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7. Abstract

A criticality safety evaluation of the 100K Area ion exchange modules (IXM) and ion exchange columns (IXC) was completed to support operations without a criticality alarm system. The results show that the IXM's and IXC's are well below the criticality design limit of k_{eff} = 0.95 for normal and off-normal conditions.

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ABSTRACT

A criticality safety evaluation of the 100K area ion exchange modules (IXM) and ion exchange columns (IXC) was completed to support operations without a criticality alarm system. The IXMs are in a fixed geometry set in concrete. The IXCs are individual cells and can be placed in several locations. The results show that the normal configuration of the IXMs and IXCs is well below the criticality design limit of k_{eff}= 0.95 with the maximum being the IXCs stored in the concrete burial box with k_{eff} = 0.159.

The IXMs and IXCs are both depleted with inorganic cations and anions as well as various radionuclides present in the basin water. The radionuclides compete with the other ions for the active sites on the ion exchange media. The IXMs and IXCs will preferentially remove the ions with higher valences before removing the radionuclides with lower valences. Most of the uranium and plutonium in the basin water is in a neutral valence state, and therefore the IXMs and IXCs will not retain either metal due to ionic interaction, but will act as a mechanical filter for both substances.

For this evaluations off-normal analysis, it was assumed that the IXMs and IXCs only removed plutonium from the water. It was also assumed that the IXMs or IXCs were left online indefinitely to accumulate this material. The IXMs are usually changed out about every four months and the IXCs are changed out about every two months.

For the IXMs the most reactive case filled only the top one-third of the cell, and would contain approximately 18 kg of plutonium at a calculated

k_{eff} of 0.95. At the assumed inlet concentration of 1.5 E-6 grams plutonium per liter and no decrease in filtering efficiency it would take about 42 years to accumulate the 18 kgs.

For the IXCs the most reactive case filled only the top one-third of the cell, and would contain approximately 3.3 kgs of plutonium at k_{eff} = 0.95. At the assumed inlet concentration of 4.0 E-6 grams plutonium per liter and no decrease in filtering efficiency it would take about 9 years to accumulate this amount.

For the IXCs in the concrete burial box, a close packed 5 by 5 array was used. The homogeneously filled IXCs would each contain approximately 5.3 kgs of plutonium at k_{eff} = 0.95. Each IXC would need to be in operation for about 14 years for this material to accumulate.

For all of these cases, the IXMs or IXCs would need to be left online more than 30 times the normal online time, and only accumulate plutonium. Neither of these situations are credible. Therefore, operations may proceed without a criticality alarm system.

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1.0 INTRODUCTION

A criticality safety evaluation of the 100K area ion exchange modules (IXM), and ion exchange columns (IXC) was completed. The conclusions show that the normal configuration of the IXMs and IXCs is well below the criticality design limit of k_{eff}= 0.95 with the maximum being the IXCs in the concrete burial box with $k_{eff} \pm 2\sigma = 0.159 \pm 0.001$.

The IXMs and IXCs are located in the 105KE and 105KW buildings. Figure 1 shows the approximate locations of the IXMs, IXCs, and lead caves. The concrete burial box is separate from the IXMs and IXCs. The IXMs and IXCs are independent systems.

An IXM consists of six steel cells set in concrete (Figures 2 and 3) in a 2 by 3 array. There are two IXMs placed next to each other. The IXCs are individual steel cells. The IXCs are used three at a time while filtering (see Figures 4 and 5) and are then placed into either a lead vault or into a concrete burial box.

The IXMs are used to remove inorganics and radionuclides from the basin water. The basin water flows through a sand filter, then enters the top of the module where it is piped to the six parallel cells. The water then exits the IXM and flows back to the basin.

Each IXM cell is 106.68 cm tall and 40.64 cm in diameter. Each cell contains approximately 92 kg of resin beads that are made up of styrene-divinyl benzene with a cation to anion ratio of 1:1.

The IXCs are also used to remove inorganics and radionuclides from the basin water. The water from the basin recirculation pumps passes through cartridge filters, the chillers, and then can be piped through the three parallel IXCs. The water then flows back to the basin.

Each IXC is 151.13 cm tall and 45.72 cm in diameter. Each IXC contains approximately 172 kg of resin beads. This resin is the same as that found in the IXMs.

The results of the analysis in this CSER show that operations may proceed without criticality alarm coverage.

2.0 CRITICALITY ANALYSIS

2.1 PHYSICAL PROPERTIES AND ASSUMPTIONS

Ion Exchange Module (Figures 2 and 3, Drawing H-1-46792 Sheets 1-4))

Carbon Steel 7.62 g/cm^3	
Height (outside) is	106.680 cm (42.0 in.)
Height (inside) is	105.727 cm (41.625 in.)
Wall is	0.4763 cm (0.1875 in.)
ID is	38.735 cm (15.25 in.)

OD is	40.640 cm	(16.0 in.)
Resin Capacity	~92 kg	(203 lbs)

Ion Exchange Column (Figures 4 and 5. Drawing H-1-34793 and H-1-34789 Sheet 1)

Carbon Steel 7.62 g/cm^3

Height (outside) is	151.130 cm	(59.5 in.)
Height (inside) is	149.860 cm	(59.0 in.)
Wall is	0.635 cm	(0.25 in.)
ID is	44.450 cm	(17.5 in.)
OD is	45.720 cm	(18.0 in.)
Resin Capacity	~172 kg	(378 lbs)

Concrete density is 2.3 g/cm^3

Resin beads
- Styrene-divinyl benzene
- Composition $H_{16}C_{15}$
- Resin density is 0.92 g/cm^3
- Bead shipping density is 0.74 g/cm^3

Flow into IXMs is 150 gal/min, into each IXC is 50 gal/min.

Uranium is 0.95 wt% ^{235}U and 99.05 wt% ^{238}U for the normal enrichment cases and 1.25 wt% ^{235}U and 98.75 wt% ^{238}U for the higher enrichment cases.

Plutonium is 6 wt% ^{240}Pu and 94 wt% ^{239}Pu.

The presence and buildup of non-fissionable materials in the ion exchange materials was ignored.

Uranium to plutonium mass ratio is assumed to be 400:1 or 10:1 for the off normal conditions. Data received after completion of analysis shows IXCs have ratio of about 60:1, but 10:1 is still conservative for off-normal conditions. See Appendix B.

Limit for amount of uranium in module assuming UO_2^{++} is 0.243 g/cm^3. This is based on the ion capacity of the resin and the valence of the UO_2. UO_2^{++} is the most common valence state for UO_2, and its presence in the basin water is very unlikely.

IXM inlet water actinide concentration (average):
- Both concentrations are conservatively rounded up.
- Total uranium is 6.0 E-4 g/L (Appendix A and B analysis)
- Total plutonium is 1.5 E-6 g/L (Appendix A and B analysis)

IXC inlet water actinide concentration (average):
- Both concentrations are conservatively rounded up.
- Total uranium is 2.5 E-4 g/L (Appendix A and B analysis)
- Total plutonium is 4.0 E-6 g/L (Appendix A and B analysis).

IXM and IXC efficiency assumed to be a constant 95%.

IXMs are changed out every six months or earlier unless analysis shows they have not accumulated more than 110 grams of plutonium, and are still efficiently removing contaminants.

IXCs are changed out every one to two months as needed according to analysis.

The two IXMs, placed adjacent to each other, are separated by 96.52 cm of concrete between the nearest cells.

The concrete burial box (Drawing H-1-44980 Sheet 1) with used IXCs was modeled as a close packed 5 x 5 array of IXCs in a 30.48-cm-thick concrete box. Figures 6 and 7 show the model. This model is conservative since the IXCs are randomly oriented in the burial box, and the box is much actually larger with 10.16-cm-thick concrete walls. The box is then placed on a railroad car.

The case of the IXCs stored in the lead caves (Drawing H-1-45071 Sheet 5) was not explicitly modelled. The results for the IXCs in the concrete burial box will be a conservative bounding limit due to the number of IXCs in the burial box. The lead caves only have three or six IXCs in them (KE and KW respectively), while the model for the concrete burial box includes 25 IXCs in a close packed square array (the most reactive configuration.)

Conversion from liquid concentration to IXM or IXC buildup per year is calculated as follows:

buildup per year = concentration (g/L) * efficiency * flow (gal/min)
* 3.785 L/gal * 60 (min/h) * 24 (h/d) * 365 (d/y)

2.2 IXM AND IXC NORMAL OPERATION

Under normal circumstances, the IXM or IXC is depleted with inorganic cations and anions consisting of Ca^{++} Mg^{++}, Na^{+}, Cl^{-}, SO_4^{--} and HCO_3^{-} ions as well as various radionuclides present in the basin water. The radionuclides compete with the other ions for the active sites on the ion exchange media. The IXMs and IXCs will preferentially remove the ions with higher valences before the radionuclides with lower valences.

Most of the uranium and plutonium in the basin water is in a neutral valence state, and therefore the IXMs and IXCs will not be retaining either metal due to ionic interaction, but will be acting as a mechanical filter for both substances.

Several very conservative assumptions were made for the analysis. It was assumed that: the IXM or IXC is left in service until it is saturated with ions, and the only ions available in the basin are uranium or plutonium (or a mixture of the two).

Using uranium in the form UO_2^{++}, which is a very unlikely valence state, yields a resin saturation limit of 0.243 g/cm^3 of uranium.

2.2.1 IXM Specific Analysis

For an IXM the limit of 0.243 g/cm^3 would give approximately 192 kg of uranium with a U_{235} content of 1.825 g. Also using the assumption that the uranium to plutonium ratio is 400:1 (conservative estimate from basin water analysis) will yield approximately 480 g of plutonium. For these materials a k_{eff} of 0.111 is calculated. Using the uranium concentration of 6.0 E-4 g/L, it would take about 1.1 years to accumulate this material. The IXM would be at its capacity and could not hold any more fissile material. These accumulation time results are dependant on the concentrations of materials in the basin, and the specific material removal efficiencies of the IXM. When the IXM is drained for shipping, the calculated k_{eff} is 0.125. All IXM k_{eff} results can be found in Table 1.

Calculations show that the two IXMs are isolated from each other by the concrete separating the cells.

This analysis was also completed using 1.25 wt% enriched uranium in place of the 0.95 wt% enriched uranium. This results in a k_{eff} of 0.149 with a U:Pu ratio of 400:1 and no water in the IXMs.

2.2.2 IXC Specific Analysis

The IXC limit of 0.243 g/cm^3 gives approximately 56 kg of uranium with a U_{235} content of 537 g. Using the assumption that the U:Pu ratio is 400:1, the material buildup in an IXC yields approximately 141 g of plutonium. For these materials a k_{eff} of 0.109 is calculated. Using the uranium inlet concentration of 2.5 E-4 g/L and the removal efficiency of 95%, it would take about 2.4 years to accumulate this material. The IXC would be at its capacity and could not hold any more fissile material. These accumulation time results are dependant on the concentrations of materials in the basin, and the specific material removal efficiencies of the IXC. When the IXC is drained for shipping, the calculated k_{eff} is 0.116. All IXC k_{eff} results can be found in Table 2.

This analysis was also completed using 1.25 wt% enriched uranium in place of the 0.95 wt% enriched uranium. This resulted in a k_{eff} of 0.139 with a U:Pu ratio of 400:1 and no H_2O in the IXCs.

2.2.3 IXCs in Concrete Burial Box Analysis

For the 5 by 5 array of IXCs in the burial box, k_{eff} is 0.159 without H_2O and 0.128 with H_2O. When 1.25 wt% enriched uranium is used in place of the normal 0.95 wt% enriched uranium, the resulting k_{eff} is 0.189 without H_2O and 0.155 with H_2O.

2.3 OFF-NORMAL CONDITIONS

For the off-normal conditions, the IXMs and IXCs both had three scenarios considered. For the first case, the IXMs and IXCs were homogeneously filled, all of the material was plutonium (uranium and other materials were not considered) and there was no physical limit placed on how much plutonium could be held. For the second case, the IXMs and IXCs only had

the top one-third filled, all of the material was plutonium (uranium and other materials were not considered) and there was no physical limit placed on how much plutonium could be held. The final case had a uranium to plutonium ratio of 10:1 instead of the 400:1 for normal conditions, and there was no changeout time limit.

2.3.1 IXM Specific Analysis

With all IXM cells filled homogeneously, the IXM will contain plutonium at a concentration of approximately 37 g/L yielding about 27.7 kg of plutonium at a calculated k_{eff} of 0.95. Using the assumed IXM inlet concentration of 1.5 E-6 g plutonium per liter this would take about 63 years to accumulate.

If only the top one-third of the IXM cell is used, then the IXM would contain plutonium at a concentration of 52 g/L giving about 13 kg of plutonium at a calculated k_{eff} of 0.95. It would take about 30 years to accumulate the 13 kg. Assuming a normal six month operating time, this represents at least 60 times the normal operational lifetime of an IXM.

The final case used the uranium to plutonium ratio of 10:1 with no H_2O and an IXM limit of 0.243 g/cm^3 for fissile material. With these assumptions the $k_{eff} \approx 0.75$ is calculated. The absence of H_2O corresponds to a drained IXM. This case is safely subcritical. All IXM results can be found in Table 1.

2.3.2 IXC Specific Analysis

Using the same assumptions as before, at a calculated k_{eff} of 0.95 the homogeneously filled IXCs will contain 41 grams of plutonium per liter yielding approximately 9.5 kg of plutonium in the IXC. Using the IXC inlet plutonium concentration of 4.0 E-6 g/L, this would take about 25 years to accumulate.

If only the top one-third of the IXC is used, the IXC would contain plutonium at a concentration of 43 g/L giving approximately 3.3 kg of plutonium at $k_{eff} = 0.95$. It would take about 9 years to accumulate this amount. Assuming a normal two month operating lifetime, this represents at least 54 times the normal operational lifetime of an IXC.

The final case used the uranium to plutonium ratio of 10:1 with H_2O and the IXC limit of 0.243 g/cm^3 for fissile material. With these assumptions a $k_{eff} = 0.717$ is calculated. If the IXC is drained then k_{eff} is 0.673. If 1.25 wt% enriched uranium is used then $k_{eff} = 0.715$ with water and $k_{eff} = 0.675$ without. There is no significant change between the 0.95 wt% and 1.25 wt% uranium cases and the results are all safely subcritical. All IXC results can be found in Table 2.

2.3.3 IXCs in Concrete Burial Box Analysis

For these analyses, the IXCs are again assumed to be in a close packed square 5 by 5 array. The homogeneously filled IXCs will each contain approximately 5.2 kg of plutonium at $k_{eff} = 0.95$. Each IXC would have a

concentration of 22.5 g of plutonium per liter. Each IXC would need to be in operation for about 13.7 years for this material to accumulate.

An analysis for the top one-third only case was not completed because of the actual randomness of the IXCs orientation in the burial box.

The final case used the uranium to plutonium ratio of 10:1 and the IXC limit of 0.243 g/cm^3 for fissile material. With these assumptions k_{eff} = 0.834 with water and k_{eff} = 0.914 without. For 1.25 wt% enriched uranium, k_{eff} = 0.842 with water and k_{eff} = 0.924 without. These cases are all safely subcritical.

A parametric study of interspersed moderation in the concrete burial box was also completed. The results show that the most reactive configuration is with no interspersed moderation present, and the addition of interspersed moderation lowers the calculated k_{eff}. These results may be found at the end of Table 2.

3.0 CODE VALIDATION

The MCNP program (Briesmeister 1990, LANL 1986) is maintained and the configuration is controlled on the Hanford Site CRAY X/MP-232EA computer. Any changes or modifications are verified with a standard set of analyses that meet quality assurance requirements (Carter 1991). MCNP Version 4.2, was used for these analyses.

The MCNP Monte Carlo neutron and photon transport program is widely used and accepted throughout the nuclear industry. Its use for analyzing N Reactor fuel has been extensively validated by comparing calculated reactivities to experimental results (Erickson 1991, Schwinkendorf 1991, and Wilcox 1989). It has also been validated for use with uranium solutions in Wittekind 1992.

4.0 CONCLUSIONS

A criticality in an IXM is not credible. The quantities of uranium and plutonium needed for a criticality and the time necessary to accumulate those quantities would not allow a criticality. Most uranium and plutonium is actually held up by the filtering action of the IXM. Therefore, the quantities used in the calculations based on ionic trapping are extremes and cannot be obtained. All analyses ignored the presence and buildup of non-fissionable materials in the ion exchange materials. In the off-normal conditions the IXMs are still safely subcritical with double contingencies considered. The different contingencies are leaving the IXMs online for many times the normal time combined with only accumulating plutonium, or accumulating both uranium and plutonium at a ratio of 10:1 which is much more plutonium than the normal 400:1.

A criticality of the IXCs is also not credible either while in use, or stored in the lead caves or the concrete burial box. The quantities of uranium and plutonium needed for a criticality and the time necessary to

accumulate those quantities would not allow a criticality. Most uranium and plutonium is actually held up by the filtering action of the IXC. Therefore, the quantities used in the calculations based on ionic trapping are extremes and cannot be obtained. All analyses ignored the presence and buildup of non-fissionable materials in the ion exchange materials. The contingencies analyzed for the IXCs are the same as for the IXMs described in the previous paragraph.

The Nuclear Criticality Safety Manual, WHC-CM-4-29, states that:

"A CAS shall be installed and maintained operational for all fissionable material facilities and for fissionable material outside the core of nuclear reactor facilities, unless one of the following criteria is met:

1. A CAS is not required when a documented safety analysis shows that it is not needed due to the physical form and isotopic distribution of fissionable material. Such analyses shall be approved by the independent safety review organization.

2. A CAS is not required when intervening shielding ensures that the maximum calculated dose in occupied locations will not exceed 25 rems whole body exposure or equivalent from the maximum accident of concern. Detection without facility evacuation is required in accordance with Item 5.2.2 of this section.

3. A CAS is not required when fissionable material packaging/shipping requirements have been complied with, and the material is either awaiting transport or in route in sealed, approved shipping containers."

The basis for not requiring a CAS for these operations is criterion #1 above. This evaluation for IXMs and IXCs shows that an accidental criticality is not credible during the operations or storage of IXMs and IXCs. This is included under "due to the physical form and isotopic distribution of the fissionable material."

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Table 1. IXM Analysis Results

Case	K_{eff}	$\pm 1\ \sigma$	Description
Full tanks. Fissile material density = 0.243 g/cm^3			
IXM009	0.110939	0.0003	U:Pu = 400:1, with H_2O
IXM017	0.124786	0.0005	U:Pu = 400:1, no H_2O
IXM033	0.149323	0.0005	IXM017 but U^{235} = 1.25 wt% enriched
IXM036	0.746104	0.0024	U:Pu = 10:1, no H_2O
IXM019	0.110939	0.0003	Case IXM009 but two modules side-by-side
Full tanks, with H_2O, parametric study			
IXM001	0.593042	0.0015	15.18 g/L Plutonium
IXM006	0.868974	0.0027	30.36 g/L Plutonium
IXM023	0.915566	0.0026	34.16 g/L Plutonium
IXM024	0.960198	0.0025	37.95 g/L Plutonium
IXM014	1.010111	0.0034	41.75 g/L Plutonium
IXM015	1.017690	0.0029	43.64 g/L Plutonium
IXM007	1.033724	0.0026	45.54 g/L Plutonium
IXM008	1.134719	0.0032	60.72 g/L Plutonium
Full tanks, no H_2O, parametric study			
IXM028	0.883597	0.0034	30.36 g/L Plutonium
IXM030	0.917803	0.0033	33.40 g/L Plutonium
IXM032	0.943908	0.0029	36.05 g/L Plutonium
IXM034	0.947822	0.0030	37.19 g/L Plutonium
IXM016	0.998756	0.0024	41.75 g/L Plutonium
1/3 full tanks, with H_2O, parametric study			
IXM010	0.505816	0.0019	15.18 g/L Plutonium
IXM011	0.753822	0.0026	30.36 g/L Plutonium
IXM012	0.901921	0.0031	45.54 g/L Plutonium
IXM025	0.956173	0.0032	53.13 g/L Plutonium
IXM026	0.970706	0.0036	56.93 g/L Plutonium
IXM013	0.997191	0.0028	60.72 g/L Plutonium
1/3 full tanks, no H_2O, parametric study			
IXM027	0.833994	0.0026	45.54 g/L Plutonium
IXM029	0.896035	0.0039	56.93 g/L Plutonium
IXM031	0.940632	0.0035	68.31 g/L Plutonium

Table 2. IXC Analysis Results

Case	K_{eff}	$\pm 1\ \sigma$	Description
Three IXCs, Full tank, 0.243 g/cm^3 U + Pu, U:Pu ratio 400:1			
IXC654	0.116035	0.0006	0.95 wt% uranium, no H_2O
IXC655	0.108851	0.0005	0.95 wt% uranium, with H_2O
IXC656	0.138636	0.0007	1.25 wt% uranium, no H_2O
IXC657	0.130436	0.0007	1.25 wt% uranium, with H_2O
Three IXCs, Full tank, 0.243 g/cm^3 U + Pu, U:Pu ratio 10:1			
IXC650	0.672758	0.0030	0.95 wt% uranium, no H_2O
IXC651	0.717356	0.0024	0.95 wt% uranium, with H_2O
IXC652	0.674721	0.0029	1.25 wt% uranium, no H_2O
IXC653	0.715415	0.0024	1.25 wt% uranium, with H_2O
Single IXC, Full tank, with H_2O, parametric study			
IXC003	0.883247	0.0031	37.95 g/L Plutonium
IXC002	0.930116	0.0031	43.64 g/L Plutonium
IXC006	0.942290	0.0026	46.00 g/L Plutonium
IXC004	0.947927	0.0031	45.54 g/L Plutonium
IXC005	0.973875	0.0033	50.00 g/L Plutonium
IXC001	1.034104	0.0040	60.72 g/L Plutonium
Single IXC, Full tank, without H_2O, parametric study			
IXC102	0.747119	0.0030	36.05 g/L Plutonium
IXC103	0.787920	0.0041	42.00 g/L Plutonium
IXC104	0.797888	0.0036	44.00 g/L Plutonium
IXC101	0.810350	0.0039	45.54 g/L Plutonium
Single IXC, 1/3 tank, with H_2O, parametric study			
IXC203	0.938754	0.0030	46.00 g/L Plutonium
IXC204	0.953029	0.0041	48.00 g/L Plutonium
IXC202	0.985265	0.0037	53.13 g/L Plutonium
IXC201	1.030940	0.0039	60.72 g/L Plutonium
Single IXC, 1/3 tank, without H_2O, parametric study			
IXC301	0.877843	0.0041	68.31 g/L Plutonium
IXC302	0.886457	0.0040	75.00 g/L Plutonium
IXC303	0.921181	0.0041	100.0 g/L Plutonium
Three IXCs, 1/3 tank, with H_2O, parametric study			
IXC402	0.943551	0.0029	42.00 g/L Plutonium
IXC401	1.034545	0.0029	53.13 g/L Plutonium

Table 2. IXC Analysis Results (cont.)

Case	K_{eff}	$\pm 1\ \sigma$	Description
Three IXCs, 1/3 tank, without H_2O, parametric study			
IXC501	0.973114	0.0042	75.00 g/L Plutonium
Three IXCs, Full tank, with H_2O, parametric study			
IXC603	0.939327	0.0030	40.00 g/L Plutonium
IXC602	0.958983	0.0032	42.00 g/L Plutonium
IXC601	0.962780	0.0032	43.64 g/L Plutonium
Three IXCs, Full tank, without H_2O, parametric study			
IXC701	0.882575	0.0042	44.00 g/L plutonium
IXC702	0.910301	0.0043	50.00 g/L plutonium
5 x 5 array of IXCs, 0.243 g/cm^3 U + Pu, U:Pu ratio 400:1			
IXC854	0.158575	0.0006	0.95 wt% uranium, no H_2O
IXC855	0.127713	0.0005	0.95 wt% uranium, with H_2O
IXC856	0.188819	0.0007	1.25 wt% uranium, no H_2O
IXC857	0.154574	0.0008	1.25 wt% uranium, with H_2O
5 x 5 array of IXCs, 0.243 g/cm^3 U + Pu, U:Pu ratio 10:1			
IXC850	0.914093	0.0020	0.95 wt% uranium, no H_2O
IXC851	0.833741	0.0020	0.95 wt% uranium, with H_2O
IXC852	0.924219	0.0031	1.25 wt% uranium, no H_2O
IXC853	0.841965	0.0014	1.25 wt% uranium, with H_2O
5 x 5 array of IXCs, Full tanks, without H_2O, parametric study			
IXC803	0.767271	0.0018	15.18 g/L plutonium
IXC806	0.937606	0.0020	22.00 g/L plutonium
IXC804	0.954352	0.0021	23.00 g/L plutonium
IXC805	0.995268	0.0027	25.00 g/L plutonium
IXC802	1.072349	0.0024	30.36 g/L plutonium
IXC801	1.221488	0.0032	45.54 g/L plutonium
5 x 5 array of IXCs, Full tanks, 22 g/L Plutonium, without H_2O, parametric study			
IXC901	0.813878	0.0027	1.00 g/cm^3 interspersed.
IXC902	0.840204	0.0024	0.50 g/cm^3 interspersed.
IXC906	0.890348	0.0021	0.25 g/cm^3 interspersed.
IXC905	0.918830	0.0028	0.10 g/cm^3 interspersed.
IXC904	0.923022	0.0022	0.05 g/cm^3 interspersed.
IXC903	0.929810	0.0022	0.01 g/cm^3 interspersed.

Figure 1. Map Showing Locations of Ion Exchange Modules and Ion Exchange Columns.

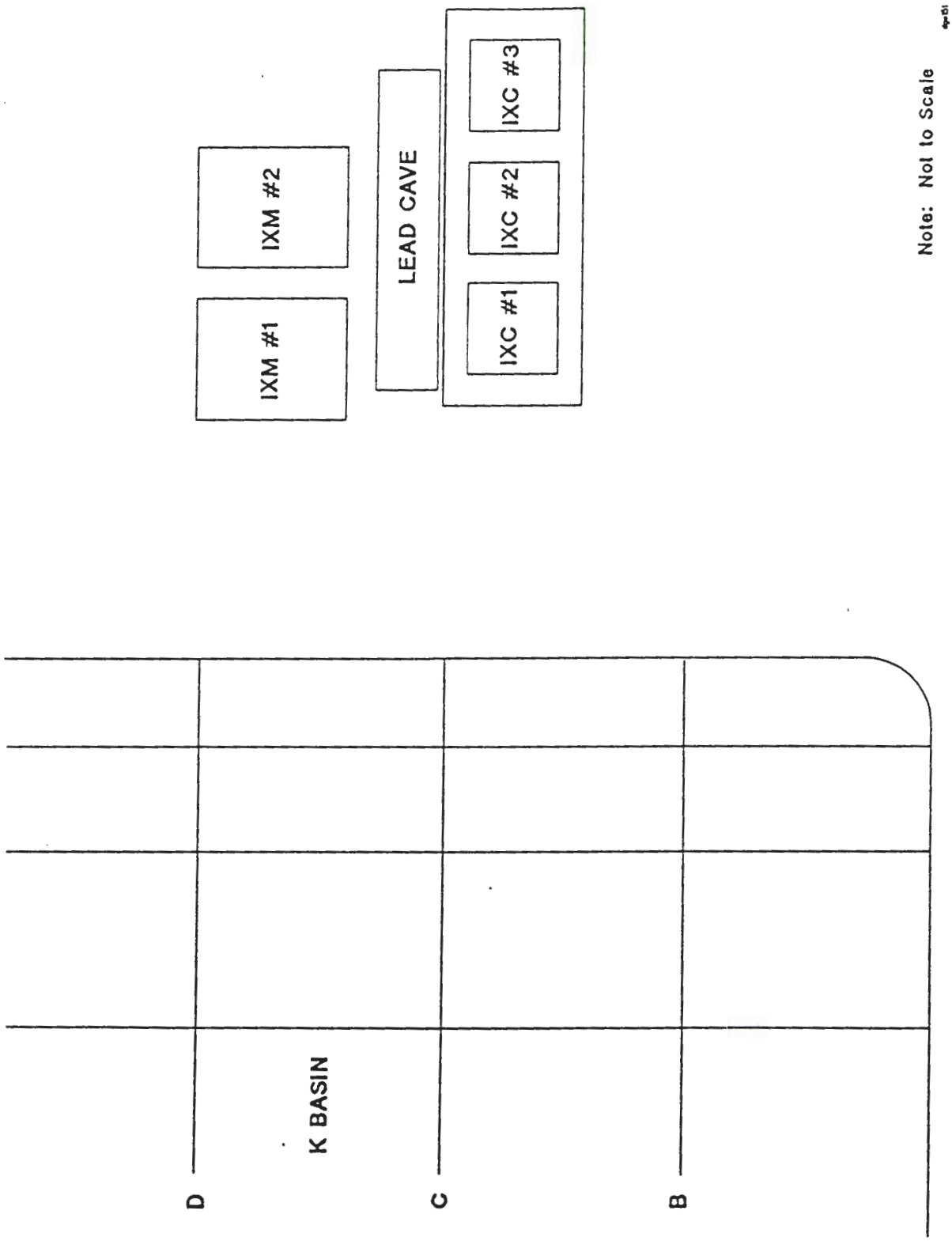


Figure 2. Ion Exchange Module - Top View.

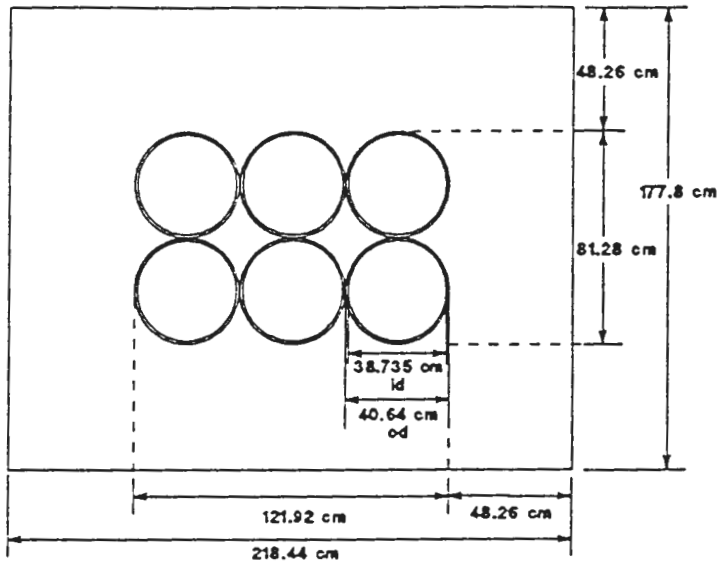


Figure 3. Ion Exchange Module - Side View.

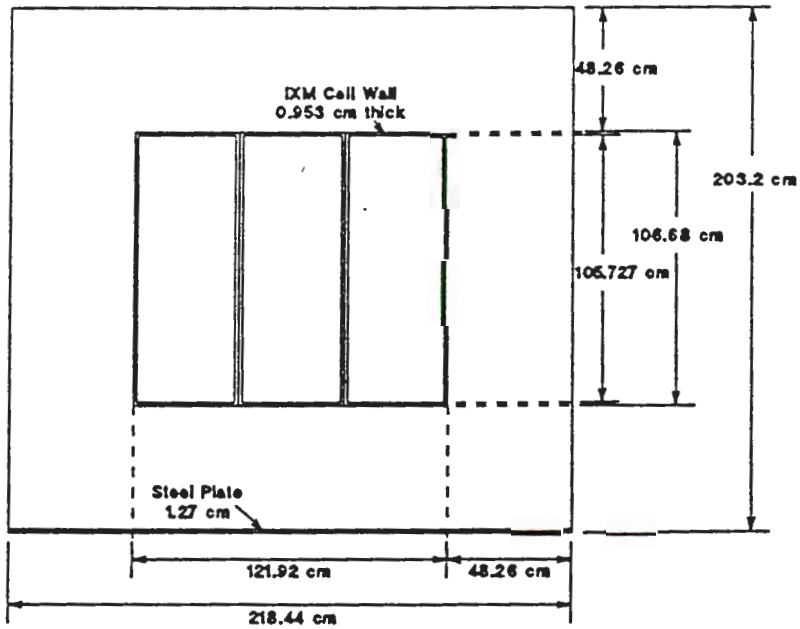


Figure 4. Ion Exchange Columns - Top View.

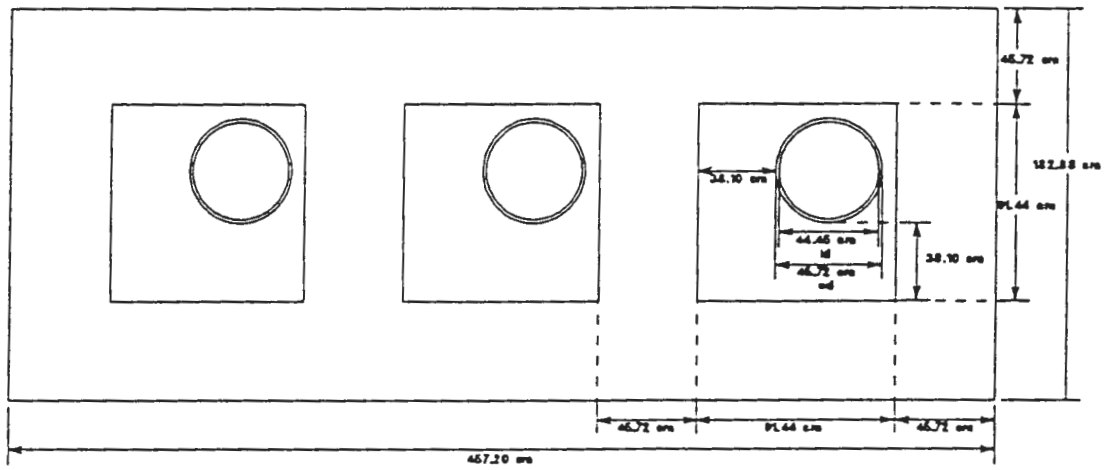


Figure 5. Ion Exchange Columns - Side View.

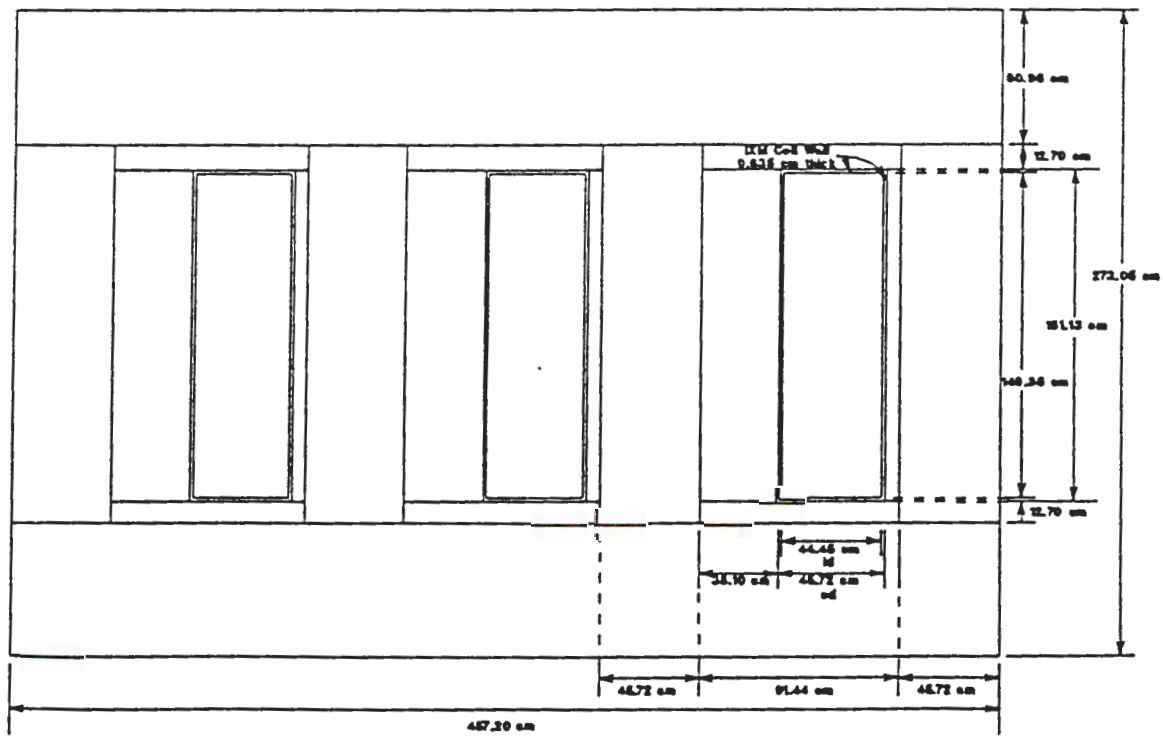


Figure 6. Ion Exchange Columns in Burial Box - Top View.

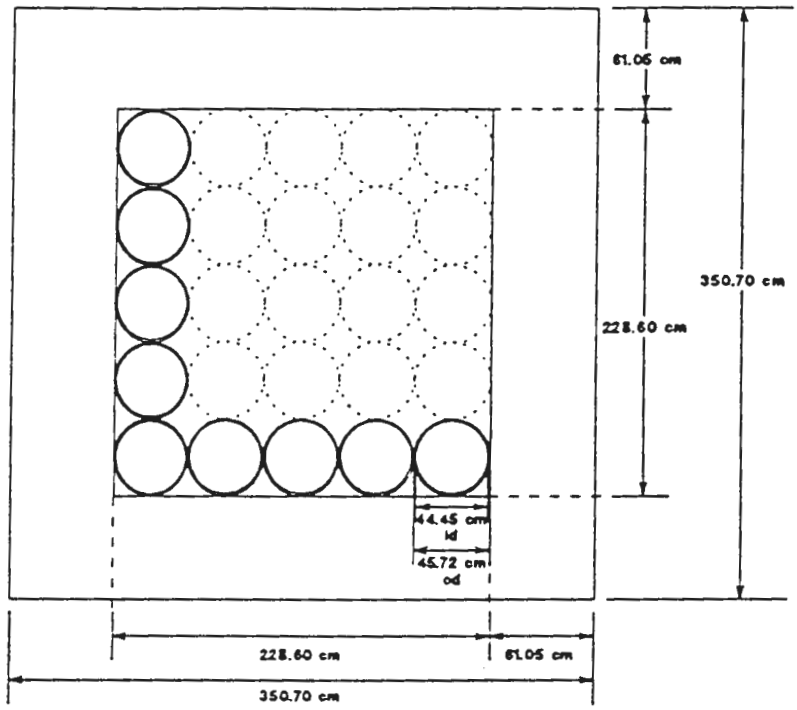
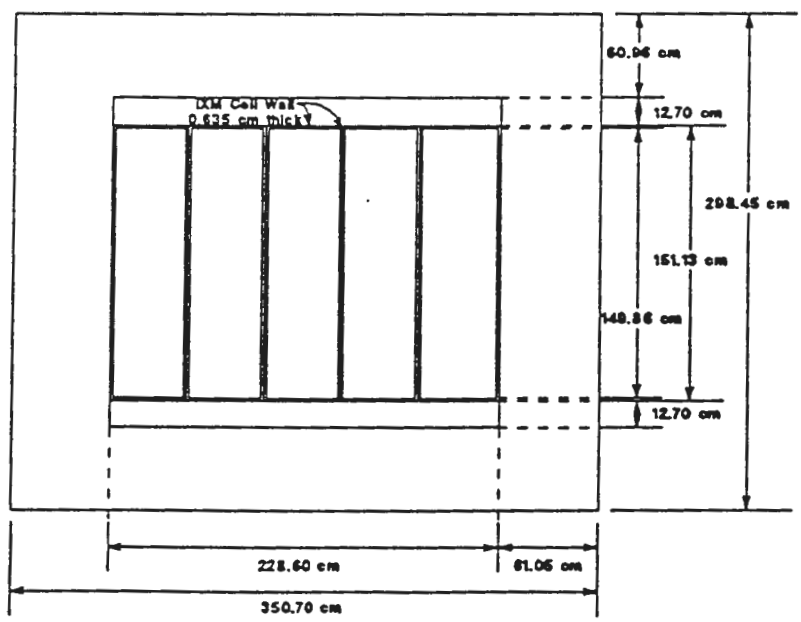


Figure 7. Ion Exchange Columns in Burial Box - Side View.



APPENDIX A.

URANIUM AND PLUTONIUM IN KE BASIN WATER SAMPLES

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Westinghouse
Hanford Company

Internal
Memo

From: Safety Technical Support 93EMW.001
Phone: 3-1578 X0-44
Date: April 16, 1993
Subject: URANIUM AND PLUTONIUM IN KE BASIN WATER SAMPLES

To: D. G. Erickson H0-38

cc:	L. D. Alwardt	X0-44	C. L. Bennett	X0-44
	G. L. Bennett	X3-68	K. R. Conn	X0-44
	C. D. Lucas	X0-35	A. L. Ramble	H4-68
	J. P. Schmidt	X0-41	R. V. Skinner (2)	S6-21
	H. Toffer	H0-38	D. J. Watson	X0-41
	EMW File/LB			

References:

(1) WHC-NR-M-2, Process Standards - N Reactor, Standard No. C-303, "Fissile Material Control - KE and KW Storage," dated February 19, 1993.

(2) WHC-NR-M-2, Process Standards - N Reactor, Standard No. D-403, "Monitoring of KE & KW Basins - Reactor Shutdown and Defueled," dated May 15, 1989.

(3) Procedure 59/60-43-1, "Take Water Samples from Primary and Secondary Cooling Systems, 100 KE/KW," dated October 23, 1989.

(4) "Nuclear Isotopes," Fourteenth Edition, General Electric Company, San Jose, California, revised 1989.

(5) "Radiological Health Handbook," Bureau of Radiological Health, Revised Edition dated January 1970.

1.0 Summary

This memo transmits uranium and plutonium concentrations reported for water samples taken periodically at the KE Basin. The samples represent locations at the center of the basin and at the inlet and outlet of the Ion Exchange Modules (IXM) and the Ion Columns. The analytic results provide a basis for determining buildup of fissile material in these systems for use in current criticality studies. The data are from samples taken at weekly intervals and sent to the 222S Laboratory for analysis. Results reported in Table 2 have been excerpted from 222S report sheets. Uranium values appear in grams per litre as reported while the plutonium values are converted from the reported microcuries per litre to grams per litre.

2.0 Procedural Control

Sampling activities are performed as directed in Process Standards - N Reactor (Reference 2).

The weekly sampling interval is established in a standard related specifically to control of fissile material (Reference 1).

Locations for the IXM and Ion Column samples are specified in a procedure for sampling the water cooling system (Reference 3).

Transmittal of the samples to the laboratory is initiated using the standard form, BC 6000-366(11/89), Environmental Sample Chain-of-Custody/Record Sheet, Attachment 1. The desired analyses are indicated by execution of form BC-6700-181, Request for Special Analysis (RSA), Attachment 2, which accompanies the sample shipment along with a routine Radioactive Shipment Record form.

Analyses for each sample are reported on individual reporting sheets similar to the example sheet (Attachment 3) for the IXM outlet sample taken on March 1, 1993. The notation at the center of the page, KE SP-16, was added by M. A. Green, Hazardous and Radiological Waste Control (H&RWC), to identify the sample as that from the IXM Outlet station for the KE Basin. Table 1 lists the sample locations included in this memo with the corresponding sample designators as assigned in Reference 3.

Table 1. KE Basin Sample Locations and Corresponding Sample Designators

SAMPLE LOCATION	SAMPLE DESIGNATOR
Ion Column #1 outlet	SP-1
Ion Column #2 outlet	SP-2
Ion Column #3 outlet	SP-3
Ion Column common inlet	SP-9
Center Basin	SP-10
IXM Inlet	SP-15
IXM Outlet	SP-16

Attachments 1 and 2 are the chain of custody and RSA forms initiated for the sample analysis shown in Attachment 3. A file of these record sheets is maintained by the H&RWC staff of Operations Assurance at 100N and was the source used in compiling this memo.

3.0 DATA TABULATION

Table 2 lists the uranium and plutonium results since they were first included in RSAs in November 1992. All data are reported in units of grams per litre. As noted in the summary, plutonium values were converted from the reported microcuries per litre to grams per litre. The conversion is based on the Specific Activity (SpA). The SpA, curies per gram, is derived

(Reference 5) from the formula $SpA = \frac{3.578X1.0E+05}{(T1/2)(AtomicMass)}$ where T1/2 is the half life in years. Half lives (Reference 4) for converting the Pu isotope results were:

Pu 238 = 87.7yr, Pu 239 = 2.41E+04yr, Pu 240 = 6.56E+03yr

The reciprocal of SpA, g/Ci, is used in converting uCi/L to g/L with incorporation of the factor 1.0E-06 to convert uCi to Ci. Conversion factors for the Pu isotopes were:

Pu 238 = 5.83E-08 g/uCi, Pu 239 = 1.61E-05 g/uCi, and Pu 240 = 4.41E-06 g/uCi

Conversion of Pu 239/240 results from uCi/L to g/L assumed 100 percent Pu 239. A test calculation based on 94 percent Pu 239 and 6 percent Pu 240 resulted in a total content about 5 percent less than the result based on 100 percent Pu 239. The higher value for Pu 239 only is thus conservative as well as a simplification of the conversion.

Values for Pu 238 and Pu239/240 are added for the Total Pu column in the table.

Table 2. Summary of Recent Uranium and Plutonium Analyses for 105 KE Basin

Date	Location	Uranium	Pu 238	Pu239/240	Total Pu
		g/L	g/L	g/L	g/L
11-10-92	Center Basin	6.83E-05	4.20E-10	7.50E-07	7.51E-07
11-10-92	IXM in	4.86E-05	7.46E-10	1.37E-06	1.37E-06
11-10-92	IMX out	7.50E-06	1.22E-11	2.24E-08	2.24E-08
11-17-92	Center Basin	3.73E-04	6.65E-10	1.18E-06	1.18E-06
11-17-92	IXM in	3.06E-04	3.87E-10	6.10E-07	6.11E-07
11-17-92	IMX out	1.62E-06	7.75E-11	1.04E-07	1.04E-07
11-24-92	Center Basin	9.49E-04	1.56E-10	2.90E-07	2.90E-07
11-24-92	IXM in	2.57E-04	3.75E-10	6.73E-07	6.73E-07
11-24-92	IXM out	7.96E-06	2.10E-11	4.12E-08	4.12E-08
12-01-92	Center Basin	7.76E-04	3.30E-10	4.69E-07	4.69E-07
12-01-92	IXMs off line				
12-08-92	Center Basin	1.07E-03	2.85E-10	4.69E-07	4.96E-07
12-08-92	IXMs off line				

Date	Location	Uranium	Pu 238	Pu239/240	Total Pu
		g/L	g/L	g/L	g/L
12-15-92	Center Basin	8.24E-03	8.40E-08	1.26E-04	1.26E-04
12-15-92	IXM in	5.19E-03	1.52E-09	2.59E-06	2.59E-06
12-15-92	IXM out	4.15E-06	5.41E-12	8.76E-09	8.76E-09
12-15-92	Ion Columns in	5.41E-04	3.14E-10	5.30E-07	5.30E-07
12-15-92	Column 1 out	5.14E-06	3.54E-11	5.70E-08	5.70E-08
12-15-92	Column 2 out	5.15E-05	2.16E-10	3.54E-07	3.54E-07
12-15-92	Column 3 out	9.79E-06	6.12E-11	6.96E-08	6.97E-08
12-22-92	Center Basin	7.26E-04	1.11E-09	1.87E-06	1.87E-06
12-22-92	IXM in	1.38E-04	5.25E-10	5.33E-07	5.34E-07
12-22-92	IXM out	8.96E-06	9.33E-11	1.27E-07	1.27E-07
12-22-92	Ion Columns in	2.31E-04	4.86E-10	6.81E-07	6.81E-07
12-22-92	Column 1 out	1.19E-05	7.00E-10	3.22E-07	3.23E-07
12-22-92	Column 2 out	8.67E-05	5.08E-10	6.84E-07	6.85E-07
12-22-92	Column 3 out	8.68E-06	7.99E-11	1.01E-07	1.01E-07
12-29-92	Center Basin	3.83E-04	7.35E-10	1.10E-06	1.10E-06
12-29-92	IXM in	1.43E-05	6.30E-10	9.53E-07	9.54E-07
12-29-92	IXM out	1.42E-06	1.29E-10	1.85E-07	1.85E-07
12-29-92	Ion Columns in	3.42E-04	6.76E-10	1.03E-06	1.03E-06
12-29-92	Column 1 out	6.50E-06	4.68E-10	6.62E-07	6.62E-07
12-29-92	Column 2 out	9.78E-06	7.29E-10	1.18E-06	1.18E-06
12-29-92	Column 3 out	4.80E-04	1.39E-10	2.13E-07	2.13E-07
01-05-93	Center Basin	2.64E-04	1.08E-09	1.42E-06	1.42E-06
01-05-93	IXM in	1.31E-04	4.62E-10	6.94E-07	6.94E-07
01-05-93	IXM out	8.78E-06	1.14E-10	1.69E-07	1.69E-07
01-05-93	Ion Columns in	2.49E-04	6.82E-10	1.09E-06	1.09E-06
01-05-93	Column 1 out	4.93E-05	6.70E-10	1.03E-06	1.03E-06
01-05-93	Column 2 out	8.62E-05	8.80E-10	1.36E-06	1.36E-06
01-05-93	Column 3 out	1.92E-04	1.54E-09	2.61E-06	2.61E-06

D. G. Erickson
Page 5
April 16, 1993

93EMW.001

Date	Location	Uranium	Pu 238	Pu239/240	Total Pu
		g/L	g/L	g/L	g/L
01-12-93	Center Basin	2.74E-04	7.11E-10	1.11E-06	1.11E-06
01-12-93	IXM in	2.62E-04	2.03E-09	3.53E-06	3.53E-06
01-12-93	IXM out	6.37E-05	2.33E-10	4.11E-07	4.11E-07
01-12-93	Ion Columns in	8.27E-05	1.21E-08	2.01E-05	2.01E-05
01-12-93	Column 1 out	9.79E-05	5.95E-10	8.31E-07	8.31E-07
01-12-93	Column 2 out	5.78E-05	4.18E-10	5.30E-07	5.30E-07
01-12-93	Column 3 out	3.40E-05	4.47E-09	4.75E-07	4.79E-07
01-19-93	Center Basin	2.23E-04	7.70E-10	1.21E-06	1.21E-06
01-19-93	IXM in	1.91E-04	7.23E-10	1.15E-06	1.15E-06
01-19-93	IXM out	2.08E-07	4.74E-10	6.28E-07	6.28E-07
01-19-93	Ion Columns in	1.12E-04	1.23E-09	2.01E-06	2.01E-06
01-19-93	Column 1 out	3.41E-05	6.82E-10	1.03E-06	1.03E-06
01-19-93	Column 2 out	4.98E-05	7.23E-10	8.77E-07	8.78E-07
01-19-93	Column 3 out	4.05E-05	4.37E-10	5.60E-07	5.61E-07
01-26-93	Center Basin	8.65E-05	4.41E-10	5.92E-07	5.93E-07
01-26-93	IXM in	5.53E-05	5.18E-10	7.02E-07	7.02E-07
01-26-93	IXM out	7.20E-06	3.51E-10	4.23E-07	4.24E-07
01-26-93	Ion Columns in	9.75E-05	6.94E-10	1.05E-06	1.05E-06
01-26-93	Column 1 out	1.94E-05	2.02E-10	3.28E-07	3.28E-07
01-26-93	Column 2 out	2.19E-05	1.33E-10	2.43E-07	2.43E-07
01-26-93	Column 3 out	3.03E-05	3.01E-10	5.09E-07	5.09E-07
02-02-93	Center Basin	9.69E-05	3.17E-10	5.83E-07	5.83E-07
02-02-93	IXM in	5.57E-05	4.69E-10	6.65E-07	6.65E-07
02-02-93	IXM out	5.14E-05	1.86E-10	3.04E-07	3.04E-07
02-02-93	Ion Columns in	7.52E-05	8.80E-10	1.43E-06	1.43E-06
02-02-93	Column 1 out	7.02E-06	1.71E-10	1.07E-07	1.07E-07
02-02-93	Column 2 out	1.41E-04	1.36E-09	2.13E-07	2.14E-07
02-02-93	Column 3 out	6.48E-06	8.69E-11	1.58E-07	1.58E-07

Date	Location	Uranium	Pu 238	Pu239/240	Total Pu
		g/L	g/L	g/L	g/L
02-09-93	Center Basin	7.45E-05	3.45E-10	5.89E-07	5.89E-07
02-09-93	IXM in	4.94E-05	2.60E-10	4.54E-07	4.54E-07
02-09-93	IXM out	2.51E-05	2.32E-10	3.93E-07	3.93E-07
02-09-93	Ion Columns taken out of service on 02-04-93				
02-16-93	Center Basin	7.02E-05	6.59E-10	9.11E-07	9.12E-07
02-16-93	IXM in	9.27E-05	1.01E-09	1.67E-06	1.68E-06
02-16-93	IXM out	6.99E-06	3.44E-10	4.35E-07	4.35E-07
02-23-93	Center Basin	4.28E-05	3.77E-10	7.16E-07	7.16E-07
02-23-93	IXM in	1.67E-05	1.88E-10	3.16E-07	3.16E-07
02-23-93	IXM out	3.28E-06	1.47E-10	2.27E-07	2.27E-07
03-01-93	Center Basin	4.75E-05	5.47E-10	8.39E-07	8.40E-07
03-01-93	IXM in	1.31E-04	1.09E-09	1.77E-06	1.77E-06
03-01-93	IXM out	8.82E-06	4.20E-10	5.75E-07	5.75E-07
03-09-93	Center Basin	4.27E-05	2.20E-09	3.96E-06	3.96E-06
03-09-93	IXM in	5.71E-05	9.27E-10	1.51E-06	1.51E-06
03-09-93	IXM out	6.46E-05	1.06E-09	1.80E-06	1.80E-06

4.0 Discussion

The time interval covered by Table 2, November 1992 to March 1993, represents early stages in the service life of the KE IXMs and ion columns. IXM module no. 14 was placed on stream on November 3, 1992 and taken off line on November 30, 1992 (from the KE IXM Module Data Log). Module no. 15 was placed on line on December 14, 1992 and was joined on line when Module no. 14 was returned to service on December 18, 1992. Both Modules, 14 and 15, were taken off line on February 3, 1993 and returned to service on February 4, 1993. Modules 14 and 15 were again taken off line on March 2, 1993 and returned to service on March 8, 1993.

Ion column units numbered 230, 231, and 232 were first placed in service in positions 1, 2, and 3 respectively on December 4, 1992 and all were taken off line on February 4, 1993 (from the KE Ion Column Data Log).

A comparison with concurrent monitoring of the KW Basin indicates the total plutonium concentrations in KE are >2.6E+03 times those in KW and the uranium ratio, KE/KW, is 1.5E+02. These comparisons are made using the analyses for a central KW Basin sample (SP-10) taken on March 1, 1993

(Attachment 4). The conversion of Pu units to g/L results in a total Pu of <3.23E-10 g/L at KW for comparison with the corresponding KE value of 8.40E-07 g/L on the same date from Table 2.

The center of basin ratios of uranium to total plutonium on March 1, 1993 were 975 at KW and 56.5 at KE while the average for all KE ratios from Table 2 was 412.

If you have questions, please contact me on 3-1578.

E. M. Woodruff, Principal Engineer
Safety Technical Support

Reviewed by:

K. R. Conn, Senior Engineer
Safety Technical Support

Concurrence:

C. L. Bennett, Manager
Safety Technical Support

ymf

Attachments (4)

ATTACHMENT 1

ENVIRONMENTAL SAMPLE CHAIN-OF-CUSTODY/RECORD SHEET

EP-CC No. 030193KE-1	1 Logbook Page No.: H&RWC Sample Log: pg.52
2. WHC Contact: D.W. Eckert	Phone: 373-4955 / MSIN: X0-35
3. Sampler (print)	4 Sampler (sign)
5 Analytical Lab WHC-222-S Lab.	
Charge Code: E-11456	

6 Sample No.	7. Location	8. Date 1993	9. Time	10 Samples: Composite	Grab	Replicate	11. Type	Gamma	Gr Alpha-Beta					13. Remarks Routine
0261WQL	KE-SP-10	3/1	1000		X		Water							NOTE:
														SEE R.S.A.
0262WQL	KE-SP-15	3/1	1000		X		Water							FOR ANALYSIS
														REQUESTED[
0263WQL	KE-SP-16	3/1	1000		X		Water							

VALIDATED LIFETIME
By H&RWC MAR 03 1993
Initial

CUSTODIANSHIP

14. Relinquished by	15. Received by ☐ Transport ☐ Storage ☐ Anal. ☐ Disposal	Date/Time
Relinquished by	Received by ☐ Transport ☐ Storage ☐ Anal. ☐ Disposal	Date/Time
Relinquished by	Received by ☐ Transport ☐ Storage ☐ Anal. ☐ Disposal	Date/Time
Relinquished by	Received by ☐ Transport ☐ Storage ☐ Anal. ☐ Disposal	Date/Time
Relinquished by	Received by ☐ Transport ☐ Storage ☐ Anal. ☐ Disposal	Date/Time
Relinquished by	Received by ☐ Transport ☐ Storage ☐ Anal. ☐ Disposal	Date/Time

16. Disposal Confirmed by	Date	Time	17. Chain-of-Custody Returned by	Date	Time
		:			:

NOTE: This form is to accompany the sample(s) at all times. In the event the sample(s) is/are discarded or destroyed the completed form shall be returned to the company contact.

BC 6000 366 (11/89)

ATTACHMENT 2

REQUEST FOR SPECIAL ANALYSIS (RSA)

1. Sample Origin: 105KE-Basin	2. Date Submitted: 3/01/93	4. Requester Name: D.W. Eckert	6. Charge Code/Work Package: E-11456
	3. Date Required: 3/23/93	5. Requester Phone/MSIN: 373-4955 X0-35	

7. Customer ID	8. Laboratory ID
0261WQL: KE-SP-10	
0262WQL: KE-SP-15	
0263WQL: KE-SP-16	

11. Number of Samples: 3

12. Volume of Samples: 500ml

13. Protocols: X None/NA; ___ NQA-1; ___ CERCLA; ___ RCRA; ___ Other

14. Sample Type: ___ Solid; ___ Soil; ___ Slurry; ___ Gas; X Water; ___ Waste; ___ Solution; ___ Sludge; ___ Other (specify)

15. Storage Requirements: X None/NA; ___ Specify

LIFETIME VALIDATED 1993

9. Determination	10. Expected Range
GEA on each for:Co-60,	Cs-134,Cs-137,Mn-54
Plus:Total Alpha,Total Pu,Sr-90,Uranium,H-3	
SB125.	
Conductivity on SP-10:	0261WQL

16. Process Knowledge/Known Listed Wastes: X Unknown; ___ Known (Please attach list); ___ Previously submitted for this Project

Initial

17. Survey: ___ HPT; Reading (Contact/Uncorrected) ___ mRem/hr

18. Disposition of Waste: ___ Return to Client; X Dispose per 222-S Procedures; ___ Other

Date Disposed:

19. Additional Information

Level of uncertainty less than 20% at the two sigma level.

*****OPERATING SAMPLES*****

20. Chain of Custody: X No; ___ Yes Number: 030193KE-1

21. Assigned Custodial Group (circle one): PCL PDSU ENV Process

22. Sample Received By: ___ Date: ___ Time: ___

23. Laboratory Manager (if required): ___ Date: ___

BC-6700-181 (03/92)

ATTACHMENT 3

SAMPLE STATUS REPORT FOR E 7911. H&RWC 0263WQL TIME: 3/19/93 8:43
DISPATCHED: 3/ 5/93 13:12 SAMPLE HAS NOT BEEN SLURPED
RECEIVED: 3/ 5/93 13:28

EXT.	DETER.	RESULTS OR STATUS		OUT OF RANGE?	GOOD ANS?	CHARGE CODE
****	********	**********		***	***	******
1211	AT-LIQ	8.92000E-02 uCi/L		N	Y	PC41G
2162	GEA-LIQ	< 2.13000E-03 uCi/L	Co-60	N	Y	PC41G
2162	GEA-LIQ	< 2.45000E-03 uCi/L	Cs-134	N	Y	PC41G
2162	GEA-LIQ	7.40000E 00 uCi/L	Cs-137	N	Y	PC41G
2162	GEA-LIQ	< 1.96000E-03 uCi/L	Mn-54	N	Y	PC41G
2162	GEA-LIQ	< 2.62000E-02 uCi/L	Sb-125	N	Y	PC41G
3421	Pu-LIQ	7.21000E-03 uCi/L	PU-238	N	Y	PC41G
3421	Pu-LIQ	3.57000E-02 uCi/L	PU239/240	N	Y	PC41G
3862	Sr-LIQ	1.08000E 00 uCi/L		N	Y	PC41G
4431	U-LIQ	8.81999E-06 G/L		N	Y	PC41G
5787	H3	2.89000E 00 uCi/ML		N	Y	PC41G

END OF REPORT

KE Sp. 16
3-1-93

RECEIVED
MAR 2[illegible]-93

LIFETIME
VALIDATED
By H&RWC MAR 24 1993
Initial

ATTACHMENT 4

SAMPLE STATUS REPORT FOR E 7912. H&RWC 0264WQL TIME: 3/19/93 8:44
DISPATCHED: 3/ 5/93 13:12 SAMPLE HAS NOT BEEN SLURPED
RECEIVED: 3/ 5/93 13:28

EXT.	DETER.	RESULTS OR STATUS		OUT OF RANGE?	GOOD ANS?	CHARGE CODE
****	********	**********		***	***	******
1211	AT-LIQ	< 6.22000E-05 uCi/L		N	Y	PC41G
1641	CONDUCT	2.01000E 00 uMHOS/CM		N	Y	PC41G
2162	GEA-LIQ	< 2.28000E-05 uCi/L	Co-60	N	Y	PC41G
2162	GEA-LIQ	7.82000E-04 uCi/L	Cs-134	N	Y	PC41G
2162	GEA-LIQ	1.71000E-01 uCi/L	Cs-137	N	Y	PC41G
2162	GEA-LIQ	< 2.54000E-05 uCi/L	Mn-54	N	Y	PC41G
2162	GEA-LIQ	< 4.51000E-04 uCi/L	Sb-125	N	Y	PC41G
3421	Pu-LIQ	< 2.00000E-05 uCi/L	PU-238	N	Y	PC41G
3421	Pu-LIQ	< 2.00000E-05 uCi/L	PU239/240	N	Y	PC41G
3862	Sr-LIQ	3.65000E-03 uCi/L		N	Y	PC41G
4431	U-LIQ	3.15000E-07 G/L		N	Y	PC41G
5787	H3	5.85000E-02 uCi/ML		N	Y	PC41G

END OF REPORT

MAR 25 1993 QWE

KW Sp-10

3-1-93

RECEIVED
APR 4-93

LIFETIME
VALIDATED
By H&RWC MAR 24 1993
Initial

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APPENDIX B.

Tabulated results for Ion Exchange Modules and Ion Exchange Columns

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Ion Exchange Modules

	Uranium g/L		239/240 Plutonium g/L	
Date	IXM in	IXM out	IXM in	IXM out
11-10-92	4.86E-05	7.50E-06	1.37E-06	2.24E-08
11-17-92	3.06E-04	1.62E-06	6.10E-07	1.04E-07
11-24-92	2.57E-04	7.96E-06	6.73E-07	4.12E-08
12-15-92	5.16E-03	4.19E-06	2.59E-06	8.76E-09
12-22-92	1.38E-04	8.96E-06	5.31E-07	1.26E-07
12-29-92	1.43E-05	1.42E-06	9.53E-07	1.85E-07
01-05-93	1.31E-04	8.78E-06	6.94E-07	1.69E-07
01-12-93	2.62E-04	6.37E-05	3.53E-06	4.11E-07
01-19-93	1.91E-04	2.08E-07	1.15E-06	6.28E-07
01-26-93	5.53E-05	7.20E-06	7.02E-07	4.23E-07
02-02-93	5.67E-05	5.14E-05	6.63E-07	3.04E-07
02-09-93	4.94E-05	2.51E-05	4.54E-07	3.93E-07
Average	5.56E-04	1.57E-05	1.16E-06	2.35E-07

U:Pu ratio = 479.12

Ion Exchange Columns

	Uranium g/L					239/240 Plutonium g/L				
Date	IC in	IC 1 out	IC 2 out	IC 3 out	ave out	IC in	IC 1 out	IC 2 out	IC 3 out	ave out
12-15-92	5.41E-04	5.14E-06	5.15E-05	9.79E-06	2.21E-05	5.30E-07	5.70E-08	3.54E-07	6.96E-08	1.60E-07
12-22-92	2.31E-04	1.29E-05	8.67E-05	8.68E-06	3.61E-05	6.81E-07	3.22E-07	6.84E-07	1.01E-07	3.69E-07
12-29-92	3.42E-04	6.50E-06	9.78E-06	4.80E-04	1.65E-04	1.03E-06	2.98E-07	1.18E-06	2.13E-07	5.64E-07
01-05-93	2.49E-04	4.93E-05	8.62E-05	1.92E-04	1.09E-04	1.09E-06	1.03E-06	1.36E-06	2.61E-06	1.67E-06
01-12-93	8.27E-05	9.75E-05	5.78E-05	3.40E-05	6.31E-05	2.01E-05	8.31E-07	5.30E-07	4.75E-07	6.12E-07
01-19-93	1.12E-04	3.41E-05	4.98E-05	4.05E-05	4.15E-05	2.01E-06	1.03E-06	8.77E-07	5.60E-07	8.22E-07
01-26-93	9.75E-05	1.94E-05	2.19E-05	3.03E-05	2.39E-05	1.05E-06	3.28E-07	2.43E-07	5.09E-07	3.60E-07
02-02-93	7.52E-05	7.02E-06	1.41E-04	6.48E-06	5.15E-05	1.43E-06	1.07E-07	2.13E-07	1.58E-07	1.59E-07
Average	2.16E-04	2.90E-05	6.31E-05	1.00E-04	6.41E-05	3.49E-06	5.00E-07	6.80E-07	5.87E-07	5.89E-07

U:Pu ratio = 61.97

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APPENDIX C.

SAMPLE MCNP OUTPUT FILES FOR IXM'S AND IXC'S

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Output file for MCNP case IXM024

```
1mcnp     version 4.2   ld=3/5/91                          01/14/93 15:01:59
*********************************************************************************                    probid =   01/14/93 15:01:59
 edt 465711, sd-mp-swd-30001, rev 0, certified
 ecn 137360 with prpr unicos6 patch file p.421Va


  ie=  0   lf=   20808   ll=   54015
  ie=  0   lf=   20808   ll=   54015
   1-       message:
   2-
   3-        IXM024 - Single IXM module 5,000g Pu per cell, full tank model
   4-       c
   5-       c    m            x  -x    y  -y    z  -z    r  -r  u=  imp:n=  $
   6-         1  2  -7.82    -1  15  -16                 $ IXM 1 Tank Bottom
   7-         2  3  -0.950   -1  16  -17                 $ IXM 1 Level 1
   8-         3  3  -0.950   -1  17  -18                 $ IXM 1 Level 2
   9-         4  3  -0.950   -1  18  -19                 $ IXM 1 Level 3
  10-         5  3  -0.950   -1  19  -20                 $ IXM 1 Level 4
  11-         6  3  -0.950   -1  20  -21                 $ IXM 1 Level 5
  12-         7  3  -0.950   -1  21  -22                 $ IXM 1 Level 6
  13-         8  3  -0.950   -1  22  -23                 $ IXM 1 Level 7
  14-         9  2  -7.82    -1  23  -24                 $ IXM 1 Tank Top
  15-        10  2  -7.82     1  -2   15 -24             $ IXM 1 Tank Wall
  16-        11  2  -7.82    -3  15  -16                 $ IXM 2 Tank Bottom
  17-        12  3  -0.950   -3  16  -17                 $ IXM 2 Level 1
  18-        13  3  -0.950   -3  17  -18                 $ IXM 2 Level 2
  19-        14  3  -0.950   -3  18  -19                 $ IXM 2 Level 3
  20-        15  3  -0.950   -3  19  -20                 $ IXM 2 Level 4
  21-        16  3  -0.950   -3  20  -21                 $ IXM 2 Level 5
  22-        17  3  -0.950   -3  21  -22                 $ IXM 2 Level 6
  23-        18  3  -0.950   -3  22  -23                 $ IXM 2 Level 7
  24-        19  2  -7.82    -3  23  -24                 $ IXM 2 Tank Top
  25-        20  2  -7.82     3  -4   15 -24             $ IXM 2 Tank Wall
  26-        21  2  -7.82    -5  15  -16                 $ IXM 3 Tank Bottom
  27-        22  3  -0.950   -5  16  -17                 $ IXM 3 Level 1
  28-        23  3  -0.950   -5  17  -18                 $ IXM 3 Level 2
  29-        24  3  -0.950   -5  18  -19                 $ IXM 3 Level 3
  30-        25  3  -0.950   -5  19  -20                 $ IXM 3 Level 4
  31-        26  3  -0.950   -5  20  -21                 $ IXM 3 Level 5
  32-        27  3  -0.950   -5  21  -22                 $ IXM 3 Level 6
  33-        28  3  -0.950   -5  22  -23                 $ IXM 3 Level 7
  34-        29  2  -7.82    -5  23  -24                 $ IXM 3 Tank Top
  35-        30  2  -7.82     5  -6   15 -24             $ IXM 3 Tank Wall
  36-        31  2  -7.82    -7  15  -16                 $ IXM 4 Tank Bottom
  37-        32  3  -0.950   -7  16  -17                 $ IXM 4 Level 1
  38-        33  3  -0.950   -7  17  -18                 $ IXM 4 Level 2
  39-        34  3  -0.950   -7  18  -19                 $ IXM 4 Level 3
  40-        35  3  -0.950   -7  19  -20                 $ IXM 4 Level 4
  41-        36  3  -0.950   -7  20  -21                 $ IXM 4 Level 5
  42-        37  3  -0.950   -7  21  -22                 $ IXM 4 Level 6
  43-        38  3  -0.950   -7  22  -23                 $ IXM 4 Level 7
  44-        39  2  -7.82    -7  23  -24                 $ IXM 4 Tank Top
  45-        40  2  -7.82     7  -8   15 -24             $ IXM 4 Tank Wall
  46-        41  2  -7.82    -9  15  -16                 $ IXM 5 Tank Bottom
  47-        42  3  -0.950   -9  16  -17                 $ IXM 5 Level 1
  48-        43  3  -0.950   -9  17  -18                 $ IXM 5 Level 2
  49-        44  3  -0.950   -9  18  -19                 $ IXM 5 Level 3
  50-        45  3  -0.950   -9  19  -20                 $ IXM 5 Level 4
  51-        46  3  -0.950   -9  20  -21                 $ IXM 5 Level 5
  52-        47  3  -0.950   -9  21  -22                 $ IXM 5 Level 6
  53-        48  3  -0.950   -9  22  -23                 $ IXM 5 Level 7
  54-        49  2  -7.82    -9  23  -24                 $ IXM 5 Tank Top
  55-        50  2  -7.82     9 -10   15 -24             $ IXM 5 Tank Wall
  56-        51  2  -7.82   -11  15  -16                 $ IXM 6 Tank Bottom
  57-        52  3  -0.950  -11  16  -17                 $ IXM 6 Level 1
```

```
 58-        53  3  -0.950  -11  17  -18                  $ IXM 6 Level 2
 59-        54  3  -0.950  -11  18  -19                  $ IXM 6 Level 3
 60-        55  3  -0.950  -11  19  -20                  $ IXM 6 Level 4
 61-        56  3  -0.950  -11  20  -21                  $ IXM 6 Level 5
 62-        57  3  -0.950  -11  21  -22                  $ IXM 6 Level 6
 63-        58  3  -0.950  -11  22  -23                  $ IXM 6 Level 7
 64-        59  2  -7.82   -11  23  -24                  $ IXM 6 Tank Top
 65-        60  2  -7.82    11 -12   15 -24              $ IXM 6 Tank Wall
 66-        61  1  -2.3     26 -27   28 -29   24 -25     $ Top Concrete
 67-        62  1  -2.3     26 -27   28 -29   15 -24
 68-                         2   4    6   8   10  12
 69-                        30  31                       $ Concrete surrounding IXMs
 70-        63  1  -2.3     26 -27   28 -29   14 -15     $ Bottom Concrete
 71-        64  2  -7.82    26 -27   28 -29   13 -14     $ Steel Floor Plate
 72-        65  1  -2.3    -30  15  -24                  $ Possible Detector Hole #1
 73-        66  1  -2.3     30 -31   15 -24              $ Possible Detector Tube #1
 74-        67  1  -2.3    -32  15  -24                  $ Possible Detector Hole #2
 75-        68  1  -2.3     32 -33   15 -24              $ Possible Detector Tube #2
 76-        69  0          -26: 27: -28: 29: -13: 25     $ Outside Everything
 77-
 78-         1  c/z  -40.641 -20.321   19.3675    $ IXM 1 inner surface
 79-         2  c/z  -40.641 -20.321   20.3200    $ IXM 1 outer surface
 80-         3  c/z    0.000 -20.321   19.3675    $ IXM 2 inner surface
 81-         4  c/z    0.000 -20.321   20.3200    $ IXM 2 outer surface
 82-         5  c/z   40.641 -20.321   19.3675    $ IXM 3 inner surface
 83-         6  c/z   40.641 -20.321   20.3200    $ IXM 3 outer surface
 84-         7  c/z  -40.641  20.321   19.3675    $ IXM 4 inner surface
 85-         8  c/z  -40.641  20.321   20.3200    $ IXM 4 outer surface
 86-         9  c/z    0.000  20.321   19.3675    $ IXM 5 inner surface
 87-        10  c/z    0.000  20.321   20.3200    $ IXM 5 outer surface
 88-        11  c/z   40.641  20.321   19.3675    $ IXM 6 inner surface
 89-        12  c/z   40.641  20.321   20.3200    $ IXM 6 outer surface
 90-        13  pz     0.000                      $ Bottom of steel plate
 91-        14  pz     1.270                      $ Top of plate/Bottom of concrete
 92-        15  pz    49.530                      $ Bottom of tank (outside)
 93-        16  pz    50.9588                     $ Bottom of tank (inside)
 94-        17  pz    66.1988                     $ Level 1
 95-        18  pz    81.4388                     $ Level 2
 96-        19  pz    96.6788                     $ Level 3
 97-        20  pz   111.9188                     $ Level 4
 98-        21  pz   127.1588                     $ Level 5
 99-        22  pz   142.3988                     $ Level 6
100-        23  pz   155.7338                     $ Top of tank (inside)
101-        24  pz   156.2100                     $ Top of tank (outside)
102-        25  pz   203.2000                     $ Top of concrete
103-        26  px  -109.2200                     $ Left side of IXM
104-        27  px   109.2200                     $ Right side of IXM
105-        28  py   -88.9000                     $ Front of IXM
106-        29  py    88.9000                     $ Back of IXM
107-        30  c/z  -20.320  0.000    2.54       $ Possible Detector Hole #1
108-        31  c/z   20.320  0.000    2.60       $ Possible Detector Tube #1
109-        32  c/z  -20.320  0.000    2.54       $ Possible Detector Hole #2
110-        33  c/z   20.320  0.000    2.60       $ Possible Detector Tube #2
111-
112-       mode   n
113-       imp:n  1 67r  0
114-       m1     13027.50c -0.034                 $Al      Concrete
115-              20000.50c -0.044                 $Ca      (Common
116-              26000.55c -0.014                 $Fe       Portland)
117-               1001.50c -0.010                 $H
118-               8016.50c -0.532                 $O
119-              14000.50c -0.337                 $Si
120-              11023.50c -0.029                 $Na
121-       m2      6000.50c -0.0100                $C       Carbon Steel
122-              26000.55c -0.9900                $Fe
123-       m3      1001.50c -8.6030e-2             $H       Resin/H2O/Pu/U
124-               6000.50c -6.6105e-1             $C
125-               8016.50c -2.4254e-1             $O
126-              94239.55c -9.7592e-3             $Pu239
127-              94240.50c -6.2554e-4             $Pu240
128-       m4      1001.50c -0.0869                $H       Resin/H2O
warning.  material   4 is not used in the problem.
129-               6000.50c -0.6680                $C
```

```
  130-              8016.50c -0.2451                $0
  131-       mt3    lwtr.01t
  132-       mt4    lwtr.01t
 warning.  material   4 is not used in the problem.
  133-       kcode  1000   0.5   5   50
  134-       ksrc   -40.0 -20.0  100.   0.0 -20.0  100.0  40.0 -20.0  100.0
  135-              -40.0  20.0  100.   0.0  20.0  100.0  40.0  20.0  100.0
  136-       totnu
  137-       print
  138-       ctme
1     initial source from ksrc card.                                                    print table 90

 original number of points                          6
    points not in any cell                     0
    points in cells of zero importance         0
    points in void cells                       0
    points in ambiguous cells                  0
 total points rejected                              0
 points remaining                                   6
 points after expansion or contraction            999
 nominal source size                             1000

 initial guess for k(eff.)                    0.500000

 cycles to skip before tallying                     5

1material composition                                                                  print table 40

 material
  number     component nuclide, atom fraction

    1          13027,  0.02134      20000,  0.01859      26000,  0.00425       1001,  0.16803
                8016,  0.56324      14000,  0.20319      11023,  0.02136
    2           6000,  0.04486      26000,  0.95514
    3           1001,  0.54858       6000,  0.35369       8016,  0.09745      94239,  0.00026
               94240,  0.00002
 associated thermal s(a,b) data sets:    lwtr.01t



 material
  number     component nuclide, mass fraction

    1          13027,  0.03400      20000,  0.04400      26000,  0.01400       1001,  0.01000
                8016,  0.53200      14000,  0.33700      11023,  0.02900
    2           6000,  0.01000      26000,  0.99000
    3           1001,  0.08603       6000,  0.66105       8016,  0.24254      94239,  0.00976
               94240,  0.00063
1cell volumes and masses                                                               print table 50
```

	cell	atom density	gram density	input volume	calculated volume	mass	pieces	reason volume not calculated
1	1	8.74038E-02	7.82000E+00	0.00000E+00	1.68371E+03	1.31666E+04	1	
2	2	8.90208E-02	9.50000E-01	0.00000E+00	1.79590E+04	1.70610E+04	1	
3	3	8.90208E-02	9.50000E-01	0.00000E+00	1.79590E+04	1.70610E+04	1	
4	4	8.90208E-02	9.50000E-01	0.00000E+00	1.79590E+04	1.70610E+04	1	
5	5	8.90208E-02	9.50000E-01	0.00000E+00	1.79590E+04	1.70610E+04	1	
6	6	8.90208E-02	9.50000E-01	0.00000E+00	1.79590E+04	1.70610E+04	1	
7	7	8.90208E-02	9.50000E-01	0.00000E+00	1.79590E+04	1.70610E+04	1	
8	8	8.90208E-02	9.50000E-01	0.00000E+00	1.57141E+04	1.49284E+04	1	
9	9	8.74038E-02	7.82000E+00	0.00000E+00	5.61160E+02	4.38827E+03	1	
10	10	8.74038E-02	7.82000E+00	0.00000E+00	1.26693E+04	9.90737E+04	1	
11	11	8.74038E-02	7.82000E+00	0.00000E+00	1.68371E+03	1.31666E+04	1	
12	12	8.90208E-02	9.50000E-01	0.00000E+00	1.79590E+04	1.70610E+04	1	
13	13	8.90208E-02	9.50000E-01	0.00000E+00	1.79590E+04	1.70610E+04	1	
14	14	8.90208E-02	9.50000E-01	0.00000E+00	1.79590E+04	1.70610E+04	1	
15	15	8.90208E-02	9.50000E-01	0.00000E+00	1.79590E+04	1.70610E+04	1	
16	16	8.90208E-02	9.50000E-01	0.00000E+00	1.79590E+04	1.70610E+04	1	
17	17	8.90208E-02	9.50000E-01	0.00000E+00	1.79590E+04	1.70610E+04	1	
18	18	8.90208E-02	9.50000E-01	0.00000E+00	1.57141E+04	1.49284E+04	1	

19	19	8.74038E-02	7.82000E+00	0.00000E+00	5.61160E+02	4.38827E+03	1	
20	20	8.74038E-02	7.82000E+00	0.00000E+00	1.26693E+04	9.90737E+04	1	
21	21	8.74038E-02	7.82000E+00	0.00000E+00	1.68371E+03	1.31666E+04	1	
22	22	8.90208E-02	9.50000E-01	0.00000E+00	1.79590E+04	1.70610E+04	1	
23	23	8.90208E-02	9.50000E-01	0.00000E+00	1.79590E+04	1.70610E+04	1	
24	24	8.90208E-02	9.50000E-01	0.00000E+00	1.79590E+04	1.70610E+04	1	
25	25	8.90208E-02	9.50000E-01	0.00000E+00	1.79590E+04	1.70610E+04	1	
26	26	8.90208E-02	9.50000E-01	0.00000E+00	1.79590E+04	1.70610E+04	1	
27	27	8.90208E-02	9.50000E-01	0.00000E+00	1.79590E+04	1.70610E+04	1	
28	28	8.90208E-02	9.50000E-01	0.00000E+00	1.57141E+04	1.49284E+04	1	
29	29	8.74038E-02	7.82000E+00	0.00000E+00	5.61160E+02	4.38827E+03	1	
30	30	8.74038E-02	7.82000E+00	0.00000E+00	1.26693E+04	9.90737E+04	1	
31	31	8.74038E-02	7.82000E+00	0.00000E+00	1.68371E+03	1.31666E+04	1	
32	32	8.90208E-02	9.50000E-01	0.00000E+00	1.79590E+04	1.70610E+04	1	
33	33	8.90208E-02	9.50000E-01	0.00000E+00	1.79590E+04	1.70610E+04	1	
34	34	8.90208E-02	9.50000E-01	0.00000E+00	1.79590E+04	1.70610E+04	1	
35	35	8.90208E-02	9.50000E-01	0.00000E+00	1.79590E+04	1.70610E+04	1	
36	36	8.90208E-02	9.50000E-01	0.00000E+00	1.79590E+04	1.70610E+04	1	
37	37	8.90208E-02	9.50000E-01	0.00000E+00	1.79590E+04	1.70610E+04	1	
38	38	8.90208E-02	9.50000E-01	0.00000E+00	1.57141E+04	1.49284E+04	1	
39	39	8.74038E-02	7.82000E+00	0.00000E+00	5.61160E+02	4.38827E+03	1	
40	40	8.74038E-02	7.82000E+00	0.00000E+00	1.26693E+04	9.90737E+04	1	
41	41	8.74038E-02	7.82000E+00	0.00000E+00	1.68371E+03	1.31666E+04	1	
42	42	8.90208E-02	9.50000E-01	0.00000E+00	1.79590E+04	1.70610E+04	1	
43	43	8.90208E-02	9.50000E-01	0.00000E+00	1.79590E+04	1.70610E+04	1	
44	44	8.90208E-02	9.50000E-01	0.00000E+00	1.79590E+04	1.70610E+04	1	
45	45	8.90208E-02	9.50000E-01	0.00000E+00	1.79590E+04	1.70610E+04	1	
46	46	8.90208E-02	9.50000E-01	0.00000E+00	1.79590E+04	1.70610E+04	1	
47	47	8.90208E-02	9.50000E-01	0.00000E+00	1.79590E+04	1.70610E+04	1	
48	48	8.90208E-02	9.50000E-01	0.00000E+00	1.57141E+04	1.49284E+04	1	
49	49	8.74038E-02	7.82000E+00	0.00000E+00	5.61160E+02	4.38827E+03	1	
50	50	8.74038E-02	7.82000E+00	0.00000E+00	1.26693E+04	9.90737E+04	1	
51	51	8.74038E-02	7.82000E+00	0.00000E+00	1.68371E+03	1.31666E+04	1	
52	52	8.90208E-02	9.50000E-01	0.00000E+00	1.79590E+04	1.70610E+04	1	
53	53	8.90208E-02	9.50000E-01	0.00000E+00	1.79590E+04	1.70610E+04	1	
54	54	8.90208E-02	9.50000E-01	0.00000E+00	1.79590E+04	1.70610E+04	1	
55	55	8.90208E-02	9.50000E-01	0.00000E+00	1.79590E+04	1.70610E+04	1	
56	56	8.90208E-02	9.50000E-01	0.00000E+00	1.79590E+04	1.70610E+04	1	
57	57	8.90208E-02	9.50000E-01	0.00000E+00	1.79590E+04	1.70610E+04	1	
58	58	8.90208E-02	9.50000E-01	0.00000E+00	1.57141E+04	1.49284E+04	1	
59	59	8.74038E-02	7.82000E+00	0.00000E+00	5.61160E+02	4.38827E+03	1	
60	60	8.74038E-02	7.82000E+00	0.00000E+00	1.26693E+04	9.90737E+04	1	
61	61	8.17913E-02	2.30000E+00	0.00000E+00	1.82503E+06	4.19756E+06	0	
62	62	8.17913E-02	2.30000E+00	0.00000E+00	0.00000E+00	0.00000E+00	0	asymmetric
63	63	8.17913E-02	2.30000E+00	0.00000E+00	1.87435E+06	4.31101E+06	0	
64	64	8.74038E-02	7.82000E+00	0.00000E+00	4.93251E+04	3.85722E+05	0	
65	65	8.17913E-02	2.30000E+00	0.00000E+00	2.16222E+03	4.97311E+03	1	
66	66	8.17913E-02	2.30000E+00	0.00000E+00	0.00000E+00	0.00000E+00	0	asymmetric
67	67	8.17913E-02	2.30000E+00	0.00000E+00	2.16222E+03	4.97311E+03	1	
68	68	8.17913E-02	2.30000E+00	0.00000E+00	0.00000E+00	0.00000E+00	0	asymmetric
69	69	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00	0	infinite

1surface areas print table 50

surface		input area	calculated area	reason area not calculated
1	1	0.00000E+00	1.29818E+04	
2	2	0.00000E+00	1.36203E+04	
3	3	0.00000E+00	1.29818E+04	
4	4	0.00000E+00	1.36203E+04	
5	5	0.00000E+00	1.29818E+04	
6	6	0.00000E+00	1.36203E+04	
7	7	0.00000E+00	1.29818E+04	
8	8	0.00000E+00	1.36203E+04	
9	9	0.00000E+00	1.29818E+04	
10	10	0.00000E+00	1.36203E+04	
11	11	0.00000E+00	1.29818E+04	
12	12	0.00000E+00	1.36203E+04	
13	13	0.00000E+00	3.88386E+04	
14	14	0.00000E+00	3.88386E+04	
15	15	0.00000E+00	3.88386E+04	
16	16	0.00000E+00	7.07047E+03	
17	17	0.00000E+00	7.07047E+03	

18	18	0.00000E+00	7.07047E+03	
19	19	0.00000E+00	7.07047E+03	
20	20	0.00000E+00	7.07047E+03	
21	21	0.00000E+00	7.07047E+03	
22	22	0.00000E+00	7.07047E+03	
23	23	0.00000E+00	7.07047E+03	
24	24	0.00000E+00	3.88386E+04	
25	25	0.00000E+00	3.88386E+04	
26	26	0.00000E+00	3.61290E+04	
27	27	0.00000E+00	3.61290E+04	
28	28	0.00000E+00	4.43870E+04	
29	29	0.00000E+00	4.43870E+04	
30	30	0.00000E+00	1.70254E+03	
31	31	0.00000E+00	0.00000E+00	asymmetric
32	32	0.00000E+00	1.70254E+03	
33	33	0.00000E+00	0.00000E+00	

1cells print table 60

	cell	mat	atom density	gram density	volume	mass	pieces	neutron importance
1	1	2	8.74038E-02	7.82000E+00	1.68371E+03	1.31666E+04	1	1.00000E+00
2	2	3s	8.90208E-02	9.50000E-01	1.79590E+04	1.70610E+04	1	1.00000E+00
3	3	3s	8.90208E-02	9.50000E-01	1.79590E+04	1.70610E+04	1	1.00000E+00
4	4	3s	8.90208E-02	9.50000E-01	1.79590E+04	1.70610E+04	1	1.00000E+00
5	5	3s	8.90208E-02	9.50000E-01	1.79590E+04	1.70610E+04	1	1.00000E+00
6	6	3s	8.90208E-02	9.50000E-01	1.79590E+04	1.70610E+04	1	1.00000E+00
7	7	3s	8.90208E-02	9.50000E-01	1.79590E+04	1.70610E+04	1	1.00000E+00
8	8	3s	8.90208E-02	9.50000E-01	1.57141E+04	1.49284E+04	1	1.00000E+00
9	9	2	8.74038E-02	7.82000E+00	5.61160E+02	4.38827E+03	1	1.00000E+00
10	10	2	8.74038E-02	7.82000E+00	1.26693E+04	9.90737E+04	1	1.00000E+00
11	11	2	8.74038E-02	7.82000E+00	1.68371E+03	1.31666E+04	1	1.00000E+00
12	12	3s	8.90208E-02	9.50000E-01	1.79590E+04	1.70610E+04	1	1.00000E+00
13	13	3s	8.90208E-02	9.50000E-01	1.79590E+04	1.70610E+04	1	1.00000E+00
14	14	3s	8.90208E-02	9.50000E-01	1.79590E+04	1.70610E+04	1	1.00000E+00
15	15	3s	8.90208E-02	9.50000E-01	1.79590E+04	1.70610E+04	1	1.00000E+00
16	16	3s	8.90208E-02	9.50000E-01	1.79590E+04	1.70610E+04	1	1.00000E+00
17	17	3s	8.90208E-02	9.50000E-01	1.79590E+04	1.70610E+04	1	1.00000E+00
18	18	3s	8.90208E-02	9.50000E-01	1.57141E+04	1.49284E+04	1	1.00000E+00
19	19	2	8.74038E-02	7.82000E+00	5.61160E+02	4.38827E+03	1	1.00000E+00
20	20	2	8.74038E-02	7.82000E+00	1.26693E+04	9.90737E+04	1	1.00000E+00
21	21	2	8.74038E-02	7.82000E+00	1.68371E+03	1.31666E+04	1	1.00000E+00
22	22	3s	8.90208E-02	9.50000E-01	1.79590E+04	1.70610E+04	1	1.00000E+00
23	23	3s	8.90208E-02	9.50000E-01	1.79590E+04	1.70610E+04	1	1.00000E+00
24	24	3s	8.90208E-02	9.50000E-01	1.79590E+04	1.70610E+04	1	1.00000E+00
25	25	3s	8.90208E-02	9.50000E-01	1.79590E+04	1.70610E+04	1	1.00000E+00
26	26	3s	8.90208E-02	9.50000E-01	1.79590E+04	1.70610E+04	1	1.00000E+00
27	27	3s	8.90208E-02	9.50000E-01	1.79590E+04	1.70610E+04	1	1.00000E+00
28	28	3s	8.90208E-02	9.50000E-01	1.57141E+04	1.49284E+04	1	1.00000E+00
29	29	2	8.74038E-02	7.82000E+00	5.61160E+02	4.38827E+03	1	1.00000E+00
30	30	2	8.74038E-02	7.82000E+00	1.26693E+04	9.90737E+04	1	1.00000E+00
31	31	2	8.74038E-02	7.82000E+00	1.68371E+03	1.31666E+04	1	1.00000E+00
32	32	3s	8.90208E-02	9.50000E-01	1.79590E+04	1.70610E+04	1	1.00000E+00
33	33	3s	8.90208E-02	9.50000E-01	1.79590E+04	1.70610E+04	1	1.00000E+00
34	34	3s	8.90208E-02	9.50000E-01	1.79590E+04	1.70610E+04	1	1.00000E+00
35	35	3s	8.90208E-02	9.50000E-01	1.79590E+04	1.70610E+04	1	1.00000E+00
36	36	3s	8.90208E-02	9.50000E-01	1.79590E+04	1.70610E+04	1	1.00000E+00
37	37	3s	8.90208E-02	9.50000E-01	1.79590E+04	1.70610E+04	1	1.00000E+00
38	38	3s	8.90208E-02	9.50000E-01	1.57141E+04	1.49284E+04	1	1.00000E+00
39	39	2	8.74038E-02	7.82000E+00	5.61160E+02	4.38827E+03	1	1.00000E+00
40	40	2	8.74038E-02	7.82000E+00	1.26693E+04	9.90737E+04	1	1.00000E+00
41	41	2	8.74038E-02	7.82000E+00	1.68371E+03	1.31666E+04	1	1.00000E+00
42	42	3s	8.90208E-02	9.50000E-01	1.79590E+04	1.70610E+04	1	1.00000E+00
43	43	3s	8.90208E-02	9.50000E-01	1.79590E+04	1.70610E+04	1	1.00000E+00
44	44	3s	8.90208E-02	9.50000E-01	1.79590E+04	1.70610E+04	1	1.00000E+00
45	45	3s	8.90208E-02	9.50000E-01	1.79590E+04	1.70610E+04	1	1.00000E+00
46	46	3s	8.90208E-02	9.50000E-01	1.79590E+04	1.70610E+04	1	1.00000E+00
47	47	3s	8.90208E-02	9.50000E-01	1.79590E+04	1.70610E+04	1	1.00000E+00
48	48	3s	8.90208E-02	9.50000E-01	1.57141E+04	1.49284E+04	1	1.00000E+00
49	49	2	8.74038E-02	7.82000E+00	5.61160E+02	4.38827E+03	1	1.00000E+00
50	50	2	8.74038E-02	7.82000E+00	1.26693E+04	9.90737E+04	1	1.00000E+00
51	51	2	8.74038E-02	7.82000E+00	1.68371E+03	1.31666E+04	1	1.00000E+00
52	52	3s	8.90208E-02	9.50000E-01	1.79590E+04	1.70610E+04	1	1.00000E+00

53	53	3s	8.90208E-02	9.50000E-01	1.79590E+04	1.70610E+04	1	1.00000E+00
54	54	3s	8.90208E-02	9.50000E-01	1.79590E+04	1.70610E+04	1	1.00000E+00
55	55	3s	8.90208E-02	9.50000E-01	1.79590E+04	1.70610E+04	1	1.00000E+00
56	56	3s	8.90208E-02	9.50000E-01	1.79590E+04	1.70610E+04	1	1.00000E+00
57	57	3s	8.90208E-02	9.50000E-01	1.79590E+04	1.70610E+04	1	1.00000E+00
58	58	3s	8.90208E-02	9.50000E-01	1.57141E+04	1.49284E+04	1	1.00000E+00
59	59	2	8.74038E-02	7.82000E+00	5.61160E+02	4.38827E+03	1	1.00000E+00
60	60	2	8.74038E-02	7.82000E+00	1.26693E+04	9.90737E+04	1	1.00000E+00
61	61	1	8.17913E-02	2.30000E+00	1.82503E+06	4.19756E+06	0	1.00000E+00
62	62	1	8.17913E-02	2.30000E+00	0.00000E+00	0.00000E+00	0	1.00000E+00
63	63	1	8.17913E-02	2.30000E+00	1.87435E+06	4.31101E+06	0	1.00000E+00
64	64	2	8.74038E-02	7.82000E+00	4.93251E+04	3.85722E+05	0	1.00000E+00
65	65	1	8.17913E-02	2.30000E+00	2.16222E+03	4.97311E+03	1	1.00000E+00
66	66	1	8.17913E-02	2.30000E+00	0.00000E+00	0.00000E+00	0	1.00000E+00
67	67	1	8.17913E-02	2.30000E+00	2.16222E+03	4.97311E+03	1	1.00000E+00
68	68	1	8.17913E-02	2.30000E+00	0.00000E+00	0.00000E+00	0	1.00000E+00
69	69	0	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00	0	0.00000E+00

total 4.58332E+06 1.03078E+07

1surfaces print table 70

surface		trans	type	surface coefficients		
1	1		c/z	-4.0641000E+01	-2.0321000E+01	1.9367500E+01
2	2		c/z	-4.0641000E+01	-2.0321000E+01	2.0320000E+01
3	3		c/z	0.0000000E+00	-2.0321000E+01	1.9367500E+01
4	4		c/z	0.0000000E+00	-2.0321000E+01	2.0320000E+01
5	5		c/z	4.0641000E+01	-2.0321000E+01	1.9367500E+01
6	6		c/z	4.0641000E+01	-2.0321000E+01	2.0320000E+01
7	7		c/z	-4.0641000E+01	2.0321000E+01	1.9367500E+01
8	8		c/z	-4.0641000E+01	2.0321000E+01	2.0320000E+01
9	9		c/z	0.0000000E+00	2.0321000E+01	1.9367500E+01
10	10		c/z	0.0000000E+00	2.0321000E+01	2.0320000E+01
11	11		c/z	4.0641000E+01	2.0321000E+01	1.9367500E+01
12	12		c/z	4.0641000E+01	2.0321000E+01	2.0320000E+01
13	13		pz	0.0000000E+00		
14	14		pz	1.2700000E+00		
15	15		pz	4.9530000E+01		
16	16		pz	5.0958800E+01		
17	17		pz	6.6198800E+01		
18	18		pz	8.1438800E+01		
19	19		pz	9.6678800E+01		
20	20		pz	1.1191880E+02		
21	21		pz	1.2715880E+02		
22	22		pz	1.4239880E+02		
23	23		pz	1.5573380E+02		
24	24		pz	1.5621000E+02		
25	25		pz	2.0320000E+02		
26	26		px	-1.0922000E+02		
27	27		px	1.0922000E+02		
28	28		py	-8.8900000E+01		
29	29		py	8.8900000E+01		
30	30		c/z	-2.0320000E+01	0.0000000E+00	2.5400000E+00
31	31		c/z	2.0320000E+01	0.0000000E+00	2.6000000E+00
32	32		c/z	-2.0320000E+01	0.0000000E+00	2.5400000E+00
33	33		c/z	2.0320000E+01	0.0000000E+00	2.6000000E+00

1 temperatures of the cells. print table 72

time: 0.0000E+00

cell	tmp 1
1	2.5300E-08
2	2.5300E-08
3	2.5300E-08
4	2.5300E-08
5	2.5300E-08
6	2.5300E-08
7	2.5300E-08
8	2.5300E-08
9	2.5300E-08
10	2.5300E-08
11	2.5300E-08
12	2.5300E-08

```
    13        2.5300E-08
    14        2.5300E-08
    15        2.5300E-08
    16        2.5300E-08
    17        2.5300E-08
    18        2.5300E-08
    19        2.5300E-08
    20        2.5300E-08
    21        2.5300E-08
    22        2.5300E-08
    23        2.5300E-08
    24        2.5300E-08
    25        2.5300E-08
    26        2.5300E-08
    27        2.5300E-08
    28        2.5300E-08
    29        2.5300E-08
    30        2.5300E-08
    31        2.5300E-08
    32        2.5300E-08
    33        2.5300E-08
    34        2.5300E-08
    35        2.5300E-08
    36        2.5300E-08
    37        2.5300E-08
    38        2.5300E-08
    39        2.5300E-08
    40        2.5300E-08
    41        2.5300E-08
    42        2.5300E-08
    43        2.5300E-08
    44        2.5300E-08
    45        2.5300E-08
    46        2.5300E-08
    47        2.5300E-08
    48        2.5300E-08
    49        2.5300E-08
    50        2.5300E-08
    51        2.5300E-08
    52        2.5300E-08
    53        2.5300E-08
    54        2.5300E-08
    55        2.5300E-08
    56        2.5300E-08
    57        2.5300E-08
    58        2.5300E-08
    59        2.5300E-08
    60        2.5300E-08
    61        2.5300E-08
    62        2.5300E-08
    63        2.5300E-08
    64        2.5300E-08
    65        2.5300E-08
    66        2.5300E-08
    67        2.5300E-08
    68        2.5300E-08

        2 warning messages so far.
   ie=  0   lf=   54015   ll=  234533
   ie=  0   lf=   54015   ll=  234533
1cross-section tables                                                    print table 100

     table    length

                        tables from file /p/mcnp/rmccs

   1001.50c    1153  njoy                                          (  1301)      79/07/31.
   6000.50c   16126  njoy                                          (  1306)      79/07/31.
   8016.50c   23669  njoy                                           ( 1276)     05/14/81
  13027.50c   22891  njoy                                          (  1313)      79/09/08.
  26000.55c   84136  njoy                                          ( 260)       10/21/82
  94239.55c   67551  njoy                              total nu     ( 1399)      02/21/85
  94240.50c   42744  njoy                              total nu     (  1380)      79/09/13.
```

```
                    tables from file /p/mcnp/endf5p

 11023.50c   36270  njoy                                                    (  1311)      79/06/21.
 14000.50c   48275  njoy                                                    (  1314)      79/06/21.

                    tables from file /p/mcnp/endf5u

 20000.50c   26104  njoy                                                    (  1320)      79/06/22.

                    tables from file /p/mcnp/tmccs

  lwtr.01t   10193  hydrogen in light water at 300 degrees kelvin          1001     0     010/22/85

 total      379112

warning.  neutron energy cutoff is below some cross-section tables.



use of dynamically allocated storage

    general              52235
    tallies                  0
    bank                  3902
    cross sections      379112

    total               435249
  ie=  0   lf=  234533   ll=  435253
  ie=  0   lf=  234533   ll=  435253

*********************************************************************
dump no.  1 on file   runtpe          nps =       0          ctm =    0.00


source distribution written to file srctp          cycle =     0

        3 warning messages so far.
1   starting mcrun.      field length =      0      cp0 =  0.02                                  print table 110

      IXM024 - Single IXM module 5,000g Pu per cell, full tank model


    nps    x          y          z       cell   surf     u          v          w          time       weight     energy

      1 -4.000E+01 -2.000E+01  1.000E+02     5      0  5.085E-01  4.733E-01  7.193E-01  0.000E+00  1.001E+00  2.209E+00
      2 -4.000E+01 -2.000E+01  1.000E+02     5      0  8.952E-01 -4.447E-01 -2.944E-02  0.000E+00  1.001E+00  4.904E+00
      3 -4.000E+01 -2.000E+01  1.000E+02     5      0 -6.184E-01 -4.495E-01  6.446E-01  0.000E+00  1.001E+00  3.809E-01
      4 -4.000E+01 -2.000E+01  1.000E+02     5      0  9.710E-01 -5.665E-02 -2.323E-01  0.000E+00  1.001E+00  1.331E+00
      5 -4.000E+01 -2.000E+01  1.000E+02     5      0  5.861E-01  1.496E-01 -7.963E-01  0.000E+00  1.001E+00  1.902E+00
      6 -4.000E+01 -2.000E+01  1.000E+02     5      0 -6.489E-02 -1.626E-01  9.845E-01  0.000E+00  1.001E+00  4.410E-01
      7 -4.000E+01 -2.000E+01  1.000E+02     5      0 -7.068E-02  3.263E-02 -9.970E-01  0.000E+00  1.001E+00  4.750E-01
      8 -4.000E+01 -2.000E+01  1.000E+02     5      0 -3.915E-01  4.664E-01 -7.932E-01  0.000E+00  1.001E+00  4.136E+00
      9 -4.000E+01 -2.000E+01  1.000E+02     5      0 -2.368E-01  9.215E-01 -3.079E-01  0.000E+00  1.001E+00  7.453E-02
     10 -4.000E+01 -2.000E+01  1.000E+02     5      0  1.946E-01 -3.204E-01  9.271E-01  0.000E+00  1.001E+00  3.128E+00
     11 -4.000E+01 -2.000E+01  1.000E+02     5      0 -6.698E-01 -7.177E-01 -1.905E-01  0.000E+00  1.001E+00  1.014E+00
     12 -4.000E+01 -2.000E+01  1.000E+02     5      0 -8.398E-01 -4.129E-01  3.524E-01  0.000E+00  1.001E+00  1.395E+00
     13 -4.000E+01 -2.000E+01  1.000E+02     5      0 -1.714E-01 -8.572E-01  4.857E-01  0.000E+00  1.001E+00  7.748E-01
     14 -4.000E+01 -2.000E+01  1.000E+02     5      0 -2.489E-01 -5.118E-01 -8.222E-01  0.000E+00  1.001E+00  1.101E+00
     15 -4.000E+01 -2.000E+01  1.000E+02     5      0 -2.959E-01  2.119E-01  9.314E-01  0.000E+00  1.001E+00  1.951E+00
     16 -4.000E+01 -2.000E+01  1.000E+02     5      0  1.395E-01 -9.829E-01  1.202E-01  0.000E+00  1.001E+00  2.186E+00
     17 -4.000E+01 -2.000E+01  1.000E+02     5      0  6.909E-01 -7.110E-01  1.307E-01  0.000E+00  1.001E+00  1.865E+00
     18 -4.000E+01 -2.000E+01  1.000E+02     5      0 -6.580E-01  5.320E-01 -5.329E-01  0.000E+00  1.001E+00  1.229E+00
     19 -4.000E+01 -2.000E+01  1.000E+02     5      0 -9.903E-01 -1.380E-01  1.353E-02  0.000E+00  1.001E+00  1.305E+00
     20 -4.000E+01 -2.000E+01  1.000E+02     5      0  7.462E-01  4.859E-01 -4.551E-01  0.000E+00  1.001E+00  1.000E+00
     21 -4.000E+01 -2.000E+01  1.000E+02     5      0 -1.977E-01  9.797E-01  3.360E-02  0.000E+00  1.001E+00  3.990E+00
     22 -4.000E+01 -2.000E+01  1.000E+02     5      0 -9.117E-01 -3.647E-01 -1.891E-01  0.000E+00  1.001E+00  2.665E-01
     23 -4.000E+01 -2.000E+01  1.000E+02     5      0 -4.287E-01  8.361E-01 -3.423E-01  0.000E+00  1.001E+00  1.156E+00
     24 -4.000E+01 -2.000E+01  1.000E+02     5      0  1.080E-01  3.412E-01 -9.338E-01  0.000E+00  1.001E+00  2.669E+00
     25 -4.000E+01 -2.000E+01  1.000E+02     5      0 -9.111E-01 -9.012E-03 -4.122E-01  0.000E+00  1.001E+00  2.185E+00
     26 -4.000E+01 -2.000E+01  1.000E+02     5      0 -2.568E-01 -6.391E-01 -7.249E-01  0.000E+00  1.001E+00  4.225E+00
     27 -4.000E+01 -2.000E+01  1.000E+02     5      0 -2.912E-01  8.086E-01  5.113E-01  0.000E+00  1.001E+00  1.079E+00
```

28	-4.000E+01	-2.000E+01	1.000E+02	5	0	1.472E-01	-9.514E-01	2.705E-01	0.000E+00	1.001E+00	3.461E+00
29	-4.000E+01	-2.000E+01	1.000E+02	5	0	-6.135E-01	-7.645E-01	-1.978E-01	0.000E+00	1.001E+00	1.836E+00
30	-4.000E+01	-2.000E+01	1.000E+02	5	0	-5.702E-01	5.651E-01	-5.963E-01	0.000E+00	1.001E+00	4.556E-01
31	-4.000E+01	-2.000E+01	1.000E+02	5	0	-6.607E-01	5.373E-01	-5.242E-01	0.000E+00	1.001E+00	6.415E-01
32	-4.000E+01	-2.000E+01	1.000E+02	5	0	-9.742E-02	-3.639E-01	-9.263E-01	0.000E+00	1.001E+00	2.764E+00
33	-4.000E+01	-2.000E+01	1.000E+02	5	0	-1.965E-01	-3.145E-01	-9.287E-01	0.000E+00	1.001E+00	2.785E-01
34	-4.000E+01	-2.000E+01	1.000E+02	5	0	4.097E-01	8.465E-01	-3.399E-01	0.000E+00	1.001E+00	9.097E-01
35	-4.000E+01	-2.000E+01	1.000E+02	5	0	-4.048E-02	8.831E-01	4.675E-01	0.000E+00	1.001E+00	3.360E-01
36	-4.000E+01	-2.000E+01	1.000E+02	5	0	3.371E-01	-9.269E-01	-1.652E-01	0.000E+00	1.001E+00	6.376E-01
37	-4.000E+01	-2.000E+01	1.000E+02	5	0	-1.867E-01	9.756E-01	-1.155E-01	0.000E+00	1.001E+00	2.186E+00
38	-4.000E+01	-2.000E+01	1.000E+02	5	0	-2.616E-01	2.336E-01	-9.365E-01	0.000E+00	1.001E+00	7.314E-01
39	-4.000E+01	-2.000E+01	1.000E+02	5	0	9.780E-01	-7.641E-02	-1.939E-01	0.000E+00	1.001E+00	2.997E-01
40	-4.000E+01	-2.000E+01	1.000E+02	5	0	2.580E-01	-7.076E-01	6.578E-01	0.000E+00	1.001E+00	1.444E+00
41	-4.000E+01	-2.000E+01	1.000E+02	5	0	-3.212E-01	-7.678E-01	-5.543E-01	0.000E+00	1.001E+00	1.914E+00
42	-4.000E+01	-2.000E+01	1.000E+02	5	0	5.039E-01	-1.460E-01	8.513E-01	0.000E+00	1.001E+00	1.502E+00
43	-4.000E+01	-2.000E+01	1.000E+02	5	0	6.080E-01	5.487E-01	5.738E-01	0.000E+00	1.001E+00	5.971E+00
44	-4.000E+01	-2.000E+01	1.000E+02	5	0	-2.932E-01	9.304E-01	-2.199E-01	0.000E+00	1.001E+00	1.827E+00
45	-4.000E+01	-2.000E+01	1.000E+02	5	0	-8.475E-01	-3.993E-01	-3.497E-01	0.000E+00	1.001E+00	1.928E+00
46	-4.000E+01	-2.000E+01	1.000E+02	5	0	1.200E-01	-9.195E-01	-3.743E-01	0.000E+00	1.001E+00	1.351E+00
47	-4.000E+01	-2.000E+01	1.000E+02	5	0	7.085E-01	5.879E-01	3.904E-01	0.000E+00	1.001E+00	2.288E+00
48	-4.000E+01	-2.000E+01	1.000E+02	5	0	4.261E-01	9.046E-01	9.254E-03	0.000E+00	1.001E+00	1.230E+00
49	-4.000E+01	-2.000E+01	1.000E+02	5	0	5.431E-01	4.270E-01	-7.230E-01	0.000E+00	1.001E+00	1.433E+00
50	-4.000E+01	-2.000E+01	1.000E+02	5	0	-1.053E-01	-9.805E-01	1.658E-01	0.000E+00	1.001E+00	6.572E-01

```
cycle     1  k(collision)  1.134512  removal lifetime(abs)  1.0416E+04  source points generated   2247

cycle     2  k(collision)  1.042371  removal lifetime(abs)  1.0647E+04  source points generated    970

cycle     3  k(collision)  0.995926  removal lifetime(abs)  1.1966E+04  source points generated    955

cycle     4  k(collision)  1.001276  removal lifetime(abs)  1.1702E+04  source points generated    987

cycle     5  k(collision)  1.020171  removal lifetime(abs)  1.2050E+04  source points generated   1018

source distribution written to file srctp          cycle =     5

cycle     6  k(collision)  0.947635  removal lifetime(abs)  1.1733E+04  source points generated    991

 estimator      cycle     7   ave of     2 cycles      combination          simple average     combined average      corr
k(collision)       1.006909        0.977272 0.0303    k(col/abs)          0.000000 0.0000     0.000000 0.0000    0.0000
k(absorption)      0.982952        0.990614 0.0077    k(abs/tk ln)        0.000000 0.0000     0.000000 0.0000    0.0000
k(trk length)      1.008874        0.978675 0.0309    k(tk ln/col)        0.000000 0.0000     0.000000 0.0000    0.0000
rem life(col)    1.2469E+04      1.2037E+04 0.0358
rem life(abs)    1.2113E+04      1.1923E+04 0.0159    life(col/abs)     0.0000E+00 0.0000   0.0000E+00 0.0000    0.0000
source points generated    1021

 estimator      cycle     8   ave of     3 cycles      combination          simple average     combined average      corr
k(collision)       0.968837        0.974460 0.0178    k(col/abs)          0.978097 0.0088     0.979566 0.0107   -0.2948
k(absorption)      0.963970        0.981733 0.0101    k(abs/tk ln)        0.979211 0.0087     0.980217 0.0103   -0.3417
k(trk length)      0.972720        0.976690 0.0180    k(tk ln/col)        0.975575 0.0179     0.965327 0.0356    0.9988
rem life(col)    1.1556E+04      1.1877E+04 0.0249
rem life(abs)    1.1734E+04      1.1860E+04 0.0106    life(col/abs)     1.1869E+04 0.0178   1.1847E+04 0.0013    0.9987
source points generated     937

source distribution written to file srctp          cycle =     8

 estimator      cycle     9   ave of     4 cycles      combination          simple average     combined average      corr
k(collision)       0.964367        0.971937 0.0129    k(col/abs)          0.971631 0.0091     0.971632 0.0112    0.0057
k(absorption)      0.940102        0.971325 0.0129    k(abs/tk ln)        0.972436 0.0093     0.972414 0.0114    0.0184
k(trk length)      0.964119        0.973547 0.0131    k(tk ln/col)        0.972742 0.0130     0.965358 0.0172    0.9978
rem life(col)    1.2375E+04      1.2001E+04 0.0203    k(col/abs/tk ln)    0.972270 0.0097     0.966186 0.0218
rem life(abs)    1.2483E+04      1.2016E+04 0.0149    life(col/abs)     1.2009E+04 0.0170   1.2021E+04 0.0177    0.8703
source points generated     978

 estimator      cycle    10   ave of     5 cycles      combination          simple average     combined average      corr
k(collision)       0.976621        0.972874 0.0100    k(col/abs)          0.970957 0.0071     0.971004 0.0082   -0.0164
k(absorption)      0.959905        0.969041 0.0103    k(abs/tk ln)        0.972159 0.0072     0.972135 0.0084   -0.0216
k(trk length)      0.982193        0.975277 0.0103    k(tk ln/col)        0.974075 0.0102     0.967059 0.0126    0.9950
rem life(col)    1.2416E+04      1.2084E+04 0.0171    k(col/abs/tk ln)    0.972397 0.0075     0.968586 0.0152
rem life(abs)    1.2305E+04      1.2074E+04 0.0125    life(col/abs)     1.2079E+04 0.0144   1.2068E+04 0.0136    0.8902
source points generated     991

 estimator      cycle    11   ave of     6 cycles      combination          simple average     combined average      corr
```

```
k(collision)      0.931973        0.966057 0.0108    k(col/abs)          0.967600 0.0068    0.967971 0.0074  -0.0206
k(absorption)     0.969653        0.969143 0.0084    k(abs/tk ln)        0.968550 0.0070    0.968719 0.0075  -0.0245
k(trk length)     0.931357        0.967957 0.0114    k(tk ln/col)        0.967007 0.0111    0.956014 0.0112   0.9970
rem life(col)   1.1991E+04      1.2069E+04 0.0140    k(col/abs/tk ln)    0.967719 0.0078    0.963754 0.0115
rem life(abs)   1.2135E+04      1.2084E+04 0.0102    life(col/abs)     1.2076E+04 0.0117  1.2090E+04 0.0109   0.8757
source points generated   1004

source distribution written to file srctp          cycle =    11

 estimator     cycle    12   ave of     7 cycles     combination        simple average    combined average     corr
k(collision)      0.990209        0.969507 0.0098    k(col/abs)          0.969565 0.0061    0.969583 0.0063   0.0061
k(absorption)     0.972506        0.969624 0.0071    k(abs/tk ln)        0.970645 0.0063    0.970281 0.0064   0.0031
k(trk length)     0.993927        0.971667 0.0103    k(tk ln/col)        0.970587 0.0100    0.956577 0.0097   0.9973
rem life(col)   1.1865E+04      1.2040E+04 0.0121    k(col/abs/tk ln)    0.970266 0.0071    0.964309 0.0102
rem life(abs)   1.1652E+04      1.2022E+04 0.0101    life(col/abs)     1.2031E+04 0.0106  1.2022E+04 0.0110   0.8401
source points generated   1051

 estimator     cycle    13   ave of     8 cycles     combination        simple average    combined average     corr
k(collision)      0.978307        0.970607 0.0086    k(col/abs)          0.970770 0.0054    0.970820 0.0056   0.0342
k(absorption)     0.980096        0.970933 0.0063    k(abs/tk ln)        0.972129 0.0056    0.971692 0.0057   0.0431
k(trk length)     0.984934        0.973325 0.0091    k(tk ln/col)        0.971966 0.0088    0.958165 0.0086   0.9958
rem life(col)   1.1713E+04      1.1999E+04 0.0111    k(col/abs/tk ln)    0.971622 0.0063    0.964451 0.0086
rem life(abs)   1.1820E+04      1.1997E+04 0.0090    life(col/abs)     1.1998E+04 0.0096  1.1997E+04 0.0097   0.8491
source points generated    985

 estimator     cycle    14   ave of     9 cycles     combination        simple average    combined average     corr
k(collision)      0.937943        0.966978 0.0085    k(col/abs)          0.969109 0.0051    0.969945 0.0050   0.0054
k(absorption)     0.973699        0.971240 0.0056    k(abs/tk ln)        0.970392 0.0053    0.970768 0.0051   0.0139
k(trk length)     0.939291        0.969543 0.0089    k(tk ln/col)        0.968261 0.0087    0.953629 0.0082   0.9966
rem life(col)   1.2492E+04      1.2054E+04 0.0107    k(col/abs/tk ln)    0.969254 0.0061    0.963540 0.0079
rem life(abs)   1.2375E+04      1.2039E+04 0.0086    life(col/abs)     1.2046E+04 0.0094  1.2036E+04 0.0092   0.8747
source points generated   1028

source distribution written to file srctp          cycle =    14

 estimator     cycle    15   ave of    10 cycles     combination        simple average    combined average     corr
k(collision)      0.974644        0.967744 0.0076    k(col/abs)          0.970908 0.0049    0.971793 0.0050   0.0573
k(absorption)     0.999553        0.974071 0.0058    k(abs/tk ln)        0.971794 0.0049    0.972511 0.0050   0.0102
k(trk length)     0.969270        0.969516 0.0080    k(tk ln/col)        0.968630 0.0078    0.964259 0.0078   0.9908
rem life(col)   1.1449E+04      1.1993E+04 0.0109    k(col/abs/tk ln)    0.970444 0.0056    0.972603 0.0066
rem life(abs)   1.1680E+04      1.2003E+04 0.0083    life(col/abs)     1.1998E+04 0.0093  1.2007E+04 0.0085   0.8899
source points generated   1027

 estimator     cycle    16   ave of    11 cycles     combination        simple average    combined average     corr
k(collision)      0.957302        0.966795 0.0069    k(col/abs)          0.970999 0.0044    0.972080 0.0045   0.0246
k(absorption)     0.986517        0.975203 0.0053    k(abs/tk ln)        0.971653 0.0045    0.972713 0.0045  -0.0333
k(trk length)     0.953980        0.968104 0.0074    k(tk ln/col)        0.967449 0.0071    0.964201 0.0070   0.9894
rem life(col)   1.2722E+04      1.2059E+04 0.0112    k(col/abs/tk ln)    0.970034 0.0051    0.972953 0.0058
rem life(abs)   1.2746E+04      1.2071E+04 0.0093    life(col/abs)     1.2065E+04 0.0101  1.2075E+04 0.0096   0.9146
source points generated    981

 estimator     cycle    17   ave of    12 cycles     combination        simple average    combined average     corr
k(collision)      0.994833        0.969132 0.0068    k(col/abs)          0.971323 0.0041    0.971841 0.0041  -0.0978
k(absorption)     0.954939        0.973514 0.0052    k(abs/tk ln)        0.971654 0.0041    0.972129 0.0041  -0.1145
k(trk length)     0.988387        0.969794 0.0069    k(tk ln/col)        0.969463 0.0068    0.968912 0.0071   0.9843
rem life(col)   1.2614E+04      1.2106E+04 0.0109    k(col/abs/tk ln)    0.970813 0.0047    0.971957 0.0044
rem life(abs)   1.2526E+04      1.2109E+04 0.0091    life(col/abs)     1.2107E+04 0.0098  1.2110E+04 0.0092   0.9250
source points generated   1070

source distribution written to file srctp          cycle =    17

 estimator     cycle    18   ave of    13 cycles     combination        simple average    combined average     corr
k(collision)      0.965586        0.968859 0.0062    k(col/abs)          0.970641 0.0038    0.971027 0.0039  -0.0848
k(absorption)     0.959333        0.972423 0.0049    k(abs/tk ln)        0.970846 0.0039    0.971225 0.0039  -0.0917
k(trk length)     0.962971        0.969269 0.0064    k(tk ln/col)        0.969064 0.0063    0.968707 0.0065   0.9836
rem life(col)   1.3268E+04      1.2195E+04 0.0124    k(col/abs/tk ln)    0.970184 0.0044    0.971022 0.0041
rem life(abs)   1.3137E+04      1.2188E+04 0.0105    life(col/abs)     1.2191E+04 0.0113  1.2181E+04 0.0104   0.9520
source points generated    987

 estimator     cycle    19   ave of    14 cycles     combination        simple average    combined average     corr
k(collision)      0.948043        0.967372 0.0060    k(col/abs)          0.968930 0.0039    0.969222 0.0040   0.0284
k(absorption)     0.945320        0.970487 0.0050    k(abs/tk ln)        0.969191 0.0040    0.969459 0.0040   0.0118
k(trk length)     0.950021        0.967894 0.0061    k(tk ln/col)        0.967633 0.0060    0.967261 0.0062   0.9843
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rem life(col)   1.2610E+04     1.2225E+04 0.0117     k(col/abs/tk ln)    0.968585 0.0044     0.969313 0.0043
rem life(abs)   1.2445E+04     1.2206E+04 0.0098     life(col/abs)     1.2215E+04 0.0106   1.2190E+04 0.0097   0.9521
source points generated    984

 estimator      cycle    20   ave of    15 cycles     combination          simple average    combined average     corr
k(collision)      0.977176       0.968026 0.0056     k(col/abs)          0.968423 0.0037     0.968473 0.0038  -0.0156
k(absorption)     0.945498       0.968821 0.0049     k(abs/tk ln)        0.968845 0.0037     0.968841 0.0038  -0.0498
k(trk length)     0.982504       0.968868 0.0058     k(tk ln/col)        0.968447 0.0057     0.967696 0.0058   0.9832
rem life(col)   1.2331E+04     1.2232E+04 0.0109     k(col/abs/tk ln)    0.968572 0.0041     0.968763 0.0041
rem life(abs)   1.2309E+04     1.2213E+04 0.0092     life(col/abs)     1.2222E+04 0.0099   1.2196E+04 0.0090   0.9522
source points generated   1027

source distribution written to file srctp          cycle =    20

 estimator      cycle    21   ave of    16 cycles     combination          simple average    combined average     corr
k(collision)      0.913088       0.964592 0.0064     k(col/abs)          0.965947 0.0043     0.966360 0.0043   0.1680
k(absorption)     0.944524       0.967303 0.0049     k(abs/tk ln)        0.966312 0.0044     0.966638 0.0043   0.1414
k(trk length)     0.912114       0.965321 0.0066     k(tk ln/col)        0.964957 0.0064     0.964006 0.0065   0.9885
rem life(col)   1.2962E+04     1.2277E+04 0.0108     k(col/abs/tk ln)    0.965739 0.0048     0.966501 0.0046
rem life(abs)   1.2754E+04     1.2247E+04 0.0090     life(col/abs)     1.2262E+04 0.0098   1.2215E+04 0.0086   0.9565
source points generated    978

 estimator      cycle    22   ave of    17 cycles     combination          simple average    combined average     corr
k(collision)      0.948174       0.963626 0.0061     k(col/abs)          0.965512 0.0041     0.966111 0.0041   0.1621
k(absorption)     0.968926       0.967398 0.0046     k(abs/tk ln)        0.965658 0.0041     0.966273 0.0041   0.1326
k(trk length)     0.941452       0.963917 0.0063     k(tk ln/col)        0.963772 0.0062     0.963315 0.0062   0.9868
rem life(col)   1.3061E+04     1.2324E+04 0.0108     k(col/abs/tk ln)    0.964981 0.0046     0.966124 0.0043
rem life(abs)   1.2990E+04     1.2290E+04 0.0091     life(col/abs)     1.2307E+04 0.0099   1.2254E+04 0.0087   0.9614
source points generated   1090

 estimator      cycle    23   ave of    18 cycles     combination          simple average    combined average     corr
k(collision)      0.930048       0.961761 0.0060     k(col/abs)          0.964268 0.0041     0.965219 0.0040   0.1991
k(absorption)     0.956179       0.966775 0.0044     k(abs/tk ln)        0.964326 0.0042     0.965354 0.0040   0.1729
k(trk length)     0.927205       0.961878 0.0063     k(tk ln/col)        0.961819 0.0062     0.961599 0.0061   0.9881
rem life(col)   1.2274E+04     1.2321E+04 0.0102     k(col/abs/tk ln)    0.963471 0.0046     0.965181 0.0042
rem life(abs)   1.2289E+04     1.2290E+04 0.0086     life(col/abs)     1.2306E+04 0.0093   1.2257E+04 0.0082   0.9612
source points generated    950

source distribution written to file srctp          cycle =    23

 estimator      cycle    24   ave of    19 cycles     combination          simple average    combined average     corr
k(collision)      0.902953       0.958666 0.0066     k(col/abs)          0.962348 0.0043     0.964339 0.0040   0.2603
k(absorption)     0.952638       0.966031 0.0042     k(abs/tk ln)        0.962527 0.0044     0.964435 0.0040   0.2334
k(trk length)     0.907636       0.959023 0.0067     k(tk ln/col)        0.958844 0.0066     0.958502 0.0068   0.9892
rem life(col)   1.2563E+04     1.2334E+04 0.0097     k(col/abs/tk ln)    0.961240 0.0050     0.964544 0.0043
rem life(abs)   1.2750E+04     1.2315E+04 0.0084     life(col/abs)     1.2324E+04 0.0089   1.2300E+04 0.0083   0.9541
source points generated    980

 estimator      cycle    25   ave of    20 cycles     combination          simple average    combined average     corr
k(collision)      0.974570       0.959461 0.0063     k(col/abs)          0.962197 0.0041     0.963514 0.0039   0.2122
k(absorption)     0.944087       0.964934 0.0042     k(abs/tk ln)        0.962197 0.0041     0.963543 0.0039   0.2044
k(trk length)     0.967767       0.959460 0.0064     k(tk ln/col)        0.959460 0.0063     0.959461 0.0065   0.9875
rem life(col)   1.2257E+04     1.2330E+04 0.0092     k(col/abs/tk ln)    0.961285 0.0047     0.963516 0.0041
rem life(abs)   1.2291E+04     1.2313E+04 0.0079     life(col/abs)     1.2322E+04 0.0085   1.2300E+04 0.0078   0.9539
source points generated   1069

 estimator      cycle    26   ave of    21 cycles     combination          simple average    combined average     corr
k(collision)      0.950822       0.959049 0.0060     k(col/abs)          0.961418 0.0040     0.962472 0.0038   0.2233
k(absorption)     0.940839       0.963786 0.0041     k(abs/tk ln)        0.961426 0.0040     0.962502 0.0038   0.2148
k(trk length)     0.951164       0.959065 0.0061     k(tk ln/col)        0.959057 0.0060     0.959048 0.0062   0.9876
rem life(col)   1.3383E+04     1.2380E+04 0.0096     k(col/abs/tk ln)    0.960634 0.0045     0.962475 0.0040
rem life(abs)   1.3259E+04     1.2358E+04 0.0084     life(col/abs)     1.2369E+04 0.0089   1.2338E+04 0.0081   0.9623
source points generated   1019

source distribution written to file srctp          cycle =    26

 estimator      cycle    27   ave of    22 cycles     combination          simple average    combined average     corr
k(collision)      0.925275       0.957514 0.0060     k(col/abs)          0.960222 0.0040     0.961535 0.0038   0.2689
k(absorption)     0.944961       0.962931 0.0040     k(abs/tk ln)        0.960293 0.0040     0.961576 0.0038   0.2570
k(trk length)     0.928039       0.957655 0.0060     k(tk ln/col)        0.957584 0.0060     0.957537 0.0061   0.9881
rem life(col)   1.2961E+04     1.2406E+04 0.0094     k(col/abs/tk ln)    0.959367 0.0045     0.961574 0.0040
rem life(abs)   1.2790E+04     1.2378E+04 0.0081     life(col/abs)     1.2392E+04 0.0087   1.2348E+04 0.0078   0.9634
source points generated   1002
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 estimator      cycle    28   ave of     23 cycles      combination          simple average     combined average     corr
k(collision)      0.989192        0.958892 0.0059      k(col/abs)           0.960235 0.0038     0.960768 0.0037    0.1614
k(absorption)     0.931851        0.961579 0.0041      k(abs/tk ln)         0.960228 0.0038     0.960765 0.0037    0.1617
k(trk length)     0.985754        0.958876 0.0059      k(tk ln/col)         0.958884 0.0058     0.958885 0.0060    0.9883
rem life(col)   1.2136E+04      1.2395E+04 0.0090      k(col/abs/tk ln)     0.959782 0.0043     0.960763 0.0038
rem life(abs)   1.2286E+04      1.2374E+04 0.0078      life(col/abs)      1.2384E+04 0.0083   1.2353E+04 0.0075    0.9617
source points generated    1101

 estimator      cycle    29   ave of     24 cycles      combination          simple average     combined average     corr
k(collision)      0.936007        0.957938 0.0057      k(col/abs)           0.959607 0.0037     0.960298 0.0036    0.1723
k(absorption)     0.954294        0.961276 0.0040      k(abs/tk ln)         0.959513 0.0038     0.960257 0.0036    0.1741
k(trk length)     0.931854        0.957750 0.0057      k(tk ln/col)         0.957844 0.0057     0.957901 0.0058    0.9883
rem life(col)   1.2107E+04      1.2383E+04 0.0087      k(col/abs/tk ln)     0.958988 0.0042     0.960299 0.0037
rem life(abs)   1.2290E+04      1.2370E+04 0.0074      life(col/abs)      1.2377E+04 0.0080   1.2359E+04 0.0071    0.9592
source points generated     946

source distribution written to file srctp          cycle =    29

 estimator      cycle    30   ave of     25 cycles      combination          simple average     combined average     corr
k(collision)      0.927171        0.956707 0.0056      k(col/abs)           0.958785 0.0037     0.959709 0.0035    0.1924
k(absorption)     0.950962        0.960863 0.0038      k(abs/tk ln)         0.958755 0.0037     0.959696 0.0035    0.1924
k(trk length)     0.930162        0.956647 0.0056      k(tk ln/col)         0.956677 0.0056     0.956681 0.0057    0.9885
rem life(col)   1.2713E+04      1.2396E+04 0.0084      k(col/abs/tk ln)     0.958073 0.0042     0.959698 0.0036
rem life(abs)   1.3120E+04      1.2400E+04 0.0075      life(col/abs)      1.2398E+04 0.0078   1.2402E+04 0.0076    0.9417
source points generated    1018

 estimator      cycle    31   ave of     26 cycles      combination          simple average     combined average     corr
k(collision)      0.947854        0.956367 0.0054      k(col/abs)           0.959124 0.0036     0.960209 0.0034    0.1663
k(absorption)     0.987331        0.961881 0.0038      k(abs/tk ln)         0.959043 0.0036     0.960161 0.0034    0.1605
k(trk length)     0.945133        0.956204 0.0054      k(tk ln/col)         0.956285 0.0054     0.956307 0.0055    0.9884
rem life(col)   1.1756E+04      1.2371E+04 0.0083      k(col/abs/tk ln)     0.958151 0.0040     0.960168 0.0036
rem life(abs)   1.1940E+04      1.2383E+04 0.0074      life(col/abs)      1.2377E+04 0.0077   1.2388E+04 0.0074    0.9434
source points generated     996

 estimator      cycle    32   ave of     27 cycles      combination          simple average     combined average     corr
k(collision)      0.932821        0.955495 0.0053      k(col/abs)           0.959242 0.0034     0.960503 0.0033    0.1047
k(absorption)     0.991787        0.962989 0.0038      k(abs/tk ln)         0.959215 0.0034     0.960486 0.0033    0.1063
k(trk length)     0.935598        0.955441 0.0053      k(tk ln/col)         0.955468 0.0053     0.955467 0.0054    0.9885
rem life(col)   1.1993E+04      1.2357E+04 0.0081      k(col/abs/tk ln)     0.957975 0.0039     0.960486 0.0035
rem life(abs)   1.2209E+04      1.2376E+04 0.0071      life(col/abs)      1.2367E+04 0.0075   1.2385E+04 0.0071    0.9419
source points generated     984

source distribution written to file srctp          cycle =    32

 estimator      cycle    33   ave of     28 cycles      combination          simple average     combined average     corr
k(collision)      0.935880        0.954794 0.0052      k(col/abs)           0.959081 0.0033     0.960518 0.0032    0.0881
k(absorption)     0.973594        0.963368 0.0037      k(abs/tk ln)         0.959098 0.0033     0.960523 0.0032    0.0917
k(trk length)     0.938278        0.954828 0.0051      k(tk ln/col)         0.954811 0.0051     0.954815 0.0052    0.9885
rem life(col)   1.1035E+04      1.2310E+04 0.0087      k(col/abs/tk ln)     0.957663 0.0037     0.960509 0.0034
rem life(abs)   1.1327E+04      1.2339E+04 0.0075      life(col/abs)      1.2324E+04 0.0080   1.2360E+04 0.0074    0.9514
source points generated    1039

 estimator      cycle    34   ave of     29 cycles      combination          simple average     combined average     corr
k(collision)      0.974637        0.955479 0.0050      k(col/abs)           0.959147 0.0032     0.960338 0.0031    0.0636
k(absorption)     0.947330        0.962815 0.0036      k(abs/tk ln)         0.959181 0.0032     0.960358 0.0031    0.0659
k(trk length)     0.975669        0.955547 0.0050      k(tk ln/col)         0.955513 0.0050     0.955518 0.0051    0.9887
rem life(col)   1.2193E+04      1.2306E+04 0.0084      k(col/abs/tk ln)     0.957947 0.0036     0.960337 0.0032
rem life(abs)   1.2340E+04      1.2339E+04 0.0073      life(col/abs)      1.2322E+04 0.0077   1.2363E+04 0.0071    0.9507
source points generated    1013

 estimator      cycle    35   ave of     30 cycles      combination          simple average     combined average     corr
k(collision)      0.901173        0.953668 0.0052      k(col/abs)           0.958467 0.0032     0.960213 0.0030    0.0109
k(absorption)     0.976319        0.963265 0.0035      k(abs/tk ln)         0.958568 0.0032     0.960241 0.0030    0.0166
k(trk length)     0.905266        0.953871 0.0052      k(tk ln/col)         0.953769 0.0052     0.953878 0.0053    0.9898
rem life(col)   1.1970E+04      1.2295E+04 0.0082      k(col/abs/tk ln)     0.956935 0.0037     0.960221 0.0032
rem life(abs)   1.2502E+04      1.2344E+04 0.0070      life(col/abs)      1.2320E+04 0.0075   1.2369E+04 0.0070    0.9360
source points generated     882

source distribution written to file srctp          cycle =    35

 estimator      cycle    36   ave of     31 cycles      combination          simple average     combined average     corr
k(collision)      0.969421        0.954176 0.0051      k(col/abs)           0.958840 0.0031     0.960561 0.0029    0.0183
k(absorption)     0.970645        0.963503 0.0034      k(abs/tk ln)         0.958998 0.0031     0.960640 0.0029    0.0257
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k(trk length)      0.973148        0.954492 0.0050     k(tk ln/col)        0.954334 0.0050     0.954458 0.0051    0.9897
rem life(col)    1.1948E+04      1.2284E+04 0.0080     k(col/abs/tk ln)    0.957391 0.0036     0.960581 0.0031
rem life(abs)    1.2108E+04      1.2337E+04 0.0068     life(col/abs)     1.2310E+04 0.0073   1.2364E+04 0.0068    0.9364
source points generated    1084

 estimator      cycle    37    ave of     32 cycles      combination          simple average     combined average     corr
k(collision)       0.979894        0.954980 0.0050     k(col/abs)          0.959333 0.0030     0.961003 0.0029    0.0276
k(absorption)      0.969358        0.963686 0.0033     k(abs/tk ln)        0.959450 0.0030     0.961046 0.0029    0.0341
k(trk length)      0.977619        0.955215 0.0049     k(tk ln/col)        0.955098 0.0049     0.955220 0.0050    0.9898
rem life(col)    1.2527E+04      1.2291E+04 0.0077     k(col/abs/tk ln)    0.957960 0.0035     0.961018 0.0030
rem life(abs)    1.2508E+04      1.2342E+04 0.0066     life(col/abs)     1.2317E+04 0.0071   1.2369E+04 0.0066    0.9366
source points generated    1011

 estimator      cycle    38    ave of     33 cycles      combination          simple average     combined average     corr
k(collision)       0.997974        0.956283 0.0050     k(col/abs)          0.959864 0.0030     0.961319 0.0028    0.0056
k(absorption)      0.955769        0.963446 0.0032     k(abs/tk ln)        0.959894 0.0030     0.961289 0.0028    0.0146
k(trk length)      0.992397        0.956342 0.0049     k(tk ln/col)        0.956312 0.0050     0.956368 0.0050    0.9899
rem life(col)    1.3564E+04      1.2330E+04 0.0081     k(col/abs/tk ln)    0.958690 0.0035     0.961290 0.0029
rem life(abs)    1.3477E+04      1.2376E+04 0.0070     life(col/abs)     1.2353E+04 0.0074   1.2407E+04 0.0068    0.9463
source points generated    1015

source distribution written to file srctp          cycle =    38

 estimator      cycle    39    ave of     34 cycles      combination          simple average     combined average     corr
k(collision)       0.964389        0.956521 0.0049     k(col/abs)          0.960035 0.0029     0.961466 0.0027    0.0074
k(absorption)      0.966915        0.963548 0.0031     k(abs/tk ln)        0.960142 0.0029     0.961493 0.0027    0.0175
k(trk length)      0.969760        0.956736 0.0048     k(tk ln/col)        0.956629 0.0048     0.956799 0.0049    0.9894
rem life(col)    1.2585E+04      1.2337E+04 0.0079     k(col/abs/tk ln)    0.958935 0.0034     0.961474 0.0028
rem life(abs)    1.2760E+04      1.2388E+04 0.0068     life(col/abs)     1.2363E+04 0.0073   1.2418E+04 0.0067    0.9453
source points generated     957

*************************************************************************
dump no.  2 on file   runtpe          nps =   40415          ctm =   15.11

 estimator      cycle    40    ave of     35 cycles      combination          simple average     combined average     corr
k(collision)       0.905938        0.955076 0.0050     k(col/abs)          0.958907 0.0031     0.960633 0.0028    0.0875
k(absorption)      0.935207        0.962738 0.0032     k(abs/tk ln)        0.959099 0.0030     0.960657 0.0028    0.0894
k(trk length)      0.912021        0.955459 0.0048     k(tk ln/col)        0.955268 0.0049     0.955741 0.0049    0.9898
rem life(col)    1.2208E+04      1.2334E+04 0.0077     k(col/abs/tk ln)    0.957758 0.0035     0.960722 0.0029
rem life(abs)    1.2618E+04      1.2394E+04 0.0066     life(col/abs)     1.2364E+04 0.0070   1.2423E+04 0.0066    0.9384
source points generated     947

 estimator      cycle    41    ave of     36 cycles      combination          simple average     combined average     corr
k(collision)       1.000239        0.956331 0.0050     k(col/abs)          0.959741 0.0031     0.961407 0.0028    0.1198
k(absorption)      0.977585        0.963151 0.0031     k(abs/tk ln)        0.959929 0.0030     0.961437 0.0028    0.1222
k(trk length)      1.000411        0.956708 0.0049     k(tk ln/col)        0.956519 0.0049     0.956991 0.0049    0.9905
rem life(col)    1.3403E+04      1.2363E+04 0.0078     k(col/abs/tk ln)    0.958730 0.0036     0.961502 0.0029
rem life(abs)    1.2872E+04      1.2408E+04 0.0065     life(col/abs)     1.2385E+04 0.0071   1.2432E+04 0.0064    0.9312
source points generated    1108

source distribution written to file srctp          cycle =    41

 estimator      cycle    42    ave of     37 cycles      combination          simple average     combined average     corr
k(collision)       0.969563        0.956688 0.0049     k(col/abs)          0.960208 0.0030     0.961898 0.0028    0.1320
k(absorption)      0.984474        0.963727 0.0031     k(abs/tk ln)        0.960410 0.0030     0.961937 0.0028    0.1359
k(trk length)      0.970990        0.957094 0.0048     k(tk ln/col)        0.956891 0.0048     0.957387 0.0048    0.9906
rem life(col)    1.1875E+04      1.2350E+04 0.0077     k(col/abs/tk ln)    0.959170 0.0035     0.961996 0.0029
rem life(abs)    1.1894E+04      1.2394E+04 0.0065     life(col/abs)     1.2372E+04 0.0070   1.2417E+04 0.0064    0.9323
source points generated     991

 estimator      cycle    43    ave of     38 cycles      combination          simple average     combined average     corr
k(collision)       0.984428        0.957418 0.0048     k(col/abs)          0.960702 0.0030     0.962324 0.0027    0.1439
k(absorption)      0.973521        0.963985 0.0030     k(abs/tk ln)        0.960881 0.0030     0.962350 0.0027    0.1473
k(trk length)      0.983102        0.957778 0.0047     k(tk ln/col)        0.957598 0.0047     0.958066 0.0047    0.9908
rem life(col)    1.1253E+04      1.2321E+04 0.0079     k(col/abs/tk ln)    0.959727 0.0034     0.962411 0.0028
rem life(abs)    1.1434E+04      1.2368E+04 0.0066     life(col/abs)     1.2345E+04 0.0071   1.2397E+04 0.0065    0.9385
source points generated    1015

 estimator      cycle    44    ave of     39 cycles      combination          simple average     combined average     corr
k(collision)       0.945266        0.957107 0.0047     k(col/abs)          0.960640 0.0029     0.962378 0.0027    0.1386
k(absorption)      0.971352        0.964174 0.0029     k(abs/tk ln)        0.960730 0.0029     0.962358 0.0027    0.1386
k(trk length)      0.938592        0.957286 0.0046     k(tk ln/col)        0.957196 0.0046     0.957379 0.0046    0.9899
```

```
 rem life(col)   1.2038E+04     1.2314E+04 0.0077     k(col/abs/tk ln)    0.959522 0.0034     0.962384 0.0028
 rem life(abs)   1.1987E+04     1.2359E+04 0.0065     life(col/abs)     1.2336E+04 0.0070   1.2385E+04 0.0064   0.9381
 source points generated    951

 source distribution written to file srctp          cycle =    44

  estimator      cycle    45   ave of    40 cycles     combination          simple average    combined average     corr
 k(collision)      0.979132       0.957657 0.0046     k(col/abs)          0.960263 0.0029     0.961244 0.0027   0.0710
 k(absorption)     0.911964       0.962868 0.0032     k(abs/tk ln)        0.960321 0.0028     0.961232 0.0027   0.0761
 k(trk length)     0.976813       0.957774 0.0045     k(tk ln/col)        0.957716 0.0045     0.957843 0.0045   0.9900
 rem life(col)   1.4438E+04     1.2367E+04 0.0086     k(col/abs/tk ln)    0.959433 0.0033     0.961239 0.0028
 rem life(abs)   1.3839E+04     1.2396E+04 0.0070     life(col/abs)     1.2381E+04 0.0077   1.2422E+04 0.0065   0.9482
 source points generated   1002

  estimator      cycle    46   ave of    41 cycles     combination          simple average    combined average     corr
 k(collision)      0.933926       0.957079 0.0045     k(col/abs)          0.959852 0.0028     0.960922 0.0027   0.0809
 k(absorption)     0.952947       0.962626 0.0031     k(abs/tk ln)        0.960023 0.0028     0.960960 0.0027   0.0824
 k(trk length)     0.943234       0.957420 0.0044     k(tk ln/col)        0.957249 0.0045     0.957661 0.0044   0.9889
 rem life(col)   1.2617E+04     1.2373E+04 0.0084     k(col/abs/tk ln)    0.959041 0.0032     0.961029 0.0027
 rem life(abs)   1.2502E+04     1.2398E+04 0.0068     life(col/abs)     1.2386E+04 0.0075   1.2421E+04 0.0064   0.9479
 source points generated    966

  estimator      cycle    47   ave of    42 cycles     combination          simple average    combined average     corr
 k(collision)      0.918363       0.956157 0.0045     k(col/abs)          0.959008 0.0029     0.960136 0.0028   0.1306
 k(absorption)     0.930369       0.961858 0.0031     k(abs/tk ln)        0.959195 0.0029     0.960176 0.0027   0.1316
 k(trk length)     0.920122       0.956532 0.0044     k(tk ln/col)        0.956344 0.0045     0.956825 0.0044   0.9894
 rem life(col)   1.2668E+04     1.2380E+04 0.0082     k(col/abs/tk ln)    0.958182 0.0033     0.960272 0.0028
 rem life(abs)   1.2554E+04     1.2402E+04 0.0067     life(col/abs)     1.2391E+04 0.0073   1.2422E+04 0.0062   0.9478
 source points generated    960

 source distribution written to file srctp          cycle =    47

  estimator      cycle    48   ave of    43 cycles     combination          simple average    combined average     corr
 k(collision)      0.991574       0.956980 0.0045     k(col/abs)          0.958977 0.0028     0.959672 0.0027   0.0678
 k(absorption)     0.923814       0.960974 0.0032     k(abs/tk ln)        0.959182 0.0028     0.959760 0.0027   0.0646
 k(trk length)     0.993448       0.957390 0.0044     k(tk ln/col)        0.957185 0.0044     0.957677 0.0044   0.9897
 rem life(col)   1.3232E+04     1.2400E+04 0.0082     k(col/abs/tk ln)    0.958448 0.0032     0.959893 0.0027
 rem life(abs)   1.2833E+04     1.2412E+04 0.0065     life(col/abs)     1.2406E+04 0.0073   1.2423E+04 0.0060   0.9465
 source points generated   1034

  estimator      cycle    49   ave of    44 cycles     combination          simple average    combined average     corr
 k(collision)      0.931042       0.956391 0.0044     k(col/abs)          0.959006 0.0028     0.959857 0.0027   0.0365
 k(absorption)     0.989475       0.961621 0.0032     k(abs/tk ln)        0.959217 0.0027     0.959939 0.0026   0.0332
 k(trk length)     0.932001       0.956813 0.0043     k(tk ln/col)        0.956602 0.0044     0.957117 0.0044   0.9899
 rem life(col)   1.3112E+04     1.2416E+04 0.0081     k(col/abs/tk ln)    0.958275 0.0031     0.960073 0.0027
 rem life(abs)   1.3047E+04     1.2426E+04 0.0065     life(col/abs)     1.2421E+04 0.0072   1.2436E+04 0.0060   0.9479
 source points generated    986

  estimator      cycle    50   ave of    45 cycles     combination          simple average    combined average     corr
 k(collision)      0.973473       0.956770 0.0044     k(col/abs)          0.959216 0.0027     0.960022 0.0026   0.0376
 k(absorption)     0.963462       0.961662 0.0031     k(abs/tk ln)        0.959394 0.0027     0.960082 0.0026   0.0341
 k(trk length)     0.970885       0.957126 0.0042     k(tk ln/col)        0.956948 0.0043     0.957400 0.0043   0.9899
 rem life(col)   1.3109E+04     1.2432E+04 0.0080     k(col/abs/tk ln)    0.958519 0.0031     0.960198 0.0026
 rem life(abs)   1.3092E+04     1.2441E+04 0.0065     life(col/abs)     1.2436E+04 0.0071   1.2450E+04 0.0060   0.9490
 source points generated    994

 source distribution written to file srctp          cycle =    50
1problem summary

     run terminated when    50 kcode cycles were done.                                          01/14/93 15:34:41
      IXM024 - Single IXM module 5,000g Pu per cell, full tank model                   probid =   01/14/93 15:01:59
0
 neutron creation     tracks      weight        energy          neutron loss        tracks      weight        energy
                                  (per source particle)                                         (per source particle)

 source               51332     9.7405E-01    2.1043E+00       escape                371     3.4780E-03    1.1481E-03
                                                               energy cutoff           0     0.            0.
                                                               time cutoff             0     0.            0.
 weight window            0     0.            0.               weight window           0     0.            0.
 cell importance          0     0.            0.               cell importance         0     0.            0.
 weight cutoff            0     7.0180E-02    5.7564E-05       weight cutoff       50961     7.0135E-02    3.4724E-05
 energy importance        0     0.            0.               energy importance       0     0.            0.
 dxtran                   0     0.            0.               dxtran                  0     0.            0.
```

forced collisions	0	0.	0.
exp. transform	0	0.	0.
upscattering	0	0.	3.9923E-07
(n,xn)	0	0.	0.
fission	0	0.	0.
total	51332	1.0442E+00	2.1044E+00

forced collisions	0	0.	0.
exp. transform	0	0.	0.
downscattering	0	0.	2.0800E+00
capture	0	6.4426E-01	2.2187E-02
loss to (n,xn)	0	0.	0.
loss to fission	0	3.2636E-01	1.0686E-03
total	51332	1.0442E+00	2.1044E+00

number of neutrons banked	0
neutron tracks per source particle	1.0000E+00
neutron collisions per source particle	1.1011E+02
total neutron collisions	5652417
net multiplication	1.0000E+00 0.0005

average lifetime, shakes	
escape	5.0941E+04
capture	1.2194E+04
capture or escape	1.2332E+04
any termination	1.4151E+04

cutoffs	
tco	1.0000+120
eco	0.0000E+00
wc1	-5.0000E-01
wc2	-2.5000E-01

computer time so far in this run	19.30 minutes
computer time in mcrun	19.28 minutes
source particles per minute	2.6624E+03
random numbers generated	66120491

maximum number ever in bank	0
bank overflows to backup file	0
field length	0
most random numbers used was	11643 in history 22584

range of sampled source weights = 4.4504E-01 to 1.1338E+00

1warning. the following cells are bounded by cells with neutron importances print table 120
that may be a factor of four or more different.

cell	importance	maximum neighbor	importance	ratio	minimum neighbor	importance	ratio
67	no data available yet for this cell.						
68	no data available yet for this cell.						

1neutron activity in each cell print table 126

	cell	tracks entering	population	collisions	collisions * weight (per history)	number weighted energy	flux weighted energy	average track weight (relative)	average track mfp (cm)
1	1	263	125	527	6.8910E-03	3.2264E-04	5.4960E-01	7.6940E-01	2.5595E+00
2	2	1077	577	25392	3.4684E-01	1.6331E-04	5.6022E-01	7.9764E-01	1.6055E+00
3	3	2356	1269	60581	8.2563E-01	1.5189E-04	5.0204E-01	7.9272E-01	1.5321E+00
4	4	3637	1978	91673	1.2280E+00	1.5542E-04	5.2633E-01	7.7129E-01	1.5658E+00
5	5	4218	2339	113073	1.5215E+00	1.6267E-04	5.3254E-01	7.7321E-01	1.5827E+00
6	6	3001	1688	80033	1.1045E+00	1.5272E-04	5.2508E-01	7.9727E-01	1.5480E+00
7	7	2013	1092	55359	7.6589E-01	1.4960E-04	5.0056E-01	8.0237E-01	1.5154E+00
8	8	962	534	25006	3.4423E-01	1.4679E-04	4.9148E-01	8.0118E-01	1.5141E+00
9	9	241	105	175	2.1803E-03	2.2116E-04	5.1165E-01	7.5636E-01	2.3160E+00
10	10	8904	3422	12978	1.6674E-01	2.5311E-04	5.1617E-01	7.4604E-01	2.5399E+00
11	11	326	144	630	8.0433E-03	3.1607E-04	4.9457E-01	7.7063E-01	2.8824E+00
12	12	1383	726	32087	4.4254E-01	1.3886E-04	4.6535E-01	7.9775E-01	1.4719E+00
13	13	3101	1639	78835	1.0783E+00	1.4686E-04	4.8238E-01	7.9342E-01	1.5103E+00
14	14	5313	2885	137906	1.8656E+00	1.5356E-04	5.0554E-01	7.7850E-01	1.5380E+00
15	15	6453	3545	167366	2.2595E+00	1.5651E-04	5.0696E-01	7.7742E-01	1.5510E+00
16	16	4699	2567	120557	1.6726E+00	1.5661E-04	5.0855E-01	8.0328E-01	1.5508E+00
17	17	2555	1444	65144	9.0362E-01	1.5226E-04	5.1118E-01	8.0469E-01	1.5279E+00
18	18	1306	709	31243	4.4265E-01	1.6242E-04	5.2985E-01	8.2038E-01	1.5669E+00
19	19	367	151	225	3.0438E-03	2.1338E-04	6.0016E-01	7.6230E-01	2.3272E+00
20	20	13406	5347	19292	2.4995E-01	2.6769E-04	5.0510E-01	7.5502E-01	2.5983E+00
21	21	446	203	861	1.0862E-02	2.6485E-04	5.8424E-01	7.3432E-01	2.6627E+00
22	22	1895	1015	47881	6.6612E-01	1.5093E-04	4.8940E-01	8.0595E-01	1.5225E+00
23	23	4072	2149	103134	1.4380E+00	1.5803E-04	5.2576E-01	8.0742E-01	1.5775E+00
24	24	6239	3321	163335	2.2133E+00	1.5277E-04	5.1048E-01	7.8360E-01	1.5413E+00
25	25	7124	3799	193014	2.6294E+00	1.4788E-04	4.9716E-01	7.8158E-01	1.5168E+00
26	26	5496	2852	137829	1.9061E+00	1.4683E-04	4.9516E-01	7.9945E-01	1.5125E+00
27	27	3204	1668	81920	1.1236E+00	1.4740E-04	5.1162E-01	7.9680E-01	1.5287E+00
28	28	1389	670	30322	4.1607E-01	1.4963E-04	5.0825E-01	8.0095E-01	1.5271E+00
29	29	394	146	313	3.9436E-03	1.6674E-04	4.3820E-01	7.4388E-01	2.1720E+00
30	30	14258	5392	20685	2.6715E-01	2.7797E-04	5.4263E-01	7.5514E-01	2.5560E+00
31	31	523	218	949	1.2900E-02	3.0870E-04	4.5708E-01	7.8517E-01	2.8606E+00
32	32	2106	1133	54698	7.6154E-01	1.4269E-04	4.5123E-01	8.0628E-01	1.4713E+00
33	33	4148	2220	108517	1.5133E+00	1.5291E-04	5.1162E-01	8.0569E-01	1.5441E+00
34	34	6075	3298	161063	2.2021E+00	1.4837E-04	4.9522E-01	7.8802E-01	1.5148E+00
35	35	6462	3586	173181	2.3756E+00	1.5881E-04	5.2190E-01	7.8605E-01	1.5646E+00
36	36	4306	2357	109740	1.5195E+00	1.4708E-04	4.9027E-01	7.9903E-01	1.5118E+00
37	37	2701	1430	69016	9.5217E-01	1.3555E-04	4.6121E-01	7.9931E-01	1.4512E+00
38	38	1266	677	31767	4.3838E-01	1.6037E-04	5.4060E-01	8.0411E-01	1.5776E+00
39	39	419	154	306	3.8385E-03	2.4485E-04	6.0994E-01	7.4180E-01	2.8023E+00

40	40	12729	4940	18103	2.3573E-01	2.8118E-04	5.3941E-01	7.5953E-01	2.6516E+00
41	41	659	274	1243	1.5696E-02	3.0013E-04	5.4558E-01	7.5032E-01	2.6771E+00
42	42	2911	1556	71230	9.8870E-01	1.5966E-04	5.2828E-01	8.0621E-01	1.5723E+00
43	43	6097	3283	157953	2.2192E+00	1.6470E-04	5.4562E-01	8.1325E-01	1.5952E+00
44	44	8334	4541	226672	3.0719E+00	1.4701E-04	5.0154E-01	7.8408E-01	1.5248E+00
45	45	8999	4875	239168	3.2582E+00	1.5539E-04	5.0658E-01	7.8587E-01	1.5452E+00
46	46	7365	3985	196093	2.6790E+00	1.5069E-04	5.0598E-01	7.9376E-01	1.5359E+00
47	47	4714	2533	124959	1.7240E+00	1.5161E-04	5.1856E-01	8.0094E-01	1.5488E+00
48	48	1946	1024	46511	6.5164E-01	1.4875E-04	4.7831E-01	8.0906E-01	1.5010E+00
49	49	528	231	388	4.6631E-03	2.2157E-04	5.2935E-01	7.3307E-01	2.3841E+00
50	50	19727	7681	27748	3.6302E-01	2.9049E-04	5.4161E-01	7.5940E-01	2.6402E+00
51	51	751	327	1370	1.8753E-02	4.0296E-04	5.3662E-01	7.9301E-01	2.8606E+00
52	52	3089	1668	83921	1.1751E+00	1.6095E-04	5.3977E-01	8.1317E-01	1.5909E+00
53	53	5868	3122	154212	2.1465E+00	1.5163E-04	4.9849E-01	8.0549E-01	1.5328E+00
54	54	7783	4190	211816	2.9002E+00	1.4890E-04	5.0434E-01	7.9027E-01	1.5334E+00
55	55	7675	4141	208233	2.8224E+00	1.5393E-04	5.1658E-01	7.8356E-01	1.5505E+00
56	56	6031	3189	147630	2.0428E+00	1.5866E-04	5.1753E-01	8.0409E-01	1.5570E+00
57	57	4496	2408	123828	1.7225E+00	1.4090E-04	4.6224E-01	8.0531E-01	1.4715E+00
58	58	2062	1098	48347	6.7745E-01	1.6256E-04	5.3152E-01	8.1510E-01	1.5761E+00
59	59	599	229	460	6.1355E-03	2.4296E-04	4.9702E-01	7.7377E-01	2.3487E+00
60	60	16843	6473	23944	3.1079E-01	2.7882E-04	5.3654E-01	7.6080E-01	2.6606E+00
61	61	2571	1229	87659	9.5554E-01	5.2279E-05	2.3454E-01	5.9318E-01	2.1331E+00
62	62	47763	19359	733918	8.6520E+00	7.9512E-05	2.9601E-01	6.4646E-01	2.2621E+00
63	63	2880	1389	103317	1.1312E+00	5.4234E-05	2.3537E-01	5.9593E-01	2.1329E+00
64	64	86	57	160	1.2209E-03	3.6356E-05	2.2570E-01	4.1434E-01	1.6233E+00
65	65	1111	548	2901	3.8269E-02	1.0119E-04	3.0039E-01	7.2572E-01	2.3196E+00
66	66	1466	777	4020	5.2615E-02	8.9920E-05	2.6843E-01	7.1369E-01	2.2957E+00
67	67	0	0	0	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
68	68	0	0	0	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
total		323187	153701	5652417	7.5557E+01				

1neutron weight balance in each cell -- external events print table 130

	cell	entering	source	energy cutoff	time cutoff	exiting	total
1	1	4.0433E-03	0.0000E+00	0.0000E+00	0.0000E+00	-3.6250E-03	4.1835E-04
2	2	1.2169E-02	5.3382E-03	0.0000E+00	0.0000E+00	-1.3305E-02	4.2021E-03
3	3	2.6093E-02	1.2107E-02	0.0000E+00	0.0000E+00	-2.8355E-02	9.8448E-03
4	4	3.9411E-02	1.7930E-02	0.0000E+00	0.0000E+00	-4.2490E-02	1.4851E-02
5	5	4.1509E-02	2.5629E-02	0.0000E+00	0.0000E+00	-4.9351E-02	1.7787E-02
6	6	3.2701E-02	1.6466E-02	0.0000E+00	0.0000E+00	-3.5660E-02	1.3507E-02
7	7	2.1693E-02	1.1654E-02	0.0000E+00	0.0000E+00	-2.4030E-02	9.3170E-03
8	8	1.0477E-02	5.2389E-03	0.0000E+00	0.0000E+00	-1.1717E-02	3.9990E-03
9	9	3.5920E-03	0.0000E+00	0.0000E+00	0.0000E+00	-3.3833E-03	2.0870E-04
10	10	1.3235E-01	0.0000E+00	0.0000E+00	0.0000E+00	-1.2023E-01	1.2117E-02
11	11	4.8602E-03	0.0000E+00	0.0000E+00	0.0000E+00	-4.2542E-03	6.0602E-04
12	12	1.6887E-02	5.3075E-03	0.0000E+00	0.0000E+00	-1.6862E-02	5.3334E-03
13	13	3.4877E-02	1.5211E-02	0.0000E+00	0.0000E+00	-3.6792E-02	1.3296E-02
14	14	5.7193E-02	2.7583E-02	0.0000E+00	0.0000E+00	-6.2700E-02	2.2077E-02
15	15	6.6349E-02	3.7274E-02	0.0000E+00	0.0000E+00	-7.6634E-02	2.6990E-02
16	16	5.1741E-02	2.5512E-02	0.0000E+00	0.0000E+00	-5.7075E-02	2.0179E-02
17	17	2.9374E-02	1.2852E-02	0.0000E+00	0.0000E+00	-3.0854E-02	1.1373E-02
18	18	1.4465E-02	6.9807E-03	0.0000E+00	0.0000E+00	-1.6092E-02	5.3536E-03
19	19	5.5405E-03	0.0000E+00	0.0000E+00	0.0000E+00	-5.2724E-03	2.6816E-04
20	20	2.0159E-01	0.0000E+00	0.0000E+00	0.0000E+00	-1.8375E-01	1.7837E-02
21	21	6.4735E-03	0.0000E+00	0.0000E+00	0.0000E+00	-5.6708E-03	8.0271E-04
22	22	2.1120E-02	1.0115E-02	0.0000E+00	0.0000E+00	-2.3634E-02	7.6011E-03
23	23	4.4357E-02	2.2607E-02	0.0000E+00	0.0000E+00	-4.9668E-02	1.7296E-02
24	24	6.6419E-02	3.3868E-02	0.0000E+00	0.0000E+00	-7.4210E-02	2.6077E-02
25	25	7.2760E-02	4.2105E-02	0.0000E+00	0.0000E+00	-8.4006E-02	3.0859E-02
26	26	6.0686E-02	2.8831E-02	0.0000E+00	0.0000E+00	-6.7187E-02	2.2330E-02
27	27	3.6304E-02	1.6444E-02	0.0000E+00	0.0000E+00	-3.9727E-02	1.3021E-02
28	28	1.6194E-02	6.1689E-03	0.0000E+00	0.0000E+00	-1.7426E-02	4.9371E-03
29	29	5.7075E-03	0.0000E+00	0.0000E+00	0.0000E+00	-5.3631E-03	3.4436E-04
30	30	2.1332E-01	0.0000E+00	0.0000E+00	0.0000E+00	-1.9429E-01	1.9033E-02
31	31	8.0734E-03	0.0000E+00	0.0000E+00	0.0000E+00	-7.2711E-03	8.0227E-04
32	32	2.2843E-02	1.1784E-02	0.0000E+00	0.0000E+00	-2.5640E-02	8.9863E-03
33	33	4.5551E-02	2.2964E-02	0.0000E+00	0.0000E+00	-5.0319E-02	1.8196E-02
34	34	6.5018E-02	3.3366E-02	0.0000E+00	0.0000E+00	-7.1986E-02	2.6398E-02
35	35	6.3776E-02	4.0975E-02	0.0000E+00	0.0000E+00	-7.6413E-02	2.8338E-02
36	36	4.7595E-02	2.2540E-02	0.0000E+00	0.0000E+00	-5.1589E-02	1.8546E-02
37	37	2.9657E-02	1.4072E-02	0.0000E+00	0.0000E+00	-3.2024E-02	1.1705E-02

38	38	1.3355E-02	7.0245E-03	0.0000E+00	0.0000E+00	-1.5034E-02	5.3456E-03
39	39	6.1587E-03	0.0000E+00	0.0000E+00	0.0000E+00	-5.7951E-03	3.6363E-04
40	40	1.9234E-01	0.0000E+00	0.0000E+00	0.0000E+00	-1.7545E-01	1.6888E-02
41	41	9.7881E-03	0.0000E+00	0.0000E+00	0.0000E+00	-8.6632E-03	1.1250E-03
42	42	3.2378E-02	1.5166E-02	0.0000E+00	0.0000E+00	-3.5426E-02	1.2118E-02
43	43	6.6040E-02	3.4523E-02	0.0000E+00	0.0000E+00	-7.3958E-02	2.6605E-02
44	44	8.8390E-02	4.6502E-02	0.0000E+00	0.0000E+00	-9.8583E-02	3.6309E-02
45	45	9.2238E-02	5.1991E-02	0.0000E+00	0.0000E+00	-1.0591E-01	3.8317E-02
46	46	7.9072E-02	4.1603E-02	0.0000E+00	0.0000E+00	-8.9478E-02	3.1197E-02
47	47	5.0905E-02	2.6552E-02	0.0000E+00	0.0000E+00	-5.7116E-02	2.0341E-02
48	48	2.2545E-02	8.7400E-03	0.0000E+00	0.0000E+00	-2.3921E-02	7.3640E-03
49	49	7.6393E-03	0.0000E+00	0.0000E+00	0.0000E+00	-7.2196E-03	4.1964E-04
50	50	2.9776E-01	0.0000E+00	0.0000E+00	0.0000E+00	-2.7250E-01	2.5259E-02
51	51	1.1743E-02	0.0000E+00	0.0000E+00	0.0000E+00	-1.0654E-02	1.0888E-03
52	52	3.2521E-02	1.9020E-02	0.0000E+00	0.0000E+00	-3.7466E-02	1.4075E-02
53	53	6.4059E-02	3.3700E-02	0.0000E+00	0.0000E+00	-7.2693E-02	2.5066E-02
54	54	8.2151E-02	4.4869E-02	0.0000E+00	0.0000E+00	-9.2997E-02	3.4023E-02
55	55	7.7741E-02	4.6003E-02	0.0000E+00	0.0000E+00	-9.0542E-02	3.3202E-02
56	56	6.7690E-02	3.0306E-02	0.0000E+00	0.0000E+00	-7.3343E-02	2.4653E-02
57	57	4.8628E-02	2.6591E-02	0.0000E+00	0.0000E+00	-5.5406E-02	1.9813E-02
58	58	2.3444E-02	1.0534E-02	0.0000E+00	0.0000E+00	-2.5805E-02	8.1736E-03
59	59	9.0595E-03	0.0000E+00	0.0000E+00	0.0000E+00	-8.5492E-03	5.1030E-04
60	60	2.5525E-01	0.0000E+00	0.0000E+00	0.0000E+00	-2.3283E-01	2.2425E-02
61	61	3.5425E-02	0.0000E+00	0.0000E+00	0.0000E+00	-2.5660E-02	9.7654E-03
62	62	7.0853E-01	0.0000E+00	0.0000E+00	0.0000E+00	-6.2919E-01	7.9332E-02
63	63	4.0197E-02	0.0000E+00	0.0000E+00	0.0000E+00	-2.9193E-02	1.1004E-02
64	64	7.0705E-04	0.0000E+00	0.0000E+00	0.0000E+00	-5.3322E-04	1.7383E-04
65	65	1.5511E-02	0.0000E+00	0.0000E+00	0.0000E+00	-1.5193E-02	3.1730E-04
66	66	2.0477E-02	0.0000E+00	0.0000E+00	0.0000E+00	-2.0015E-02	4.6208E-04
67	67	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
68	68	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
total		4.0845E+00	9.7405E-01	0.0000E+00	0.0000E+00	-4.0880E+00	9.7057E-01

1neutron weight balance in each cell -- variance reduction events print table 130

	cell	weight window	cell importance	weight cutoff	energy importance	dxtran	forced collision	exponential transform	total
1	1	0.0000E+00	0.0000E+00	3.1036E-05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	3.1036E-05
2	2	0.0000E+00	0.0000E+00	1.5857E-05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	1.5857E-05
3	3	0.0000E+00	0.0000E+00	2.1787E-05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	2.1787E-05
4	4	0.0000E+00	0.0000E+00	-5.9836E-05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	-5.9836E-05
5	5	0.0000E+00	0.0000E+00	1.8544E-05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	1.8544E-05
6	6	0.0000E+00	0.0000E+00	-5.7046E-05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	-5.7046E-05
7	7	0.0000E+00	0.0000E+00	-4.1855E-05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	-4.1855E-05
8	8	0.0000E+00	0.0000E+00	2.7264E-05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	2.7264E-05
9	9	0.0000E+00	0.0000E+00	-1.7092E-05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	-1.7092E-05
10	10	0.0000E+00	0.0000E+00	-8.3252E-06	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	-8.3252E-06
11	11	0.0000E+00	0.0000E+00	-5.7217E-05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	-5.7217E-05
12	12	0.0000E+00	0.0000E+00	-1.4729E-05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	-1.4729E-05
13	13	0.0000E+00	0.0000E+00	-2.9106E-05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	-2.9106E-05
14	14	0.0000E+00	0.0000E+00	-1.1607E-05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	-1.1607E-05
15	15	0.0000E+00	0.0000E+00	-2.4939E-05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	-2.4939E-05
16	16	0.0000E+00	0.0000E+00	-1.3319E-05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	-1.3319E-05
17	17	0.0000E+00	0.0000E+00	-2.8455E-05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	-2.8455E-05
18	18	0.0000E+00	0.0000E+00	-1.0099E-05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	-1.0099E-05
19	19	0.0000E+00	0.0000E+00	-2.7573E-05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	-2.7573E-05
20	20	0.0000E+00	0.0000E+00	-3.8770E-05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	-3.8770E-05
21	21	0.0000E+00	0.0000E+00	1.0646E-05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	1.0646E-05
22	22	0.0000E+00	0.0000E+00	-1.8521E-05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	-1.8521E-05
23	23	0.0000E+00	0.0000E+00	-5.6121E-05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	-5.6121E-05
24	24	0.0000E+00	0.0000E+00	1.4449E-04	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	1.4449E-04
25	25	0.0000E+00	0.0000E+00	-2.4141E-05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	-2.4141E-05
26	26	0.0000E+00	0.0000E+00	3.8289E-05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	3.8289E-05
27	27	0.0000E+00	0.0000E+00	1.0434E-04	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	1.0434E-04
28	28	0.0000E+00	0.0000E+00	1.9577E-05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	1.9577E-05
29	29	0.0000E+00	0.0000E+00	3.0736E-05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	3.0736E-05
30	30	0.0000E+00	0.0000E+00	2.1628E-04	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	2.1628E-04
31	31	0.0000E+00	0.0000E+00	-1.7682E-05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	-1.7682E-05
32	32	0.0000E+00	0.0000E+00	4.4407E-05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	4.4407E-05
33	33	0.0000E+00	0.0000E+00	6.7578E-05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	6.7578E-05
34	34	0.0000E+00	0.0000E+00	-8.2784E-05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	-8.2784E-05
35	35	0.0000E+00	0.0000E+00	-1.0533E-04	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	-1.0533E-04

36	36	0.0000E+00	0.0000E+00	1.8254E-05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	1.8254E-05
37	37	0.0000E+00	0.0000E+00	7.0668E-05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	7.0668E-05
38	38	0.0000E+00	0.0000E+00	-3.6731E-05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	-3.6731E-05
39	39	0.0000E+00	0.0000E+00	-5.1379E-06	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	-5.1379E-06
40	40	0.0000E+00	0.0000E+00	-1.7573E-04	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	-1.7573E-04
41	41	0.0000E+00	0.0000E+00	1.0329E-05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	1.0329E-05
42	42	0.0000E+00	0.0000E+00	-6.4920E-05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	-6.4920E-05
43	43	0.0000E+00	0.0000E+00	-1.5639E-05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	-1.5639E-05
44	44	0.0000E+00	0.0000E+00	3.1126E-05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	3.1126E-05
45	45	0.0000E+00	0.0000E+00	-3.3170E-05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	-3.3170E-05
46	46	0.0000E+00	0.0000E+00	6.9475E-05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	6.9475E-05
47	47	0.0000E+00	0.0000E+00	2.7558E-05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	2.7558E-05
48	48	0.0000E+00	0.0000E+00	1.2982E-05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	1.2982E-05
49	49	0.0000E+00	0.0000E+00	1.4062E-05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	1.4062E-05
50	50	0.0000E+00	0.0000E+00	2.1985E-05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	2.1985E-05
51	51	0.0000E+00	0.0000E+00	-3.7633E-05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	-3.7633E-05
52	52	0.0000E+00	0.0000E+00	-8.8138E-05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	-8.8138E-05
53	53	0.0000E+00	0.0000E+00	-4.6728E-05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	-4.6728E-05
54	54	0.0000E+00	0.0000E+00	1.0977E-05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	1.0977E-05
55	55	0.0000E+00	0.0000E+00	-7.8158E-05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	-7.8158E-05
56	56	0.0000E+00	0.0000E+00	2.8260E-05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	2.8260E-05
57	57	0.0000E+00	0.0000E+00	-6.1977E-05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	-6.1977E-05
58	58	0.0000E+00	0.0000E+00	-7.8656E-06	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	-7.8656E-06
59	59	0.0000E+00	0.0000E+00	-3.4783E-05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	-3.4783E-05
60	60	0.0000E+00	0.0000E+00	1.0902E-04	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	1.0902E-04
61	61	0.0000E+00	0.0000E+00	9.1202E-05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	9.1202E-05
62	62	0.0000E+00	0.0000E+00	-2.5934E-04	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	-2.5934E-04
63	63	0.0000E+00	0.0000E+00	4.4205E-04	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	4.4205E-04
64	64	0.0000E+00	0.0000E+00	1.0209E-05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	1.0209E-05
65	65	0.0000E+00	0.0000E+00	-1.9988E-05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	-1.9988E-05
66	66	0.0000E+00	0.0000E+00	-3.3204E-06	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	-3.3204E-06
67	67	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
68	68	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
total		0.0000E+00	0.0000E+00	4.5185E-05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	4.5185E-05

1neutron weight balance in each cell -- physical events print table 130

	cell	(n,xn)	fission	capture	loss to (n,xn)	loss to fission	total
1	1	0.0000E+00	0.0000E+00	-4.4939E-04	0.0000E+00	0.0000E+00	-4.4939E-04
2	2	0.0000E+00	0.0000E+00	-2.3381E-03	0.0000E+00	-1.8799E-03	-4.2180E-03
3	3	0.0000E+00	0.0000E+00	-5.5508E-03	0.0000E+00	-4.3158E-03	-9.8666E-03
4	4	0.0000E+00	0.0000E+00	-8.2623E-03	0.0000E+00	-6.5284E-03	-1.4791E-02
5	5	0.0000E+00	0.0000E+00	-1.0117E-02	0.0000E+00	-7.6890E-03	-1.7806E-02
6	6	0.0000E+00	0.0000E+00	-7.5763E-03	0.0000E+00	-5.8737E-03	-1.3450E-02
7	7	0.0000E+00	0.0000E+00	-5.2269E-03	0.0000E+00	-4.0482E-03	-9.2751E-03
8	8	0.0000E+00	0.0000E+00	-2.2507E-03	0.0000E+00	-1.7755E-03	-4.0262E-03
9	9	0.0000E+00	0.0000E+00	-1.9161E-04	0.0000E+00	0.0000E+00	-1.9161E-04
10	10	0.0000E+00	0.0000E+00	-1.2109E-02	0.0000E+00	0.0000E+00	-1.2109E-02
11	11	0.0000E+00	0.0000E+00	-5.4880E-04	0.0000E+00	0.0000E+00	-5.4880E-04
12	12	0.0000E+00	0.0000E+00	-3.0042E-03	0.0000E+00	-2.3145E-03	-5.3187E-03
13	13	0.0000E+00	0.0000E+00	-7.3943E-03	0.0000E+00	-5.8727E-03	-1.3267E-02
14	14	0.0000E+00	0.0000E+00	-1.2464E-02	0.0000E+00	-9.6014E-03	-2.2065E-02
15	15	0.0000E+00	0.0000E+00	-1.5070E-02	0.0000E+00	-1.1894E-02	-2.6965E-02
16	16	0.0000E+00	0.0000E+00	-1.1359E-02	0.0000E+00	-8.8066E-03	-2.0166E-02
17	17	0.0000E+00	0.0000E+00	-6.2272E-03	0.0000E+00	-5.1173E-03	-1.1344E-02
18	18	0.0000E+00	0.0000E+00	-2.9867E-03	0.0000E+00	-2.3569E-03	-5.3435E-03
19	19	0.0000E+00	0.0000E+00	-2.4059E-04	0.0000E+00	0.0000E+00	-2.4059E-04
20	20	0.0000E+00	0.0000E+00	-1.7799E-02	0.0000E+00	0.0000E+00	-1.7799E-02
21	21	0.0000E+00	0.0000E+00	-8.1335E-04	0.0000E+00	0.0000E+00	-8.1335E-04
22	22	0.0000E+00	0.0000E+00	-4.3695E-03	0.0000E+00	-3.2130E-03	-7.5825E-03
23	23	0.0000E+00	0.0000E+00	-9.6867E-03	0.0000E+00	-7.5528E-03	-1.7240E-02
24	24	0.0000E+00	0.0000E+00	-1.4792E-02	0.0000E+00	-1.1430E-02	-2.6222E-02
25	25	0.0000E+00	0.0000E+00	-1.7446E-02	0.0000E+00	-1.3389E-02	-3.0835E-02
26	26	0.0000E+00	0.0000E+00	-1.2736E-02	0.0000E+00	-9.6325E-03	-2.2369E-02
27	27	0.0000E+00	0.0000E+00	-7.5379E-03	0.0000E+00	-5.5872E-03	-1.3125E-02
28	28	0.0000E+00	0.0000E+00	-2.7444E-03	0.0000E+00	-2.2123E-03	-4.9567E-03
29	29	0.0000E+00	0.0000E+00	-3.7510E-04	0.0000E+00	0.0000E+00	-3.7510E-04
30	30	0.0000E+00	0.0000E+00	-1.9249E-02	0.0000E+00	0.0000E+00	-1.9249E-02
31	31	0.0000E+00	0.0000E+00	-7.8459E-04	0.0000E+00	0.0000E+00	-7.8459E-04
32	32	0.0000E+00	0.0000E+00	-5.0402E-03	0.0000E+00	-3.9905E-03	-9.0307E-03
33	33	0.0000E+00	0.0000E+00	-1.0277E-02	0.0000E+00	-7.9860E-03	-1.8263E-02

34	34	0.0000E+00	0.0000E+00	-1.4837E-02	0.0000E+00	-1.1479E-02	-2.6316E-02
35	35	0.0000E+00	0.0000E+00	-1.5831E-02	0.0000E+00	-1.2402E-02	-2.8233E-02
36	36	0.0000E+00	0.0000E+00	-1.0400E-02	0.0000E+00	-8.1642E-03	-1.8564E-02
37	37	0.0000E+00	0.0000E+00	-6.5176E-03	0.0000E+00	-5.2584E-03	-1.1776E-02
38	38	0.0000E+00	0.0000E+00	-2.9400E-03	0.0000E+00	-2.3689E-03	-5.3088E-03
39	39	0.0000E+00	0.0000E+00	-3.5849E-04	0.0000E+00	0.0000E+00	-3.5849E-04
40	40	0.0000E+00	0.0000E+00	-1.6712E-02	0.0000E+00	0.0000E+00	-1.6712E-02
41	41	0.0000E+00	0.0000E+00	-1.1353E-03	0.0000E+00	0.0000E+00	-1.1353E-03
42	42	0.0000E+00	0.0000E+00	-6.6886E-03	0.0000E+00	-5.3647E-03	-1.2053E-02
43	43	0.0000E+00	0.0000E+00	-1.4913E-02	0.0000E+00	-1.1676E-02	-2.6589E-02
44	44	0.0000E+00	0.0000E+00	-2.0689E-02	0.0000E+00	-1.5651E-02	-3.6340E-02
45	45	0.0000E+00	0.0000E+00	-2.1716E-02	0.0000E+00	-1.6568E-02	-3.8283E-02
46	46	0.0000E+00	0.0000E+00	-1.7809E-02	0.0000E+00	-1.3457E-02	-3.1266E-02
47	47	0.0000E+00	0.0000E+00	-1.1512E-02	0.0000E+00	-8.8561E-03	-2.0369E-02
48	48	0.0000E+00	0.0000E+00	-4.1358E-03	0.0000E+00	-3.2412E-03	-7.3770E-03
49	49	0.0000E+00	0.0000E+00	-4.3370E-04	0.0000E+00	0.0000E+00	-4.3370E-04
50	50	0.0000E+00	0.0000E+00	-2.5281E-02	0.0000E+00	0.0000E+00	-2.5281E-02
51	51	0.0000E+00	0.0000E+00	-1.0512E-03	0.0000E+00	0.0000E+00	-1.0512E-03
52	52	0.0000E+00	0.0000E+00	-7.8851E-03	0.0000E+00	-6.1015E-03	-1.3987E-02
53	53	0.0000E+00	0.0000E+00	-1.4290E-02	0.0000E+00	-1.0730E-02	-2.5020E-02
54	54	0.0000E+00	0.0000E+00	-1.9386E-02	0.0000E+00	-1.4648E-02	-3.4034E-02
55	55	0.0000E+00	0.0000E+00	-1.8825E-02	0.0000E+00	-1.4299E-02	-3.3124E-02
56	56	0.0000E+00	0.0000E+00	-1.3695E-02	0.0000E+00	-1.0986E-02	-2.4682E-02
57	57	0.0000E+00	0.0000E+00	-1.1298E-02	0.0000E+00	-8.4526E-03	-1.9751E-02
58	58	0.0000E+00	0.0000E+00	-4.5749E-03	0.0000E+00	-3.5908E-03	-8.1657E-03
59	59	0.0000E+00	0.0000E+00	-4.7551E-04	0.0000E+00	0.0000E+00	-4.7551E-04
60	60	0.0000E+00	0.0000E+00	-2.2534E-02	0.0000E+00	0.0000E+00	-2.2534E-02
61	61	0.0000E+00	0.0000E+00	-9.8566E-03	0.0000E+00	0.0000E+00	-9.8566E-03
62	62	0.0000E+00	0.0000E+00	-7.9073E-02	0.0000E+00	0.0000E+00	-7.9073E-02
63	63	0.0000E+00	0.0000E+00	-1.1446E-02	0.0000E+00	0.0000E+00	-1.1446E-02
64	64	0.0000E+00	0.0000E+00	-1.8404E-04	0.0000E+00	0.0000E+00	-1.8404E-04
65	65	0.0000E+00	0.0000E+00	-2.9731E-04	0.0000E+00	0.0000E+00	-2.9731E-04
66	66	0.0000E+00	0.0000E+00	-4.5876E-04	0.0000E+00	0.0000E+00	-4.5876E-04
67	67	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
68	68	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
total		0.0000E+00	0.0000E+00	-6.4426E-01	0.0000E+00	-3.2636E-01	-9.7062E-01

1neutron activity of each nuclide in each cell, per source particle print table 140

	cell	nuclides	atom fraction	total collisions	collisions * weight	weight lost to capture	weight loss to fission	weight gain by (n,xn)
1	1	6000.50c	4.4858E-02	9	1.4194E-04	1.7328E-08	0.0000E+00	0.0000E+00
		26000.55c	9.5514E-01	518	6.7491E-03	4.4937E-04	0.0000E+00	0.0000E+00
2	2	1001.50c	5.4858E-01	22712	3.0700E-01	1.4446E-03	0.0000E+00	0.0000E+00
		6000.50c	3.5369E-01	2013	3.0038E-02	1.0811E-05	0.0000E+00	0.0000E+00
		8016.50c	9.7449E-02	455	6.9839E-03	2.3729E-06	0.0000E+00	0.0000E+00
		94239.55c	2.6236E-04	206	4.5070E-03	7.9022E-04	1.8799E-03	0.0000E+00
		94240.50c	1.6746E-05	6	1.0778E-04	9.0131E-05	1.6111E-08	0.0000E+00
3	3	1001.50c	5.4858E-01	53921	7.2719E-01	3.4179E-03	0.0000E+00	0.0000E+00
		6000.50c	3.5369E-01	4989	7.4403E-02	2.9678E-05	0.0000E+00	0.0000E+00
		8016.50c	9.7449E-02	1165	1.7493E-02	7.7025E-06	0.0000E+00	0.0000E+00
		94239.55c	2.6236E-04	491	1.0548E-02	1.8702E-03	4.3158E-03	0.0000E+00
		94240.50c	1.6746E-05	15	2.3709E-04	2.2532E-04	4.1758E-08	0.0000E+00
4	4	1001.50c	5.4858E-01	81721	1.0838E+00	5.1094E-03	0.0000E+00	0.0000E+00
		6000.50c	3.5369E-01	7562	1.1014E-01	4.1024E-05	0.0000E+00	0.0000E+00
		8016.50c	9.7449E-02	1624	2.4239E-02	6.0125E-06	0.0000E+00	0.0000E+00
		94239.55c	2.6236E-04	745	1.5875E-02	2.8072E-03	6.5283E-03	0.0000E+00
		94240.50c	1.6746E-05	21	3.1292E-04	2.9868E-04	5.5065E-08	0.0000E+00
5	5	1001.50c	5.4858E-01	100750	1.3431E+00	6.2890E-03	0.0000E+00	0.0000E+00
		6000.50c	3.5369E-01	9265	1.3531E-01	5.0168E-05	0.0000E+00	0.0000E+00
		8016.50c	9.7449E-02	2147	3.1513E-02	1.5486E-05	0.0000E+00	0.0000E+00
		94239.55c	2.6236E-04	872	1.8912E-02	3.2361E-03	7.6889E-03	0.0000E+00
		94240.50c	1.6746E-05	39	5.5803E-04	5.2613E-04	1.0295E-07	0.0000E+00
6	6	1001.50c	5.4858E-01	71366	9.7546E-01	4.5893E-03	0.0000E+00	0.0000E+00
		6000.50c	3.5369E-01	6508	9.7511E-02	3.2978E-05	0.0000E+00	0.0000E+00
		8016.50c	9.7449E-02	1473	2.2490E-02	2.1572E-05	0.0000E+00	0.0000E+00
		94239.55c	2.6236E-04	659	1.4331E-02	2.5311E-03	5.8688E-03	0.0000E+00

		94240.50c	1.6746E-05	27	4.4113E-04	4.0130E-04	4.9509E-06	0.0000E+00
7	7	1001.50c	5.4858E-01	49528	6.7758E-01	3.1808E-03	0.0000E+00	0.0000E+00
		6000.50c	3.5369E-01	4368	6.6609E-02	2.9973E-05	0.0000E+00	0.0000E+00
		8016.50c	9.7449E-02	1003	1.5489E-02	9.1635E-06	0.0000E+00	0.0000E+00
		94239.55c	2.6236E-04	443	9.8327E-03	1.7318E-03	4.0482E-03	0.0000E+00
		94240.50c	1.6746E-05	17	2.9499E-04	2.7517E-04	5.7256E-08	0.0000E+00
8	8	1001.50c	5.4858E-01	22240	3.0244E-01	1.4332E-03	0.0000E+00	0.0000E+00
		6000.50c	3.5369E-01	2038	3.1040E-02	1.4447E-05	0.0000E+00	0.0000E+00
		8016.50c	9.7449E-02	527	8.1217E-03	6.0300E-06	0.0000E+00	0.0000E+00
		94239.55c	2.6236E-04	198	4.3367E-03	7.4130E-04	1.7755E-03	0.0000E+00
		94240.50c	1.6746E-05	3	5.8368E-05	5.5710E-05	1.0333E-08	0.0000E+00
9	9	6000.50c	4.4858E-02	4	5.7481E-05	1.9812E-08	0.0000E+00	0.0000E+00
		26000.55c	9.5514E-01	171	2.1228E-03	1.9159E-04	0.0000E+00	0.0000E+00
10	10	6000.50c	4.4858E-02	283	3.8542E-03	8.0012E-07	0.0000E+00	0.0000E+00
		26000.55c	9.5514E-01	12695	1.6289E-01	1.2108E-02	0.0000E+00	0.0000E+00
11	11	6000.50c	4.4858E-02	18	2.4930E-04	4.3397E-08	0.0000E+00	0.0000E+00
		26000.55c	9.5514E-01	612	7.7940E-03	5.4876E-04	0.0000E+00	0.0000E+00
12	12	1001.50c	5.4858E-01	28759	3.9253E-01	1.8496E-03	0.0000E+00	0.0000E+00
		6000.50c	3.5369E-01	2506	3.7940E-02	1.9619E-05	0.0000E+00	0.0000E+00
		8016.50c	9.7449E-02	552	8.5657E-03	1.8726E-06	0.0000E+00	0.0000E+00
		94239.55c	2.6236E-04	260	5.6539E-03	9.8174E-04	2.3145E-03	0.0000E+00
		94240.50c	1.6746E-05	10	1.5806E-04	1.5133E-04	2.8053E-08	0.0000E+00
13	13	1001.50c	5.4858E-01	70385	9.5313E-01	4.4785E-03	0.0000E+00	0.0000E+00
		6000.50c	3.5369E-01	6341	9.4059E-02	3.2654E-05	0.0000E+00	0.0000E+00
		8016.50c	9.7449E-02	1439	2.2243E-02	1.1979E-05	0.0000E+00	0.0000E+00
		94239.55c	2.6236E-04	646	1.4119E-02	2.5364E-03	5.8727E-03	0.0000E+00
		94240.50c	1.6746E-05	24	3.4581E-04	3.3475E-04	6.3211E-08	0.0000E+00
14	14	1001.50c	5.4858E-01	122789	1.6446E+00	7.7060E-03	0.0000E+00	0.0000E+00
		6000.50c	3.5369E-01	11344	1.6667E-01	5.9124E-05	0.0000E+00	0.0000E+00
		8016.50c	9.7449E-02	2651	3.9692E-02	2.4422E-05	0.0000E+00	0.0000E+00
		94239.55c	2.6236E-04	1088	2.3687E-02	4.1834E-03	9.5993E-03	0.0000E+00
		94240.50c	1.6746E-05	34	5.3223E-04	4.9065E-04	2.1627E-06	0.0000E+00
15	15	1001.50c	5.4858E-01	149025	1.9919E+00	9.3205E-03	0.0000E+00	0.0000E+00
		6000.50c	3.5369E-01	13722	2.0093E-01	7.4853E-05	0.0000E+00	0.0000E+00
		8016.50c	9.7449E-02	3251	4.8792E-02	3.7818E-05	0.0000E+00	0.0000E+00
		94239.55c	2.6236E-04	1329	2.8862E-02	5.1120E-03	1.1891E-02	0.0000E+00
		94240.50c	1.6746E-05	39	5.7269E-04	5.2524E-04	3.5695E-06	0.0000E+00
16	16	1001.50c	5.4858E-01	107391	1.4747E+00	6.8620E-03	0.0000E+00	0.0000E+00
		6000.50c	3.5369E-01	9891	1.4962E-01	5.5752E-05	0.0000E+00	0.0000E+00
		8016.50c	9.7449E-02	2261	3.4725E-02	1.0995E-05	0.0000E+00	0.0000E+00
		94239.55c	2.6236E-04	970	2.1410E-02	3.7918E-03	8.8064E-03	0.0000E+00
		94240.50c	1.6746E-05	44	6.8407E-04	6.3858E-04	1.2060E-07	0.0000E+00
17	17	1001.50c	5.4858E-01	58117	7.9796E-01	3.7312E-03	0.0000E+00	0.0000E+00
		6000.50c	3.5369E-01	5240	7.9625E-02	3.3291E-05	0.0000E+00	0.0000E+00
		8016.50c	9.7449E-02	1213	1.8327E-02	1.2815E-05	0.0000E+00	0.0000E+00
		94239.55c	2.6236E-04	558	1.2111E-02	2.2233E-03	5.1172E-03	0.0000E+00
		94240.50c	1.6746E-05	16	2.5350E-04	2.2649E-04	1.2706E-07	0.0000E+00
18	18	1001.50c	5.4858E-01	27800	3.8940E-01	1.7985E-03	0.0000E+00	0.0000E+00
		6000.50c	3.5369E-01	2556	3.9932E-02	1.3563E-05	0.0000E+00	0.0000E+00
		8016.50c	9.7449E-02	617	9.7312E-03	1.2245E-05	0.0000E+00	0.0000E+00
		94239.55c	2.6236E-04	261	5.7360E-03	1.0305E-03	2.3568E-03	0.0000E+00
		94240.50c	1.6746E-05	9	1.3807E-04	1.3187E-04	2.4744E-08	0.0000E+00
19	19	6000.50c	4.4858E-02	4	5.9973E-05	6.5461E-09	0.0000E+00	0.0000E+00
		26000.55c	9.5514E-01	221	2.9839E-03	2.4058E-04	0.0000E+00	0.0000E+00
20	20	6000.50c	4.4858E-02	386	5.4295E-03	1.1358E-06	0.0000E+00	0.0000E+00
		26000.55c	9.5514E-01	18906	2.4452E-01	1.7798E-02	0.0000E+00	0.0000E+00
21	21	6000.50c	4.4858E-02	23	2.8354E-04	9.0760E-08	0.0000E+00	0.0000E+00
		26000.55c	9.5514E-01	838	1.0579E-02	8.1326E-04	0.0000E+00	0.0000E+00

22	22	1001.50c	5.4858E-01	42742	5.8858E-01	2.7529E-03	0.0000E+00	0.0000E+00
		6000.50c	3.5369E-01	3889	5.8996E-02	2.1888E-05	0.0000E+00	0.0000E+00
		8016.50c	9.7449E-02	882	1.3653E-02	1.4809E-05	0.0000E+00	0.0000E+00
		94239.55c	2.6236E-04	354	8.1261E-03	1.3930E-03	3.2130E-03	0.0000E+00
		94240.50c	1.6746E-05	14	2.0065E-04	1.8696E-04	4.0241E-08	0.0000E+00
23	23	1001.50c	5.4858E-01	91954	1.2691E+00	5.9626E-03	0.0000E+00	0.0000E+00
		6000.50c	3.5369E-01	8352	1.2747E-01	4.9687E-05	0.0000E+00	0.0000E+00
		8016.50c	9.7449E-02	1968	3.0005E-02	1.3278E-05	0.0000E+00	0.0000E+00
		94239.55c	2.6236E-04	833	1.8401E-02	3.2692E-03	7.5485E-03	0.0000E+00
		94240.50c	1.6746E-05	27	4.3088E-04	3.9197E-04	4.3888E-06	0.0000E+00
24	24	1001.50c	5.4858E-01	145789	1.9546E+00	9.2368E-03	0.0000E+00	0.0000E+00
		6000.50c	3.5369E-01	13132	1.9453E-01	8.3071E-05	0.0000E+00	0.0000E+00
		8016.50c	9.7449E-02	3089	4.6901E-02	3.0367E-05	0.0000E+00	0.0000E+00
		94239.55c	2.6236E-04	1288	2.8168E-02	4.9109E-03	1.1430E-02	0.0000E+00
		94240.50c	1.6746E-05	37	5.4995E-04	5.3058E-04	9.9597E-08	0.0000E+00
25	25	1001.50c	5.4858E-01	172140	2.3222E+00	1.0914E-02	0.0000E+00	0.0000E+00
		6000.50c	3.5369E-01	15654	2.3122E-01	8.8373E-05	0.0000E+00	0.0000E+00
		8016.50c	9.7449E-02	3666	5.5785E-02	4.5216E-05	0.0000E+00	0.0000E+00
		94239.55c	2.6236E-04	1503	3.3024E-02	5.7119E-03	1.3389E-02	0.0000E+00
		94240.50c	1.6746E-05	51	7.1688E-04	6.8607E-04	1.2838E-07	0.0000E+00
26	26	1001.50c	5.4858E-01	122907	1.6829E+00	7.9453E-03	0.0000E+00	0.0000E+00
		6000.50c	3.5369E-01	11149	1.6807E-01	5.8631E-05	0.0000E+00	0.0000E+00
		8016.50c	9.7449E-02	2654	4.0538E-02	2.4073E-05	0.0000E+00	0.0000E+00
		94239.55c	2.6236E-04	1082	2.3842E-02	4.1759E-03	9.6322E-03	0.0000E+00
		94240.50c	1.6746E-05	37	5.4982E-04	5.3220E-04	2.2225E-07	0.0000E+00
27	27	1001.50c	5.4858E-01	73315	9.9528E-01	4.6985E-03	0.0000E+00	0.0000E+00
		6000.50c	3.5369E-01	6470	9.6830E-02	3.3446E-05	0.0000E+00	0.0000E+00
		8016.50c	9.7449E-02	1494	2.2995E-02	1.0395E-05	0.0000E+00	0.0000E+00
		94239.55c	2.6236E-04	616	1.3940E-02	2.4385E-03	5.5871E-03	0.0000E+00
		94240.50c	1.6746E-05	25	3.9207E-04	3.5696E-04	7.3255E-08	0.0000E+00
28	28	1001.50c	5.4858E-01	27054	3.6697E-01	1.7308E-03	0.0000E+00	0.0000E+00
		6000.50c	3.5369E-01	2450	3.7069E-02	1.7220E-05	0.0000E+00	0.0000E+00
		8016.50c	9.7449E-02	562	8.7311E-03	4.4645E-06	0.0000E+00	0.0000E+00
		94239.55c	2.6236E-04	251	5.4009E-03	9.2453E-04	2.2123E-03	0.0000E+00
		94240.50c	1.6746E-05	5	8.1361E-05	6.7327E-05	1.5965E-08	0.0000E+00
29	29	6000.50c	4.4858E-02	7	7.0643E-05	3.3583E-08	0.0000E+00	0.0000E+00
		26000.55c	9.5514E-01	306	3.8730E-03	3.7507E-04	0.0000E+00	0.0000E+00
30	30	6000.50c	4.4858E-02	405	5.5527E-03	1.6552E-06	0.0000E+00	0.0000E+00
		26000.55c	9.5514E-01	20280	2.6160E-01	1.9247E-02	0.0000E+00	0.0000E+00
31	31	6000.50c	4.4858E-02	27	3.4757E-04	9.3932E-08	0.0000E+00	0.0000E+00
		26000.55c	9.5514E-01	922	1.2553E-02	7.8449E-04	0.0000E+00	0.0000E+00
32	32	1001.50c	5.4858E-01	48858	6.7223E-01	3.1635E-03	0.0000E+00	0.0000E+00
		6000.50c	3.5369E-01	4400	6.7699E-02	2.0368E-05	0.0000E+00	0.0000E+00
		8016.50c	9.7449E-02	998	1.5704E-02	6.2043E-06	0.0000E+00	0.0000E+00
		94239.55c	2.6236E-04	430	9.6343E-03	1.6999E-03	3.9905E-03	0.0000E+00
		94240.50c	1.6746E-05	12	1.6544E-04	1.5030E-04	3.3744E-08	0.0000E+00
33	33	1001.50c	5.4858E-01	96680	1.3343E+00	6.2737E-03	0.0000E+00	0.0000E+00
		6000.50c	3.5369E-01	8840	1.3417E-01	5.7092E-05	0.0000E+00	0.0000E+00
		8016.50c	9.7449E-02	2088	3.2634E-02	2.7102E-05	0.0000E+00	0.0000E+00
		94239.55c	2.6236E-04	877	1.9449E-02	3.4767E-03	7.9809E-03	0.0000E+00
		94240.50c	1.6746E-05	32	5.1667E-04	4.4275E-04	5.0112E-06	0.0000E+00
34	34	1001.50c	5.4858E-01	143405	1.9416E+00	9.1495E-03	0.0000E+00	0.0000E+00
		6000.50c	3.5369E-01	13216	1.9602E-01	7.8203E-05	0.0000E+00	0.0000E+00
		8016.50c	9.7449E-02	3100	4.6993E-02	3.2812E-05	0.0000E+00	0.0000E+00
		94239.55c	2.6236E-04	1296	2.8067E-02	4.8911E-03	1.1479E-02	0.0000E+00
		94240.50c	1.6746E-05	46	7.1657E-04	6.8549E-04	1.2794E-07	0.0000E+00
35	35	1001.50c	5.4858E-01	154185	2.0956E+00	9.7914E-03	0.0000E+00	0.0000E+00
		6000.50c	3.5369E-01	14221	2.1086E-01	8.9917E-05	0.0000E+00	0.0000E+00
		8016.50c	9.7449E-02	3337	5.0462E-02	4.1717E-05	0.0000E+00	0.0000E+00
		94239.55c	2.6236E-04	1397	3.0146E-02	5.2920E-03	1.2402E-02	0.0000E+00

		94240.50c	1.6746E-05	41	6.4595E-04	6.1576E-04	1.2210E-07	0.0000E+00
36	36	1001.50c	5.4858E-01	97925	1.3426E+00	6.3252E-03	0.0000E+00	0.0000E+00
		6000.50c	3.5369E-01	8801	1.3244E-01	4.9013E-05	0.0000E+00	0.0000E+00
		8016.50c	9.7449E-02	2079	3.1989E-02	1.6465E-05	0.0000E+00	0.0000E+00
		94239.55c	2.6236E-04	902	1.9737E-02	3.5258E-03	8.1640E-03	0.0000E+00
		94240.50c	1.6746E-05	33	5.3703E-04	4.8317E-04	2.1494E-07	0.0000E+00
37	37	1001.50c	5.4858E-01	61668	8.4195E-01	3.9766E-03	0.0000E+00	0.0000E+00
		6000.50c	3.5369E-01	5517	8.3007E-02	3.9753E-05	0.0000E+00	0.0000E+00
		8016.50c	9.7449E-02	1244	1.9315E-02	5.4063E-06	0.0000E+00	0.0000E+00
		94239.55c	2.6236E-04	570	1.2584E-02	2.2526E-03	5.2584E-03	0.0000E+00
		94240.50c	1.6746E-05	17	2.5332E-04	2.4328E-04	4.5745E-08	0.0000E+00
38	38	1001.50c	5.4858E-01	28355	3.8675E-01	1.8177E-03	0.0000E+00	0.0000E+00
		6000.50c	3.5369E-01	2588	3.9323E-02	1.2366E-05	0.0000E+00	0.0000E+00
		8016.50c	9.7449E-02	560	8.8041E-03	7.0497E-06	0.0000E+00	0.0000E+00
		94239.55c	2.6236E-04	256	5.6666E-03	1.0027E-03	2.3689E-03	0.0000E+00
		94240.50c	1.6746E-05	8	1.0424E-04	1.0016E-04	1.8846E-08	0.0000E+00
39	39	6000.50c	4.4858E-02	3	4.2813E-05	5.7828E-09	0.0000E+00	0.0000E+00
		26000.55c	9.5514E-01	303	3.7957E-03	3.5848E-04	0.0000E+00	0.0000E+00
40	40	6000.50c	4.4858E-02	390	5.7707E-03	1.0486E-06	0.0000E+00	0.0000E+00
		26000.55c	9.5514E-01	17713	2.2995E-01	1.6711E-02	0.0000E+00	0.0000E+00
41	41	6000.50c	4.4858E-02	24	3.3122E-04	5.7181E-08	0.0000E+00	0.0000E+00
		26000.55c	9.5514E-01	1219	1.5365E-02	1.1353E-03	0.0000E+00	0.0000E+00
42	42	1001.50c	5.4858E-01	63446	8.7123E-01	4.0785E-03	0.0000E+00	0.0000E+00
		6000.50c	3.5369E-01	5851	8.8786E-02	3.5885E-05	0.0000E+00	0.0000E+00
		8016.50c	9.7449E-02	1332	2.0612E-02	2.1393E-05	0.0000E+00	0.0000E+00
		94239.55c	2.6236E-04	581	1.2838E-02	2.2601E-03	5.3645E-03	0.0000E+00
		94240.50c	1.6746E-05	20	3.2867E-04	2.9272E-04	1.3764E-07	0.0000E+00
43	43	1001.50c	5.4858E-01	140515	1.9541E+00	9.1393E-03	0.0000E+00	0.0000E+00
		6000.50c	3.5369E-01	13116	2.0062E-01	7.2787E-05	0.0000E+00	0.0000E+00
		8016.50c	9.7449E-02	2990	4.6855E-02	3.1209E-05	0.0000E+00	0.0000E+00
		94239.55c	2.6236E-04	1288	2.8392E-02	5.0081E-03	1.1676E-02	0.0000E+00
		94240.50c	1.6746E-05	44	6.8897E-04	6.6181E-04	1.2399E-07	0.0000E+00
44	44	1001.50c	5.4858E-01	202567	2.7177E+00	1.2926E-02	0.0000E+00	0.0000E+00
		6000.50c	3.5369E-01	18056	2.6719E-01	1.0670E-04	0.0000E+00	0.0000E+00
		8016.50c	9.7449E-02	4230	6.3352E-02	3.4411E-05	0.0000E+00	0.0000E+00
		94239.55c	2.6236E-04	1758	3.8678E-02	6.7095E-03	1.5651E-02	0.0000E+00
		94240.50c	1.6746E-05	61	9.6984E-04	9.1214E-04	2.9044E-07	0.0000E+00
45	45	1001.50c	5.4858E-01	213060	2.8730E+00	1.3485E-02	0.0000E+00	0.0000E+00
		6000.50c	3.5369E-01	19624	2.9075E-01	1.1909E-04	0.0000E+00	0.0000E+00
		8016.50c	9.7449E-02	4545	6.9199E-02	3.3320E-05	0.0000E+00	0.0000E+00
		94239.55c	2.6236E-04	1873	4.0965E-02	7.1275E-03	1.6563E-02	0.0000E+00
		94240.50c	1.6746E-05	66	1.0344E-03	9.5081E-04	4.7605E-06	0.0000E+00
46	46	1001.50c	5.4858E-01	174962	2.3656E+00	1.1203E-02	0.0000E+00	0.0000E+00
		6000.50c	3.5369E-01	15982	2.3804E-01	8.5264E-05	0.0000E+00	0.0000E+00
		8016.50c	9.7449E-02	3590	5.4997E-02	3.9214E-05	0.0000E+00	0.0000E+00
		94239.55c	2.6236E-04	1508	3.3409E-02	5.7598E-03	1.3457E-02	0.0000E+00
		94240.50c	1.6746E-05	51	7.5881E-04	7.2197E-04	1.3389E-07	0.0000E+00
47	47	1001.50c	5.4858E-01	111485	1.5226E+00	7.2140E-03	0.0000E+00	0.0000E+00
		6000.50c	3.5369E-01	10165	1.5254E-01	6.0889E-05	0.0000E+00	0.0000E+00
		8016.50c	9.7449E-02	2297	3.5543E-02	1.0628E-05	0.0000E+00	0.0000E+00
		94239.55c	2.6236E-04	983	2.1876E-02	3.7920E-03	8.8559E-03	0.0000E+00
		94240.50c	1.6746E-05	29	4.5294E-04	4.3490E-04	1.9540E-07	0.0000E+00
48	48	1001.50c	5.4858E-01	41479	5.7559E-01	2.6791E-03	0.0000E+00	0.0000E+00
		6000.50c	3.5369E-01	3816	5.7911E-02	2.1297E-05	0.0000E+00	0.0000E+00
		8016.50c	9.7449E-02	852	1.3372E-02	2.8968E-06	0.0000E+00	0.0000E+00
		94239.55c	2.6236E-04	358	8.0341E-03	1.3597E-03	3.2411E-03	0.0000E+00
		94240.50c	1.6746E-05	6	7.3536E-05	7.2818E-05	1.4295E-08	0.0000E+00
49	49	6000.50c	4.4858E-02	13	1.4051E-04	5.2418E-08	0.0000E+00	0.0000E+00
		26000.55c	9.5514E-01	375	4.5226E-03	4.3365E-04	0.0000E+00	0.0000E+00

50	50	6000.50c	4.4858E-02	568	8.0526E-03	3.7394E-06	0.0000E+00	0.0000E+00
		26000.55c	9.5514E-01	27180	3.5496E-01	2.5277E-02	0.0000E+00	0.0000E+00
51	51	6000.50c	4.4858E-02	30	4.8018E-04	4.5405E-08	0.0000E+00	0.0000E+00
		26000.55c	9.5514E-01	1340	1.8272E-02	1.0512E-03	0.0000E+00	0.0000E+00
52	52	1001.50c	5.4858E-01	74915	1.0385E+00	4.8566E-03	0.0000E+00	0.0000E+00
		6000.50c	3.5369E-01	6767	1.0328E-01	4.0340E-05	0.0000E+00	0.0000E+00
		8016.50c	9.7449E-02	1557	2.4044E-02	2.4221E-05	0.0000E+00	0.0000E+00
		94239.55c	2.6236E-04	659	1.4966E-02	2.6567E-03	6.1014E-03	0.0000E+00
		94240.50c	1.6746E-05	23	3.5598E-04	3.0720E-04	1.0416E-07	0.0000E+00
53	53	1001.50c	5.4858E-01	137488	1.8933E+00	8.9250E-03	0.0000E+00	0.0000E+00
		6000.50c	3.5369E-01	12648	1.9252E-01	7.6971E-05	0.0000E+00	0.0000E+00
		8016.50c	9.7449E-02	2845	4.4291E-02	3.1486E-05	0.0000E+00	0.0000E+00
		94239.55c	2.6236E-04	1190	2.6799E-02	4.6322E-03	1.0729E-02	0.0000E+00
		94240.50c	1.6746E-05	41	6.5138E-04	6.2452E-04	1.1671E-07	0.0000E+00
54	54	1001.50c	5.4858E-01	189090	2.5634E+00	1.2114E-02	0.0000E+00	0.0000E+00
		6000.50c	3.5369E-01	17070	2.5461E-01	9.0715E-05	0.0000E+00	0.0000E+00
		8016.50c	9.7449E-02	3953	5.9941E-02	3.0127E-05	0.0000E+00	0.0000E+00
		94239.55c	2.6236E-04	1641	3.6290E-02	6.2472E-03	1.4644E-02	0.0000E+00
		94240.50c	1.6746E-05	62	9.6355E-04	9.0432E-04	4.0558E-06	0.0000E+00
55	55	1001.50c	5.4858E-01	185794	2.4951E+00	1.1788E-02	0.0000E+00	0.0000E+00
		6000.50c	3.5369E-01	16906	2.4787E-01	9.4055E-05	0.0000E+00	0.0000E+00
		8016.50c	9.7449E-02	3867	5.7754E-02	4.0465E-05	0.0000E+00	0.0000E+00
		94239.55c	2.6236E-04	1612	3.5436E-02	6.1132E-03	1.4299E-02	0.0000E+00
		94240.50c	1.6746E-05	54	8.5041E-04	7.8888E-04	2.7274E-07	0.0000E+00
56	56	1001.50c	5.4858E-01	131472	1.7985E+00	8.4130E-03	0.0000E+00	0.0000E+00
		6000.50c	3.5369E-01	12133	1.8453E-01	6.6190E-05	0.0000E+00	0.0000E+00
		8016.50c	9.7449E-02	2782	4.3402E-02	3.0276E-05	0.0000E+00	0.0000E+00
		94239.55c	2.6236E-04	1212	2.6328E-02	4.7329E-03	1.0986E-02	0.0000E+00
		94240.50c	1.6746E-05	31	4.7200E-04	4.5289E-04	8.4978E-08	0.0000E+00
57	57	1001.50c	5.4858E-01	110650	1.5237E+00	7.2019E-03	0.0000E+00	0.0000E+00
		6000.50c	3.5369E-01	9971	1.5143E-01	5.1990E-05	0.0000E+00	0.0000E+00
		8016.50c	9.7449E-02	2262	3.4745E-02	2.1578E-05	0.0000E+00	0.0000E+00
		94239.55c	2.6236E-04	920	2.1165E-02	3.6355E-03	8.4526E-03	0.0000E+00
		94240.50c	1.6746E-05	25	4.0195E-04	3.8707E-04	7.3000E-08	0.0000E+00
58	58	1001.50c	5.4858E-01	43037	5.9715E-01	2.7699E-03	0.0000E+00	0.0000E+00
		6000.50c	3.5369E-01	3955	6.0192E-02	2.2534E-05	0.0000E+00	0.0000E+00
		8016.50c	9.7449E-02	945	1.4582E-02	8.1262E-06	0.0000E+00	0.0000E+00
		94239.55c	2.6236E-04	391	8.6839E-03	1.5076E-03	3.5907E-03	0.0000E+00
		94240.50c	1.6746E-05	19	2.9240E-04	2.6681E-04	5.2026E-08	0.0000E+00
59	59	6000.50c	4.4858E-02	6	7.5288E-05	2.3920E-08	0.0000E+00	0.0000E+00
		26000.55c	9.5514E-01	454	6.0603E-03	4.7549E-04	0.0000E+00	0.0000E+00
60	60	6000.50c	4.4858E-02	496	7.0793E-03	1.3881E-06	0.0000E+00	0.0000E+00
		26000.55c	9.5514E-01	23448	3.0371E-01	2.2532E-02	0.0000E+00	0.0000E+00
61	61	13027.50c	2.1339E-02	464	5.7596E-03	3.5665E-04	0.0000E+00	0.0000E+00
		20000.50c	1.8591E-02	732	8.2920E-03	6.6120E-04	0.0000E+00	0.0000E+00
		26000.55c	4.2453E-03	673	7.2911E-03	9.4966E-04	0.0000E+00	0.0000E+00
		1001.50c	1.6803E-01	52946	5.5729E-01	4.3887E-03	0.0000E+00	0.0000E+00
		8016.50c	5.6324E-01	26038	2.9557E-01	6.9017E-05	0.0000E+00	0.0000E+00
		14000.50c	2.0319E-01	5706	6.7750E-02	2.5882E-03	0.0000E+00	0.0000E+00
		11023.50c	2.1361E-02	1100	1.3584E-02	8.4323E-04	0.0000E+00	0.0000E+00
62	62	13027.50c	2.1339E-02	4397	6.0468E-02	3.1416E-03	0.0000E+00	0.0000E+00
		20000.50c	1.8591E-02	6355	7.6743E-02	5.6000E-03	0.0000E+00	0.0000E+00
		26000.55c	4.2453E-03	5291	6.0288E-02	6.9027E-03	0.0000E+00	0.0000E+00
		1001.50c	1.6803E-01	432502	4.8853E+00	3.4670E-02	0.0000E+00	0.0000E+00
		8016.50c	5.6324E-01	224367	2.7742E+00	8.9190E-04	0.0000E+00	0.0000E+00
		14000.50c	2.0319E-01	50822	6.5746E-01	2.0836E-02	0.0000E+00	0.0000E+00
		11023.50c	2.1361E-02	10184	1.3761E-01	7.0302E-03	0.0000E+00	0.0000E+00
63	63	13027.50c	2.1339E-02	573	7.2523E-03	4.7258E-04	0.0000E+00	0.0000E+00
		20000.50c	1.8591E-02	908	1.0065E-02	8.1580E-04	0.0000E+00	0.0000E+00
		26000.55c	4.2453E-03	731	7.5441E-03	9.6208E-04	0.0000E+00	0.0000E+00

		1001.50c	1.6803E-01	62241	6.5726E-01	5.0754E-03	0.0000E+00	0.0000E+00
		8016.50c	5.6324E-01	30715	3.5156E-01	9.4550E-05	0.0000E+00	0.0000E+00
		14000.50c	2.0319E-01	6754	7.9739E-02	2.9755E-03	0.0000E+00	0.0000E+00
		11023.50c	2.1361E-02	1395	1.7764E-02	1.0502E-03	0.0000E+00	0.0000E+00
64	64	6000.50c	4.4858E-02	3	2.1717E-05	1.0356E-08	0.0000E+00	0.0000E+00
		26000.55c	9.5514E-01	157	1.1992E-03	1.8403E-04	0.0000E+00	0.0000E+00
65	65	13027.50c	2.1339E-02	22	3.2714E-04	1.0162E-05	0.0000E+00	0.0000E+00
		20000.50c	1.8591E-02	25	3.3558E-04	1.9405E-05	0.0000E+00	0.0000E+00
		26000.55c	4.2453E-03	24	3.0745E-04	3.3810E-05	0.0000E+00	0.0000E+00
		1001.50c	1.6803E-01	1655	2.0850E-02	1.3688E-04	0.0000E+00	0.0000E+00
		8016.50c	5.6324E-01	924	1.2696E-02	3.8334E-06	0.0000E+00	0.0000E+00
		14000.50c	2.0319E-01	220	3.2337E-03	7.8279E-05	0.0000E+00	0.0000E+00
		11023.50c	2.1361E-02	31	5.1900E-04	1.4935E-05	0.0000E+00	0.0000E+00
66	66	13027.50c	2.1339E-02	36	5.1867E-04	2.0837E-05	0.0000E+00	0.0000E+00
		20000.50c	1.8591E-02	37	4.5057E-04	4.0077E-05	0.0000E+00	0.0000E+00
		26000.55c	4.2453E-03	37	4.5719E-04	4.3839E-05	0.0000E+00	0.0000E+00
		1001.50c	1.6803E-01	2330	2.9291E-02	1.8821E-04	0.0000E+00	0.0000E+00
		8016.50c	5.6324E-01	1271	1.7468E-02	4.4686E-06	0.0000E+00	0.0000E+00
		14000.50c	2.0319E-01	262	3.7755E-03	1.2456E-04	0.0000E+00	0.0000E+00
		11023.50c	2.1361E-02	47	6.5361E-04	3.6770E-05	0.0000E+00	0.0000E+00
67	67	13027.50c	2.1339E-02	0	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
		20000.50c	1.8591E-02	0	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
		26000.55c	4.2453E-03	0	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
		1001.50c	1.6803E-01	0	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
		8016.50c	5.6324E-01	0	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
		14000.50c	2.0319E-01	0	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
		11023.50c	2.1361E-02	0	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
68	68	13027.50c	2.1339E-02	0	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
		20000.50c	1.8591E-02	0	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
		26000.55c	4.2453E-03	0	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
		1001.50c	1.6803E-01	0	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
		8016.50c	5.6324E-01	0	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
		14000.50c	2.0319E-01	0	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
		11023.50c	2.1361E-02	0	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
total				5652417	7.5882E+01	6.4426E-01	3.2636E-01	0.0000E+00

total over all cells for each nuclide

		1001.50c		4645115	6.1795E+01	3.0620E-01	0.0000E+00	0.0000E+00
		6000.50c		375781	5.6198E+00	2.1519E-03	0.0000E+00	0.0000E+00
		8016.50c		369461	4.7671E+00	1.8830E-03	0.0000E+00	0.0000E+00
		11023.50c		12757	1.7013E-01	8.9753E-03	0.0000E+00	0.0000E+00
		13027.50c		5492	7.4326E-02	4.0018E-03	0.0000E+00	0.0000E+00
		14000.50c		63764	8.1196E-01	2.6602E-02	0.0000E+00	0.0000E+00
		20000.50c		8057	9.5886E-02	7.1365E-03	0.0000E+00	0.0000E+00
		26000.55c		134414	1.7294E+00	1.2961E-01	0.0000E+00	0.0000E+00
		94239.55c		36355	7.9997E-01	1.4007E-01	3.2633E-01	0.0000E+00
		94240.50c		1221	1.8850E-02	1.7523E-02	3.2289E-05	0.0000E+00

```
**********************************************************************
dump no.  3 on file   runtpe          nps =   51332          ctm =   19.28

      3 warning messages so far.

run terminated when    50 kcode cycles were done.

mcnp     version 4.2   3/5/91                    01/14/93 15:34:41                    probid =   01/14/93 15:01:59
```

Output file for MCNP case IXC602

```
1mcnp     version 4.2   ld=3/5/91                    03/09/93 15:16:42                probid =   03/09/93 15:16:42
*********************************************************************
 edt 465711, sd-mp-swd-30001, rev 0, certified
 ecn 137360 with prpr unicos6 patch file p.421Va


  ie=  0   lf=   20808   ll=   37072
  ie=  0   lf=   20808   ll=   37072
   1-        message:
   2-
   3-         IXC602 - Three IXCs 42.00 g/l Pu per cell, full tank model
   4-        c
   5-        c    m   dens      data
   6-          1  0              1  -2    3  -4   5  -6    fill=1
   7-          2  1  -2.3      (-7:  8:  -9: 10:-11: 12)   u=1  $ Concrete
   8-          3  0               7  -8    9 -10  11 -12
   9-                                  (13: -15: 23)       u=1  $ Void
  10-          4  2  -7.82     -13  15  -23 (14: -16: 22)   u=1  $ IXC Wall
  11-          5  3  -0.9512   -14  16  -17                 u=1  $ IXC Level 1
  12-          6  3  -0.9512   -14  17  -18                 u=1  $ IXC Level 2
  13-          7  3  -0.9512   -14  18  -19                 u=1  $ IXC Level 3
  14-          8  3  -0.9512   -14  19  -20                 u=1  $ IXC Level 4
  15-          9  3  -0.9512   -14  20  -21                 u=1  $ IXC Level 5
  16-         10  3  -0.9512   -14  21  -22                 u=1  $ IXC Level 6
  17-         11  like 1 but trcl=1
  18-         12  like 1 but trcl=2
  19-         13  1  -2.3       25 -26 3 -4 5 -6 #1 #11 #12
  20-         14  0            -24 (-25: 26: -3: 4: -5: 6)      $ Void
  21-         15  0             24                              $ Outside World
  22-
  23-          1  px   -83.8200                    $ Left concrete
  24-          2  px    53.3400                    $ Right concrete
  25-          3  py  -106.6800                    $ Front concrete
  26-          4  py    76.2000                    $ Back concrete
  27-          5  pz   -73.6600                    $ Concrete below IXC
  28-          6  pz   224.7900                    $ Concrete above IXC
  29-          7  px   -60.9600                    $ Left space
  30-          8  px    30.4800                    $ Right space
  31-          9  py   -60.9600                    $ Front space
  32-         10  py    30.4800                    $ Back space
  33-         11  pz   -12.7000                    $ Space below IXC
  34-         12  pz   163.8300                    $ Space above IXC
  35-         13  cz    22.8600                    $ IXC outer surface
  36-         14  cz    22.2250                    $ IXC inner surface
  37-         15  pz     0.0000                    $ Bottom of ICX (outside)
  38-         16  pz     0.6350                    $ Bottom of IXC (inside)
  39-         17  pz    25.6350                    $ Level 1
  40-         18  pz    50.6350                    $ Level 2
  41-         19  pz    75.6350                    $ Level 3
  42-         20  pz   100.6350                    $ Level 4
  43-         21  pz   125.6350                    $ Level 5
  44-         22  pz   150.4950                    $ Top of IXC (inside)
  45-         23  pz   151.1300                    $ Top of IXC (outside)
  46-         24  so  1000.00                      $ Outside World
  47-         25  px  -106.6800                    $ Left concrete
  48-         26  px   350.5200                    $ Right concrete
  49-
  50-        mode   n
  51-        imp:n  1 13r 0
  52-        tr1    137.17  0.0  0.0
  53-        tr2    274.34  0.0  0.0
  54-        m1    13027.50c -0.034                $Al      Concrete
  55-              20000.50c -0.044                $Ca      (Common
  56-              26000.55c -0.014                $Fe       Portland)
  57-               1001.50c -0.010                $H
```

```
 58-              8016.50c -0.532                    $O
 59-             14000.50c -0.337                    $Si
 60-             11023.50c -0.029                    $Na
 61-       m2     6000.50c -0.0100                   $C        Carbon Steel
 62-             26000.55c -0.9900                   $Fe
 63-       m3     1001.50c -8.5934e-2                $H        Resin/H2O/Pu/U
 64-              6000.50c -6.6032e-1                $C
 65-              8016.50c -2.4227e-1                $O
 66-             94239.55c -1.0789e-2                $Pu239
 67-             94240.50c -6.9153e-4                $Pu240
 68-       m4     1001.50c -0.0869                   $H        Resin/H2O
warning.  material   4 is not used in the problem.
 69-              6000.50c -0.6680                   $C
 70-              8016.50c -0.2451                   $O
 71-       mt3    lwtr.01t
 72-       mt4    lwtr.01t
warning.  material   4 is not used in the problem.
 73-       kcode  1000   0.5   5   50
 74-       ksrc   0.0 0.0 75.0
 75-       totnu
 76-       print
 77-       ctme

surfaces      3 and  11003 of cell    13 are the same.   11003 will be deleted.

surfaces      3 and  12003 of cell    13 are the same.   12003 will be deleted.

surfaces      4 and  11004 of cell    13 are the same.   11004 will be deleted.

surfaces      4 and  12004 of cell    13 are the same.   12004 will be deleted.

surfaces      5 and  11005 of cell    13 are the same.   11005 will be deleted.

surfaces      5 and  12005 of cell    13 are the same.   12005 will be deleted.

surfaces      6 and  11006 of cell    13 are the same.   11006 will be deleted.

surfaces      6 and  12006 of cell    13 are the same.   12006 will be deleted.

warning.     8 surfaces were deleted for being the same as others.                    print table 90
1     initial source from ksrc card.

original number of points                          1
   points not in any cell                     0
   points in cells of zero importance         0
   points in void cells                       0
   points in ambiguous cells                  0
total points rejected                              0
points remaining                                   1
points after expansion or contraction           1000
nominal source size                             1000

initial guess for k(eff.)                    0.500000

cycles to skip before tallying                     5
                                                                                        print table 40
1material composition

material
 number     component nuclide, atom fraction

    1          13027,  0.02134     20000,  0.01859     26000,  0.00425     1001,  0.16803
                8016,  0.56324     14000,  0.20319     11023,  0.02136
    2           6000,  0.04486     26000,  0.95514
    3           1001,  0.54856      6000,  0.35369      8016,  0.09745    94239,  0.00029
               94240,  0.00002
 associated thermal s(a,b) data sets:    lwtr.01t


 material
```

number	component nuclide, mass fraction							
1	13027,	0.03400	20000,	0.04400	26000,	0.01400	1001,	0.01000
	8016,	0.53200	14000,	0.33700	11023,	0.02900		
2	6000,	0.01000	26000,	0.99000				
3	1001,	0.08593	6000,	0.66032	8016,	0.24227	94239,	0.01079
	94240,	0.00069						

1cell volumes and masses

print table 50

	cell	atom density	gram density	input volume	calculated volume	mass	pieces	reason volume not calculated
1	1	0.00000E+00	0.00000E+00	0.00000E+00	7.48627E+06	0.00000E+00	0	
2	2	8.17913E-02	2.30000E+00	0.00000E+00	0.00000E+00	0.00000E+00	0	infinite
3	3	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00	0	asymmetric
4	4	8.74038E-02	7.82000E+00	0.00000E+00	1.55635E+04	1.21707E+05	1	
5	5	8.90369E-02	9.51200E-01	0.00000E+00	3.87948E+04	3.69016E+04	1	
6	6	8.90369E-02	9.51200E-01	0.00000E+00	3.87948E+04	3.69016E+04	1	
7	7	8.90369E-02	9.51200E-01	0.00000E+00	3.87948E+04	3.69016E+04	1	
8	8	8.90369E-02	9.51200E-01	0.00000E+00	3.87948E+04	3.69016E+04	1	
9	9	8.90369E-02	9.51200E-01	0.00000E+00	3.87948E+04	3.69016E+04	1	
10	10	8.90369E-02	9.51200E-01	0.00000E+00	3.85775E+04	3.66950E+04	1	
11	11	0.00000E+00	0.00000E+00	0.00000E+00	7.48627E+06	0.00000E+00	0	
12	12	0.00000E+00	0.00000E+00	0.00000E+00	7.48627E+06	0.00000E+00	0	
13	13	8.17913E-02	2.30000E+00	0.00000E+00	2.49542E+06	5.73947E+06	0	
14	14	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00	0	asymmetric
15	15	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00	0	infinite

1surface areas

print table 50

	surface	input area	calculated area	reason area not calculated
1	1	0.00000E+00	5.45805E+04	
2	2	0.00000E+00	5.45805E+04	
3	3	0.00000E+00	1.36451E+05	
4	4	0.00000E+00	1.36451E+05	
5	5	0.00000E+00	8.36127E+04	
6	6	0.00000E+00	8.36127E+04	
7	7	0.00000E+00	1.61419E+04	
8	8	0.00000E+00	1.61419E+04	
9	9	0.00000E+00	1.61419E+04	
10	10	0.00000E+00	1.61419E+04	
11	11	0.00000E+00	8.36127E+03	
12	12	0.00000E+00	8.36127E+03	
13	13	0.00000E+00	2.17073E+04	
14	14	0.00000E+00	2.09270E+04	
15	15	0.00000E+00	1.64173E+03	
16	16	0.00000E+00	1.55179E+03	
17	17	0.00000E+00	1.55179E+03	
18	18	0.00000E+00	1.55179E+03	
19	19	0.00000E+00	1.55179E+03	
20	20	0.00000E+00	1.55179E+03	
21	21	0.00000E+00	1.55179E+03	
22	22	0.00000E+00	1.55179E+03	
23	23	0.00000E+00	1.64173E+03	
24	24	0.00000E+00	1.25664E+07	
25	25	0.00000E+00	5.45805E+04	
26	26	0.00000E+00	5.45805E+04	
27	11001	0.00000E+00	5.45805E+04	
28	11002	0.00000E+00	5.45805E+04	
29	12001	0.00000E+00	5.45805E+04	
30	12002	0.00000E+00	5.45805E+04	

1cells

print table 60

	cell	mat	atom density	gram density	volume	mass	pieces	neutron importance
1	1	0	0.00000E+00	0.00000E+00	7.48627E+06	0.00000E+00	0	1.00000E+00
2	2	1	8.17913E-02	2.30000E+00	0.00000E+00	0.00000E+00	0	1.00000E+00
3	3	0	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00	0	1.00000E+00
4	4	2	8.74038E-02	7.82000E+00	1.55635E+04	1.21707E+05	1	1.00000E+00
5	5	3s	8.90369E-02	9.51200E-01	3.87948E+04	3.69016E+04	1	1.00000E+00
6	6	3s	8.90369E-02	9.51200E-01	3.87948E+04	3.69016E+04	1	1.00000E+00

```
     7     7    3s 8.90369E-02 9.51200E-01 3.87948E+04 3.69016E+04     1  1.00000E+00
     8     8    3s 8.90369E-02 9.51200E-01 3.87948E+04 3.69016E+04     1  1.00000E+00
     9     9    3s 8.90369E-02 9.51200E-01 3.87948E+04 3.69016E+04     1  1.00000E+00
    10    10    3s 8.90369E-02 9.51200E-01 3.85775E+04 3.66950E+04     1  1.00000E+00
    11    11    0  0.00000E+00 0.00000E+00 7.48627E+06 0.00000E+00     0  1.00000E+00
    12    12    0  0.00000E+00 0.00000E+00 7.48627E+06 0.00000E+00     0  1.00000E+00
    13    13    1  8.17913E-02 2.30000E+00 2.49542E+06 5.73947E+06     0  1.00000E+00
    14    14    0  0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00     0  1.00000E+00
    15    15    0  0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00     0  0.00000E+00

 total                                     2.52023E+07 6.08238E+06
1surfaces                                                                          print table 70

       surface     trans  type   surface coefficients

     1     1              px   -8.3820000E+01
     2     2              px    5.3340000E+01
     3     3              py   -1.0668000E+02
     4     4              py    7.6200000E+01
     5     5              pz   -7.3660000E+01
     6     6              pz    2.2479000E+02
     7     7              px   -6.0960000E+01
     8     8              px    3.0480000E+01
     9     9              py   -6.0960000E+01
    10    10              py    3.0480000E+01
    11    11              pz   -1.2700000E+01
    12    12              pz    1.6383000E+02
    13    13              cz    2.2860000E+01
    14    14              cz    2.2225000E+01
    15    15              pz    0.0000000E+00
    16    16              pz    6.3500000E-01
    17    17              pz    2.5635000E+01
    18    18              pz    5.0635000E+01
    19    19              pz    7.5635000E+01
    20    20              pz    1.0063500E+02
    21    21              pz    1.2563500E+02
    22    22              pz    1.5049500E+02
    23    23              pz    1.5113000E+02
    24    24              so    1.0000000E+03
    25    25              px   -1.0668000E+02
    26    26              px    3.5052000E+02
    27  11001          1   px    5.3350000E+01
    28  11002          1   px    1.9051000E+02
    29  12001          2   px    1.9052000E+02
    30  12002          2   px    3.2768000E+02
1  temperatures of the cells.                                                      print table 72

     time:       0.0000E+00

     cell          tmp 1
       2         2.5300E-08
       4         2.5300E-08
       5         2.5300E-08
       6         2.5300E-08
       7         2.5300E-08
       8         2.5300E-08
       9         2.5300E-08
      10         2.5300E-08
      13         2.5300E-08

        3 warning messages so far.
   ie=  0   lf=   37072   ll=  219553
   ie=  0   lf=   37072   ll=  219553
1cross-section tables                                                              print table 100

     table    length

                        tables from file /p/mcnp/rmccs

   1001.50c    1153  njoy                                                  (  1301)      79/07/31.
   6000.50c   16126  njoy                                                  (  1306)      79/07/31.
   8016.50c   23669  njoy                                                   ( 1276)     05/14/81
  13027.50c   22891  njoy                                                  (  1313)      79/09/08.
```

```
 26000.55c   84136  njoy                                                          ( 260)       10/21/82
 94239.55c   67551  njoy                                        total nu           ( 1399)      02/21/85
 94240.50c   42744  njoy                                        total nu           (  1380)      79/09/13.

                       tables from file /p/mcnp/endf5p

 11023.50c   36270  njoy                                                          (  1311)      79/06/21.
 14000.50c   48275  njoy                                                          (  1314)      79/06/21.

                       tables from file /p/mcnp/endf5u

 20000.50c   26104  njoy                                                          (  1320)      79/06/22.

                       tables from file /p/mcnp/tmccs

  lwtr.01t   10193  hydrogen in light water at 300 degrees kelvin                1001     0     010/22/85

 total      379112

 warning.  neutron energy cutoff is below some cross-section tables.



 use of dynamically allocated storage

    general              35255
    tallies                  0
    bank                  5902
    cross sections      379112

    total               420269
  ie=  0   lf=  219553   ll=  420273
  ie=  0   lf=  219553   ll=  420273

*********************************************************************
dump no.  1 on file   runtpe          nps =       0          ctm =    0.00


source distribution written to file srctp          cycle =     0

        4 warning messages so far.
1   starting mcrun.      field length =      0      cp0 =  0.02                                    print table 110

      IXC602 - Three IXCs 42.00 g/l Pu per cell, full tank model
```

nps	x	y	z	cell	surf	u	v	w	time	weight	energy
1	0.000E+00	0.000E+00	7.500E+01	7	0	5.085E-01	4.733E-01	7.193E-01	0.000E+00	1.000E+00	2.209E+00
2	0.000E+00	0.000E+00	7.500E+01	7	0	8.952E-01	-4.447E-01	-2.944E-02	0.000E+00	1.000E+00	4.904E+00
3	0.000E+00	0.000E+00	7.500E+01	7	0	-6.184E-01	-4.495E-01	6.446E-01	0.000E+00	1.000E+00	3.809E-01
4	0.000E+00	0.000E+00	7.500E+01	7	0	9.710E-01	-5.665E-02	-2.323E-01	0.000E+00	1.000E+00	1.331E+00
5	0.000E+00	0.000E+00	7.500E+01	7	0	5.861E-01	1.496E-01	-7.963E-01	0.000E+00	1.000E+00	1.902E+00
6	0.000E+00	0.000E+00	7.500E+01	7	0	-6.489E-02	-1.626E-01	9.845E-01	0.000E+00	1.000E+00	4.410E-01
7	0.000E+00	0.000E+00	7.500E+01	7	0	-7.068E-02	3.263E-02	-9.970E-01	0.000E+00	1.000E+00	4.750E-01
8	0.000E+00	0.000E+00	7.500E+01	7	0	-3.915E-01	4.664E-01	-7.932E-01	0.000E+00	1.000E+00	4.136E+00
9	0.000E+00	0.000E+00	7.500E+01	7	0	-2.368E-01	9.215E-01	-3.079E-01	0.000E+00	1.000E+00	7.453E-02
10	0.000E+00	0.000E+00	7.500E+01	7	0	1.946E-01	-3.204E-01	9.271E-01	0.000E+00	1.000E+00	3.128E+00
11	0.000E+00	0.000E+00	7.500E+01	7	0	-6.698E-01	-7.177E-01	-1.905E-01	0.000E+00	1.000E+00	1.014E+00
12	0.000E+00	0.000E+00	7.500E+01	7	0	-8.398E-01	-4.129E-01	3.524E-01	0.000E+00	1.000E+00	1.395E+00
13	0.000E+00	0.000E+00	7.500E+01	7	0	-1.714E-01	-8.572E-01	4.857E-01	0.000E+00	1.000E+00	7.748E-01
14	0.000E+00	0.000E+00	7.500E+01	7	0	-2.489E-01	-5.118E-01	-8.222E-01	0.000E+00	1.000E+00	1.101E+00
15	0.000E+00	0.000E+00	7.500E+01	7	0	-2.959E-01	2.119E-01	9.314E-01	0.000E+00	1.000E+00	1.951E+00
16	0.000E+00	0.000E+00	7.500E+01	7	0	1.395E-01	-9.829E-01	1.202E-01	0.000E+00	1.000E+00	2.186E+00
17	0.000E+00	0.000E+00	7.500E+01	7	0	6.909E-01	-7.110E-01	1.307E-01	0.000E+00	1.000E+00	1.865E+00
18	0.000E+00	0.000E+00	7.500E+01	7	0	-6.580E-01	5.320E-01	-5.329E-01	0.000E+00	1.000E+00	1.229E+00
19	0.000E+00	0.000E+00	7.500E+01	7	0	-9.903E-01	-1.380E-01	1.353E-02	0.000E+00	1.000E+00	1.305E+00
20	0.000E+00	0.000E+00	7.500E+01	7	0	7.462E-01	4.859E-01	-4.551E-01	0.000E+00	1.000E+00	1.000E+00
21	0.000E+00	0.000E+00	7.500E+01	7	0	-1.977E-01	9.797E-01	3.360E-02	0.000E+00	1.000E+00	3.990E+00
22	0.000E+00	0.000E+00	7.500E+01	7	0	-9.117E-01	-3.647E-01	-1.891E-01	0.000E+00	1.000E+00	2.665E-01
23	0.000E+00	0.000E+00	7.500E+01	7	0	-4.287E-01	8.361E-01	-3.423E-01	0.000E+00	1.000E+00	1.156E+00

24	0.000E+00	0.000E+00	7.500E+01	7	0	1.080E-01	3.412E-01	-9.338E-01	0.000E+00	1.000E+00	2.669E+00
25	0.000E+00	0.000E+00	7.500E+01	7	0	-9.111E-01	-9.012E-03	-4.122E-01	0.000E+00	1.000E+00	2.185E+00
26	0.000E+00	0.000E+00	7.500E+01	7	0	-2.568E-01	-6.391E-01	-7.249E-01	0.000E+00	1.000E+00	4.225E+00
27	0.000E+00	0.000E+00	7.500E+01	7	0	-2.912E-01	8.086E-01	5.113E-01	0.000E+00	1.000E+00	1.079E+00
28	0.000E+00	0.000E+00	7.500E+01	7	0	1.472E-01	-9.514E-01	2.705E-01	0.000E+00	1.000E+00	3.461E+00
29	0.000E+00	0.000E+00	7.500E+01	7	0	-6.135E-01	-7.645E-01	-1.978E-01	0.000E+00	1.000E+00	1.836E+00
30	0.000E+00	0.000E+00	7.500E+01	7	0	-5.702E-01	5.651E-01	-5.963E-01	0.000E+00	1.000E+00	4.556E-01
31	0.000E+00	0.000E+00	7.500E+01	7	0	-6.607E-01	5.373E-01	-5.242E-01	0.000E+00	1.000E+00	6.415E-01
32	0.000E+00	0.000E+00	7.500E+01	7	0	-9.742E-02	-3.639E-01	-9.263E-01	0.000E+00	1.000E+00	2.764E+00
33	0.000E+00	0.000E+00	7.500E+01	7	0	-1.965E-01	-3.145E-01	-9.287E-01	0.000E+00	1.000E+00	2.785E-01
34	0.000E+00	0.000E+00	7.500E+01	7	0	4.097E-01	8.465E-01	-3.399E-01	0.000E+00	1.000E+00	9.097E-01
35	0.000E+00	0.000E+00	7.500E+01	7	0	-4.048E-02	8.831E-01	4.675E-01	0.000E+00	1.000E+00	3.360E-01
36	0.000E+00	0.000E+00	7.500E+01	7	0	3.371E-01	-9.269E-01	-1.652E-01	0.000E+00	1.000E+00	6.376E-01
37	0.000E+00	0.000E+00	7.500E+01	7	0	-1.867E-01	9.756E-01	-1.155E-01	0.000E+00	1.000E+00	2.186E+00
38	0.000E+00	0.000E+00	7.500E+01	7	0	-2.616E-01	2.336E-01	-9.365E-01	0.000E+00	1.000E+00	7.314E-01
39	0.000E+00	0.000E+00	7.500E+01	7	0	9.780E-01	-7.641E-02	-1.939E-01	0.000E+00	1.000E+00	2.997E-01
40	0.000E+00	0.000E+00	7.500E+01	7	0	2.580E-01	-7.076E-01	6.578E-01	0.000E+00	1.000E+00	1.444E+00
41	0.000E+00	0.000E+00	7.500E+01	7	0	-3.212E-01	-7.678E-01	-5.543E-01	0.000E+00	1.000E+00	1.914E+00
42	0.000E+00	0.000E+00	7.500E+01	7	0	5.039E-01	-1.460E-01	8.513E-01	0.000E+00	1.000E+00	1.502E+00
43	0.000E+00	0.000E+00	7.500E+01	7	0	6.080E-01	5.487E-01	5.738E-01	0.000E+00	1.000E+00	5.971E+00
44	0.000E+00	0.000E+00	7.500E+01	7	0	-2.932E-01	9.304E-01	-2.199E-01	0.000E+00	1.000E+00	1.827E+00
45	0.000E+00	0.000E+00	7.500E+01	7	0	-8.475E-01	-3.993E-01	-3.497E-01	0.000E+00	1.000E+00	1.928E+00
46	0.000E+00	0.000E+00	7.500E+01	7	0	1.200E-01	-9.195E-01	-3.743E-01	0.000E+00	1.000E+00	1.351E+00
47	0.000E+00	0.000E+00	7.500E+01	7	0	7.085E-01	5.879E-01	3.904E-01	0.000E+00	1.000E+00	2.288E+00
48	0.000E+00	0.000E+00	7.500E+01	7	0	4.261E-01	9.046E-01	9.254E-03	0.000E+00	1.000E+00	1.230E+00
49	0.000E+00	0.000E+00	7.500E+01	7	0	5.431E-01	4.270E-01	-7.230E-01	0.000E+00	1.000E+00	1.433E+00
50	0.000E+00	0.000E+00	7.500E+01	7	0	-1.053E-01	-9.805E-01	1.658E-01	0.000E+00	1.000E+00	6.572E-01

cycle 1 k(collision) 1.201696 removal lifetime(abs) 1.4019E+04 source points generated 2422

cycle 2 k(collision) 1.113292 removal lifetime(abs) 1.8389E+04 source points generated 940

cycle 3 k(collision) 1.042162 removal lifetime(abs) 2.2514E+04 source points generated 926

cycle 4 k(collision) 0.963024 removal lifetime(abs) 2.5094E+04 source points generated 892

cycle 5 k(collision) 0.977979 removal lifetime(abs) 2.1080E+04 source points generated 1003

source distribution written to file srctp cycle = 5

cycle 6 k(collision) 0.970898 removal lifetime(abs) 2.4879E+04 source points generated 1003

estimator	cycle 7	ave of 2 cycles		combination	simple average		combined average		corr
k(collision)	0.955714	0.963306	0.0079	k(col/abs)	0.000000	0.0000	0.000000	0.0000	0.0000
k(absorption)	0.936966	0.958118	0.0221	k(abs/tk ln)	0.000000	0.0000	0.000000	0.0000	0.0000
k(trk length)	0.957736	0.963495	0.0060	k(tk ln/col)	0.000000	0.0000	0.000000	0.0000	0.0000
rem life(col)	2.6000E+04	2.5352E+04	0.0255						
rem life(abs)	2.5458E+04	2.5169E+04	0.0115	life(col/abs)	0.0000E+00	0.0000	0.0000E+00	0.0000	0.0000

source points generated 936

source distribution written to file srctp cycle = 7

estimator	cycle 8	ave of 3 cycles		combination	simple average		combined average		corr
k(collision)	0.956233	0.960948	0.0052	k(col/abs)	0.960060	0.0087	0.961588	0.0058	0.8367
k(absorption)	0.964282	0.959173	0.0128	k(abs/tk ln)	0.959702	0.0082	0.960399	0.0065	0.6507
k(trk length)	0.953704	0.960232	0.0049	k(tk ln/col)	0.960590	0.0050	0.960025	0.0079	0.9603
rem life(col)	2.4508E+04	2.5071E+04	0.0187						
rem life(abs)	2.4848E+04	2.5062E+04	0.0079	life(col/abs)	2.5066E+04	0.0133	2.5055E+04	0.0015	0.9970

source points generated 1030

estimator	cycle 9	ave of 4 cycles		combination	simple average		combined average		corr
k(collision)	0.964331	0.961794	0.0038	k(col/abs)	0.959005	0.0062	0.962881	0.0044	0.6945
k(absorption)	0.947349	0.956217	0.0096	k(abs/tk ln)	0.959368	0.0058	0.962166	0.0052	0.3219
k(trk length)	0.969380	0.962519	0.0042	k(tk ln/col)	0.962156	0.0039	0.961801	0.0046	0.9003
rem life(col)	2.5004E+04	2.5054E+04	0.0132	k(col/abs/tk ln)	0.960176	0.0050	0.964665	0.0039	
rem life(abs)	2.5052E+04	2.5059E+04	0.0056	life(col/abs)	2.5057E+04	0.0094	2.5063E+04	0.0010	0.9965

source points generated 998

source distribution written to file srctp cycle = 9

estimator	cycle 10	ave of 5 cycles		combination	simple average		combined average		corr
k(collision)	0.934285	0.956292	0.0065	k(col/abs)	0.958616	0.0048	0.958023	0.0053	-0.2314
k(absorption)	0.979834	0.960940	0.0089	k(abs/tk ln)	0.958893	0.0045	0.958483	0.0050	-0.3574

k(trk length)	0.934156	0.956846	0.0068	k(tk ln/col)	0.956569	0.0066	0.956018	0.0074	0.9778
rem life(col)	2.5572E+04	2.5158E+04	0.0110	k(col/abs/tk ln)	0.958026	0.0045	0.959435	0.0063	
rem life(abs)	2.5533E+04	2.5154E+04	0.0057	life(col/abs)	2.5156E+04	0.0083	2.5151E+04	0.0041	0.9426

source points generated 892

estimator	cycle 11	ave of 6 cycles		combination	simple average		combined average		corr
k(collision)	0.951090	0.955425	0.0054	k(col/abs)	0.961358	0.0049	0.958747	0.0046	-0.2827
k(absorption)	0.999046	0.967291	0.0097	k(abs/tk ln)	0.961592	0.0046	0.959401	0.0044	-0.3795
k(trk length)	0.951131	0.955894	0.0056	k(tk ln/col)	0.955659	0.0055	0.955167	0.0060	0.9784
rem life(col)	2.4087E+04	2.4979E+04	0.0115	k(col/abs/tk ln)	0.959537	0.0040	0.959828	0.0059	
rem life(abs)	2.4420E+04	2.5032E+04	0.0068	life(col/abs)	2.5005E+04	0.0091	2.5085E+04	0.0046	0.9595

source points generated 1044

source distribution written to file srctp cycle = 11

estimator	cycle 12	ave of 7 cycles		combination	simple average		combined average		corr
k(collision)	0.984142	0.959528	0.0062	k(col/abs)	0.963290	0.0046	0.962417	0.0048	-0.2255
k(absorption)	0.965626	0.967053	0.0082	k(abs/tk ln)	0.963164	0.0042	0.962181	0.0044	-0.3220
k(trk length)	0.979559	0.959274	0.0059	k(tk ln/col)	0.959401	0.0060	0.959085	0.0064	0.9804
rem life(col)	2.4566E+04	2.4920E+04	0.0101	k(col/abs/tk ln)	0.961952	0.0042	0.962055	0.0045	
rem life(abs)	2.4672E+04	2.4980E+04	0.0061	life(col/abs)	2.4950E+04	0.0080	2.5043E+04	0.0043	0.9574

source points generated 1038

estimator	cycle 13	ave of 8 cycles		combination	simple average		combined average		corr
k(collision)	0.945307	0.957750	0.0057	k(col/abs)	0.962942	0.0040	0.961942	0.0042	-0.2610
k(absorption)	0.975694	0.968133	0.0072	k(abs/tk ln)	0.962782	0.0037	0.961660	0.0038	-0.3522
k(trk length)	0.944517	0.957430	0.0055	k(tk ln/col)	0.957590	0.0056	0.957228	0.0059	0.9823
rem life(col)	2.1113E+04	2.4444E+04	0.0214	k(col/abs/tk ln)	0.961104	0.0037	0.961531	0.0040	
rem life(abs)	2.0936E+04	2.4475E+04	0.0214	life(col/abs)	2.4460E+04	0.0213	2.4460E+04	0.0230	0.9807

source points generated 940

source distribution written to file srctp cycle = 13

estimator	cycle 14	ave of 9 cycles		combination	simple average		combined average		corr
k(collision)	1.000790	0.962532	0.0071	k(col/abs)	0.967136	0.0056	0.966848	0.0060	0.1964
k(absorption)	1.000600	0.971741	0.0073	k(abs/tk ln)	0.967151	0.0056	0.966967	0.0060	0.1726
k(trk length)	1.003620	0.962562	0.0072	k(tk ln/col)	0.962547	0.0071	0.962522	0.0075	0.9900
rem life(col)	2.3980E+04	2.4393E+04	0.0190	k(col/abs/tk ln)	0.965612	0.0057	0.966909	0.0068	
rem life(abs)	2.3941E+04	2.4415E+04	0.0190	life(col/abs)	2.4404E+04	0.0189	2.4403E+04	0.0203	0.9809

source points generated 1110

estimator	cycle 15	ave of 10 cycles		combination	simple average		combined average		corr
k(collision)	0.976276	0.963907	0.0065	k(col/abs)	0.968853	0.0053	0.968360	0.0056	0.2501
k(absorption)	0.992324	0.973799	0.0069	k(abs/tk ln)	0.968641	0.0052	0.968174	0.0055	0.2077
k(trk length)	0.971762	0.963482	0.0065	k(tk ln/col)	0.963694	0.0064	0.963747	0.0068	0.9876
rem life(col)	2.4149E+04	2.4368E+04	0.0171	k(col/abs/tk ln)	0.967063	0.0053	0.968142	0.0064	
rem life(abs)	2.4497E+04	2.4424E+04	0.0170	life(col/abs)	2.4396E+04	0.0169	2.4396E+04	0.0180	0.9778

source points generated 981

source distribution written to file srctp cycle = 15

estimator	cycle 16	ave of 11 cycles		combination	simple average		combined average		corr
k(collision)	0.910820	0.959081	0.0077	k(col/abs)	0.965584	0.0059	0.967206	0.0062	0.3594
k(absorption)	0.954975	0.972088	0.0065	k(abs/tk ln)	0.965392	0.0058	0.966969	0.0061	0.3280
k(trk length)	0.910841	0.958696	0.0077	k(tk ln/col)	0.958889	0.0077	0.958842	0.0081	0.9928
rem life(col)	2.3499E+04	2.4289E+04	0.0158	k(col/abs/tk ln)	0.963288	0.0062	0.966960	0.0071	
rem life(abs)	2.3431E+04	2.4333E+04	0.0159	life(col/abs)	2.4311E+04	0.0158	2.4305E+04	0.0166	0.9785

source points generated 949

estimator	cycle 17	ave of 12 cycles		combination	simple average		combined average		corr
k(collision)	0.991835	0.961810	0.0076	k(col/abs)	0.965611	0.0054	0.966228	0.0056	0.1446
k(absorption)	0.939985	0.969413	0.0065	k(abs/tk ln)	0.965750	0.0053	0.966437	0.0055	0.0767
k(trk length)	0.999393	0.962088	0.0079	k(tk ln/col)	0.961949	0.0077	0.961457	0.0078	0.9907
rem life(col)	2.4947E+04	2.4344E+04	0.0146	k(col/abs/tk ln)	0.964437	0.0058	0.967179	0.0060	
rem life(abs)	2.4720E+04	2.4366E+04	0.0145	life(col/abs)	2.4355E+04	0.0145	2.4356E+04	0.0152	0.9768

source points generated 1078

source distribution written to file srctp cycle = 17

estimator	cycle 18	ave of 13 cycles		combination	simple average		combined average		corr
k(collision)	1.006806	0.965271	0.0078	k(col/abs)	0.967897	0.0055	0.968676	0.0055	0.2119
k(absorption)	0.983853	0.970523	0.0061	k(abs/tk ln)	0.968053	0.0054	0.968815	0.0055	0.1513
k(trk length)	1.007525	0.965583	0.0081	k(tk ln/col)	0.965427	0.0079	0.964836	0.0080	0.9925

```
rem life(col)   2.4392E+04     2.4348E+04 0.0134     k(col/abs/tk ln)    0.967126 0.0060     0.969614 0.0058
rem life(abs)   2.3952E+04     2.4334E+04 0.0135     life(col/abs)     2.4341E+04 0.0133   2.4341E+04 0.0139   0.9710
source points generated   1045

 estimator     cycle    19   ave of    14 cycles      combination          simple average     combined average     corr
k(collision)      0.954250        0.964484 0.0073     k(col/abs)          0.966217 0.0053     0.966549 0.0055   0.2382
k(absorption)     0.934496        0.967950 0.0063     k(abs/tk ln)        0.966250 0.0054     0.966627 0.0055   0.1958
k(trk length)     0.951123        0.964550 0.0075     k(tk ln/col)        0.964517 0.0074     0.964383 0.0074   0.9922
rem life(col)   2.2644E+04     2.4226E+04 0.0135     k(col/abs/tk ln)    0.965661 0.0058     0.966659 0.0058
rem life(abs)   2.2455E+04     2.4200E+04 0.0137     life(col/abs)     2.4213E+04 0.0135   2.4222E+04 0.0140   0.9748
source points generated   1011

source distribution written to file srctp          cycle =    19

 estimator     cycle    20   ave of    15 cycles      combination          simple average     combined average     corr
k(collision)      0.963229        0.964400 0.0068     k(col/abs)          0.966400 0.0050     0.966773 0.0051   0.2364
k(absorption)     0.974684        0.968399 0.0059     k(abs/tk ln)        0.966278 0.0050     0.966742 0.0051   0.1903
k(trk length)     0.958661        0.964158 0.0070     k(tk ln/col)        0.964279 0.0069     0.964736 0.0069   0.9912
rem life(col)   2.5490E+04     2.4310E+04 0.0130     k(col/abs/tk ln)    0.965652 0.0054     0.966740 0.0053
rem life(abs)   2.5535E+04     2.4289E+04 0.0132     life(col/abs)     2.4299E+04 0.0130   2.4309E+04 0.0134   0.9767
source points generated    971

 estimator     cycle    21   ave of    16 cycles      combination          simple average     combined average     corr
k(collision)      0.950611        0.963539 0.0064     k(col/abs)          0.965758 0.0047     0.966196 0.0048   0.2444
k(absorption)     0.961644        0.967977 0.0055     k(abs/tk ln)        0.965698 0.0047     0.966211 0.0048   0.1975
k(trk length)     0.952346        0.963419 0.0066     k(tk ln/col)        0.963479 0.0065     0.963683 0.0066   0.9911
rem life(col)   2.6133E+04     2.4424E+04 0.0129     k(col/abs/tk ln)    0.964978 0.0051     0.966247 0.0050
rem life(abs)   2.5952E+04     2.4393E+04 0.0130     life(col/abs)     2.4408E+04 0.0129   2.4413E+04 0.0134   0.9788
source points generated   1016

source distribution written to file srctp          cycle =    21

 estimator     cycle    22   ave of    17 cycles      combination          simple average     combined average     corr
k(collision)      0.950001        0.962742 0.0061     k(col/abs)          0.964942 0.0045     0.965373 0.0046   0.2612
k(absorption)     0.953770        0.967141 0.0052     k(abs/tk ln)        0.964762 0.0045     0.965315 0.0046   0.2200
k(trk length)     0.945814        0.962384 0.0063     k(tk ln/col)        0.962563 0.0062     0.963237 0.0062   0.9907
rem life(col)   2.5069E+04     2.4462E+04 0.0122     k(col/abs/tk ln)    0.964089 0.0049     0.965325 0.0048
rem life(abs)   2.4924E+04     2.4424E+04 0.0123     life(col/abs)     2.4443E+04 0.0122   2.4447E+04 0.0126   0.9788
source points generated   1071

 estimator     cycle    23   ave of    18 cycles      combination          simple average     combined average     corr
k(collision)      0.890877        0.958750 0.0071     k(col/abs)          0.962465 0.0050     0.964198 0.0048   0.3231
k(absorption)     0.949835        0.966180 0.0050     k(abs/tk ln)        0.962230 0.0050     0.964151 0.0048   0.2902
k(trk length)     0.888529        0.958281 0.0074     k(tk ln/col)        0.958515 0.0072     0.959703 0.0071   0.9938
rem life(col)   2.5114E+04     2.4498E+04 0.0116     k(col/abs/tk ln)    0.961070 0.0056     0.964143 0.0051
rem life(abs)   2.5181E+04     2.4466E+04 0.0117     life(col/abs)     2.4482E+04 0.0116   2.4487E+04 0.0119   0.9790
source points generated    913

source distribution written to file srctp          cycle =    23

 estimator     cycle    24   ave of    19 cycles      combination          simple average     combined average     corr
k(collision)      1.020395        0.961994 0.0075     k(col/abs)          0.963372 0.0048     0.963979 0.0046   0.1427
k(absorption)     0.939018        0.964750 0.0050     k(abs/tk ln)        0.963104 0.0048     0.963851 0.0045   0.1230
k(trk length)     1.018653        0.961458 0.0077     k(tk ln/col)        0.961726 0.0076     0.962877 0.0076   0.9948
rem life(col)   2.4340E+04     2.4490E+04 0.0110     k(col/abs/tk ln)    0.962734 0.0055     0.963851 0.0048
rem life(abs)   2.3807E+04     2.4431E+04 0.0112     life(col/abs)     2.4461E+04 0.0110   2.4477E+04 0.0113   0.9745
source points generated   1078

 estimator     cycle    25   ave of    20 cycles      combination          simple average     combined average     corr
k(collision)      0.967109        0.962250 0.0071     k(col/abs)          0.963410 0.0046     0.963920 0.0043   0.1410
k(absorption)     0.961143        0.964570 0.0048     k(abs/tk ln)        0.963158 0.0046     0.963797 0.0043   0.1212
k(trk length)     0.967203        0.961745 0.0073     k(tk ln/col)        0.961998 0.0072     0.963087 0.0072   0.9948
rem life(col)   2.4628E+04     2.4497E+04 0.0104     k(col/abs/tk ln)    0.962855 0.0052     0.963797 0.0045
rem life(abs)   2.4473E+04     2.4433E+04 0.0106     life(col/abs)     2.4465E+04 0.0104   2.4483E+04 0.0107   0.9744
source points generated    926

source distribution written to file srctp          cycle =    25

 estimator     cycle    26   ave of    21 cycles      combination          simple average     combined average     corr
k(collision)      0.962462        0.962260 0.0068     k(col/abs)          0.962147 0.0045     0.962115 0.0045   0.1211
k(absorption)     0.911338        0.962035 0.0052     k(abs/tk ln)        0.961867 0.0046     0.961918 0.0045   0.1083
k(trk length)     0.960755        0.961698 0.0069     k(tk ln/col)        0.961979 0.0069     0.963185 0.0068   0.9948
rem life(col)   2.6917E+04     2.4612E+04 0.0109     k(col/abs/tk ln)    0.961998 0.0051     0.962199 0.0047
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rem life(abs)   2.6757E+04     2.4544E+04 0.0110     life(col/abs)     2.4578E+04 0.0109   2.4585E+04 0.0112   0.9787
source points generated   1059

 estimator     cycle    27   ave of    22 cycles      combination          simple average     combined average     corr
k(collision)      0.914746        0.960100 0.0069    k(col/abs)          0.961698 0.0043     0.962147 0.0043    0.0274
k(absorption)     0.989779        0.963296 0.0052    k(abs/tk ln)        0.961335 0.0044     0.961931 0.0043    0.0115
k(trk length)     0.910567        0.959374 0.0071    k(tk ln/col)        0.959737 0.0070     0.961781 0.0068    0.9952
rem life(col)   2.3190E+04     2.4548E+04 0.0108    k(col/abs/tk ln)    0.960923 0.0050     0.962237 0.0045
rem life(abs)   2.3413E+04     2.4492E+04 0.0107    life(col/abs)     2.4520E+04 0.0107   2.4511E+04 0.0110   0.9785
source points generated    956

source distribution written to file srctp          cycle =    27

*********************************************************************
dump no.  2 on file   runtpe          nps =   28274          ctm =   15.37

 estimator     cycle    28   ave of    23 cycles      combination          simple average     combined average     corr
k(collision)      0.984371        0.961156 0.0066    k(col/abs)          0.962231 0.0042     0.962547 0.0041    0.0274
k(absorption)     0.963525        0.963306 0.0049    k(abs/tk ln)        0.962029 0.0043     0.962443 0.0041    0.0116
k(trk length)     0.991055        0.960751 0.0069    k(tk ln/col)        0.960954 0.0068     0.962167 0.0065    0.9944
rem life(col)   2.4292E+04     2.4536E+04 0.0103    k(col/abs/tk ln)    0.961738 0.0048     0.962666 0.0042
rem life(abs)   2.4390E+04     2.4488E+04 0.0102    life(col/abs)     2.4512E+04 0.0102   2.4504E+04 0.0105   0.9781
source points generated   1100

 estimator     cycle    29   ave of    24 cycles      combination          simple average     combined average     corr
k(collision)      0.976085        0.961778 0.0064    k(col/abs)          0.963022 0.0041     0.963375 0.0040    0.0476
k(absorption)     0.986344        0.964266 0.0048    k(abs/tk ln)        0.962691 0.0041     0.963178 0.0040    0.0232
k(trk length)     0.969505        0.961116 0.0066    k(tk ln/col)        0.961447 0.0065     0.963042 0.0063    0.9935
rem life(col)   2.3414E+04     2.4490E+04 0.0101    k(col/abs/tk ln)    0.962387 0.0047     0.963311 0.0042
rem life(abs)   2.3568E+04     2.4450E+04 0.0100    life(col/abs)     2.4470E+04 0.0100   2.4457E+04 0.0102   0.9783
source points generated    991

source distribution written to file srctp          cycle =    29

 estimator     cycle    30   ave of    25 cycles      combination          simple average     combined average     corr
k(collision)      0.914353        0.959881 0.0064    k(col/abs)          0.961495 0.0042     0.962019 0.0041    0.1208
k(absorption)     0.935379        0.963110 0.0048    k(abs/tk ln)        0.961078 0.0043     0.961803 0.0042    0.1020
k(trk length)     0.909364        0.959046 0.0067    k(tk ln/col)        0.959463 0.0066     0.961897 0.0063    0.9940
rem life(col)   2.6294E+04     2.4562E+04 0.0101    k(col/abs/tk ln)    0.960679 0.0048     0.962263 0.0043
rem life(abs)   2.6415E+04     2.4528E+04 0.0100    life(col/abs)     2.4545E+04 0.0100   2.4542E+04 0.0102   0.9799
source points generated    936

 estimator     cycle    31   ave of    26 cycles      combination          simple average     combined average     corr
k(collision)      0.943993        0.959270 0.0062    k(col/abs)          0.961112 0.0041     0.961721 0.0040    0.1237
k(absorption)     0.959073        0.962955 0.0046    k(abs/tk ln)        0.960639 0.0042     0.961482 0.0040    0.1054
k(trk length)     0.940238        0.958323 0.0065    k(tk ln/col)        0.958796 0.0064     0.961628 0.0061    0.9940
rem life(col)   2.5776E+04     2.4609E+04 0.0098    k(col/abs/tk ln)    0.960182 0.0047     0.962045 0.0042
rem life(abs)   2.6026E+04     2.4586E+04 0.0099    life(col/abs)     2.4597E+04 0.0098   2.4600E+04 0.0100   0.9798
source points generated   1012

source distribution written to file srctp          cycle =    31

 estimator     cycle    32   ave of    27 cycles      combination          simple average     combined average     corr
k(collision)      0.921571        0.957873 0.0062    k(col/abs)          0.960528 0.0040     0.961462 0.0039    0.1074
k(absorption)     0.969113        0.963183 0.0044    k(abs/tk ln)        0.960035 0.0044     0.961243 0.0039    0.0898
k(trk length)     0.919570        0.956887 0.0064    k(tk ln/col)        0.957380 0.0063     0.960435 0.0060    0.9943
rem life(col)   2.6175E+04     2.4667E+04 0.0097    k(col/abs/tk ln)    0.959315 0.0046     0.961772 0.0041
rem life(abs)   2.6631E+04     2.4662E+04 0.0100    life(col/abs)     2.4664E+04 0.0098   2.4667E+04 0.0099   0.9790
source points generated   1001

 estimator     cycle    33   ave of    28 cycles      combination          simple average     combined average     corr
k(collision)      0.948411        0.957535 0.0060    k(col/abs)          0.960109 0.0039     0.961005 0.0037    0.1136
k(absorption)     0.949147        0.962682 0.0043    k(abs/tk ln)        0.959642 0.0039     0.960796 0.0038    0.0949
k(trk length)     0.948903        0.956602 0.0062    k(tk ln/col)        0.957069 0.0061     0.959907 0.0058    0.9943
rem life(col)   2.6717E+04     2.4740E+04 0.0098    k(col/abs/tk ln)    0.958940 0.0044     0.961254 0.0040
rem life(abs)   2.6744E+04     2.4736E+04 0.0101    life(col/abs)     2.4738E+04 0.0099   2.4740E+04 0.0100   0.9809
source points generated   1031

source distribution written to file srctp          cycle =    33

 estimator     cycle    34   ave of    29 cycles      combination          simple average     combined average     corr
k(collision)      0.964596        0.957779 0.0058    k(col/abs)          0.959927 0.0037     0.960647 0.0036    0.1056
```

k(absorption)	0.945104	0.962076	0.0042	k(abs/tk ln)	0.959499	0.0038	0.960444	0.0036	0.0853
k(trk length)	0.965856	0.956921	0.0060	k(tk ln/col)	0.957350	0.0059	0.959966	0.0056	0.9942
rem life(col)	2.2275E+04	2.4655E+04	0.0101	k(col/abs/tk ln)	0.958925	0.0043	0.960848	0.0038	
rem life(abs)	2.2198E+04	2.4649E+04	0.0104	life(col/abs)	2.4652E+04	0.0102	2.4656E+04	0.0103	0.9831

source points generated 987

estimator	cycle 35	ave of 30 cycles		combination	simple average		combined average		corr
k(collision)	0.883609	0.955307	0.0061	k(col/abs)	0.958891	0.0038	0.960332	0.0035	0.0524
k(absorption)	0.974067	0.962475	0.0041	k(abs/tk ln)	0.958472	0.0038	0.960168	0.0036	0.0365
k(trk length)	0.883334	0.954468	0.0064	k(tk ln/col)	0.954887	0.0062	0.957339	0.0060	0.9951
rem life(col)	2.5022E+04	2.4667E+04	0.0098	k(col/abs/tk ln)	0.957417	0.0044	0.960411	0.0037	
rem life(abs)	2.5921E+04	2.4691E+04	0.0101	life(col/abs)	2.4679E+04	0.0099	2.4660E+04	0.0099	0.9763

source points generated 870

source distribution written to file srctp cycle = 35

estimator	cycle 36	ave of 31 cycles		combination	simple average		combined average		corr
k(collision)	0.966455	0.955666	0.0060	k(col/abs)	0.958766	0.0037	0.959970	0.0034	0.0416
k(absorption)	0.943570	0.961866	0.0040	k(abs/tk ln)	0.958281	0.0037	0.959754	0.0035	0.0298
k(trk length)	0.961555	0.954697	0.0061	k(tk ln/col)	0.955182	0.0060	0.957791	0.0059	0.9948
rem life(col)	2.4132E+04	2.4650E+04	0.0095	k(col/abs/tk ln)	0.957410	0.0043	0.960177	0.0037	
rem life(abs)	2.4361E+04	2.4680E+04	0.0098	life(col/abs)	2.4665E+04	0.0096	2.4643E+04	0.0096	0.9759

source points generated 1106

estimator	cycle 37	ave of 32 cycles		combination	simple average		combined average		corr
k(collision)	0.977080	0.956335	0.0058	k(col/abs)	0.958814	0.0035	0.959750	0.0033	0.0225
k(absorption)	0.943533	0.961293	0.0039	k(abs/tk ln)	0.958363	0.0036	0.959535	0.0034	0.0097
k(trk length)	0.978231	0.955433	0.0060	k(tk ln/col)	0.955884	0.0059	0.958401	0.0057	0.9948
rem life(col)	2.5281E+04	2.4669E+04	0.0092	k(col/abs/tk ln)	0.957687	0.0042	0.959930	0.0035	
rem life(abs)	2.4936E+04	2.4688E+04	0.0095	life(col/abs)	2.4679E+04	0.0093	2.4667E+04	0.0094	0.9746

source points generated 1031

source distribution written to file srctp cycle = 37

estimator	cycle 38	ave of 33 cycles		combination	simple average		combined average		corr
k(collision)	0.960972	0.956476	0.0056	k(col/abs)	0.959364	0.0035	0.960375	0.0033	0.0284
k(absorption)	0.992969	0.962253	0.0039	k(abs/tk ln)	0.958912	0.0035	0.960161	0.0033	0.0157
k(trk length)	0.960011	0.955571	0.0058	k(tk ln/col)	0.956024	0.0057	0.958545	0.0055	0.9948
rem life(col)	2.3113E+04	2.4622E+04	0.0091	k(col/abs/tk ln)	0.958100	0.0040	0.960582	0.0035	
rem life(abs)	2.3143E+04	2.4641E+04	0.0094	life(col/abs)	2.4632E+04	0.0092	2.4620E+04	0.0093	0.9757

source points generated 975

estimator	cycle 39	ave of 34 cycles		combination	simple average		combined average		corr
k(collision)	0.941697	0.956041	0.0055	k(col/abs)	0.959474	0.0034	0.960621	0.0032	0.0133
k(absorption)	0.984529	0.962908	0.0039	k(abs/tk ln)	0.958965	0.0034	0.960378	0.0032	-0.0024
k(trk length)	0.936930	0.955023	0.0057	k(tk ln/col)	0.955532	0.0056	0.958431	0.0054	0.9947
rem life(col)	2.2458E+04	2.4559E+04	0.0093	k(col/abs/tk ln)	0.957991	0.0039	0.960772	0.0034	
rem life(abs)	2.2575E+04	2.4581E+04	0.0095	life(col/abs)	2.4570E+04	0.0093	2.4557E+04	0.0094	0.9772

source points generated 947

source distribution written to file srctp cycle = 39

estimator	cycle 40	ave of 35 cycles		combination	simple average		combined average		corr
k(collision)	0.947978	0.955811	0.0053	k(col/abs)	0.959168	0.0033	0.960280	0.0032	0.0179
k(absorption)	0.949491	0.962524	0.0038	k(abs/tk ln)	0.958840	0.0033	0.960141	0.0032	-0.0051
k(trk length)	0.959688	0.955156	0.0055	k(tk ln/col)	0.955484	0.0054	0.957768	0.0053	0.9922
rem life(col)	2.4077E+04	2.4545E+04	0.0090	k(col/abs/tk ln)	0.957831	0.0038	0.960204	0.0033	
rem life(abs)	2.3500E+04	2.4550E+04	0.0093	life(col/abs)	2.4547E+04	0.0091	2.4544E+04	0.0091	0.9748

source points generated 1026

estimator	cycle 41	ave of 36 cycles		combination	simple average		combined average		corr
k(collision)	0.995963	0.956926	0.0053	k(col/abs)	0.959637	0.0032	0.960582	0.0031	0.0065
k(absorption)	0.956138	0.962347	0.0037	k(abs/tk ln)	0.959206	0.0033	0.960344	0.0031	-0.0138
k(trk length)	0.987887	0.956065	0.0054	k(tk ln/col)	0.956496	0.0054	0.957643	0.0053	0.9915
rem life(col)	2.3092E+04	2.4505E+04	0.0089	k(col/abs/tk ln)	0.958446	0.0038	0.960375	0.0032	
rem life(abs)	2.3269E+04	2.4514E+04	0.0092	life(col/abs)	2.4509E+04	0.0090	2.4504E+04	0.0091	0.9752

source points generated 1074

source distribution written to file srctp cycle = 41

estimator	cycle 42	ave of 37 cycles		combination	simple average		combined average		corr
k(collision)	0.923622	0.956026	0.0052	k(col/abs)	0.959315	0.0032	0.960487	0.0030	-0.0071
k(absorption)	0.971879	0.962605	0.0036	k(abs/tk ln)	0.958820	0.0032	0.960229	0.0030	-0.0284

```
k(trk length)      0.917938        0.955035 0.0054     k(tk ln/col)        0.955530 0.0053     0.957076 0.0053    0.9916
rem life(col)    2.3404E+04      2.4475E+04 0.0088     k(col/abs/tk ln)    0.957889 0.0037     0.960286 0.0031
rem life(abs)    2.3644E+04      2.4491E+04 0.0090     life(col/abs)     2.4483E+04 0.0088   2.4475E+04 0.0089    0.9751
source points generated     940

 estimator      cycle    43   ave of    38 cycles      combination          simple average    combined average     corr
k(collision)       0.936915        0.955523 0.0051     k(col/abs)          0.959213 0.0031     0.960520 0.0029   -0.0161
k(absorption)      0.973937        0.962903 0.0035     k(abs/tk ln)        0.958761 0.0031     0.960292 0.0029   -0.0355
k(trk length)      0.939262        0.954620 0.0053     k(tk ln/col)        0.955071 0.0052     0.956372 0.0052    0.9914
rem life(col)    2.4877E+04      2.4485E+04 0.0086     k(col/abs/tk ln)    0.957682 0.0036     0.960353 0.0031
rem life(abs)    2.4738E+04      2.4497E+04 0.0088     life(col/abs)     2.4491E+04 0.0086   2.4486E+04 0.0087    0.9749
source points generated    1042

source distribution written to file srctp          cycle =    43

 estimator      cycle    44   ave of    39 cycles      combination          simple average    combined average     corr
k(collision)       0.857291        0.953004 0.0057     k(col/abs)          0.957374 0.0036     0.959450 0.0033    0.1418
k(absorption)      0.917708        0.961744 0.0036     k(abs/tk ln)        0.956919 0.0036     0.959256 0.0033    0.1227
k(trk length)      0.856134        0.952095 0.0058     k(tk ln/col)        0.952549 0.0057     0.953895 0.0057    0.9932
rem life(col)    2.5224E+04      2.4504E+04 0.0084     k(col/abs/tk ln)    0.955614 0.0041     0.959226 0.0035
rem life(abs)    2.5517E+04      2.4523E+04 0.0086     life(col/abs)     2.4514E+04 0.0084   2.4504E+04 0.0085    0.9747
source points generated     942

 estimator      cycle    45   ave of    40 cycles      combination          simple average    combined average     corr
k(collision)       0.957184        0.953109 0.0055     k(col/abs)          0.956708 0.0035     0.958104 0.0034    0.1228
k(absorption)      0.904235        0.960306 0.0038     k(abs/tk ln)        0.956208 0.0036     0.957861 0.0034    0.1118
k(trk length)      0.952724        0.952110 0.0056     k(tk ln/col)        0.952610 0.0056     0.954045 0.0056    0.9931
rem life(col)    2.4901E+04      2.4514E+04 0.0082     k(col/abs/tk ln)    0.955175 0.0041     0.958102 0.0036
rem life(abs)    2.4497E+04      2.4523E+04 0.0084     life(col/abs)     2.4518E+04 0.0082   2.4514E+04 0.0083    0.9733
source points generated    1088

source distribution written to file srctp          cycle =    45

 estimator      cycle    46   ave of    41 cycles      combination          simple average    combined average     corr
k(collision)       0.966302        0.953431 0.0054     k(col/abs)          0.956672 0.0035     0.957907 0.0033    0.1150
k(absorption)      0.944196        0.959913 0.0038     k(abs/tk ln)        0.956169 0.0035     0.957652 0.0033    0.1044
k(trk length)      0.964988        0.952424 0.0055     k(tk ln/col)        0.952928 0.0054     0.954367 0.0054    0.9931
rem life(col)    2.6615E+04      2.4565E+04 0.0082     k(col/abs/tk ln)    0.955256 0.0040     0.957912 0.0035
rem life(abs)    2.6213E+04      2.4564E+04 0.0083     life(col/abs)     2.4565E+04 0.0082   2.4565E+04 0.0083    0.9733
source points generated    1053

 estimator      cycle    47   ave of    42 cycles      combination          simple average    combined average     corr
k(collision)       0.958915        0.953561 0.0053     k(col/abs)          0.957037 0.0034     0.958317 0.0032    0.1177
k(absorption)      0.985077        0.960513 0.0037     k(abs/tk ln)        0.956551 0.0034     0.958075 0.0033    0.1083
k(trk length)      0.959365        0.952590 0.0054     k(tk ln/col)        0.953075 0.0053     0.954474 0.0053    0.9931
rem life(col)    2.6530E+04      2.4612E+04 0.0082     k(col/abs/tk ln)    0.955554 0.0039     0.958368 0.0034
rem life(abs)    2.5955E+04      2.4597E+04 0.0082     life(col/abs)     2.4605E+04 0.0082   2.4605E+04 0.0083    0.9720
source points generated     987

source distribution written to file srctp          cycle =    47

 estimator      cycle    48   ave of    43 cycles      combination          simple average    combined average     corr
k(collision)       1.004410        0.954744 0.0053     k(col/abs)          0.957941 0.0034     0.959207 0.0033    0.1540
k(absorption)      0.987453        0.961139 0.0037     k(abs/tk ln)        0.957488 0.0035     0.959001 0.0033    0.1461
k(trk length)      1.006196        0.953836 0.0054     k(tk ln/col)        0.954290 0.0053     0.955781 0.0053    0.9935
rem life(col)    2.3041E+04      2.4576E+04 0.0082     k(col/abs/tk ln)    0.956573 0.0039     0.959358 0.0034
rem life(abs)    2.2980E+04      2.4559E+04 0.0082     life(col/abs)     2.4568E+04 0.0081   2.4568E+04 0.0082    0.9729
source points generated    1016

 estimator      cycle    49   ave of    44 cycles      combination          simple average    combined average     corr
k(collision)       0.938952        0.954385 0.0052     k(col/abs)          0.957595 0.0034     0.958867 0.0032    0.1598
k(absorption)      0.946449        0.960805 0.0036     k(abs/tk ln)        0.957147 0.0034     0.958664 0.0032    0.1516
k(trk length)      0.938529        0.953488 0.0053     k(tk ln/col)        0.953937 0.0052     0.955399 0.0052    0.9935
rem life(col)    2.4043E+04      2.4564E+04 0.0080     k(col/abs/tk ln)    0.956226 0.0039     0.959007 0.0034
rem life(abs)    2.3719E+04      2.4540E+04 0.0080     life(col/abs)     2.4552E+04 0.0080   2.4553E+04 0.0081    0.9725
source points generated     898

source distribution written to file srctp          cycle =    49

 estimator      cycle    50   ave of    45 cycles      combination          simple average    combined average     corr
k(collision)       0.954418        0.954386 0.0051     k(col/abs)          0.957591 0.0033     0.958861 0.0031    0.1598
k(absorption)      0.960426        0.960797 0.0035     k(abs/tk ln)        0.957185 0.0034     0.958684 0.0032    0.1516
k(trk length)      0.957293        0.953573 0.0052     k(tk ln/col)        0.953979 0.0051     0.955285 0.0051    0.9933
```

```
 rem life(col)   2.6140E+04     2.4599E+04 0.0079     k(col/abs/tk ln)    0.956252 0.0038     0.958983 0.0033
 rem life(abs)   2.5509E+04     2.4562E+04 0.0079     life(col/abs)     2.4580E+04 0.0079   2.4576E+04 0.0080    0.9707
 source points generated   1047

 source distribution written to file srctp          cycle =    50
1problem summary

      run terminated when    50 kcode cycles were done.                                                  03/09/93 17:46:44
       IXC602 - Three IXCs 42.00 g/l Pu per cell, full tank model                          probid =   03/09/93 15:16:42
0
 neutron creation     tracks      weight        energy          neutron loss        tracks      weight        energy
                                  (per source particle)                                           (per source particle)

 source               51283    9.7498E-01    2.1133E+00         escape                730    7.0718E-03    1.8121E-03
                                                                  energy cutoff           0    0.            0.
                                                                  time cutoff             0    0.            0.
 weight window            0    0.            0.                 weight window           0    0.            0.
 cell importance          0    0.            0.                 cell importance         0    0.            0.
 weight cutoff            0    7.4601E-02    3.0908E-05         weight cutoff       50553    7.4197E-02    8.3043E-05
 energy importance        0    0.            0.                 energy importance       0    0.            0.
 dxtran                   0    0.            0.                 dxtran                  0    0.            0.
 forced collisions        0    0.            0.                 forced collisions       0    0.            0.
 exp. transform           0    0.            0.                 exp. transform          0    0.            0.
 upscattering             0    0.            4.3891E-07         downscattering          0    0.            2.0869E+00
                                                                  capture                 0    6.4101E-01    2.3375E-02
 (n,xn)                   0    0.            0.                 loss to (n,xn)          0    0.            0.
 fission                  0    0.            0.                 loss to fission         0    3.2731E-01    1.1627E-03
    total             51283    1.0496E+00    2.1133E+00             total           51283    1.0496E+00    2.1133E+00

  number of neutrons banked                          0        average lifetime, shakes              cutoffs
  neutron tracks per source particle       1.0000E+00          escape            3.1146E+05          tco   1.0000+120
  neutron collisions per source particle 1.1576E+02            capture           2.2019E+04          eco   0.0000E+00
  total neutron collisions                   5936358           capture or escape 2.4118E+04          wc1  -5.0000E-01
  net multiplication                 1.0000E+00 0.0006         any termination   2.9273E+04          wc2  -2.5000E-01

 computer time so far in this run    28.29 minutes            maximum number ever in bank        0
 computer time in mcrun              28.27 minutes            bank overflows to backup file      0
 source particles per minute            1.8138E+03            field length                       0
 random numbers generated                 74513343            most random numbers used was    10761 in history    11203

 range of sampled source weights = 4.1288E-01 to 1.1494E+00
1neutron  activity in each cell                                                                   print table 126
```

	cell	tracks entering	population	collisions	collisions * weight (per history)	number weighted energy	flux weighted energy	average track weight (relative)	average track mfp (cm)
1	1	0	0	0	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
2	2	57503	15974	1749137	1.9248E+01	4.8845E-05	2.1403E-01	5.9699E-01	2.0988E+00
3	3	60856	15974	0	0.0000E+00	1.3734E-04	4.2016E-01	7.0708E-01	0.0000E+00
4	4	40276	17494	38603	5.0630E-01	2.6787E-04	6.0659E-01	7.6409E-01	2.5392E+00
5	5	7549	4895	254824	3.5822E+00	1.6619E-04	5.3964E-01	8.1505E-01	1.5950E+00
6	6	16763	10772	578689	8.3121E+00	1.6639E-04	5.4215E-01	8.2720E-01	1.5950E+00
7	7	30851	19909	1112173	1.5440E+01	1.7035E-04	5.4798E-01	7.9690E-01	1.6126E+00
8	8	31852	20629	1170995	1.6394E+01	1.6794E-04	5.4217E-01	8.0436E-01	1.6024E+00
9	9	19220	12334	688660	9.8696E+00	1.6324E-04	5.3372E-01	8.2654E-01	1.5841E+00
10	10	8443	5494	284735	4.0559E+00	1.6221E-04	5.2401E-01	8.2247E-01	1.5765E+00
11	11	0	0	0	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
12	12	0	0	0	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
13	13	10068	2903	58542	5.2533E-01	1.7000E-05	9.2495E-02	4.7576E-01	1.8581E+00
14	14	730	730	0	0.0000E+00	4.4995E-05	2.4702E-01	4.9657E-01	0.0000E+00
total		284111	127108	5936358	7.7934E+01				

```
1neutron  weight balance in each cell -- external events                                          print table 130
```

	cell	entering	source	energy cutoff	time cutoff	exiting	total
1	1	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	-7.7534E-02	-7.7534E-02
2	2	7.8531E-01	0.0000E+00	0.0000E+00	0.0000E+00	-4.7802E-01	3.0729E-01
3	3	8.5943E-01	0.0000E+00	0.0000E+00	0.0000E+00	-8.5943E-01	0.0000E+00
4	4	6.1551E-01	0.0000E+00	0.0000E+00	0.0000E+00	-5.7544E-01	4.0063E-02
5	5	6.5330E-02	6.0939E-02	0.0000E+00	0.0000E+00	-8.1565E-02	4.4704E-02

6	6	1.5024E-01	1.3757E-01	0.0000E+00	0.0000E+00	-1.8269E-01	1.0512E-01
7	7	2.4724E-01	2.7232E-01	0.0000E+00	0.0000E+00	-3.2496E-01	1.9460E-01
8	8	2.6566E-01	2.7395E-01	0.0000E+00	0.0000E+00	-3.3429E-01	2.0532E-01
9	9	1.7007E-01	1.6328E-01	0.0000E+00	0.0000E+00	-2.1096E-01	1.2238E-01
10	10	7.6005E-02	6.6921E-02	0.0000E+00	0.0000E+00	-9.1726E-02	5.1200E-02
11	11	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	-3.1250E-02	-3.1250E-02
12	12	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	-1.7901E-04	-1.7901E-04
13	13	1.0395E-01	0.0000E+00	0.0000E+00	0.0000E+00	-9.7757E-02	6.1936E-03
14	14	7.0718E-03	0.0000E+00	0.0000E+00	0.0000E+00	-7.0718E-03	0.0000E+00
total		3.3458E+00	9.7498E-01	0.0000E+00	0.0000E+00	-3.3529E+00	9.6791E-01

1neutron weight balance in each cell -- variance reduction events print table 130

cell		weight window	cell importance	weight cutoff	energy importance	dxtran	forced collision	exponential transform	total
1	1	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
2	2	0.0000E+00	0.0000E+00	-1.0786E-04	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	-1.0786E-04
3	3	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
4	4	0.0000E+00	0.0000E+00	2.3731E-04	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	2.3731E-04
5	5	0.0000E+00	0.0000E+00	5.6725E-05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	5.6725E-05
6	6	0.0000E+00	0.0000E+00	-7.9681E-05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	-7.9681E-05
7	7	0.0000E+00	0.0000E+00	1.6463E-04	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	1.6463E-04
8	8	0.0000E+00	0.0000E+00	-6.8140E-05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	-6.8140E-05
9	9	0.0000E+00	0.0000E+00	-5.5093E-05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	-5.5093E-05
10	10	0.0000E+00	0.0000E+00	-5.3648E-05	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	-5.3648E-05
11	11	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
12	12	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
13	13	0.0000E+00	0.0000E+00	3.0964E-04	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	3.0964E-04
14	14	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
total		0.0000E+00	0.0000E+00	4.0389E-04	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	4.0389E-04

1neutron weight balance in each cell -- physical events print table 130

cell		(n,xn)	fission	capture	loss to (n,xn)	loss to fission	total
1	1	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
2	2	0.0000E+00	0.0000E+00	-1.9822E-01	0.0000E+00	0.0000E+00	-1.9822E-01
3	3	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
4	4	0.0000E+00	0.0000E+00	-4.0300E-02	0.0000E+00	0.0000E+00	-4.0300E-02
5	5	0.0000E+00	0.0000E+00	-2.4743E-02	0.0000E+00	-2.0018E-02	-4.4761E-02
6	6	0.0000E+00	0.0000E+00	-5.7446E-02	0.0000E+00	-4.7591E-02	-1.0504E-01
7	7	0.0000E+00	0.0000E+00	-1.0609E-01	0.0000E+00	-8.8668E-02	-1.9476E-01
8	8	0.0000E+00	0.0000E+00	-1.1236E-01	0.0000E+00	-9.2896E-02	-2.0526E-01
9	9	0.0000E+00	0.0000E+00	-6.7408E-02	0.0000E+00	-5.4921E-02	-1.2233E-01
10	10	0.0000E+00	0.0000E+00	-2.7933E-02	0.0000E+00	-2.3213E-02	-5.1146E-02
11	11	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
12	12	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
13	13	0.0000E+00	0.0000E+00	-6.5032E-03	0.0000E+00	0.0000E+00	-6.5032E-03
14	14	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
total		0.0000E+00	0.0000E+00	-6.4101E-01	0.0000E+00	-3.2731E-01	-9.6831E-01

1neutron activity of each nuclide in each cell, per source particle print table 140

cell		nuclides	atom fraction	total collisions	collisions * weight	weight lost to capture	weight loss to fission	weight gain by (n,xn)
2	2	13027.50c	2.1339E-02	9558	1.1996E-01	7.9077E-03	0.0000E+00	0.0000E+00
		20000.50c	1.8591E-02	14844	1.6768E-01	1.3578E-02	0.0000E+00	0.0000E+00
		26000.55c	4.2453E-03	12817	1.3816E-01	1.7377E-02	0.0000E+00	0.0000E+00
		1001.50c	1.6803E-01	1054678	1.1216E+01	8.7749E-02	0.0000E+00	0.0000E+00
		8016.50c	5.6324E-01	520233	5.9671E+00	1.4578E-03	0.0000E+00	0.0000E+00
		14000.50c	2.0319E-01	114074	1.3536E+00	5.2096E-02	0.0000E+00	0.0000E+00
		11023.50c	2.1361E-02	22933	2.8532E-01	1.8054E-02	0.0000E+00	0.0000E+00
4	4	6000.50c	4.4858E-02	749	1.0356E-02	2.4060E-06	0.0000E+00	0.0000E+00
		26000.55c	9.5514E-01	37854	4.9595E-01	4.0298E-02	0.0000E+00	0.0000E+00
5	5	1001.50c	5.4856E-01	226761	3.1540E+00	1.4749E-02	0.0000E+00	0.0000E+00
		6000.50c	3.5369E-01	20906	3.2178E-01	1.2933E-04	0.0000E+00	0.0000E+00
		8016.50c	9.7445E-02	4894	7.6069E-02	5.2380E-05	0.0000E+00	0.0000E+00
		94239.55c	2.9036E-04	2189	4.9504E-02	8.6602E-03	2.0018E-02	0.0000E+00

		94240.50c	1.8533E-05	74	1.2024E-03	1.1517E-03	2.6859E-07	0.0000E+00
6	6	1001.50c	5.4856E-01	514932	7.3231E+00	3.4119E-02	0.0000E+00	0.0000E+00
		6000.50c	3.5369E-01	47355	7.4002E-01	2.9399E-04	0.0000E+00	0.0000E+00
		8016.50c	9.7445E-02	11191	1.7704E-01	1.2784E-04	0.0000E+00	0.0000E+00
		94239.55c	2.9036E-04	5056	1.1644E-01	2.0590E-02	4.7582E-02	0.0000E+00
		94240.50c	1.8533E-05	155	2.5064E-03	2.3153E-03	8.9417E-06	0.0000E+00
7	7	1001.50c	5.4856E-01	988181	1.3586E+01	6.3106E-02	0.0000E+00	0.0000E+00
		6000.50c	3.5369E-01	92451	1.3918E+00	5.3644E-04	0.0000E+00	0.0000E+00
		8016.50c	9.7445E-02	21493	3.2867E-01	2.5007E-04	0.0000E+00	0.0000E+00
		94239.55c	2.9036E-04	9753	2.1614E-01	3.7885E-02	8.8666E-02	0.0000E+00
		94240.50c	1.8533E-05	295	4.5438E-03	4.3162E-03	2.6371E-06	0.0000E+00
8	8	1001.50c	5.4856E-01	1041202	1.4432E+01	6.7189E-02	0.0000E+00	0.0000E+00
		6000.50c	3.5369E-01	96756	1.4736E+00	5.5018E-04	0.0000E+00	0.0000E+00
		8016.50c	9.7445E-02	22597	3.4850E-01	2.3744E-04	0.0000E+00	0.0000E+00
		94239.55c	2.9036E-04	10135	2.2791E-01	3.9896E-02	9.2886E-02	0.0000E+00
		94240.50c	1.8533E-05	305	4.8193E-03	4.4885E-03	9.8764E-06	0.0000E+00
9	9	1001.50c	5.4856E-01	612945	8.6958E+00	4.0642E-02	0.0000E+00	0.0000E+00
		6000.50c	3.5369E-01	56626	8.8376E-01	3.4887E-04	0.0000E+00	0.0000E+00
		8016.50c	9.7445E-02	13028	2.0713E-01	1.3571E-04	0.0000E+00	0.0000E+00
		94239.55c	2.9036E-04	5881	1.3575E-01	2.3574E-02	5.4912E-02	0.0000E+00
		94240.50c	1.8533E-05	180	2.9321E-03	2.7077E-03	9.1283E-06	0.0000E+00
10	10	1001.50c	5.4856E-01	253353	3.5729E+00	1.6620E-02	0.0000E+00	0.0000E+00
		6000.50c	3.5369E-01	23277	3.6043E-01	1.3480E-04	0.0000E+00	0.0000E+00
		8016.50c	9.7445E-02	5533	8.7604E-02	7.2587E-05	0.0000E+00	0.0000E+00
		94239.55c	2.9036E-04	2494	5.6630E-02	9.9494E-03	2.3213E-02	0.0000E+00
		94240.50c	1.8533E-05	78	1.2173E-03	1.1559E-03	2.2011E-07	0.0000E+00
13	13	13027.50c	2.1339E-02	280	2.8119E-03	2.8216E-04	0.0000E+00	0.0000E+00
		20000.50c	1.8591E-02	492	4.4360E-03	4.3997E-04	0.0000E+00	0.0000E+00
		26000.55c	4.2453E-03	418	3.8129E-03	5.5633E-04	0.0000E+00	0.0000E+00
		1001.50c	1.6803E-01	36301	3.1973E-01	2.8760E-03	0.0000E+00	0.0000E+00
		8016.50c	5.6324E-01	16796	1.5427E-01	1.3912E-05	0.0000E+00	0.0000E+00
		14000.50c	2.0319E-01	3532	3.3193E-02	1.6750E-03	0.0000E+00	0.0000E+00
		11023.50c	2.1361E-02	723	7.0732E-03	6.5975E-04	0.0000E+00	0.0000E+00
total				5936358	7.8259E+01	6.4101E-01	3.2731E-01	0.0000E+00

total over all cells for each nuclide

1001.50c	4728353	6.2299E+01	3.2705E-01	0.0000E+00	0.0000E+00
6000.50c	338120	5.1818E+00	1.9960E-03	0.0000E+00	0.0000E+00
8016.50c	615765	7.3464E+00	2.3478E-03	0.0000E+00	0.0000E+00
11023.50c	23656	2.9239E-01	1.8713E-02	0.0000E+00	0.0000E+00
13027.50c	9838	1.2277E-01	8.1899E-03	0.0000E+00	0.0000E+00
14000.50c	117606	1.3868E+00	5.3771E-02	0.0000E+00	0.0000E+00
20000.50c	15336	1.7212E-01	1.4018E-02	0.0000E+00	0.0000E+00
26000.55c	51089	6.3792E-01	5.8231E-02	0.0000E+00	0.0000E+00
94239.55c	35508	8.0237E-01	1.4055E-01	3.2728E-01	0.0000E+00
94240.50c	1087	1.7221E-02	1.6135E-02	3.1072E-05	0.0000E+00

****

dump no. 3 on file runtpe nps = 51283 ctm = 28.27

4 warning messages so far.

run terminated when 50 kcode cycles were done.

mcnp version 4.2 3/5/91 03/09/93 17:46:44 probid = 03/09/93 15:16:42

APPENDIX D.

CHECKLIST FOR INDEPENDENT REVIEW

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CHECKLIST FOR INDEPENDENT REVIEW

Document Reviewed: WHC-SD-NR-CSER-011

Author: DAVID G. ERICKSON

Yes	No	N/A	
[X]	[ ]	[ ]	Problem completely defined.
[X]	[ ]	[ ]	Necessary assumptions explicitly stated and supported.
[X]	[ ]	[ ]	Computer codes and data files documented.
[X]	[ ]	[ ]	Data checked for consistency with original source information as applicable.
[X]	[ ]	[ ]	Mathematical derivations checked including dimensional consistency of results.
[X]	[ ]	[ ]	Models appropriate and used within range of validity or use outside range of established validity justified.
[X]	[ ]	[ ]	Hand calculations checked for errors.
[X]	[ ]	[ ]	Code run streams correct and consistent with analysis documentation.
[X]	[ ]	[ ]	Code output consistent with input and with results reported in analysis documentation.
[X]	[ ]	[ ]	Acceptability limits on analytical results applicable and supported. Limits checked against sources.
[X]	[ ]	[ ]	Safety margins consistent with good engineering practices.
[X]	[ ]	[ ]	Conclusions consistent with analytical results and applicable limits.
[X]	[ ]	[ ]	Results and conclusions address all points required in the problem statement.
[X]	[ ]	[ ]	Have all reasonable accidents been considered?
[X]	[ ]	[ ]	Has low density water (steam) been evaluated as a moderator?
[X]	[ ]	[ ]	Is the fuel and other hardware composition correct?
[X]	[ ]	[ ]	Are the cases considered conservative? Too conservative?
[X]	[ ]	[ ]	Do the computer models adequately reflect the actual geometry? Have cross sectional cuts of the geometry been made and do they show the desired geometry?
[ ]	[ ]	[X]	Has the analysis been reviewed by Safety? This may not be required in a preliminary design.
[ ]	[ ]	[ ]	Has the reviewer completed the Criticality Safety Course for Managers and Engineers? Date completed 13 August 1993

Reviewed by: Warren D. Wittekind Date 13 August 1993

NOTE: Any hand calculations, notes, or summaries generated as part of this review should be signed, dated, and attached to this checklist. Materials should be labeled and recorded so that it is intelligible to a technically-qualified third party.

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Criticality Safety Evaluation of the 100K Area Ion Exchange Modules and Ion Exchange Columns		ECN No.

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