00
Group 2	2.4872E-01	1.5705E-05	0.0000E+00	0.0000E+00
Group 3	4.2163E-01	8.2969E-04	0.0000E+00	0.0000E+00
Group 4	5.3183E-01	5.4649E-03	0.0000E+00	0.0000E+00
Group 5	9.0849E-01	1.3821E-02	0.0000E+00	0.0000E+00
Group 6	1.3205E+00	2.1644E-02	0.0000E+00	0.0000E+00
Group 7	2.3163E+00	3.9881E-02	0.0000E+00	0.0000E+00

Scattering Cross Section [$\Sigma_{g' \rightarrow g}$]

P0 Scattering Cross Section

	$g = 1$	$g = 2$	$g = 3$	$g = 4$	$g = 5$	$g = 6$	$g = 7$
$g' = 1$	8.2716E-02	8.1963E-02	5.1642E-04	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
$g' = 2$	0.0000E+00	4.7143E-01	9.9730E-02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
$g' = 3$	0.0000E+00	0.0000E+00	9.5552E-01	1.1014E-01	1.5751E-02	2.8683E-03	1.7862E-03
$g' = 4$	0.0000E+00	0.0000E+00	0.0000E+00	7.0714E-01	3.5409E-01	4.9958E-02	2.2326E-02
$g' = 5$	0.0000E+00	0.0000E+00	0.0000E+00	2.3861E-03	8.9203E-01	4.2845E-01	1.3581E-01
$g' = 6$	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	2.1673E-01	1.1939E+00	4.3269E-01
$g' = 7$	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	9.8237E-02	6.4545E-01	2.0233E+00

P1 Scattering Cross Section

	g = 1	g = 2	g = 3	g = 4	g = 5	g = 6	g = 7
g' = 1	4.9376E-02	4.0935E-02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
g' = 2	0.0000E+00	2.7854E-01	4.3908E-02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
g' = 3	0.0000E+00	0.0000E+00	6.0837E-01	5.3404E-02	3.2058E-03	2.5700E-04	2.7629E-05
g' = 4	0.0000E+00	0.0000E+00	0.0000E+00	4.7130E-01	1.3074E-01	4.6660E-03	4.3373E-04
g' = 5	0.0000E+00	0.0000E+00	0.0000E+00	2.0882E-03	4.7579E-01	8.7587E-02	-1.4581E-03
g' = 6	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	5.0454E-02	4.7343E-01	2.0516E-02
g' = 7	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	3.9364E-03	4.3914E-02	4.4277E-01

Transport-Corrected Scattering Cross Section

	g = 1	g = 2	g = 3	g = 4	g = 5	g = 6	g = 7
g' = 1	-7.5952E-03	8.1963E-02	5.1642E-04	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
g' = 2	0.0000E+00	1.4898E-01	9.9730E-02	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
g' = 3	0.0000E+00	0.0000E+00	2.9026E-01	1.1014E-01	1.5751E-02	2.8683E-03	1.7862E-03
g' = 4	0.0000E+00	0.0000E+00	0.0000E+00	9.9991E-02	3.5409E-01	4.9958E-02	2.2326E-02
g' = 5	0.0000E+00	0.0000E+00	0.0000E+00	2.3861E-03	3.2802E-01	4.2845E-01	1.3581E-01
g' = 6	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	2.1673E-01	6.4948E-01	4.3269E-01
g' = 7	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	9.8237E-02	6.4545E-01	1.5327E+00

5) 7 Group Structure (eV)

	Upper		Lower
Group 1 :	2.000E+7	-	1.353E+6
Group 2 :	1.353E+6	-	9.119E+3
Group 3 :	9.119E+3	-	3.928E+0
Group 4 :	3.928E+0	-	6.251E-1
Group 5 :	6.251E-1	-	1.457E-1
Group 6 :	1.457E-1	-	5.692E-2
Group 7 :	5.692E-2	-	0.000E+0

6) 7 Group Fission Spectrum

Group 1	5.9252E-01
Group 2	4.0714E-01
Group 3	3.3193E-04
Group 4	0.0000E+00
Group 5	0.0000E+00
Group 6	0.0000E+00
Group 7	0.0000E+00

- 7) Reactor Operating Condition
 - (Same with Benchmark Problem 1A)
 - Total thermal power of the core: 900 MWth

- 8) Problem Cases
 - Case 1 : All rods in
 - Case 2 : All rods out