A Neutronic Analysis of TRU Recycling in PWRs Loaded with MOX-UE Fuel (MOX with U-235 Enriched U Support)

Advanced Fuel Cycle Initiative

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SUMMARY

This report presents the results of a neutronic analysis related to the homogeneous recycling of different TRU mixtures (Pu, PuNp, PuNpAm, PuNpAmCm or PuNpAmCmBkCf) in PWRs using MOX-UE fuel, i.e. MOX fuel with a U235 enriched uranium support instead of depleted uranium (i.e. containing 0.25% U235) for standard MOX fuel. It focuses mainly on reactor physics issues and does not cope with other issues like economics, fuel fabrication, transportation or reprocessing that are essential to assess a system as a whole. This will be dealt with later if it is deemed necessary.

With this in mind, and from a neutron physics point of view, the MOX-UE approach allows to multirecycle TRU as long as U235 is available, by keeping the TRU content in the fuel constant and at a value ensuring a negative moderator **void coefficient** (i.e. the loss of the coolant brings imperatively the reactor to a subcritical state). Once this value is determined, the U235 enrichment of the MOX-UE fuel is adjusted in order to reach the target burnup (51 GWd/t in this study). For the Pu-only recycling case we chose to keep the **Pu content** equal to its first cycle value which is **10%**. For the other cases (PuNp, PuNpAm, PuNpAmCm and PuNpAmCmBkCf) we chose to lower this value in order to ensure a negative void coefficient. Since we consider PWRs entirely loaded with MOX-UE, and based on previous studies, we decided to limit the **TRU content** at **8%**. The main conclusions to be drawn from this study are the following:

1) From a neutron physics point of view, **it is possible to multirecycle the entirety of the Pu, or PuNp or PuNpAm or PuNpAmCm or PuNpAmCmBkCf in a PWR fleet** using MOX-UE fuel in between one third and two thirds of the fleet. For a 100 GWe fleet producing 800 TWhe/year at static equilibrium it translates into MOX-UE fabrication capacities of between 625 tHM/year (Pu case) and 1325 tHM/year (PuNpAmCm or PuNpAmCmBkCf cases). Since all the fuel assemblies (MOX-UE and UOX) are reprocessed, the reprocessing capacity has to be about 2000 tHM/year. As a reminder, the capacity of the French reprocessing plant of La Hague is about 1600 tHM/year and that of the MOX fabrication plant MELOX is about 200 tHM/year. The amount of TRU that needs to be disposed of (in tons per year considering reprocessing losses equal to 0.1%) depending on the recycling strategy is presented in the table below where UOX stands for the open fuel cycle and Mono-MOX means monorecycling of Pu like what is done in France for example.

	UOX	**Mono MOX**	**Multi Pu**	**Multi PuNp**	**Multi PuNpAm**	**Multi PuNpAmCm**	**Multi TRU**
Pu	21.8	13.7	0.06	0.06	0.08	0.08	0.08
Np	1.20	1.13	1.14	0.002	0.003	0.003	0.003
Am	1.78	3.18	6.92	6.77	0.01	0.01	0.01
Cm	0.13	0.30	0.87	0.95	2.79	0.007	0.007
Cf	-	-	-	-	-	0.007	-
Total	**24.9**	**18.3**	**9.0**	**7.8**	**2.9**	**0.11**	**0.1**

2) **The impact of the different recycling strategies at the fabrication and reprocessing** has been evaluated from the physics standpoint. The most important effect is related to the neutron source at the fabrication when Cm is recycled. Indeed, in the PuNpAmCm case, it is between 50 and 400 times (1st and 10th recycling) higher than that of a standard MOX-Pu fuel that can be fabricated today at MELOX for example. The neutron source of the PuNpAmCmBkCf case is similar to that of the PuNpAmCm case up to the 6th recycling (i.e. 75 years after the beginning of the first recycling), when the build-up of Cf252, even though present only in minute quantities (9 mg/tHM and 50 mg/tHM at the 6th and 10th recycling)

brings about an even larger increase in the neutron source. Hence, the consequences of **Cf252 build-up would start to be noticeable only 75 years after the beginning of the first recycling** which leaves time to find a way to flush these few grams of Cf per ton HM it if it is deemed necessary (either through chemical extraction or, since Cf252's half-life is only 2.6 years, simply by letting the fuel cool a few extra years).

3) **A PWR fleet recycling its own TRU needs about 20% less natural U than a reference UOX fleet if the reprocessed uranium from the MOX-UE fuel is recycled in reactor**. This important information, i.e. multirecycling TRU in a PWR fleet consumes less natural U than a UOX fleet even though the U235 enrichment of the MOX-UE is higher than that of the reference UOX fuel, stems from the fact that the uranium reprocessed from the MOX-UE fuel still contains a lot of U235. This aspect is very important since, for example, for the PuNpAm recycling fleet the necessary natural uranium mass flow goes from about +28% when reprocessed uranium is not recycled to about -20% when it is (relative to the reference UOX reactor fleet).

4) Even though more detailed **reactor physics** analysis are required, especially to demonstrate the feasibility to load MOX-UE assemblies in existing US PWRs, the MOX-UE cores presented in this report present **no major physics show-stoppers** since the TRU content is limited to between 8% and 10% in order to ensure a negative void coefficient. The other parameters investigated, i.e. critical boron concentrations, reactivity loss per cycle, control rod worth, delayed neutron fraction, reactivity coefficients present no major show-stoppers either. The control rod worth should be increased by enriching the boron in B10 in order to ensure sufficient reactivity margins. Enriching the soluble boron or using burnable poisons might be necessary as well in order to decrease its concentration at beginning of cycle.

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ACRONYMS

FA	Fuel Assembly
FP	Fission Products
HM	Heavy Metal = U + Pu + Np + Am + Cm + Bk + Cf
MA	Minor Actinides = Np, Am, Cm, Bk and Cf or any combinations of these elements
MOX	Mixed Oxide fuel = $U_{depl}O_2$-PuO_2 or $U_{depl}O_2$-$TRUO_2$, the U used comes usually from the depleted stream of an enrichment plant, i.e. the percentage of U-235 is only about 0.25%.
MOX-UE	Mixed Oxide fuel with enriched U support = $U_{enriched}O_2$-PuO_2 or $U_{enriched}O_2$-$TRUO_2$. The U-235 enrichment, i.e. U-235/U-235+U-238 is determined to reach the target burnup.
NatU	Natural Uranium
PWR	Pressurized Water Reactor
RepU	Reprocessed Uranium
RIA	Reactivity Induced Accident
TRU	Transuranic elements, i.e. Pu, Np, Am, Cm, Bk and Cf or any combinations of these elements
SNF	Spent Nuclear Fuel
UOX	Uranium Oxyde fuel = $U_{enriched}O_2$. The U-235 enrichment, i.e. U-235/U-235+U-238 is determined to reach the target burnup.

SYSTEMS ANALYSIS CAMPAIGN

1. INTRODUCTION

Nowadays, the vast majority of nuclear electricity is produced by PWRs using enriched uranium fuel. In the process, fission products and transuranic elements (plutonium plus other minor actinides) are produced at respective rates of about 125 kg/TWhe, 30 kg/TWhe, and 4 kg/TWhe (1 TWhe = 1 billion kWhe). Concerns over repository space /**1.1**/ and heat load /**1.2**/ as well as growing spent nuclear fuel inventories have led the nuclear community into looking at the possibility to transmute Pu, Np, Am and Cm through multirecycling in either Fast Reactors, PWRs or Accelerator Driven Systems.

This report presents the results of a neutronic analysis related to the homogeneous recycling of different TRU mixtures (Pu, PuNp, PuNpAm, PuNpAmCm or PuNpAmCmBkCf) in PWRs using MOX-UE fuel, i.e. MOX fuel with a U235 enriched uranium support instead of depleted uranium (0.25%) for standard MOX fuel. This approach allows to multirecycle TRU as long as U235 is available, by keeping the TRU content in the fuel at a value ensuring a negative moderator void coefficient. Once this value is determined, the U235 enrichment of the MOX-UE fuel is adjusted in order to reach the target burnup.

Section 2 of this report presents the MOX industrial feedback experience in France, section 3 the multirecycling calculation methodology, section 4 the void coefficient issue and section 5 the results in terms of uranium enrichments, TRU mass balances with recycling number, core physics aspects, consequences on fuel fabrication and reprocessing, static equilibrium mass flows and inventories and finally the helium production in the fuel.

2. MOX INDUSTRIAL FEEDBACK EXPERIENCE IN FRANCE /2.1/ /2.2/ /2.3/

With the delay in Fast Reactors deployment, plutonium, the prime fuel for these reactors, is accumulating. Hence, certain countries decided to use it as fissile material in PWRs, replacing U-235, in what is called MOX (Mixed OXyde) fuel. However, introducing plutonium in existing PWRs has consequences on the reactivity coefficients of the core: the fuel and moderator temperature coefficients become more negative, whereas the soluble boron efficiency decreases. Thus, in order to limit the modifications of the reactor made necessary to preserve the safety margins in accidental situations, the percentage of MOX fuel assemblies is limited to between 30% and 50%.

In France, the first batch of sixteen MOX FAs (Fuel Assemblies) was loaded into the 900 MW PWR Saint Laurent B1 in September 1987. Since the neutron physics characteristics of Pu are very different from those of U-235, it was decided to limit the number of MOX FAs in the core to about 30% (Figure 2.1) in order to limit the necessary modifications to the reactor while still satisfying all the safety requirements. Compared with the standard UOX cores it was then only necessary to add 4 RCCAs (Reactivity Control Cluster Assemblies) and increase the boron concentration in the safety injection tank. An important point is that the fuel loading patterns were optimized so as to limit the neutron fluence to the vessel (the fluence to the vessel is strongly correlated with the life-time of the reactor); indeed a 40% decrease relative to UOX cores is observed.

By October 2005, about 2400 MOX FAs had been loaded in 20 PWR 900 MW units, thereby constituting a large experience of MOX recycling in PWRs. MOX rods, together with all components of the MOX FA, are designed to meet the same mechanical and thermal hydraulic conditions as UOX ones. A MOX FA contains only mixed oxide rods (UO2-PuO2) and the average Pu content is adjusted to take account of its isotopic composition (63 to 70% fissile Pu). Furthermore, in order to avoid a strong power peaking at the

UOX-MOX interfaces, whose origin lies in the larger Pu-239 and 241 fission cross sections relative to that of U-235, the MOX FAs are made up of 3 different Pu contents (Figure 2.2).

From 1987 to 1993, both UOX and MOX FAs were managed on a 3-batch annual cycle. In 1993, the Safety Authority allowed EDF (Electricite de France) to increase the UOX FAs discharge burnups. However, because the feedback experience with MOX FAs was limited in comparison to the one with UOX FAs, up to 2007 only ‘‘hybrid’’ management was implemented with respectively 3 and 4 annual cycles for MOX and UOX FAs. The U-235 enrichment of the UOX FAs went from 3.25% (3 annual cycles) to 3.7% (4 annual cycles) and the average total Pu content in the MOX FAs was about 5.3% up to 1998 and then had to be increased to 7% when it became necessary to recover Pu from more irradiated UOX FAs while keeping the same energy equivalence of the MOX FAs. The average discharge burn-up of these MOX FAs was about 38 GWd/t and the maximum observed was 42 GWd/t after three cycles.

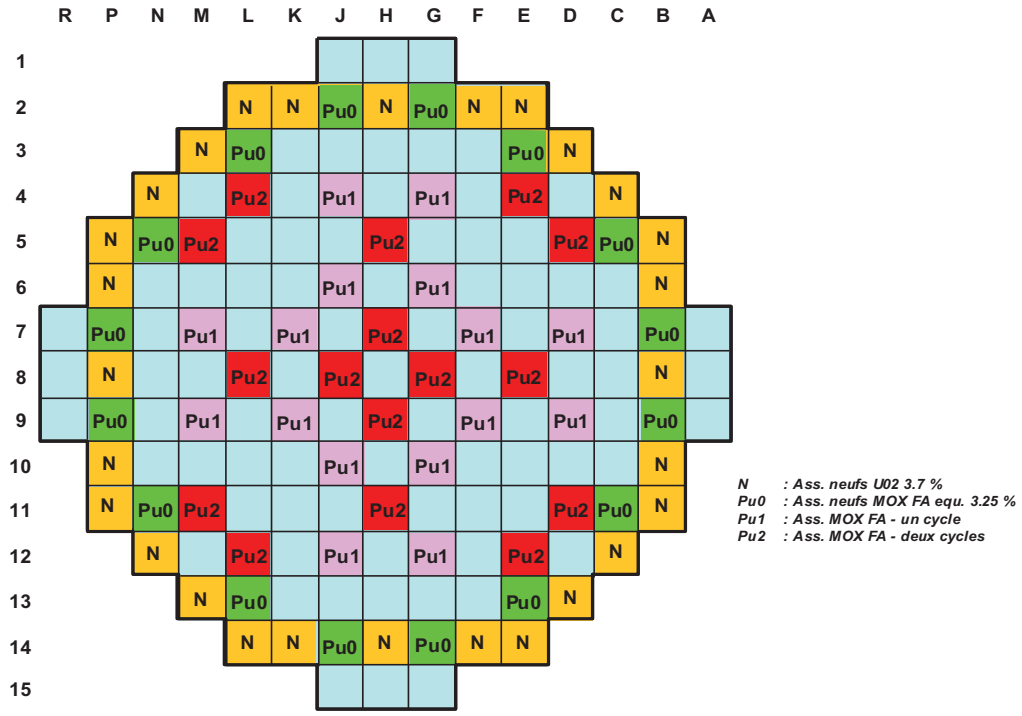

Figure 2.1. Fuel loading pattern in a 30% MOX 900 MWe PWR.

In 2007, EDF started introducing MOX FAs with a higher plutonium content (up to 8.6% total Pu) in order to match the energy equivalence of 3.7% UOX so that now both UOX and MOX FAs are managed on a 4-batch annual cycle (MOX Parity core management). This modification to the fuel loading made the addition of 4 RCCA necessary to ensure sufficient subcriticality margins. This new fuel management will also contribute to recycle more plutonium each year, with the objective of stabilizing the amount of separated plutonium, i.e. to match the amount of Pu produced in the UOX FAs and the amount of Pu loaded in the MOX FAs.

From the origin of the MOX use in EDF PWRs, some 1,800 MOX FAs have been unloaded after 3 annual cycles. Only 4 failed MOX FAs have been identified from the beginning (probably caused by debris), which gives a very satisfactory level of reliability to MOX, same or better than UOX fuel.

Load follow is authorized and applied to all reactors recycling plutonium, which are operated with the same maneuverability than those using UOX. Power ramp tests, implemented in the beginning of the 90’s, have shown that MOX fuel behaves better than UOX fuel in terms of Pellet Clad Interaction (PCI).

Improvements in neutronics calculations relating to core behavior have resulted in greater consistency between predicted values and the measurements taken during start-up tests and in operation. Computer models to test the behavior of MOX rods have also been validated by physical measurements taken during operation as well as by Post Irradiation Examination (PIE) in hot cells.

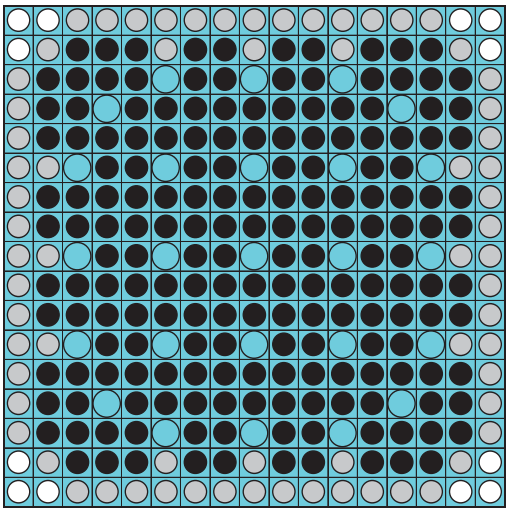

Figure 2.2. MOX FA design used in France since 1995. The Pu contents in the different rods relative to the average Pu content are respectively equal to 0.51 (white), 0.73 (grey) and 1.13 (black).

Apart from France, MOX FAs are also being used in Germany (8 PWRs + 2 BWRs), Switzerland (3 PWRs), and Belgium (2 PWRs). The Japanese electric utilities are aiming to use MOX FAs in 16-18 reactors by 2010 (about half of them BWRs and the other half PWRs). In the early stage of the program, the utilities are planning to use MOX fuel manufactured overseas using plutonium recovered from overseas reprocessing. Indeed in November 2008 AREVA signed a contract to supply 32 mixed-oxide (MOX) fuel assemblies for use in units 3 and 4 of Kansai Electric Power Co's Takahama nuclear power plants. Once the Rokkasho MOX fuel fabrication plant starts operation, plutonium recovered at Rokkasho Reprocessing Plant will also be used in due course.

This is of course only a very brief overview of the experience accumulated with reprocessing and the use of MOX fuel throughout the world. More information can be found, for example, in the IAEA reports /**2.4**/ and /**2.5**/ presenting respectively the status and advances in MOX fuel technology as well as different spent fuel reprocessing options.

Finally, it is worthwhile noting that in addition to Pu, a certain amount of U is reprocessed as well. Indeed, in France, the current production of UOX fuel (equivalent 3.7% U-235) from RepU amounts to about 40 tHM/year which is enough to fuel two 900 MWe PWRs. As of Dec. 2003, about 2900 tons of RepU have been recycled into reactors in France and about 2700 tons in Germany /**2.6**/. Belgium, Netherland, Switzeland, Japan and Spain have been using RepU as well but at a smaller scale (less than 500 tons as of Dec. 2003). Reference /**2.6**/ is recent (2007) and presents the technical characteristics of RepU, its production (past, present and future), the reactor issues of using fuel manufactured from RepU, the management facilities as well as the economic and regulatory issues.

3. MULTIRECYCLING CALCULATIONS METHODOLOGY

Reactor physics calculations. The calculations are carried out using the lattice physics capabilities of the SCALE5.1 code systems, i.e. the discrete-ordinates code NEWT coupled to the depletion code ORIGEN-S via the TRITON control module /**3.1**/. Using the discrete-ordinates approximation to the transport equation on an arbitrary grid, together with a 238-group neutron cross-section library based on ENDFB-VI, NEWT provides a robust and rigorous deterministic solution for non-orthogonal configurations. The differencing scheme employed by NEWT, the Extended Step Characteristic method, allows a computational two-dimensional mesh based on arbitrary polygons. Such a mesh can be used to closely approximate curved or irregular surfaces to provide the capability to model problems that were formerly difficult or impractical to model directly with discrete-ordinates methods.

The TRITON control module performs the task of coordination of data transfer between various physics codes available within SCALE and of invoking those codes in the proper sequence for a desired type of calculation. The high-fidelity nature of the NEWT solution in estimating angular flux distributions combined with the rigor of the ORIGEN-S depletion solver gives TRITON the capability to perform precise burnup-dependent physics calculations with few implicit approximations, and limited primarily by the accuracy of nuclide cross-sectional data. Such rigor may be necessary to capture the unique attributes of MOX fuel behavior as well as that of advanced, highly heterogeneous fuel assembly designs being deployed in current-generation reactors. Cross-sectional self-shielding is carried out by BONAMI for unresolved-range resonance data; the resolved resonance processor module CENTRM performs a 1-D discrete-ordinates code that uses pointwise cross-section data to produce a set of continuous-energy fluxes at discrete spatial intervals for each unit cell. Following a CENTRM calculation, the code PMC uses the resulting flux to collapse the pointwise continuous-energy cross sections into multigroup cross sections for each nuclide in each material in a unit (e.g., pin cell). The result is a multigroup library in which point cross-sectional data are weighted using the explicit pointwise spectrum representative of the nuclides present in a pin cell. Effects from overlapping resonances, fissile material in the fuel and surrounding moderator, anisotropic scattering, and inelastic level scattering are explicitly handled by this approach.

The TRITON model represents one fourth of a standard 17x17 fuel assembly (Figure 3.1). All the MOX-UE rods have the same U235 enrichment and the same Pu content, i.e. there is no zoning of the assembly. The 0.5 mm water gap at the periphery is represented explicitly. The model uses 3 different burnup regions (and so self-shielding regions) to take into account the different local moderating ratios: 1 for the corner rods, 1 for the other rods located at the periphery and 1 for the internal rods.

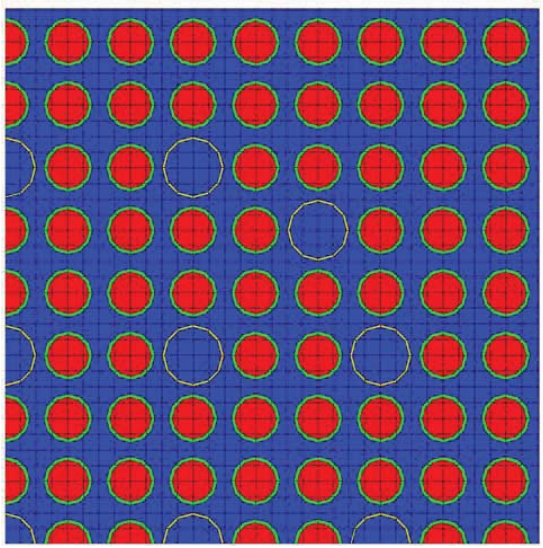

Figure 3.1. TRITON model used for the MOX-UE study (one fourth of a standard 17x17 fuel assembly)

Fuel cycle modeling. The calculations carried out simulate the fuel cycle represented on the Figure 3.2 (example of Pu recycling). After each cycle, the amount of TRU initially loaded that disappeared by either fission, capture or decay is replaced by the same amount of TRU coming from UOX spent fuels. In other words, the **TRU content at the MOX-UE fuel fabrication stage is the same at each cycle** and the U-235 enrichment is adjusted in order to maintain a constant cycle length whatever the isotopic composition of the TRU is. This can be expressed as follows for the different recycling strategies:

$$m_{X-fab}^{n+1} = m_{X-rep}^{n} + m_{X}^{UOX} = m_{X-fab}^{n} = m_{X-fab}^{n-1} = \ldots\ldots = K$$

Where m_{X-fab}^{n} and m_{X-rep}^{n} are respectively the masses of TRU per ton of initial HM for the n^{th} fabrication and n^{th} reprocessing of the MOX-UE fuel (X = Pu or Pu+Np or Pu+Np+Am or Pu+Np+Am+Cm or Pu+Np+Am+Cm+Bk+Cf depending on the recycling strategy) and m_{X}^{UOX} is the mass of TRU coming from reprocessed UOX fuel and that must be blended with m_{X-rep}^{n} so that $m_{X-fab}^{n+1} = m_{X-fab}^{n}$. The isotopic composition of m_{X}^{UOX} is given in Table 3.1 for the different X.

The ratio $\frac{m_{X-rep}^{n}}{m_{X-fab}^{n}}$, which is equal to $\frac{m_{X-rep}^{n}}{m_{X-fab}^{n+1}}$ since m_{X-fab}^{n+1} is a constant, depends on the kind of TRU being recycled. For Pu or PuNp recycling it is typically around 0.75 whereas for PuNpAm or PuNpAmCm it is typically around 0.9.

We considered a **3-batch core** with an average discharge burnup of **51 GWd/t**. The time between the end of the irradiation and the separation of the TRU from the SNF is taken to be **10 years** and there is another year between the separation and the beginning of the next irradiation in order to take into account the time necessary for the fabrication and transportation. **One cycle then corresponds to 1 year + 51 GWd/t (1500 days) + 10 years ≅ 15 years**. The losses at reprocessing are taken to be 0.1%, i.e. we consider that 99.9% of the elements being recycled are actually extracted and reused for the next cycle and that only 0.1% goes into the waste stream together with the Fission Products and the elements that are not recycled (Figure 3.2).

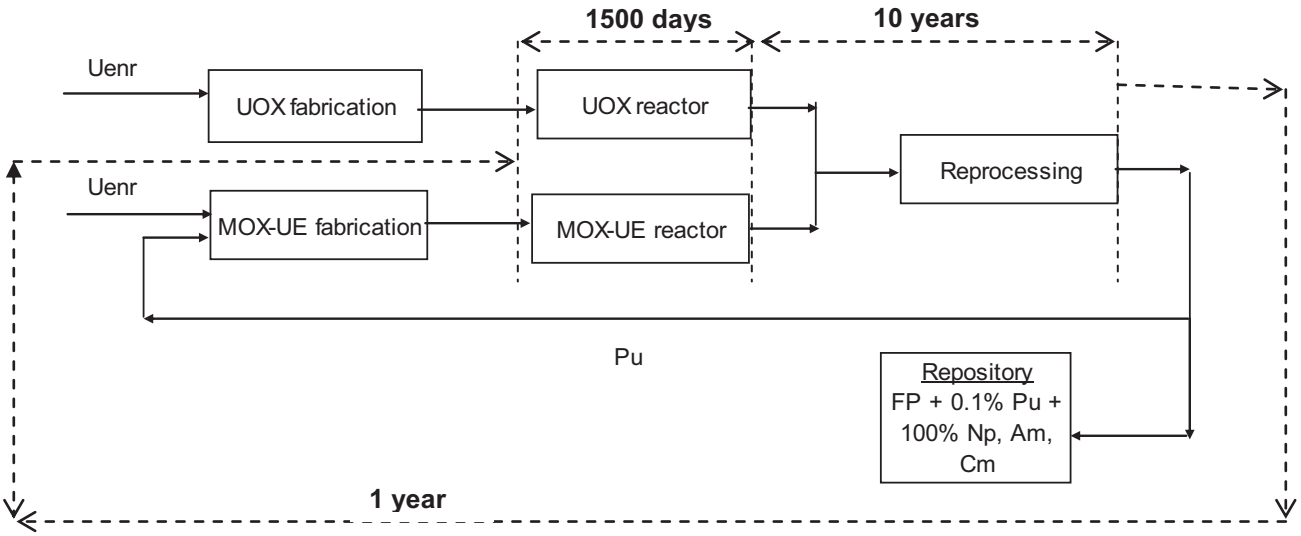

Figure 3.2. Plutonium recycling in a PWR fleet made up of UOX reactors and MOX-UE reactors.

For the Pu only recycling case we chose to keep the **Pu content** equal to its first cycle value which is **10%**. For the other cases (PuNp, PuNpAm and PuNpAmCm) we chose to lower this value in order to ensure a negative void coefficient (i.e. the loss of the coolant brings imperatively the reactor to a subcritical state). Based on the results of previous studies (see next chapter) the **TRU content** in the MOX-UE fuel was thus limited to **8%**.

The necessary MOX-UE U-235 enrichments are determined with a standard methodology: the k-infinity of the assembly at the average end of cycle burnup (34 GWd/t), without soluble boron, is equal to that of the reference 4.3% UOX assembly calculated using the same code (SCALE5.1), nuclear data (238-group library based on ENDFB-VI), methods (SN), etc.., i.e. **kinf = 1.04335** in our particular case. This strategy ensures that the different fuels will produce the same energy and thus allows relevant comparisons between them.

The amount of TRU produced by the reference 51 GWd/t UOX fuel (4.3% U-235) after 10 years of cooling time is given in Table 3.1 below and comes from the reference /**3.2**/.

Table 3.1. TRU produced by the reference 4.3% UOX fuel (51 GWd/t + 10-year cooling time)

	kg/tIHM	kg/TWe·hour	kg/GWe·year	Pu vector (%)	PuNp vector (%)	PuNpAm vector (%)	PuNpAmCm vector (%)
Np237	6.259E-01	1.504E+00	1.317E+01		5.24E+00	4.86E+00	4.83E+00
Pu238	2.948E-01	7.084E-01	6.205E+00	2.60E+00	2.47E+00	2.29E+00	2.28E+00
Pu239	6.153E+00	1.479E+01	1.295E+02	5.43E+01	5.15E+01	4.78E+01	4.75E+01
Pu240	2.930E+00	7.041E+00	6.168E+01	2.59E+01	2.45E+01	2.27E+01	2.26E+01
Pu241	1.086E+00	2.610E+00	2.286E+01	9.59E+00	9.09E+00	8.43E+00	8.39E+00
Pu242	8.639E-01	2.076E+00	1.818E+01	7.63E+00	7.23E+00	6.71E+00	6.67E+00
Am241	7.293E-01	1.752E+00	1.535E+01			5.66E+00	5.63E+00
Am242m	8.153E-04	1.959E-03	1.716E-02			6.33E-03	6.30E-03
Am243	1.984E-01	4.767E-01	4.176E+00			1.54E+00	1.53E+00
Cm242	1.980E-06	4.758E-06	4.168E-05				1.53E-05
Cm243	6.046E-04	1.453E-03	1.273E-02				4.67E-03
Cm244	5.851E-02	1.406E-01	1.232E+00				4.52E-01
Cm245	5.717E-03	1.374E-02	1.203E-01				4.42E-02
Cm246	7.285E-04	1.751E-03	1.533E-02				5.63E-03
Cm247	9.972E-06	2.396E-05	2.099E-04				7.70E-05
Cm248	7.697E-07	1.850E-06	1.620E-05				5.94E-06
Pu	**1.133E+01**	**2.722E+01**	**2.384E+02**	**1.00E+02**	**9.48E+01**	**8.79E+01**	**8.75E+01**
Np	**6.259E-01**	**1.504E+00**	**1.317E+01**		**5.24E+00**	**4.86E+00**	**4.83E+00**
Am	**9.285E-01**	**2.231E+00**	**1.954E+01**			**7.21E+00**	**7.17E+00**
Cm	**6.557E-02**	**1.576E-01**	**1.380E+00**				**5.06E-01**
Total	**1.295E+01**	**3.111E+01**	**2.725E+02**	**1.00E+02**	**1.00E+02**	**1.00E+02**	**1.00E+02**

4. THE VOID COEFFICIENT ISSUE IN A PWR LOADED WITH PU AND M.A.

The void coefficient is very important for safety and should be negative, or at least nonpositive to ensure negative feedback. For PWRs the void coefficient tends to become less negative the higher the total plutonium content and in the conventional PWR lattice changes sign from negative to positive for a total plutonium content of between 10% and 12% depending on its isotopic composition /**4.1**/. This concentration is reached at the second recycling, whatever the quality of the initial Pu loading.

Loading Am in a fuel that already contains some Pu tends to increase the reactivity of the voided configuration because it is a strongly absorbing nuclide especially in a range going from about 0.1 eV to a few eV. If the moderator is voided there are almost no neutrons left in this energy range and Am capture rate decreases considerably. It is an effect similar to that of Pu240 with its 1 eV giant resonance (Figure 4.1).

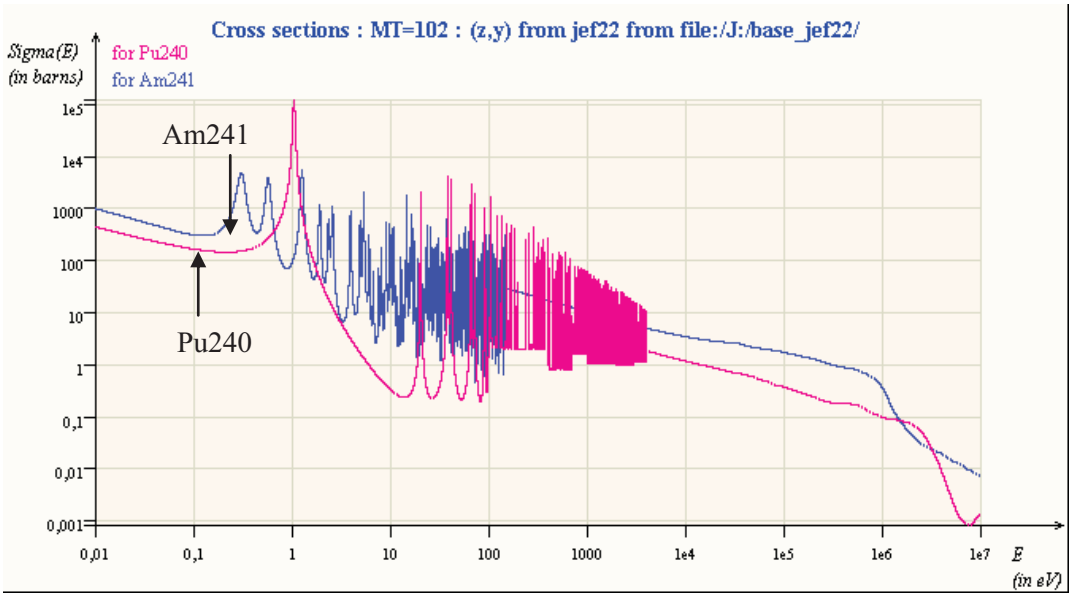

Figure 4.1. Pu-240 and Am-241 capture cross-section as a function of the neutron energy.

Reference /**4.2**/ presents the results of a study carried out to evaluate the void coefficient in an **EPR 100% MOX-UE core** containing Pu and Am. The evaluation of the void coefficient was carried out with assembly calculations at a burnup representative of the average burnup of the core at Beginning Of Cycle, (20 GWd/t in this particular case) and the criteria limiting the Am loading was the standard one, i.e. that the k_∞ in the voided situation should not be higher than that in the nominal situation (k_∞ *(voided)* $\leq$ k_∞ *(nominal)).*

It turns out that with 10% Pu (second generation Pu, i.e. about 55% fissile), the maximum Am content is about 0.63% and the corresponding U235 enrichment is 2.25%. This case was not considered further because it still had a positive Am mass balance, i.e. there was more Am at the end of the cooling time than was loaded initially. With 8% Pu, the maximum Am content is about 1.13% and the U235 enrichment is 3.97%. With a more degraded Pu (after several recycling), the Pu content had to be decreased to about 6.5% to keep the Am content of 1.13%.

The effect of Np237 and Cm244 on the void coefficient goes in the same direction but is more limited because these isotopes are less absorbing than Am241. Indeed, their thermal capture cross-sections and

resonance integrals are respectively equal to about 160 barns and 660 barns for Np237 and 13 barns and 660 barns for Cm244, whereas for Am241 they are equal to about 550 barns and 1400 barns.

Since we consider PWRs entirely loaded with MOX-UE fuel, and based on these previous results**, we decided to limit the TRU content at 8% whatever the TRU mixture was (PuNp, PuNpAm, PuNpAmCm or PuNpAmCmBkCf)** even though the maximum TRU content may be a little higher for the PuNp case.

Furthermore, for partially loaded MOX-UE cores, i.e. containing for example only 30% or 50% of MOX-UE assemblies, the global void coefficient would be less of an issue and the TRU content in the MOX-UE assemblies could be higher but in this case the concern would lie in the power distribution between the UOX and the MOX-UE assemblies. These aspects were not looked at in this study but could be interesting to tackle in the future.

5. RESULTS

5.1. URANIUM ENRICHMENTS

The TRU isotopic compositions considered for the first cycles are those coming from UOX SNF (see Table 3.1). As mentioned in the previous chapter, the first cycle does not require any U-235 enrichment in the case of Pu recycling if the Pu content is set at 10%, hence depleted uranium can be used (0.25% U235). For the next cycles the U235 enrichment must be steadily increased (Figure 5.1.1) because the Pu contains fewer and fewer of the fissile isotopes 239 and 241 (the total Pu content at the fuel fabrication remains constant and equal to 10% over the successive recyclings). It reaches a value equal to 90% of its asymptotic value (which is about 3.6%) after about 5 recyclings.

For the 8% PuNp, 8% PuNpAm and 8% PuNpAmCm cases, the necessary U235 enrichments are higher than for the 10% Pu case because there is less Pu and because the Minor Actinides do not fission very much in a PWR neutron spectrum. They are comprised between 2.3% and 3.7% for the first cycle depending on the MA that are recycled together with the Pu whereas the asymptotic values are comprised between 4.4% and 6.6% (Figure 5.1.1).

The U235 enrichments of the PuNpAmCm cases are slightly lower than that of the PuNpAm cases because of the presence of fissile isotopes in Cm, especially Cm245 which is one of the best fissile material in this type of neutron spectrum (averaged over the whole energy range, the number of neutrons produced per absorption is about 3 for Cm245 compared to about 2 for U235, Pu239 and Pu241). The U235 enrichments for the PuNpAmCmBkCf cases are the same as for the PuNpAmCm cases because Bk and Cf are present in extremely small quantities.

Knowing that the U235 enrichment for the reference 3×17 GWd/t UOX fuel is 4.3%, the necessary MOX-UE enrichments might seem high. However, the situation is actually not as bad as it looks because the quality of the Uranium at reprocessing is still very good (Figure 5.1.2). For example, for the PuNpAm recycling case, the necessary MOX-UE enrichment at equilibrium is about 6.61% but the RepU still contains about 3.94% of U235 and only 0.7% U236 which makes it a far better RepU than the one coming from UOX fuel (about 0.9% U235 and 0.7% U236). Different possibilities to utilize this RepU and the resulting natural U (NatU) economy will be presented in Section 5.5.2. The U composition cycle after cycle is given in Table 5.1.1.

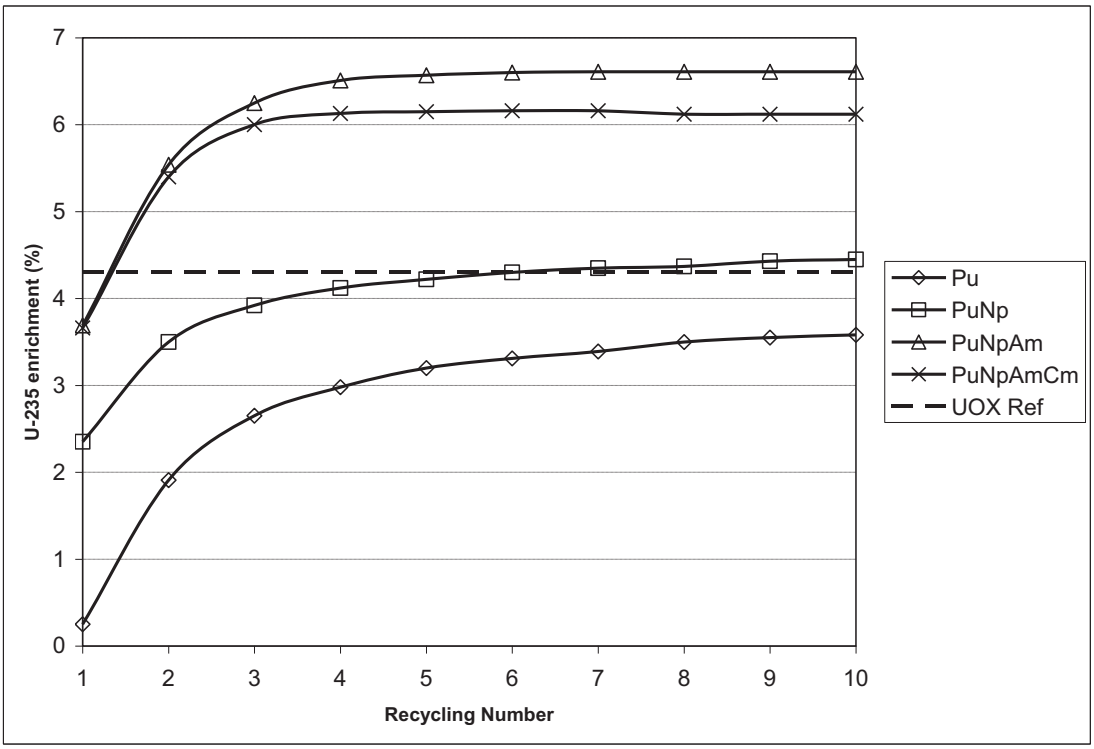

Figure 5.1.1. Evolution of the U-235 enrichment of the MOX-UE fuel with the recycling number and for the different recycling strategies. Fuel management = 3×17 GWd/t.

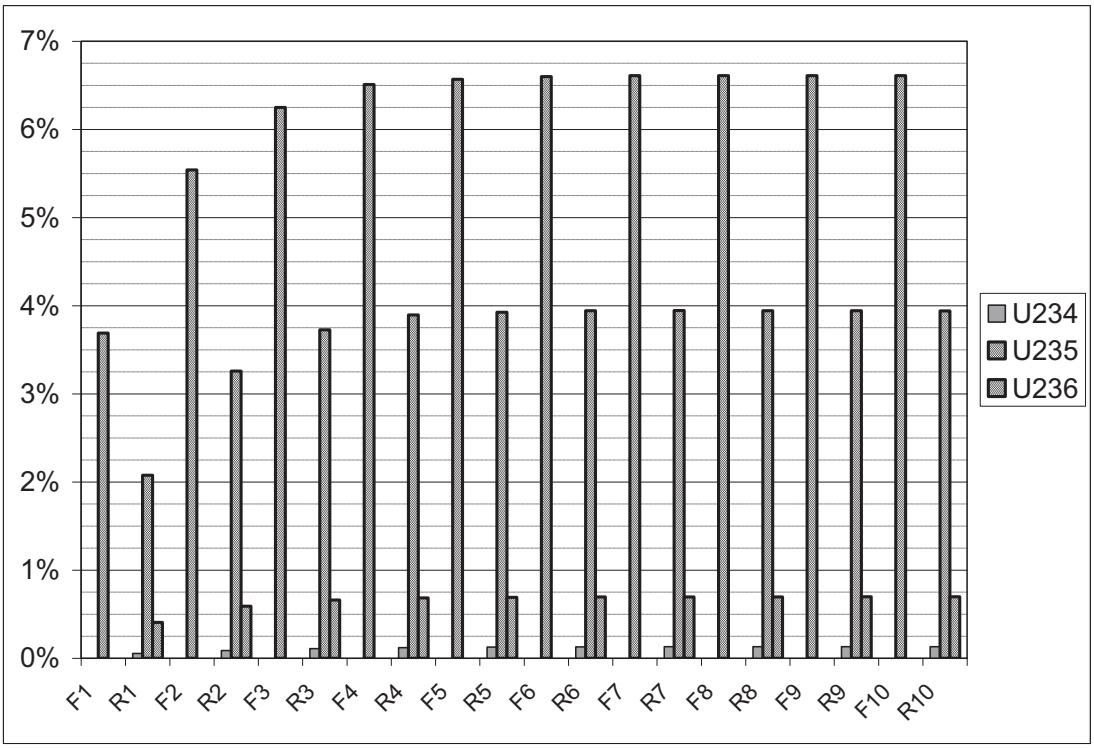

Figure 5.1.2. PuNpAm recycling case. Evolution of the Uranium isotopic composition of the MOX-UE fuel at the fabrication and reprocessing stage

Table 5.1.1. Evolution of the Uranium isotopic composition (expressed in %) of the MOX-UE fuel at the fabrication and reprocessing stages

Pu	F1	R1	F2	R2	F3	R3	F4	R4	F5	R5
U234		0.029		0.035		0.039		0.040		0.041
U235	**0.250**	0.139	**1.910**	1.077	**2.650**	1.515	**2.980**	1.710	**3.200**	1.842
U236		0.032		0.214		0.292		0.327		0.350

PuNp	F1	R1	F2	R2	F3	R3	F4	R4	F5	R5
U234		0.040		0.054		0.061		0.064		0.065
U235	**2.350**	1.258	**3.500**	1.925	**3.920**	2.171	**4.120**	2.288	**4.220**	2.343
U236		0.268		0.391		0.436		0.458		0.468

PuNpAm	F1	R1	F2	R2	F3	R3	F4	R4	F5	R5
U234		0.055		0.088		0.109		0.121		0.127
U235	**3.690**	2.076	**5.540**	3.258	**6.250**	3.726	**6.510**	3.894	**6.570**	3.926
U236		0.407		0.592		0.660		0.685		0.692

PuNpAmCm	F1	R1	F2	R2	F3	R3	F4	R4	F5	R5
U234		0.055		0.086		0.106		0.116		0.120
U235	**3.660**	2.055	**5.400**	3.152	**6.000**	3.533	**6.130**	3.602	**6.150**	3.602
U236		0.405		0.580		0.640		0.655		0.658

Table 5.1.1. Continued

Pu	F6	R6	F7	R7	F8	R8	F9	R9	F10	R10
U234		0.042		0.042		0.042		0.042		0.041
U235	**3.310**	1.905	**3.390**	1.950	**3.500**	2.018	**3.550**	2.047	**3.580**	2.063
U236		0.361		0.370		0.381		0.387		0.390

PuNp	F6	R6	F7	R7	F8	R8	F9	R9	F10	R10
U234		0.066		0.066		0.066		0.066		0.065
U235	**4.300**	2.389	**4.350**	2.417	**4.370**	2.426	**4.430**	2.463	**4.450**	2.474
U236		0.477		0.482		0.485		0.491		0.493

PuNpAm	F6	R6	F7	R7	F8	R8	F9	R9	F10	R10
U234		0.130		0.131		0.131		0.131		0.130
U235	**6.600**	3.942	**6.610**	3.946	**6.610**	3.944	**6.610**	3.943	**6.610**	3.941
U236		0.695		0.697		0.697		0.697		0.697

PuNpAmCm	F6	R6	F7	R7	F8	R8	F9	R9	F10	R10
U234		0.122		0.122		0.121		0.120		0.120
U235	**6.160**	3.602	**6.160**	3.597	**6.120**	3.565	**6.120**	3.563	**6.120**	3.561
U236		0.660		0.661		0.658		0.658		0.658

5.2. EVOLUTION OF TRU MASS BALANCES WITH RECYCLING NUMBER

The Tables 5.2.1 to 5.2.4 present for each case (Pu, PuNp, PuNpAm and PuNpAmCm) the evolution of the mass balances with the recycling number. The Δs are calculated between the separation and the fabrication of the same cycle *n*, i.e. they take into account the 10-year cooling time. The details of the mass balances can be found in Appendix 1 to 5.

Pu case. The Pu consumption rate varies between about 72 and 57 kg/TWhe. It decreases with the number of recyclings as the Pu becomes less fissile and so less absorbing. The Np237 (the only long-lived Np isotope produced during irradiation) comes mainly from two successive captures and one beta decay (U235 → U236 → U237 → Np237), hence its production rate is lower than in the reference UOX fuel mainly because the U235 enrichment is lower. The Am production rate is important (between 19 and 22 kg/TWhe), about half of it coming from the decay of Pu241 during the 10-year cooling time before reprocessing. The Cm (mainly Cm244) production rate is between 2.3 and 2.9 kg/TWhe.

Table 5.2.1. Pu recycling case – Evolution of TRU mass balances with recycling number.

	U-235 (%)	Pu content at the fabrication (%)	ΔPu (kg/TWhe)	ΔNp (kg/TWhe)	ΔAm (kg/TWhe)	ΔCm (kg/TWhe)
Réf. UOX	4.3	-	+27.2	+1.50	+2.23	+0.158
Cycle 1	0.25	10	-71.5	+0.568	+19.4	+2.28
Cycle 2	1.91	10	-64.2	+0.959	+21.1	+2.43
Cycle 3	2.65	10	-61.1	+1.10	+21.7	+2.57
Cycle 4	2.98	10	-59.6	+1.16	+21.9	+2.68
Cycle 5	3.20	10	-58.5	+1.20	+21.9	+2.77
Cycle 6	3.31	10	-58.0	+1.21	+22.0	+2.85
Cycle 7	3.39	10	-57.5	+1.23	+22.0	+2.91
Cycle 8	3.50	10	-57.0	+1.24	+22.0	+2.94
Cycle 9	3.55	10	-56.7	+1.25	+22.0	+2.98
Cycle 10	3.58	10	-56.5	+1.25	+22.0	+3.01

Figure 5.2.1. shows the evolution of the isotopic composition of the Pu at the fabrication and reprocessing stages. The effect of adding some clean Pu from UOX fuel to replace the Pu burnt during the irradiation appears clearly on this figure (the saw-like behavior). For example, at the end of the first irradiation the Pu contains about 40% of Pu239, but at the fabrication of the second cycle this percentage goes up to 45%. The Pu242 tends to accumulate cycle after cycle because its absorption cross-section (≅12 barns averaged over the whole energy range) is about a factor of 2 to 3 smaller than that of the Pu239, 240 and 241 isotopes which means that its production rate by capture on lighter Pu isotopes is larger than its destruction rate by absorption which leads to an increase of its concentration.

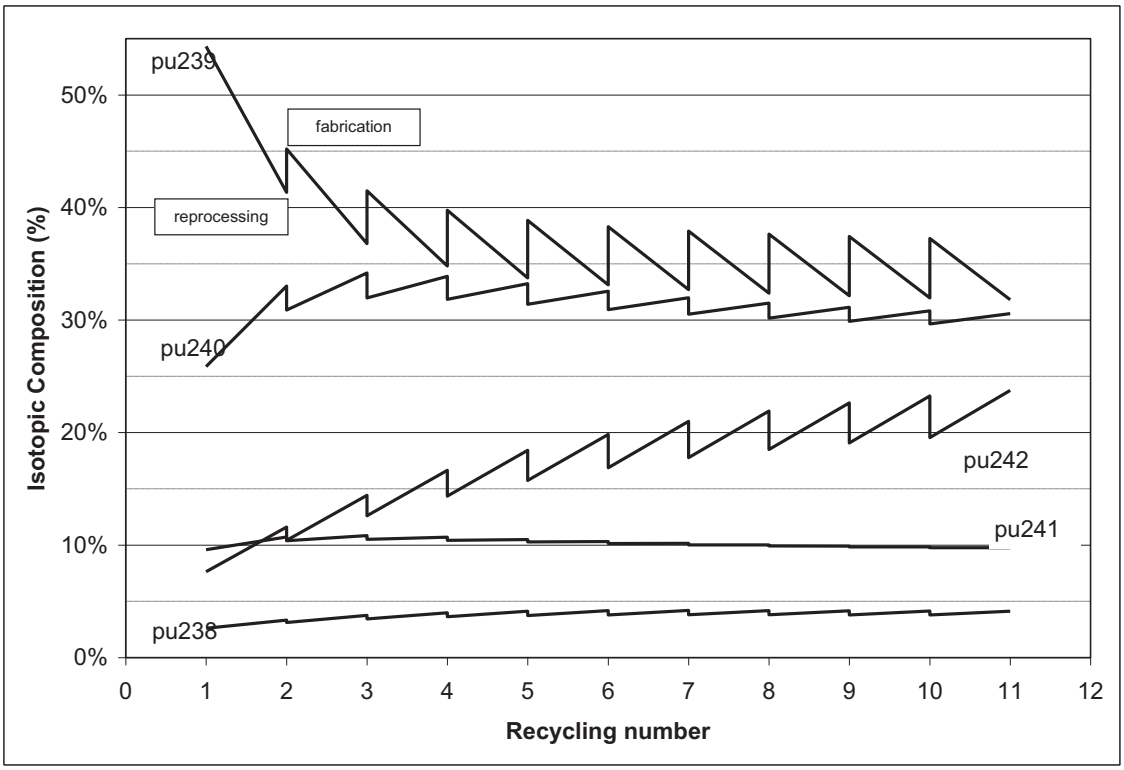

Figure 5.2.1. Pu recycling case. Evolution of the Pu isotopic composition at the different fabrication and reprocessing stages.

PuNp case. Since the Pu content is lower than for the Pu case, the Pu consumption is lower as well: it is comprised between about 47 and 39 kg/TWhe. Furthermore, because the Np237 disappears mainly by capture to form Pu238, this isotope represents between 6% and 8.5% of the total Pu against 3%-4% for the Pu case. The Np consumption rate is comprised between 4.2 and 2.2 kg/TWhe. The Am and Cm productions are smaller than in the Pu case because the Pu content is smaller, however the effect is not linear because of the Pu242 self-shielding (capture on Pu242 leads to Am243 and then to Cm244).

Table 5.2.2. Pu+Np recycling case – Evolution of TRU mass balances with recycling number

	U-235 (%)	Pu+Np content at the fabrication (%)	ΔPu (kg/TWhe)	ΔNp (kg/TWhe)	ΔAm (kg/TWhe)	ΔCm (kg/TWhe)
Réf. UOX	4.3	-	+27.2	+1.50	+2.23	+0.158
Cycle 1	2.35	7.58+0.42 = 8	-46.7	-4.21	15.7	1.95
Cycle 2	3.50	7.65+0.35 = 8	-42.7	-3.10	16.9	2.14
Cycle 3	3.92	7.68+0.32 = 8	-41.2	-2.65	17.2	2.29
Cycle 4	4.12	7.69+0.31 = 8	-40.5	-2.43	17.3	2.39
Cycle 5	4.22	7.70+0.30 = 8	-40.0	-2.32	17.3	2.47
Cycle 6	4.30	7.70+0.30 = 8	-39.7	-2.26	17.4	2.53
Cycle 7	4.35	7.70+0.30 = 8	-39.5	-2.22	17.4	2.58
Cycle 8	4.37	7.71+0.29 = 8	-39.3	-2.20	17.4	2.61
Cycle 9	4.43	7.71+0.29 = 8	-39.1	-2.17	17.4	2.63
Cycle 10	4.45	7.71+0.29 = 8	-39.0	-2.17	17.4	2.65

The Figure 5.2.2 shows the evolution of the isotopic composition of the PuNp mixture at the fabrication and reprocessing stages. The same remarks as for the Pu case apply. The only noticeable difference is the increase of the Pu238 concentration caused by capture on Np237.

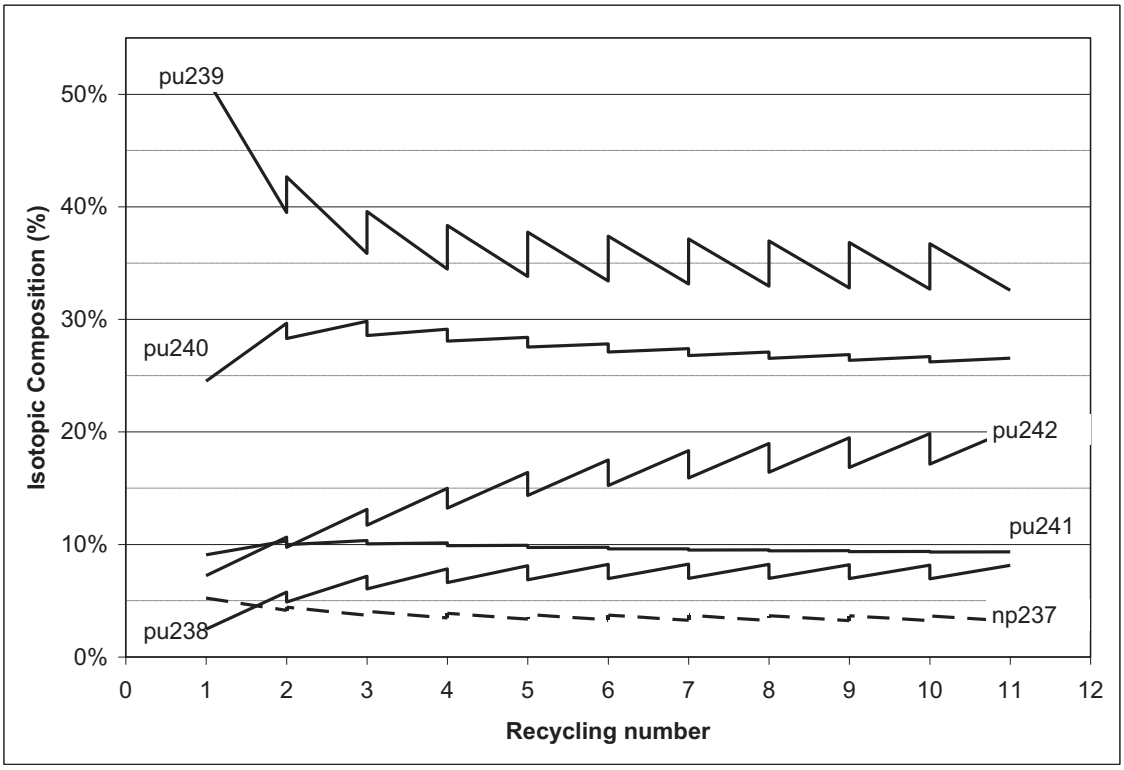

Figure 5.2.2. PuNp recycling case. Evolution of the PuNp isotopic composition at the different fabrication and reprocessing stages.

PuNpAm case. The Pu destruction rate is smaller than in the PuNp case because of the presence of Am. Indeed, Am241 disappears essentially by capture and ends up in about 90% of the time as Pu (75% Pu238 and 15% Pu242), whereas Am243 leads directly to Cm244. This explains the high content of Pu238 (between 8.5% and 17% of the total Pu depending on the cycle number) and the sharp increase in Cm production (multiplied by a factor of about 2 compared to the PuNp case). The Np consumption rate is smaller than in the PuNp case mainly because the U235 enrichment is higher which translates into a higher Np237 source term. The Am production rate under irradiation and decay is larger than its destruction rate by absorption for the first two cycles and as a consequence its content increases. At the third cycle, the amount of Am at the fabrication has increased by about 70% with regard to its first cycle value of 0.58% and the MOX-UE starts burning Am.

Table 5.2.3. Pu+Np+Am recycling case – Evolution of TRU mass balances with recycling number

	U-235 (%)	Pu+Np+Am content at the fabrication (%)	ΔPu (kg/TWhe)	ΔNp (kg/TWhe)	ΔAm (kg/TWhe)	ΔCm (kg/TWhe)
Réf. UOX	4.3	-	+27.2	+1.50	+2.23	+0.158
Cycle 1	3.69	7.03+0.39+0.58 = 8	-31.6	-3.34	5.32	3.02
Cycle 2	5.54	6.80+0.31+0.89 = 8	-21.2	-1.95	1.07	4.06
Cycle 3	6.25	6.73+0.27+1.00 = 8	-17.6	-1.40	-0.67	4.62
Cycle 4	6.51	6.72+0.26+1.03 = 8	-16.6	-1.15	-1.29	4.96
Cycle 5	6.57	6.72+0.25+1.03 = 8	-16.4	-1.05	-1.46	5.18
Cycle 6	6.60	6.73+0.24+1.03 = 8	-16.4	-0.99	-1.44	5.31
Cycle 7	6.61	6.74+0.24+1.02 = 8	-16.5	-0.95	-1.40	5.39
Cycle 8	6.61	6.74+0.24+1.02 = 8	-16.5	-0.94	-1.37	5.45
Cycle 9	6.61	6.74+0.24+1.02 = 8	-16.6	-0.93	-1.35	5.49
Cycle 10	6.61	6.74+0.24+1.02 = 8	-16.6	-0.92	-1.35	5.51

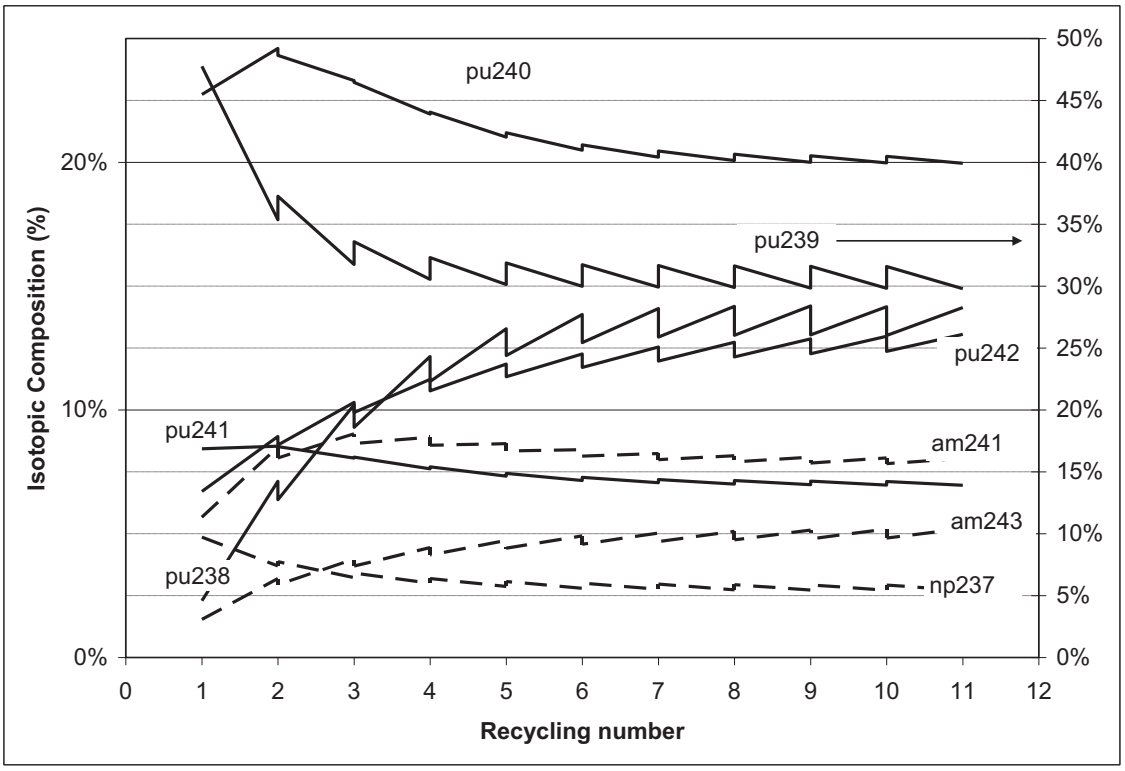

Figure 5.2.3. PuNpAm recycling case. Evolution of the PuNpAm isotopic composition at the different fabrication and reprocessing stages (the right axis corresponds to Pu239).

PuNpAmCm case. As far as Pu, Np and Am are concerned, the results are similar to those of the PuNpAm case. As mentioned earlier, the U235 enrichments are slightly lower than in the previous case because of the presence of fissile isotopes in Cm, especially Cm245. It is important to notice that Cm keeps accumulating in the fuel cycle after cycle. Its content increases from 0.04% to 0.5% from the 1st cycle to the 10th cycle, most of it (62%) being Cm244.

The amount of Cf produced increases with the number of recycling but remains very small (1.3×10^{-2} kg/TWhe at the 10th cycle which represents about 5 grams of Cf per ton of initial HM of which only 1% is Cf252). The amount of Bk at reprocessing is smaller than that of Cf by a factor of about 6000 because all Bk isotopes are short-lived and decay beta on Cf isotopes. Indeed, the longest-lived Bk isotope is Bk249 which decays on Cf249 with a 0.9 year half-life and so its concentration is divided by a factor of about 2700 during the 10-year cooling time.

Figure 5.2.4b shows that the Cm isotopes 246, 247 and 248 are still building up after the 10th cycle. Indeed the Cm concentration reaches an equilibrium only after about 35 cycles. Its concentration is then equal to about 0.6% HM compared to about 0.49% HM for the 10th recycling (cf. Table 5.2.4). The equilibrium concentrations can be found in Appendix 4.

Table 5.2.4. Pu+Np+Am+Cm recycling case – Evolution of TRU mass balances with recycling number

	U-235 (%)	Pu+Np+Am+Cm content at the fabrication (%)	ΔPu (kg/TWhe)	ΔNp (kg/TWhe)	ΔAm (kg/TWhe)	ΔCm (kg/TWhe)
Réf. UOX	4.3	-	+27.2	+1.50	+2.23	+0.158
Cycle 1	3.66	7.00+0.39+0.57+0.04 = 8	-31.2	-3.33	5.31	2.53
Cycle 2	5.40	6.67+0.30+0.87+0.15 = 8	-19.7	-1.90	1.02	2.23
Cycle 3	6.00	6.52+0.26+0.97+0.25 = 8	-15.2	-1.30	-0.66	1.66
Cycle 4	6.13	6.45+0.24+0.99+0.32 = 8	-13.6	-1.03	-1.20	1.19
Cycle 5	6.15	6.42+0.22+0.98+0.37 = 8	-13.1	-0.88	-1.25	0.85
Cycle 6	6.16	6.40+0.22+0.98+0.41 = 8	-12.9	-0.80	-1.18	0.60
Cycle 7	6.16	6.38+0.21+0.97+0.44 = 8	-12.8	-0.75	-1.10	0.44
Cycle 8	6.12	6.37+0.21+0.97+0.46 = 8	-12.7	-0.73	-1.07	0.34
Cycle 9	6.12	6.35+0.21+0.96+0.48 = 8	-12.6	-0.71	-1.04	0.26
Cycle 10	6.12	6.34+0.21+0.96+0.49 = 8	-12.5	-0.70	-1.02	0.21

Table 5.2.4. Continued

	ΔCf (kg/TWhe)
Réf. UOX	3.0×10^{-8}
Cycle 1	1.4×10^{-5}
Cycle 2	1.1×10^{-4}
Cycle 3	4.1×10^{-4}
Cycle 4	1.1×10^{-3}
Cycle 5	2.1×10^{-3}
Cycle 6	3.6×10^{-3}
Cycle 7	5.5×10^{-3}
Cycle 8	7.7×10^{-3}
Cycle 9	1.0×10^{-2}
Cycle 10	1.3×10^{-2}

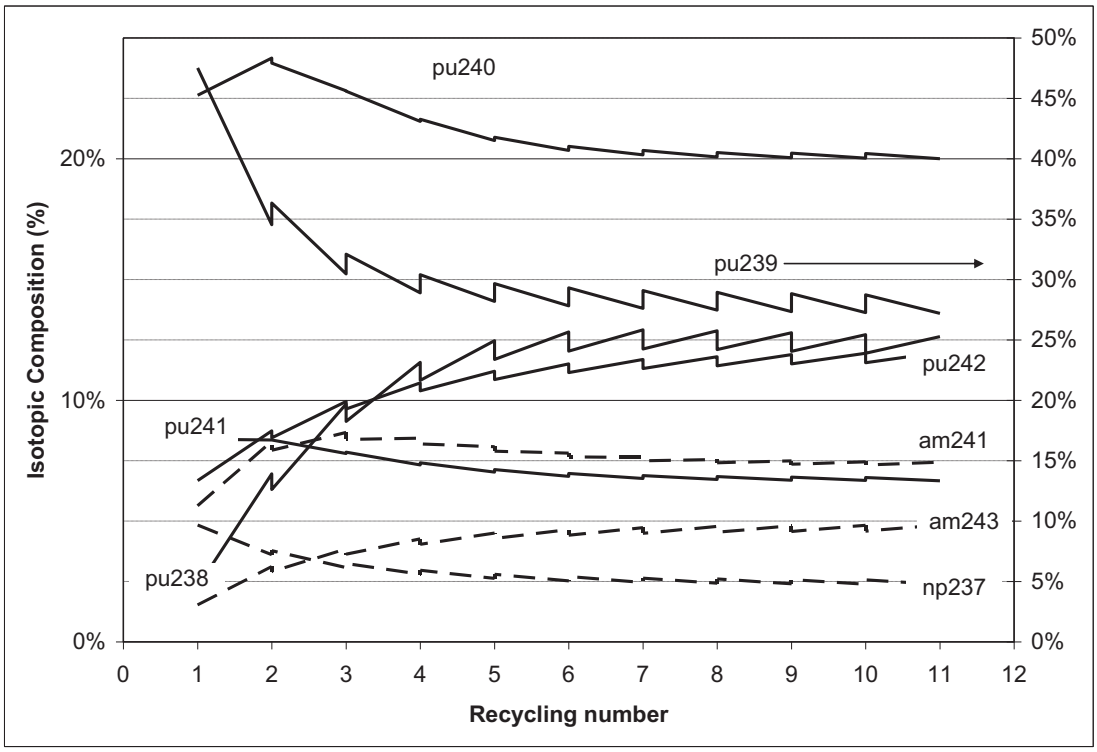

Figure 5.2.4a. PuNpAmCm recycling case. Evolution of the Pu, Np, Am isotopic composition at the different fabrication and reprocessing stages (the right axis corresponds to Pu239).

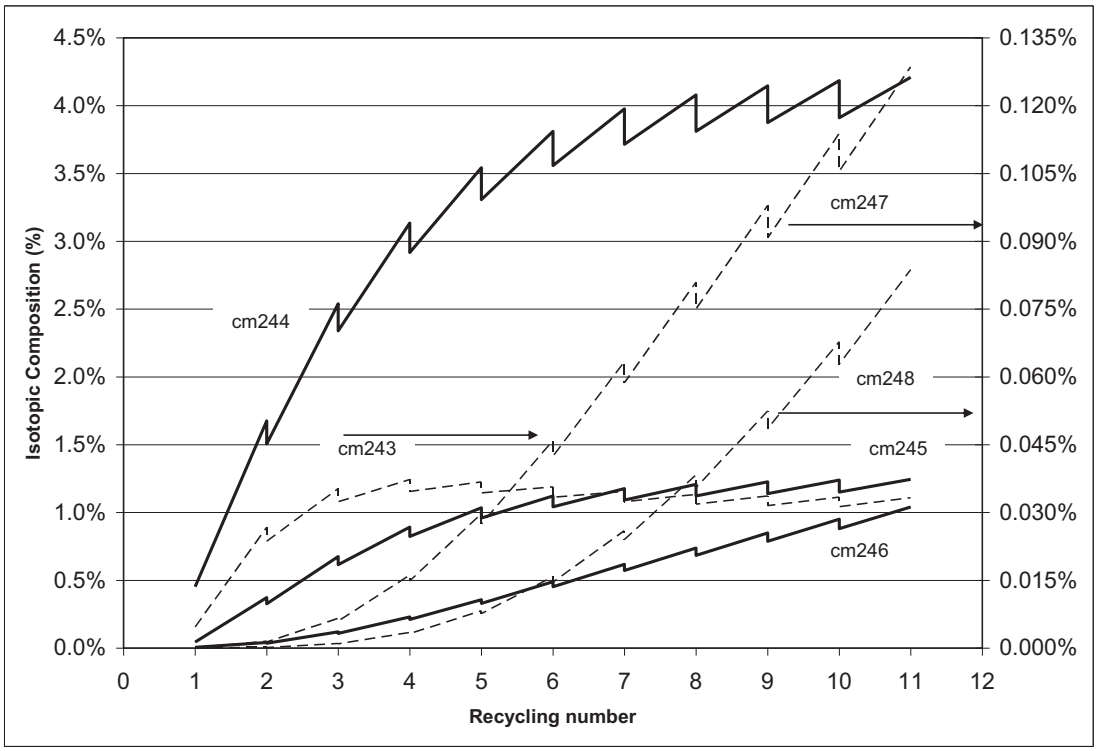

Figure 5.2.4b. PuNpAmCm recycling case. Evolution of the Cm isotopic composition at the different fabrication and reprocessing stages (the right axis corresponds to Cm243, 247 and 248).

PuNpAmCmBkCf case. Since they are present in such small quantities, the recycling of Bk and Cf does not impact the build-up of the other elements (Pu, Np, Am and Cm) compared with the PuNpAmCm case, hence Figures 5.2.4a and 5.2.4b apply here too. As mentioned earlier, Bk and Cf do not impact the U235 enrichments either, i.e. they are identical to those of the PuNpAmCm cases. As shown in Figure 5.2.5 the percentage of Bk in the TRU mixture is extremely small (about 10^{-6} % at the 10^{th} recycle). The percentage of Cf in the TRU mixture is larger than that of Bk but is still very small (about 0.006% at the 10^{th} recycle of which only about 1% is Cf252). Since the half-life of Cf252 is only 2.6 years, its concentration is divided by a factor of about 14 during the 10-year cooling time as it decays on Cm248. With a shorter (longer) cooling time, Cf252 build-up would be faster (slower).

The amount of Bk remains always smaller than that of Cf by a factor of about 6000 because all Bk isotopes are short-lived and decay beta on Cf isotopes. Indeed, as mentioned earlier, the longest-lived Bk isotope is Bk249 which decays on Cf249 with a 0.9 year half-life and so its concentration is divided by a factor of about 2700 during the 10-year cooling time.

Table 5.2.5. Pu+Np+Am+Cm+Bk+Cf recycling case – Evolution of TRU mass balances with recycling number

	U-235 (%)	Pu+Np+Am+Cm+Bk+Cf content at the fabrication (%)	ΔPu (kg/TWhe)	ΔNp (kg/TWhe)	ΔAm (kg/TWhe)
Réf. UOX	4.3	-	+27.2	+1.50	+2.23
Cycle 1	3.66	7.00+0.39+0.57+0.04+0+0 = 8	-31.2	-3.33	5.31
Cycle 2	5.40	$6.67+0.30+0.87+0.15+1.1\times10^{-10}+6.0\times10^{-7}$ = 8	-19.7	-1.90	1.02
Cycle 3	6.00	$6.52+0.26+0.97+0.25+8.0\times10^{-10}+4.8\times10^{-6}$ = 8	-15.2	-1.30	-0.66
Cycle 4	6.13	$6.45+0.24+0.99+0.32+2.9\times10^{-9}+1.9\times10^{-5}$ = 8	-13.6	-1.03	-1.20
Cycle 5	6.15	$6.42+0.22+0.98+0.37+7.2\times10^{-9}+4.9\times10^{-5}$ = 8	-13.1	-0.88	-1.25
Cycle 6	6.16	$6.40+0.22+0.98+0.41+1.4\times10^{-8}+1.0\times10^{-4}$ = 8	-12.9	-0.80	-1.18
Cycle 7	6.16	$6.38+0.21+0.97+0.44+2.4\times10^{-8}+1.7\times10^{-4}$ = 8	-12.8	-0.75	-1.10
Cycle 8	6.12	$6.37+0.21+0.97+0.46+3.5\times10^{-8}+2.6\times10^{-4}$ = 8	-12.7	-0.73	-1.07
Cycle 9	6.12	$6.35+0.21+0.96+0.48+4.9\times10^{-8}+3.7\times10^{-4}$ = 8	-12.6	-0.71	-1.04
Cycle 10	6.12	$6.34+0.21+0.96+0.49+6.4\times10^{-8}+4.9\times10^{-4}$ = 8	-12.5	-0.70	-1.02

Table 5.2.5. Continued

	ΔCm (kg/TWhe)	ΔBk (kg/TWhe)	ΔCf (kg/TWhe)
Réf. UOX	+0.158	8.1×10^{-12}	3.1×10^{-8}
Cycle 1	2.53	2.7×10^{-9}	1.4×10^{-5}
Cycle 2	2.23	1.6×10^{-8}	1.0×10^{-4}
Cycle 3	1.66	5.0×10^{-8}	3.4×10^{-4}
Cycle 4	1.19	1.0×10^{-7}	7.3×10^{-4}
Cycle 5	0.85	1.7×10^{-7}	1.2×10^{-3}
Cycle 6	0.60	2.3×10^{-7}	1.7×10^{-3}
Cycle 7	0.44	2.8×10^{-7}	2.2×10^{-3}
Cycle 8	0.34	3.3×10^{-7}	2.6×10^{-3}
Cycle 9	0.26	3.6×10^{-7}	2.9×10^{-3}
Cycle 10	0.21	3.7×10^{-7}	3.0×10^{-3}

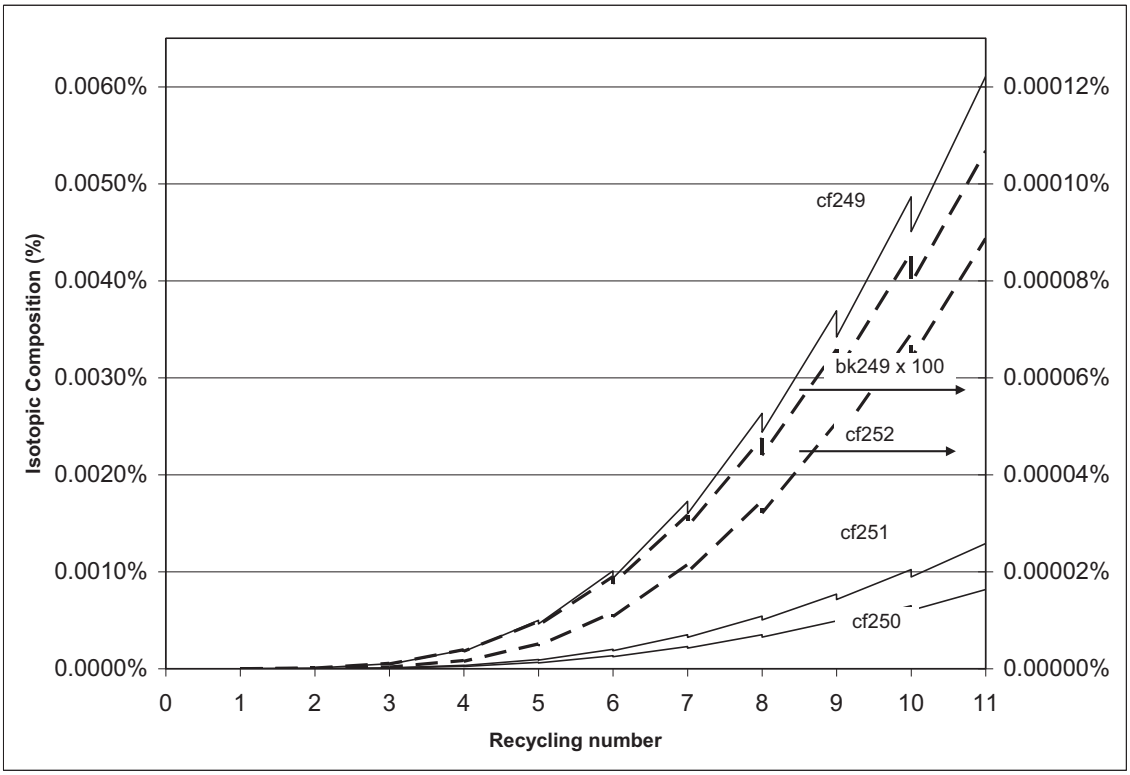

Figure 5.2.5. PuNpAmCmBkCf recycling case. Evolution of the Bk and Cf isotopic composition at the different fabrication and reprocessing stages (the right axis corresponds to Cf252 and Bk249).

Figure 5.2.5 shows that the Cf isotopes are still building up after the 10th cycle. Indeed the Cf concentration reaches an equilibrium only after about 40 cycles. The Cf252 concentration at the fabrication is then equal to about 0.3 g/tIHM compared to about 0.05 g/tIHM for the 10th recycling. The equilibrium concentrations can be found in Appendix 5.

NB: Why do we stop with Cf252? /**5.1**/ It is inadequate to answer that there is insufficient time (and neutrons) to push mass to Cf252 and beyond since we are dealing with multirecycling. First, the half-lives get shorter so that even if higher TRU isotopes are produced, they do not persist long enough to matter to fuel cycle assessments. The last isotope with half-life greater than 10 years is Cf251; the last isotope with half-life greater than 1 year is Cf252. The last isotope with half-life greater than 0.5 year is Es254. The other characteristic that limits movement beyond Cf252 is that progressively fewer isotopes have measurable β^- decay, which is the mechanism to move to heavier nuclides. None of the Fm isotopes (242 through 260) are reported as having β^- decay. For example, Fm257 (100.5 day) decays 99.79% by alpha to Cf253, with 0.21% via spontaneous fission; it has no β^- decay. Fm258 (370 μs), Fm259 (1.5 s), and Fm260 (4 ms) decay via spontaneous fission, not β decay. Hence, there does not appear to be a pathway to significant isotopes beyond Cf252 based on neutron irradiation.

5.3. CORE PHYSICS ASPECTS

Reactivity loss per cycle. The reactivity loss per cycle (17 GWd/t ≡ 500 days at full power) is about 11200 pcm for the reference UOX fuel (the reactivity loss caused by the accumulation of Xe135 during the first 150 MWd/t is not included). It goes down to about 4600 pcm for the first Pu and PuNp recycling, and to about 4100 pcm for the 10th recycling. For the PuNpAm and PuNpAmCm cases the reactivity loss per cycle is even smaller: about 3335 pcm for the 1st recycling and about 2240 pcm for the 10th recycling. The reasons for that is that in these types of fuel (1) there is more conversion fertile → fissile and (2) the fission products absorb less because there are less thermal neutrons than in UOX fuel.

Reactivity coefficients. The boron worth, which around –7 pcm/ppm with the reference UOX fuel, drops down to about –2.5 pcm/ppm with the MOX-UE fuels /**5.2**/ because of the smaller fraction of thermal neutrons. Increasing the B10 enrichment in the boric acid would increase its worth. The Fuel Temperature Coefficient (FTC) and Moderator Temperature Coefficient (MTC) are more negative in the MOX-UE cores than in the UOX core because the resonance absorption is larger. Consequences of transients leading to a cooling down of the primary circuit are impacted and should be analyzed to ensure that there are sufficient margins with regard to criticality.

Void coefficient. The important issue of the void coefficient and the impact of loading MA are discussed in Section 4 of this report.

Critical Boron Concentrations at Beginning Of Cycle. Taking into account the reactivity loss per cycle and the boron worth, the CBC at BOC (with Xe135 saturated) and Hot Full Power (HFP) are between 1900 ppm and 900 ppm in the MOX-UE (compared to 1600 ppm in the UOX). It is usually admitted that the boron concentration in the primary circuit should not be larger than 2500 ppm in order to avoid its crystallization. The configurations with the highest boron concentrations at HFP, i.e. the Pu and PuNp cases, will probably reach the limit for the Cold Zero Power conditions (i.e. isothermal temperature equal to 20 degrees C and no Xe135) and as a consequence will need to use either some burnable absorbers or enriched boron in the moderator (or both) in order to decrease the boron concentration at BOC.

Control rods worth. The control of the reactivity is ensured by the use of soluble boron dissolved in the moderator and by inserting control rods in some of the fuel assemblies. These control rods are made up of absorbing materials like boron carbide (B4C) or the silver-indium-cadmium alloy commonly referred to as AIC. The antireactivity introduced by the control rods depends on their constituents, their number, their location, the fuel loading pattern, and the neutron spectrum in the assembly. The estimation of this antireactivity necessitates whole-core calculations; however, assembly calculations already give important information related to the effect of the constituents and of the neutron spectrum (Δkinf/kinf). Figure 5.3.1 taken from reference /**5.2**/ shows that the control rods worth (Δkinf/kinf) decreases when the Pu content increases because the thermal neutron flux becomes smaller and smaller. For example, the B4C control rods worth is 29 000 pcm in a UOX assembly, whereas it is only 19 000 pcm in a MOX-UE assembly with 12%Pu. Increasing the B10 enrichment from 20% (natural B) to 70% brings about an increase of the control rods worth from 19 000 pcm to 26 000 pcm. The effect of the constituents (B4C or AIC) is similar in UOX and MOX-UE assemblies: The worth of the AIC rods is about 5000 pcm lower than that of the B4C rods.

Delayed neutron fraction. It is well known that there are less delayed neutrons in a MOX core than in a UOX core mainly because Pu239's fission products give off less of them compared to U235's. The consequence is that for the same insertion of reactivity the power of a MOX core increases faster than that of a UOX core and that, in the case of a Reactivity Induced Accident (RIA) like a control rod ejection, the total energy released during the transient is larger. The number of delayed neutrons for Minor Actinides is smaller than that of U235 as well and, in most cases, even smaller than that of Pu239 /**5.3**/. However, since the quantity of MA in the fuel is significantly smaller than that of Pu and U and since MA do not fission very much in the MOX-UE spectrum (the ratio of capture over fission is respectively about 35, 50, 75 and 15 for Np237, Am241, Am243 and Cm244), they barely contribute to the fissions compared to U and Pu isotopes (indeed their maximum contribution calculated for the 10^{th} PuNpAmCm recycling is equal to about 4.5%) and so their impact on the number of delayed neutrons is rather limited.

Prompt neutron lifetime. The prompt neutron lifetime is the average time between the birth and death (absorption or leakage) of prompt neutrons. It effects the behavior of the core in the case of a RIA. Indeed, it is shown that the maximum value of the power reached during such a transient is inversely proportional to the prompt neutron lifetime. With a UOX fuel it is typically about 25 μs whereas in a MOX fuel it is about half this value because of the larger absorption of the MOX fuel relative to the UOX fuel /**5.5**/.

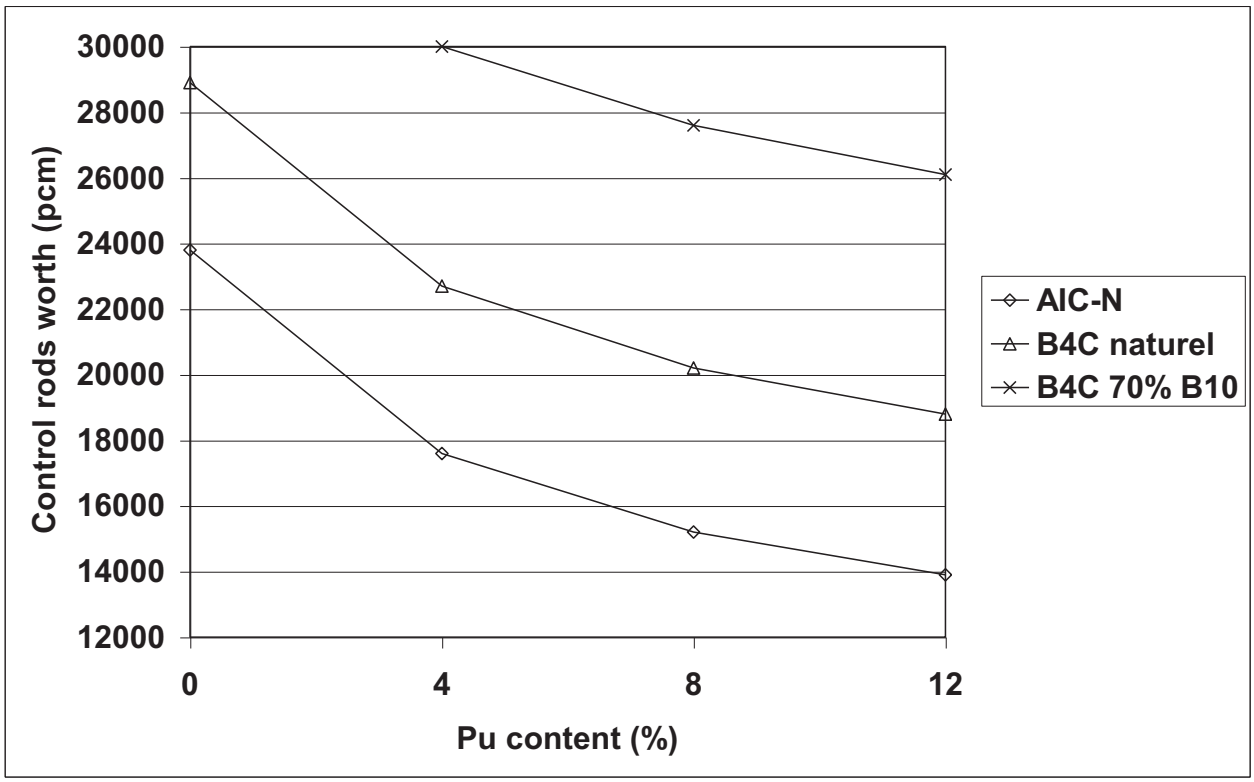

*Figure 5.3.1. Control rods worth for different Pu contents in the MOX-UE /**5.2**/*

*NB: Interesting discussions of UOX core vs. full MOX core can be found for example in the references /**5.4**/ and /**5.5**/.*

5.4. CONSEQUENCES ON FUEL FABRICATION AND REPROCESSING

Table 5.4.1 presents the alpha, beta and gamma powers (in W/tIHM) as well as the neutron sources (in n/s.tIHM) at the MOX-UE fabrication for the different recycling strategies as well as for the different recycling number (from 1 to 10). At reprocessing, only the alpha power and neutron source are given because they are driven by the actinides and so depend on the recycling strategies whereas the beta and gamma powers are driven by the amount of fission products and so are not very dependent on the recycling strategies. For a burnup of 51 GWd/t, common to all strategies presented in this paper, and after a 10-year cooling time, the **beta+gamma power from the fission products is around 1000 W/tIHM**.

NB: the isotopic data used to calculate the alpha, beta and gamma powers as well as the neutron sources are given in the Appendix 6.

Table 5.4.1 gives the absolute values for the first Pu recycling, i.e. for a 10% Pu MOX fuel that could be fabricated and reprocessed today using only existing technologies, and then all the other numbers are given relative to these taken as a reference.

Pu case. The alpha and beta powers as well as the neutron source at the fabrication increase by about 40%-50% between the first cycle and the 10th mostly because of the increase in the Pu238 content in the fuel. The increase in the alpha power and neutron source at reprocessing (about 30%) with the number of recyclings is caused by the increase of the Pu242 content which brings about a larger content of Cm244, a strong alpha and neutron emitter.

PuNp case. The increase in alpha and beta powers as well as the neutron source at the fabrication is more pronounced (a factor of 2 for the alpha and beta powers and +60% on the neutron source) than for the Pu case because the presence of Np237 in the fuel bring about a steeper increase in the Pu238 content at the fabrication. The impact at reprocessing is more limited (between +20% and +40%) than at the fabrication because even though the 8%PuNp fuel contains more Pu238 than the reference 10% Pu fuel at reprocessing, it contains less Cm244.

PuNpAm case. Am241 and Pu238 are both strong alpha emitters. Furthermore, as mentioned earlier, about 75% of the absorptions in Am241 produce Pu238 which explain the even sharper increase than for the PuNp case. Indeed, between the first and the 10th cycle the alpha power at the fabrication increases by a factor a 4 with regard the reference 10% Pu MOX. The presence of Am241 which is a strong gamma emitter as well brings about an increase of the gamma power by a factor of about 12. At reprocessing the alpha power and the neutron source are higher than the reference values by a factor of about 2.5.

PuNpAmCm case. The presence of Cm244, which is a strong alpha, gamma and neutron emitter, at the fabrication explains why this case exhibits the largest differences relative to the reference 10% Pu MOX fuel. At the first cycle fabrication the neutron source of the 8% PuNpAmCm case is already about 45 times higher than that of the reference 10% Pu case, at the second recycling it is about 150 times higher and this factor goes up to about 380 for the 10th recycling. The alpha and gamma powers at the fabrication are higher than that of the reference by a factor of, respectively, about 1.6 and 7.4 for the first cycle and about 9 and 18 for the 10th cycle. The alpha power and neutron source for the first reprocessing are both higher than that of the reference by a factor 1.5. These numbers go up to respectively about 3.4 and 20 for the 10th recycling. Even though present in very small quantity relatively to Cm244, Cf252 contribution to the neutron source at reprocessing becomes larger and larger as its (very small) concentration increases. At the 6th recycle it represents about half of the neutron source and at the 10th recycle about 75%, the rest coming from Cm244. The Cf252 concentration increases from about 0.01

g/tIHM to 0.05 g/tIHM between the 6th and the 10th reprocessing whereas the Cm244 concentration is about constant and around 3000 g/tIHM.

PuNpAmCmBkCf case. The only difference with the previous case concerns the neutron source at the fabrication because there is now a very small quantity of Cf252 in the facility. However, since Cf252 builds up very slowly, it impacts the fabrication noticeably only starting at the 6th recycling (i.e. 75 years after the beginning of the first recycling) when it is responsible for a 66% increase in the, already large, neutron source compared with the PuNpAmCm case (the masses of Cm244 and Cf252 are respectively about 2.8 kg/tHM and 9 mg/tHM). For the 7th and 10th recycling, the neutron source at the fabrication is increased by, respectively, a factor of 2 and 4.6 compared to the PuNpAmCm case. Hence, recycling Cf, together with the other TRU, has an important impact on the neutron source at the fabrication, but relatively speaking the effect is much smaller than the one observed between the PuNpAm and the PuNpAmCm cases where the multiplication factor on the neutron source is more than 100. Furthmore, the consequences of **Cf252 build-up would start to be noticeable only 75 years after the beginning of the first recycling** which leaves time to find a way to flush these few grams of Cf per ton HM if it is deemed necessary. The most obvious way to decrease the neutron source at the fabrication would of course be to let the fuel cool a few extra years. Indeed, after the 6th recycling, if the fuel is cooled for 15 years (instead of 10 years) prior to reprocessing, then the neutron source at the 7th fabrication is divided by about a factor of 2 bringing it back to the same level as for the 7th fabrication of the PuNpAmCm case.

Table 5.4.1. Impact of the recycling strategy at the fabrication and reprocessing of the MOX-UE fuel (after the 10-year cooling time). The values of the first row in bold are absolute values (expressed in W/tIHM for the alpha, beta and gamma powers, and n/s.tIHM for the neutron sources). The other numbers are relative to this first row.

		P-alpha	P-beta	P-gamm	S-neut	P-alpha	S-neut
		Fabrication				Reprocessing	
MOX-UE 10%Pu	1	**1650**	**33.9**	**0.456**	**$8.92\cdot10^{7}$** [x]	**4400** [+]	**$8.70\cdot10^{9}$** [+]
	2	1.20	1.09	1.20	1.22	1.10	1.07
	3	1.31	1.12	1.31	1.34	1.16	1.13
	4	1.38	1.11	1.38	1.41	1.20	1.18
	5	1.41	1.10	1.41	1.45	1.23	1.22
	6	1.43	1.09	1.43	1.48	1.25	1.26
	7	1.43	1.08	1.43	1.49	1.26	1.28
	8	1.43	1.07	1.43	1.50	1.26	1.30
	9	1.43	1.07	1.43	1.51	1.27	1.32
	10	1.42	1.06	1.42	1.51	1.28	1.33
MOX-UE 8%PuNp	1	0.76	0.76	0.76	0.76	1.02	0.86
	2	1.43	0.89	1.44	1.22	1.20	0.94
	3	1.75	0.93	1.76	1.43	1.29	1.01
	4	1.90	0.93	1.91	1.54	1.34	1.06
	5	1.97	0.93	1.98	1.59	1.37	1.10
	6	2.00	0.92	2.00	1.61	1.38	1.12
	7	2.00	0.91	2.01	1.63	1.39	1.14
	8	2.00	0.90	2.01	1.63	1.40	1.16
	9	1.99	0.90	2.00	1.63	1.40	1.17
	10	1.99	0.90	2.00	1.63	1.40	1.18

[x] *About half of the neutron source at the reference MOX-Pu fabrication ($8.92\cdot10^{7}$ n/s.tIHM) comes from spontaneous fissions, and the other half comes from (α,n) reactions on oxygen.*

[+] *The alpha power and neutron source at reprocessing of the reference UOX fuel are respectively 465 W/tIHM and $7.30\cdot10^{8}$ n/s.tIHM*

Table 5.4.1. Continued

		P-alpha	P-beta	P-gamm	S-neut	P-alpha	S-neut
		Fabrication				Reprocessing	
MOX-UE 8%PuNpAm	1	1.01	0.81	6.57	0.85	1.45	1.29
	2	2.26	0.97	10.3	1.60	2.00	1.73
	3	3.09	1.03	11.8	2.09	2.32	1.98
	4	3.59	1.05	12.2	2.38	2.50	2.13
	5	3.86	1.05	12.3	2.54	2.60	2.23
	6	3.99	1.05	12.3	2.61	2.65	2.29
	7	4.05	1.04	12.2	2.65	2.67	2.32
	8	4.06	1.04	12.1	2.66	2.68	2.35
	9	4.06	1.04	12.1	2.66	2.69	2.36
	10	4.05	1.04	12.1	2.65	2.69	2.38
MOX-UE 8%PuNpAmCm	1	1.62	0.85	7.36	44.7	1.53	1.46
	2	4.29	1.12	13.4	148	2.28	2.38
	3	6.23	1.26	16.3	229	2.76	3.22
	4	7.46	1.32	17.4	286	3.04	4.24
	5	8.21	1.36	17.8	324	3.20	5.61
	6	8.64	1.37	17.9	348	3.29	7.41
	7	8.87	1.38	17.9	363	3.33	9.64
	8	8.98	1.39	17.9	373	3.35	12.2
	9	9.05	1.39	17.9	379	3.37	15.1
	10	9.08	1.39	17.8	382	3.37	18.2
PuNpAmCmBkCf	1	1.62	0.85	7.36	44.7	1.53	1.46
	2	4.29	1.12	13.4	149	2.28	2.38
	3	6.23	1.26	16.3	236	2.76	3.24
	4	7.46	1.32	17.4	320	3.04	4.34
	5	8.21	1.36	17.8	427	3.20	5.92
	6	8.64	1.37	17.9	581	3.29	8.10
	7	8.87	1.38	17.9	794	3.33	10.89
	8	8.98	1.39	17.9	1066	3.35	14.25
	9	9.05	1.39	17.9	1394	3.37	18.01
	10	9.08	1.39	17.8	1761	3.37	22.1

5.5. STATIC EQUILIBRIUM MASS FLOWS

The mass of NatU as well as the SWU (Separating Work Units) necessary for the different reactor fleets are calculated with the following classic expressions /**5.6**/:

$$\frac{m(e^{out})}{m(e^{feed})} = \frac{e^{out} - e^{depl}}{e^{feed} - e^{depl}},$$

$$SWU = m(e^{out}) \times (2e^{out} - 1) \times \ln(\frac{e^{out}}{1 - e^{out}}) + (m(e^{feed}) - m(e^{out})) \times (2e^{depl} - 1) \times \ln(\frac{e^{depl}}{1 - e^{depl}})$$
$$- m(e^{feed}) \times (2e^{feed} - 1) \times \ln(\frac{e^{feed}}{1 - e^{feed}})$$

where e^{out} is the needed U235 enrichment coming out of the enrichment facility, e^{feed} is the percentage of U235 in the Uranium fed to the reprocessing facility (0.711% if NatU is used) and e^{depl} is the percentage of U235 left over in the depleted Uranium (a value of **0.25%** was considered is this study).

This percentage is the result of an economic trade-off between the cost of NatU and the cost of enriching it (the SWU). Indeed, the mass of NatU necessary to produce a given mass of enriched U decreases with the percentage of U235 left over in the DeplU whereas the number of SWU increases. For example, if it goes down from 0.25% to 0.15% then the mass of NatU necessary to produce the same mass of, let's say, 4.3% enriched U decreases by about 16% whereas the number of SWU increases by about 28%.

As mentioned in section 5.1, the RepU from the MOX-UE fuel still contains a significant amount of U235. In order to evaluate the impact of recycling this RepU on the overall NatU needs of the different reactor fleets, section 5.5.1 presents results without RepU recycling and section 5.5.2 with RepU recycling.

5.5.1. Uranium from reprocessed MOX-UE fuel is not recycled

The static equilibrium mass flows for the reference UOX open fuel cycle and a UOX+MOX monorecycling fuel cycle (similar to what is done in France) as well as for different PWR multirecycling strategies are presented in the Figures 5.5.1 to 5.5.7. All fleets generate **100 GWe** and produce **800 TWhe/year** which is representative of the actual US nuclear fleet. The losses at reprocessing are considered to be 0.1%.

Natural U. These figures show that monorecycling Pu in MOX fuel (Figure 5.5.2) saves about 10% of NatU compared to the reference UOX fleet (Figure 5.5.1) which necessitates about 16870 tU/year. Multirecycling Pu in MOX-UE fuel (Figure 5.5.3) brings this number to about 8.5%. Multirecycling Pu+Np brings about an economy of only 2% compared to the reference UOX fleet whereas the Pu+Np+Am and Pu+Np+Am+Cm cases needs more NatU than the reference UOX fleet (respectively +27.6% and +23.0%).

TRU mass flows. Monorecycling case. In order to absorb all the Pu coming from UOX fuel, it is necessary to reprocess all UOX fuel (about 1725 tHM/year) and to fabricate about 195 tHM/year of MOX fuel (about 10% of the total fuel fabrication at the fleet level). These numbers are quite close to the capacities of the French reprocessing plant of La Hague (1600 tHM/year) and of the MOX fabrication plant MELOX (200 tHM/year). Monorecycling Pu in MOX fuel allows to decrease the amount of Pu to be disposed of by about 37% (from 21.8 tons for the UOX fleet to 13.7 tons for the UOX + MOX fleet), but increases the amount of Am and Cm to be disposed of by a factor of about 2 (from about 1.9 and 0.13 tons for the UOX fleet to 3.2 and 0.30 tons for the UOX + MOX fleet). Compared to the UOX open fuel cycle, the number of Pu-bearing assemblies having to be disposed of is divided by a factor of 10 from about 3840 per year down to 390 per year (one assembly contains about 0.5 ton of HM).

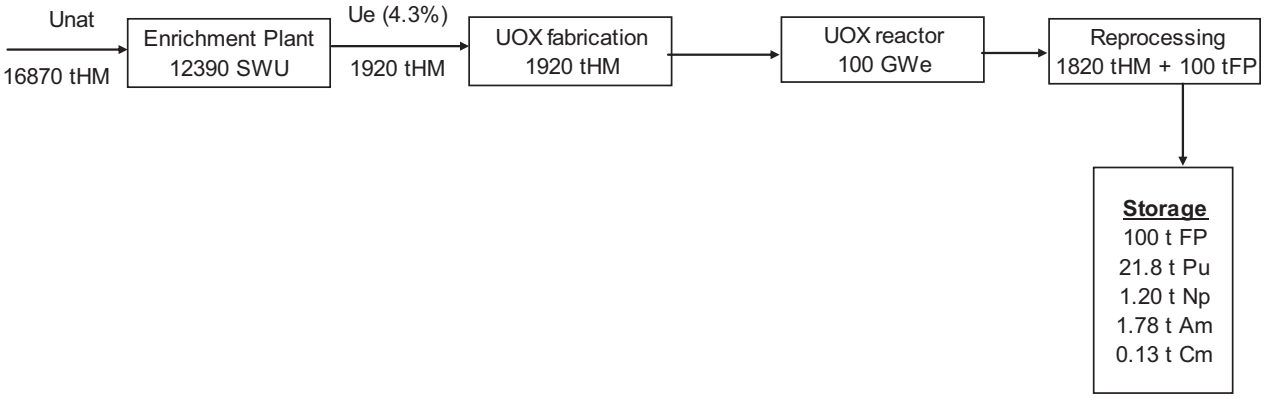

Figure 5.5.1. Static equilibrium mass flows (in tons/year) for the reference 100 GWe UOX PWR fleet generating 800 TWhe/year.

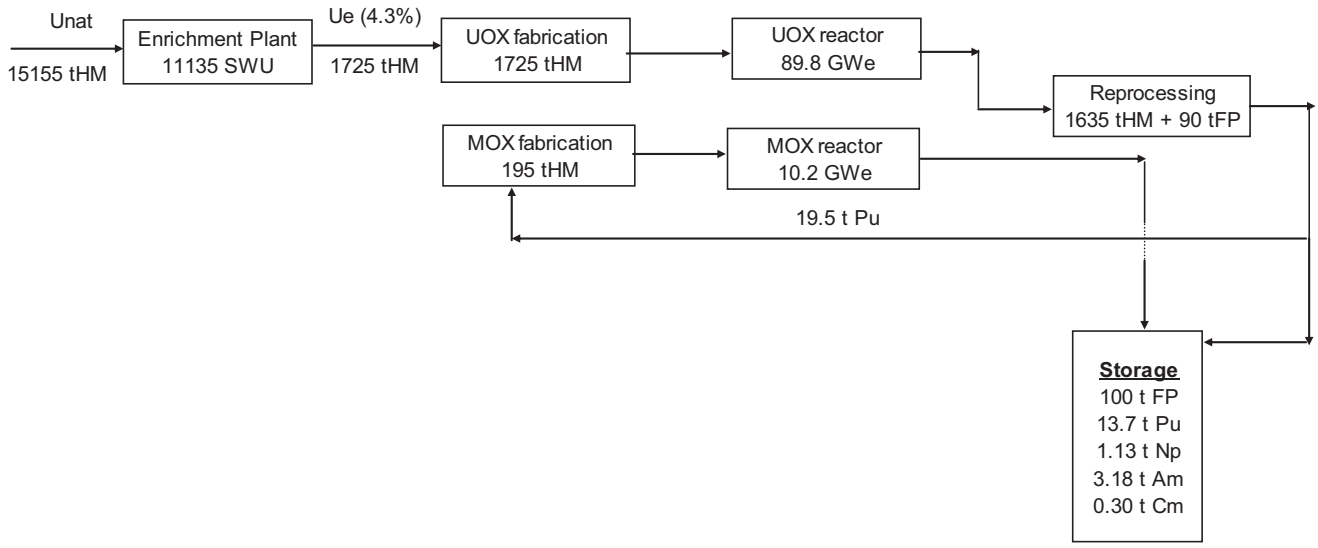

Figure 5.5.2. Static equilibrium mass flows (in tons per year) for a 100 GWe PWR fleet generating 800 TWhe/year and monorecycling Pu.

TRU mass flows. Multirecycling case. Multirecycling the entirety of the Pu, or PuNp or PuNpAm or PuNpAmCm or PuNpAmCmBkCf necessitates the use of MOX-UE fuel in respectively about 32.5%, 41%, 62%, 69% and 69% of the fleet which translates into MOX-UE fabrication capacities of between 625 tHM/year (Pu case) and 1325 tHM/year (PuNpAmCm and PuNpAmCmBkCf cases). Since all the fuel assemblies are reprocessed, the reprocessing capacity has to be 1920 tHM/year. Logically, multirecycling a specific element drastically reduces the amount of that element to be disposed of, but at the same time, increases the amount of heavier elements that would require disposal. However the balance is always positive, that is to say that the decrease in the mass to be disposed of (the element being multirecycled) is always larger than the increase in the mass of heavier elements that have to be disposed of. Depending on the recycling strategy, the amount of TRU that needs to be stored are presented on the figures below and summarized in Table 5.5.1.

Table 5.5.1. Amount of TRU (in tons HM per year) that needs to be disposed of for the different fuel cycle options considered. Common hypothesis: 100 GWe PWR fleets generating 800 TWhe/year. Losses at reprocessing = 0.1%. Only the values larger than 1kg/year are presented.

	UOX	Mono MOX	Multi Pu	Multi PuNp	Multi PuNpAm	Multi PuNpAmCm	Multi TRU*
Pu	21.8	13.7	0.06	0.06	0.08	0.08	0.08
Np	1.20	1.13	1.14	0.002	0.003	0.003	0.003
Am	1.78	3.18	6.92	6.77	0.01	0.01	0.01
Cm	0.13	0.30	0.87	0.95	2.79	0.007	0.007
Cf	-	-	-	-	-	0.007	-
Total	**24.9**	**18.3**	**9.0**	**7.8**	**2.9**	**0.11**	**0.1**

* Multi TRU = Multi PuNpAmCmBkCf

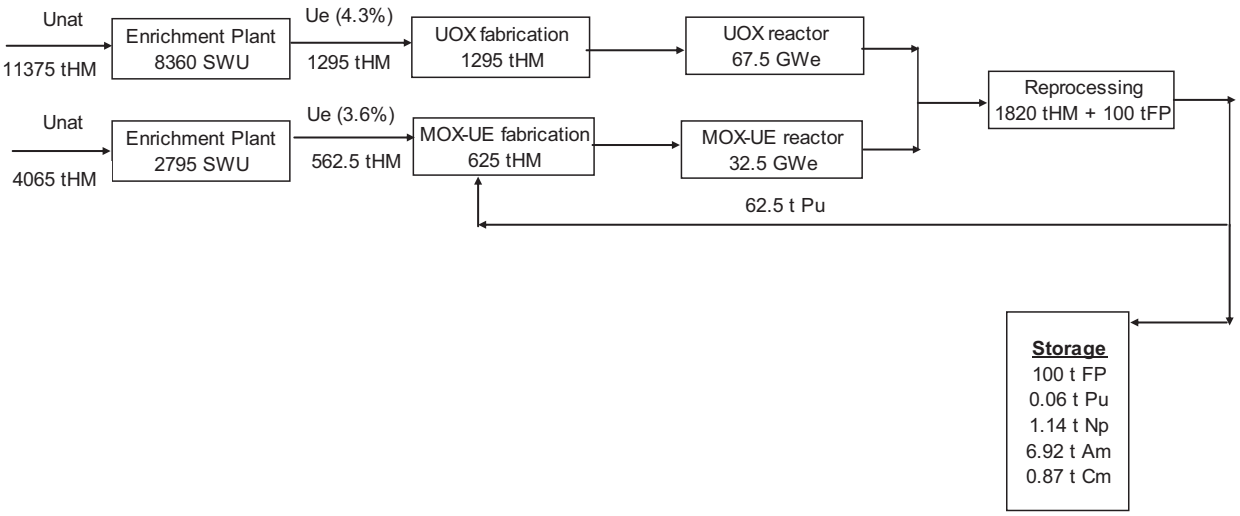

Figure 5.5.3. Static equilibrium mass flows (in tons/year) for a 100 GWe PWR fleet generating 800 TWhe/year and multirecycling Pu. No MOX-UE RepU recycling.

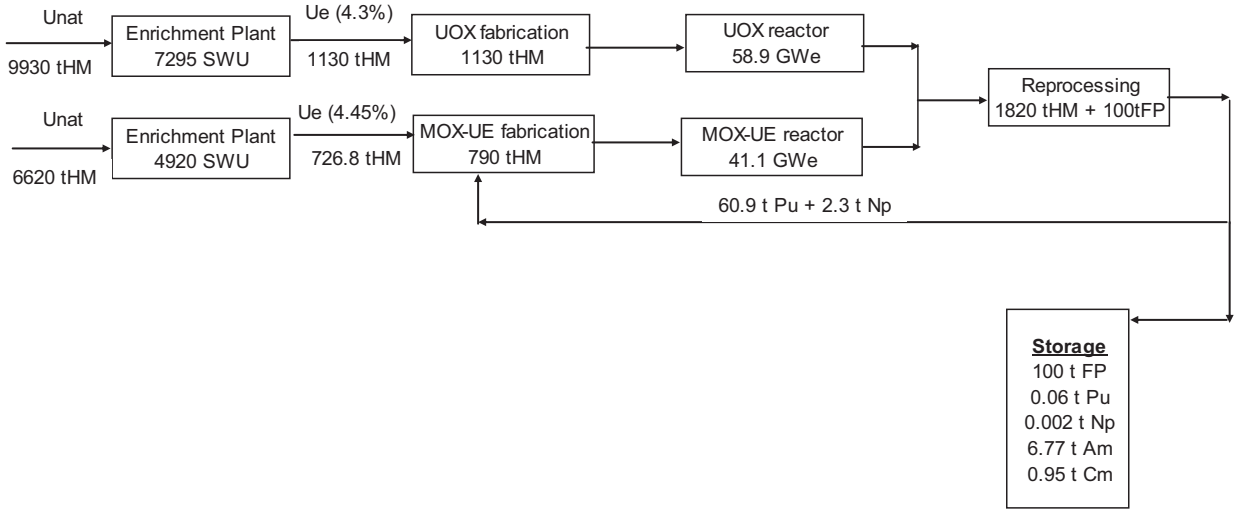

Figure 5.5.4. Static equilibrium mass flows(in tons/year) for a 100 GWe PWR fleet generating 800 TWhe/year and multirecycling Pu+Np. No MOX-UE RepU recycling.

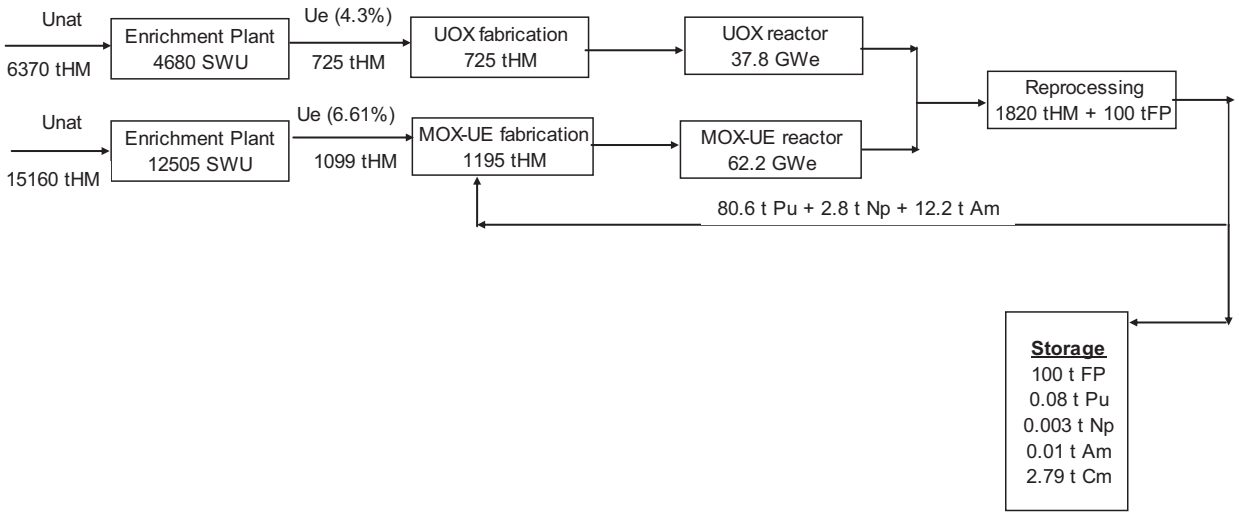

Figure 5.5.5. Static equilibrium mass flows (in tons/year) for a 100 GWe PWR fleet generating 800 TWhe/year and multirecycling Pu+Np+Am. No MOX-UE RepU recycling.

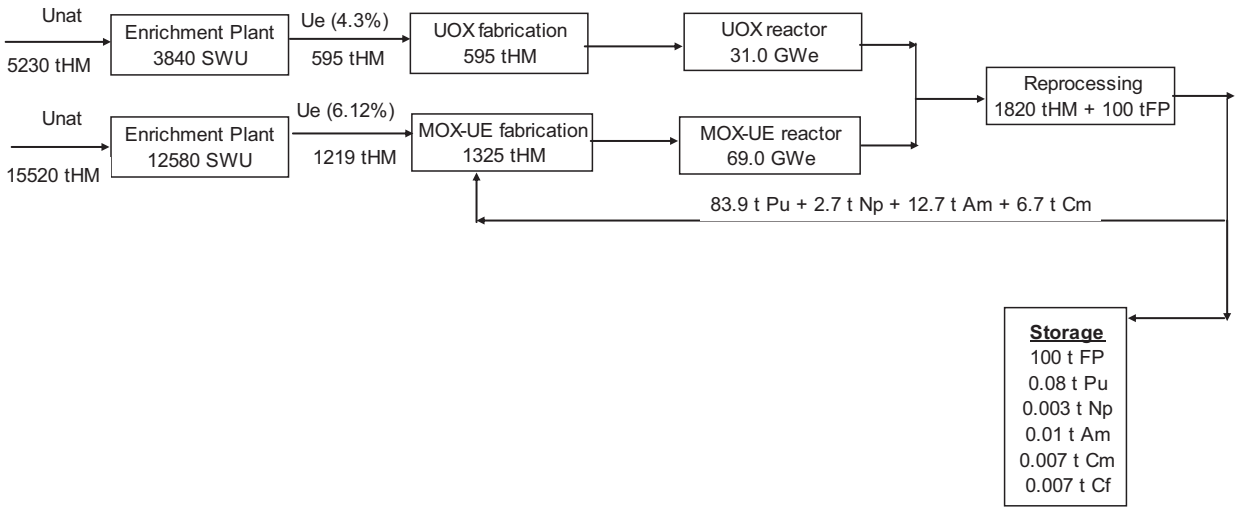

Figure 5.5.6. Static equilibrium mass flows (in tons/year) for a 100 GWe PWR fleet generating 800 TWhe/year and multirecycling Pu+Np+Am+Cm. No MOX-UE RepU recycling.

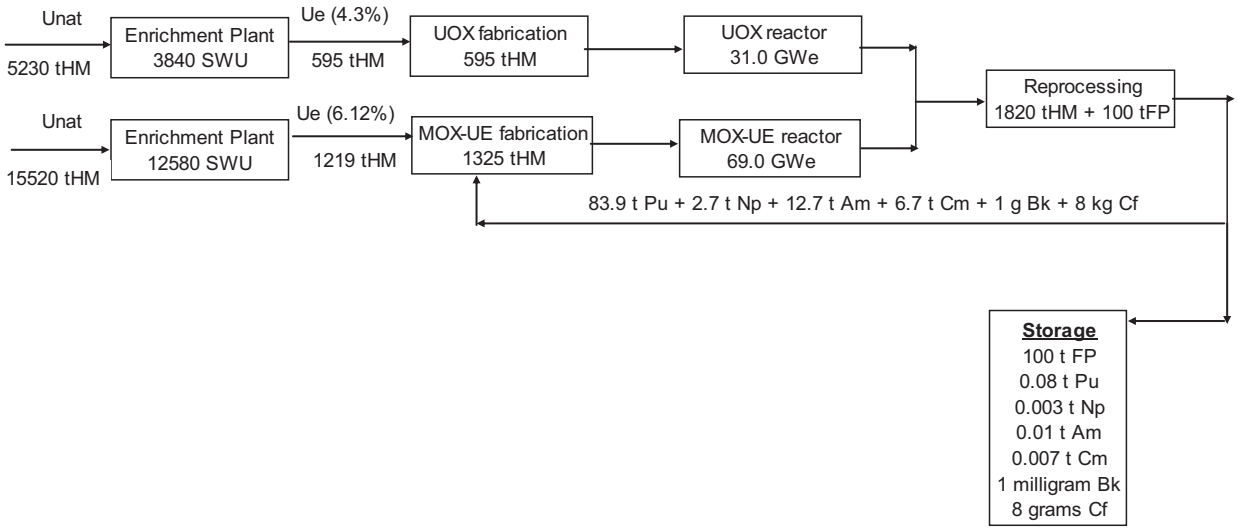

Figure 5.5.7. Static equilibrium mass flows (in tons/year) for a 100 GWe PWR fleet generating 800 TWhe/year and multirecycling Pu+Np+Am+Cm+Bk+Cf. No MOX-UE RepU recycling.

5.5.2. Uranium from reprocessed MOX-UE fuel is recycled – A preliminary assessment

As far as reactor physics is concerned, the main issue related to recycling reprocessed U lies in the presence of U236 which is a neutron poison. The main consequence of this supplementary absorption is that the U235 enrichment has to be increased to a degree that depends on the U235 and U236 reactivity worths. Another important consequence is that the Np production is significantly increased. For example the Np production which is about 1.5 kg/TWhe in the reference 4.3% UOX fuel is increased by about 65% when 0.5% U236 is present.

The reactivity worths of U235 and U236 are respectively about +5800 pcm/% and -1700 pcm/% in a UOX spectrum and about +1800 pcm/% and -1000 pcm/% in the harder MOX-UE spectrum. These numbers show that the reactivity worth of U236 is less spectrum dependent than U235's. The reason is that the UOX and MOX-UE spectra differ mainly by the number of neutrons in the thermal region (below about 1 eV); indeed since the MOX-UE fuel contains isotopes that are stong thermal absorbers, the thermal part of the spectrum is reduced compared to that in a UOX fuel. Since U236 absorbs neutrons mainly in the epithermal region and so is less sensitive to the thermal part of the spectrum its reactivity worth is less spectrum dependent. On the contrary, U235's reactivity worth is very spectrum dependent because it is a thermal absorber.

Examples of static equilibrium mass flows for Pu and Pu+Np+Am multirecycling strategies are presented in Figures 5.5.8 to 5.5.10. All fleets generate **100 GWe** and produce **800 TWhe/year** which is representative of the actual US nuclear fleet. The losses at reprocessing are considered to be 0.1%. The numbers presented in these figures are only preliminary estimates and more precise calculations should be carried out. The analysis presented in this Section makes use of the calculations presented in Appendix 6.

NB: Only the RepU from the MOX-UE is recycled, not the RepU from the UOX fuel.

Natural U. In the case of Pu multirecycling, the utilization of the 538 tons of RepU from the MOX-UE fuel to fabricate UOX fuel (Figure 5.5.8) allows an **economy in NatU of about 21%** compared to the reference UOX fleet (Figure 5.5.1) which necessitates about 16870 tU/year whereas the economy is only 8.5% when RepU is not recycled (Figure 5.5.3). In order to avoid re-enriching the RepU, and thus contaminating the enrichment facilities, the 538 tons of RepU (containing about 2.1% U235) are blended with about 757 tons of 5.9% enriched U (from NatU) in order to fabricate the necessary 1295 tons of 4.3%

enriched UOX fuel. Recycling the 538 tons of RepU saves 2215 tons of NatU per year; indeed the fleet needs about 15440 tU/year without RepU recycling and 13325 tU/year when RepU is recycled.

In the case of Pu+Np+Am multirecycling there is not enough UOX reactors to accommodate all the RepU from the MOX-UE fuel. Figure 5.5.9 shows one possibility where only the UOX reactors utilize the MOX-UE RepU. Since this RepU contains more U236 than in the Pu multirecycling case, a 0.15% over-enrichment was considered, bringing the UOX fuel enrichment at 4.45%. This strategy brings the necessary NatU from about 21530 tU/year when RepU is not recycled (Figure 5.5.5) down to about 17095 tU/year, i.e. respectively from +27.6% to +1.0% compared to the reference UOX fleet. Figure 5.5.10 shows another possibility where all the RepU from MOX-UE is utilized in the UOX and MOX-UE reactors. Since in this case the RepU will contain even more U236 than previously, a 0.3% over-enrichment was considered for the UOX reactors, bringing their enrichment at 4.6%. Furthermore, the MOX-UE enrichment is higher as well to compensate for the U236 build up: it is equal to 8% compared with 6.6% when RepU is not recycled. In this scenario, the necessary NatU goes further down from 17095 tU/year to 13600 tU/year which means an economy of about 19.4% compared to the reference UOX fleet. **Hence in the Pu+Np+Am case the necessary NatU relative to the reference UOX fleet goes from +27.6% when RepU is not recycled to -19.4% when it is recycled.**

TRU mass flows. In the Pu case, the TRU mass flows should not be too much impacted by the use of RepU in the UOX reactors because the impact on the Pu, Am and Cm mass flows are only second orders. The only substantial difference is on the Np mass flows. Indeed with about 0.2% U236 in the UOX fuel one can expect an increase in Np production of about 25%. Since at the fleet level the UOX reactors are responsible for about 72% of the Np production, the amount of Np to be stored is increased by about 18%, from 1.14 ton/year to 1.35 ton/year.

The same is true for the Pu+Np+Am case, i.e. the TRU mass flows should not be too much impacted by the use of RepU in the UOX reactors. Indeed, since Np makes up only about 5% of the Pu+Np+Am production form UOX reactors, even a doubling of the Np production would bring about only a 5% increase in the Pu+Np+Am flow mass that has to be recycled in the MOX-UE. Hence the supporting ratio of MOX-UE is similar whether RepU is recycled in the UOX reactors or not, i.e. about 62% of the fleet must be loaded with MOX-UE fuel in order to absorb the Pu+Np+Am production from the UOX reactors.

When the left-over RepU is multirecyled in the MOX-UE (Figure 5.5.10), the situation is somewhat different because U236 will build up in the MOX-UE fuel up to between about 1% and 1.5%. This will increase the Np production by the UOX reactors by about a factor of 4±1 which means an overall increase on the Pu+Np+Am production form UOX reactors of about 15%. In the meantime, the accumulation of U236 in the MOX-UE fuel brings about a decrease in its Pu+Np+Am disposition capability by about 20% because of a larger in-situ Np production coming from capture on U236. As a consequence, the supporting ratio is modified and in order to absorb the Pu+Np+Am production from the UOX reactors it will then be necessary to load about 70% of the fleet with MOX-UE fuel.

Even though this is only a preliminary assessment of the impact of recycling RepU, it shows that there is an incentive to investigate it further since it may allow an important economy in terms of NatU.

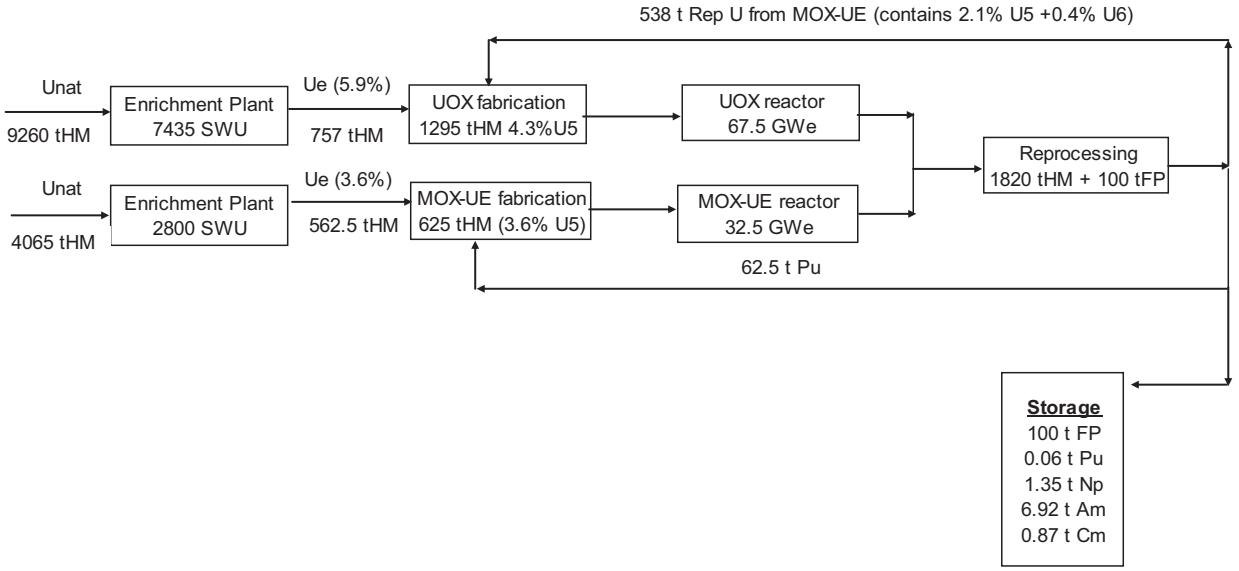

Figure 5.5.8. Static equilibrium mass flows (in tons/year) for a 100 GWe PWR fleet generating 800 TWhe/year and multirecycling Pu. RepU from MOX-UE is recycled once in UOX fuel.

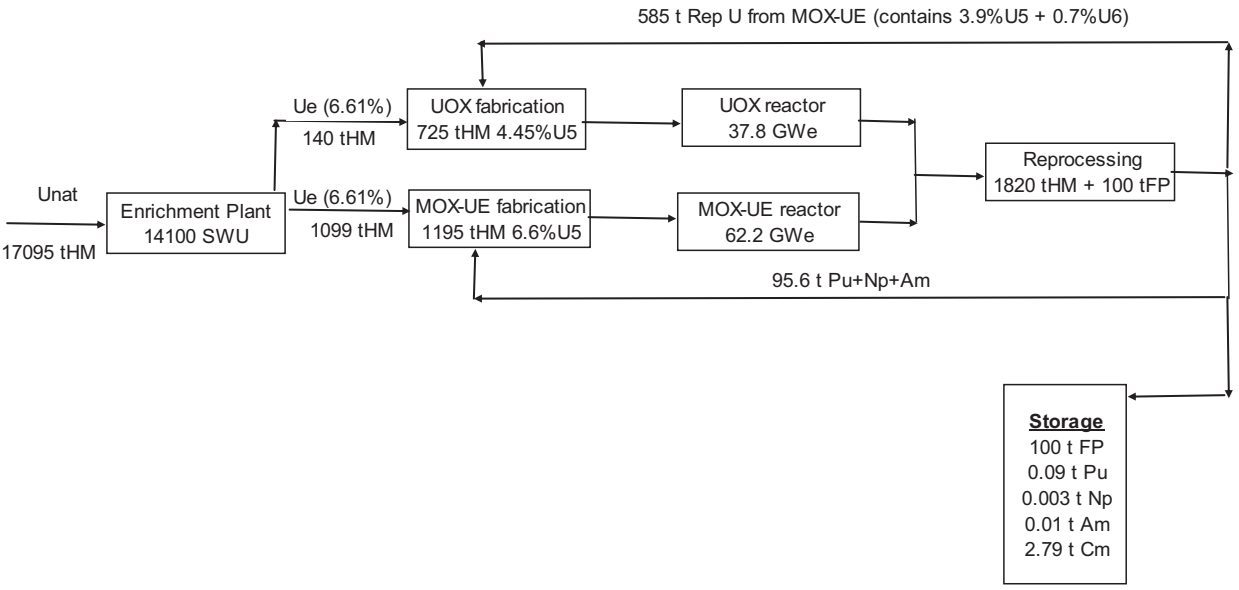

Figure 5.5.9. Static equilibrium mass flows (in tons/year) for a 100 GWe PWR fleet generating 800 TWhe/year and multirecycling Pu+Np+Am. About half of the RepU from MOX-UE is recycled once in UOX fuel.

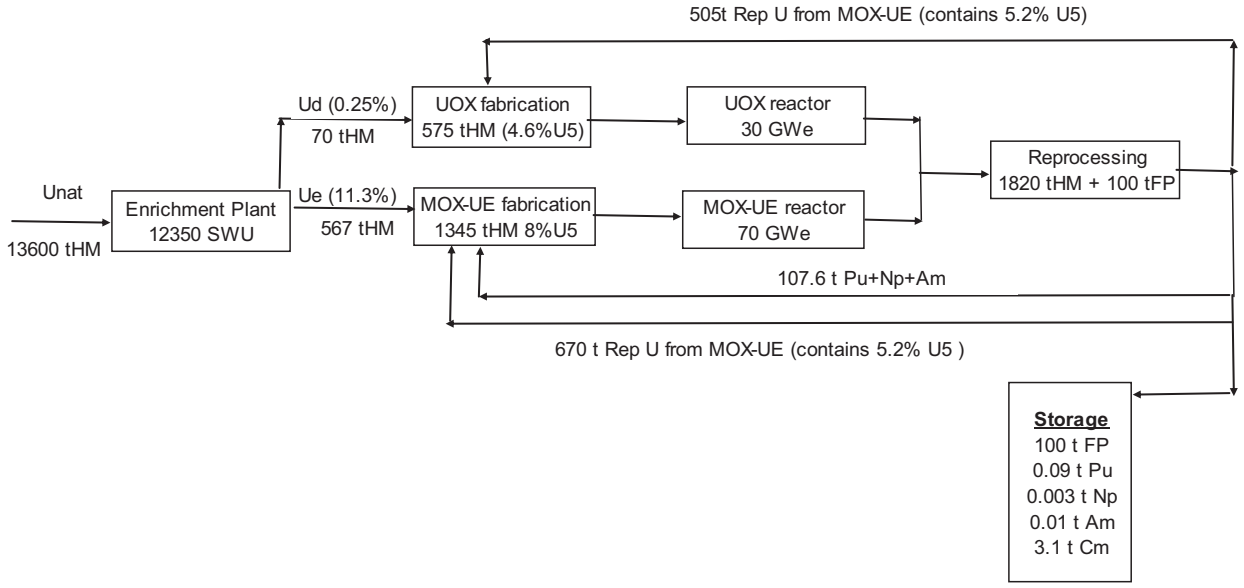

Figure 5.5.10. Static equilibrium mass flows (in tons/year) for a 100 GWe PWR fleet generating 800 TWhe/year and multirecycling Pu+Np+Am. Some RepU from MOX-UE is recycled once in UOX fuel and the left-over is multi-recycled in MOX-UE fuel.

5.6. HEAVY METAL INVENTORIES AT STATIC EQUILIBRIUM

The heavy metal inventories are the masses that are located in the following posts of the fuel cycle: the reactors, the cooling ponds and the fabrication. **They do not include the masses that have to be disposed of each year** (the elements that are not multirecycled) and which are given in Table 5.5.1. **They do not include the legacy either, i.e. the existing stockpile**.

To calculate the in-core inventories the specific power considered is equal to 86.5 tHM/GWe (≡34 Wth/gHM) for the UOX and MOX-UE reactors, i.e. there are 8650 tons of HM in the reactors in order to produce 100 GWe. The inventories in the cooling ponds are equal to 10-year worth of mass flows, i.e. 19200 tons total, whereas the inventories at the fabrication are equal to 1-year worth of mass flows, i.e. 1920 tons total.

The inventories are calculated by simply averaging the input and output of the different fuel cycle posts allowing for a quick estimation of these parameters which are important for comparing different strategies. For example (Figure 5.6.1), 1920 tHM with a burnup of 51 GWd/t (*M-in*) enter the cooling ponds every year and 1920 tHM exit from the same cooling ponds every year after having spent 10 years in them (*M-out*) so that the cooling ponds inventory is constant and equal to 19200 tHM.

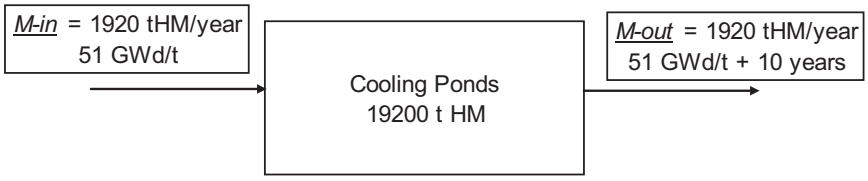

Figure 5.6.1. Cooling ponds inventory and yearly input-output

M-in and *M-out* are vectors whose components are the U, Pu, Np, Am and Cm flow masses determined in the previous chapter; their components are different depending on the recycling strategy but the sum of the components is equal to 1920 tHM/year. The cooling ponds inventory is then estimated as:

$$I\text{-}ponds = 10 \times (M\text{-}in + M\text{-}out)/2$$

Table 5.6.1 below presents the Pu, Np, Am and Cm inventories calculated using the methodology presented above. The hypothesis related to the cooling time (10 years) explains the large inventories in the cooling ponds; with a 5-year cooling time these inventories would be twice as small. For the Pu or PuNp multirecycling, the total Pu inventory is about 1000 tons compared to about 275 tons for the UOX open cycle and 485 tons for the MOX monorecycling case. When Am is recycled this number goes up about 35%, i.e. to about 1350 tons because as was already said Am transmutation leads mainly to Pu. The **numbers in bold** correspond to the elements which are multirecycled, i.e. for which the masses are constant and contained in the fuel cycle facilities (nothing to be disposed of each year, except for the reprocessing losses). The other numbers correspond to the elements that are not multirecycled, i.e. the masses in the fuel cycle facilities, but the fleet still produces a certain amount of these elements that have to be disposed of each year (see the flow masses of the previous chapter).

Table 5.6.1. Heavy Metal inventories (in tons) at static equilibrium for the different fuel cycle strategies. All PWR fleets generate 100 GWe and produce 800 TWhe per year.

	element	Core	Cooling Ponds	Fabrication	Total
UOX Open cycle	Pu	51.4	223	0	274.4
	Np	2.6	11.9	0	14.5
	Am	1.1	11.5	0	12.6
	Cm	0.51	1.8	0	2.31
MOX monorecycling	Pu	123	342	19.5	484.5
	Np	2.4	11.1	0	13.5
	Am	2.6	21.6	0.04	24.24
	Cm	1.1	4.0	0	5.1
Pu multirecycling	Pu	**289**	**641**	**62.3**	**992.3**
	Np	2.4	11.1	0	13.5
	Am	7.2	50.6	0.14	57.94
	Cm	3.1	11.1	0	14.2
PuNp multirecycling	Pu	**281**	**675**	**60.7**	**1017**
	Np	**10.2**	**24.3**	**2.3**	**36.8**
	Am	7.2	54.1	0.14	61.44
	Cm	3.3	13.2	0	16.5

Table 5.6.1. Continued

	element	Core	Cooling Ponds	Fabrication	Total
PuNpAm multirecycling	Pu	**371**	**898**	**80.4**	**1349**
	Np	**12.3**	**29.7**	**2.8**	**44.8**
	Am	**45.8**	**112**	**12.4**	**170.2**
	Cm	9.9	39.5	0	49.4
PuNpAmCm multirecycling	Pu	**385**	**932**	**83.9**	**1401**
	Np	**12.0**	**28.9**	**2.7**	**43.6**
	Am	**47.5**	**116**	**12.9**	**176.4**
	Cm	**35.3**	**87.0**	**6.4**	**128.7**
	Cf	0.01	0.07	0	0.08
PuNpAmCmBkCf multirecycling	Pu	**385**	**932**	**83.9**	**1401**
	Np	**12.0**	**28.9**	**2.7**	**43.6**
	Am	**47.5**	**116**	**12.9**	**176.4**
	Cm	**35.3**	**87.0**	**6.4**	**128.7**
	Cf	**0.03**	**0.08**	**0.006**	**0.116**

5.7. Dealing With the Spent Nuclear Fuel Legacy – A Preliminary Assessment

As of today, there are about 70,000 tHM accumulated in the SNF throughout the country /**1.1**/ (60,000 tHM in cooling ponds and 10,000 in dry storage). The TRU elements represent about 1.25% of this mass, i.e. 875 tHM, the rest being U and FP. The data presented in chapter 5.5 showed that it would be possible to equalize TRU production and consumption in a PWR fleet with, depending on the TRU being recycled, between one third and two thirds of the fleet loaded with MOX-UE fuel. That means that if the whole fleet is loaded with MOX-UE fuel, then it becomes a net TRU burner, i.e. it can recycle its own TRU as well as some TRU coming from SNF accumulated over the past 30 years.

Knowing that the specific power of the PWRs is 86.5 tHM/GWe and that the MOX-UE contains 8% of TRU, it translates into about 6.92 tTRU/GWe. If there were two reprocessing plants each about the size of the French plant of La Hague, it would then be possible to reprocess about 3200 tHM/year of SNF from which about 40 tTRU would be extracted. Since one GWe of MOX-UE needs 6.92 tTRU, with the 40 tTRU separated each year it would then be possible to start about 5.78 GWe of MOX-UE each year, i.e. it would take about 17.3 years to have a 100% MOX-UE PWR fleet loaded with about 692 tTRU from the SNF legacy.

Figure 5.7.1 presents, as an example, the case of a 100% MOX-UE fleet at static equilibrium recycling its own Pu+Np+Am as well as Pu+Np+Am coming from the leftover SNF legacy, and shows that it could accommodate about 12 tHM/year of Pu+Np+Am in addition to its own. This 100% MOX-UE fleet needs about 30% less NatU than the reference UOX fleet. The RepU is re-enriched up to 8% and then blended with another batch of 8% enriched U coming from NatU. Another possibility shown on Figure 5.7.2 does not involve re-enriching RepU, but, to compensate, it needs a relatively small amount of Highly Enriched Uranium (88 tons with 61.4% U235) to blend with in order to have the same 8% U235 enrichment for the MOX-UE fuel.

NB: According to the American Society of Standards and Testing materials (ASTM), HEU is any uranium with a U235 enrichment of more than 20%. Large HEU inventories were built up in the USA and former USSR/Russia, largely for national defence purposes. The former USSR/Russia is estimated to have produced 1 050 tons of HEU between 1950 and 1988. The USA produced 750 tons of HEU between 1945 and 1992 /**5.7**/. To lessen the proliferation threat of the weapons-grade HEU stockpiles, in accordance with the US-Russia HEU-LEU Agreement, the USA had agreed to purchase LEU down-blended from 500 tons of excess Russian HEU derived from dismantling of Russian nuclear weapons. In addition, 174 tons of US HEU had been declared excess. Under the Agreement, USEC had received 322 tons of Russian weapons-grade HEU that had been converted to LEU by the end of 2007 /**5.8**/. That is the equivalent of 12,885 nuclear warheads according to International Atomic Energy Agency definitions.

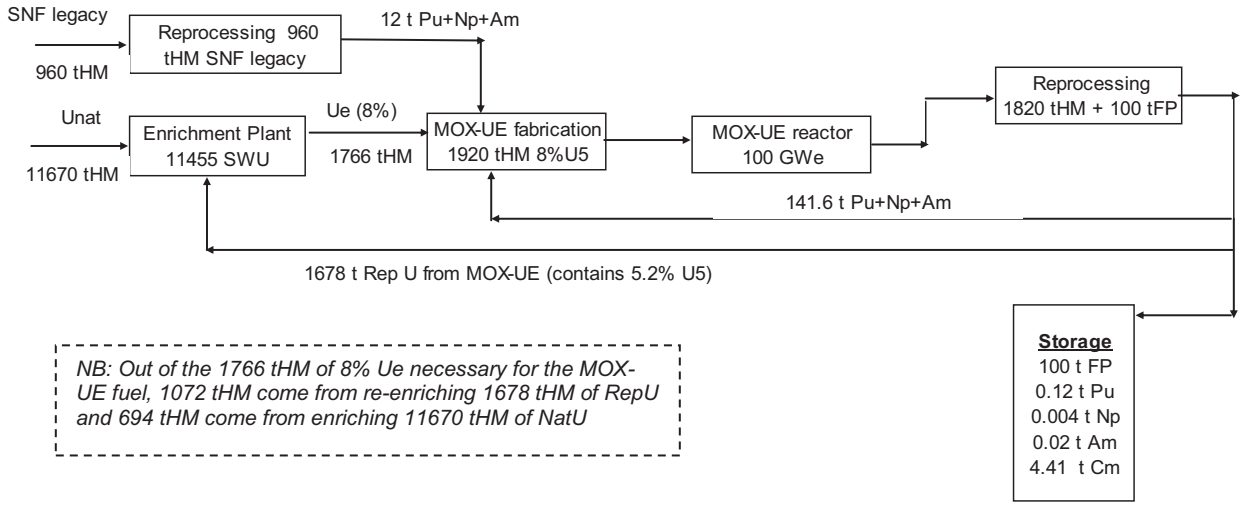

Figure 5.7.1. Mass flows (in tons/year) for a 100 GWe PWR fleet generating 800 TWhe/year and multirecycling its own Pu+Np+Am as well as that coming from SNF accumulated over the past 30 years. Option using re-enrichment of RepU.

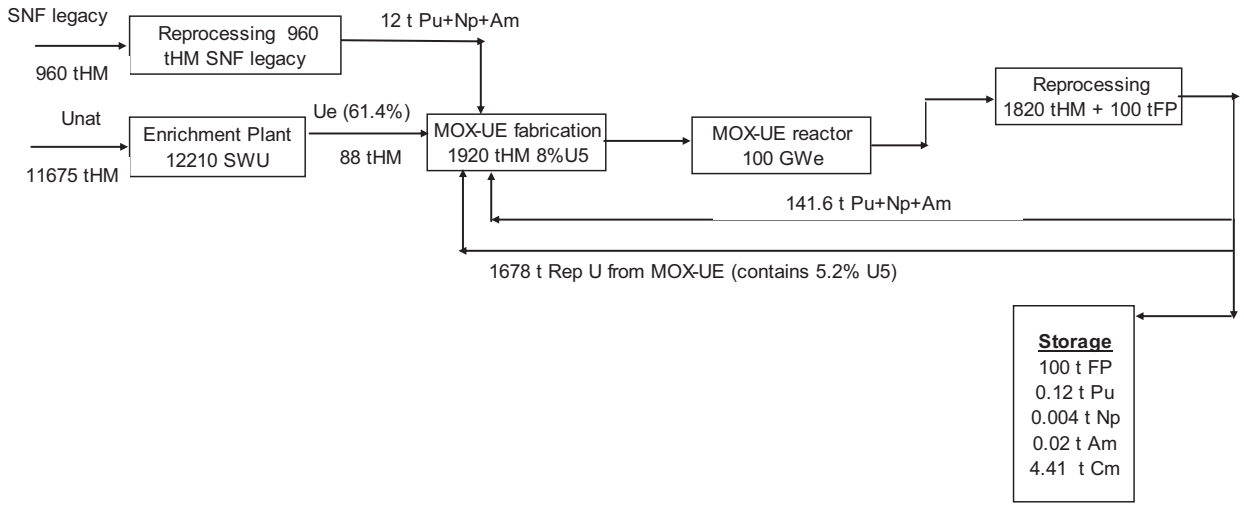

Figure 5.7.2. Mass flows (in tons/year) for a 100 GWe PWR fleet generating 800 TWhe/year and multirecycling its own Pu+Np+Am as well as that coming from SNF accumulated over the past 30 years. Option using directly RepU without re-enriching it.

5.8. HELIUM PRODUCTION IN THE MOX-UE FUEL

The internal pressure of the fuel rod has effects on its resistance to creep, to buckling and to ballooning. That is why the rod is pressurized to about 25 bars with helium at the time of fabrication. Under normal reactor operating conditions, this pressure must be lower than the limit leading to dimensional instability or heat transfer impairment. This criterion is such that the hot internal pressure, due to the accumulation of the fission gases and helium released during irradiation must be lower than the pressure which would cause, during normal operation, the reopening of the gap between the pellets and the cladding. The purpose of this criterion is to avoid thermoplastic instability, the increase of the gap causing an increase of the fuel temperature and, therefore, an acceleration of the fission gas release, thus an abnormal increment of the internal pressure of the rod.

The amount of gaseous fission products (Xe and Kr) produced during irradiation is not very dependant on the type of fuel and can be estimated as /**5.9**/:

$$V_{produced} = 0.027 \times \tau,$$

where $V_{produced}$ is the volume of gaseous fission products in cm^3/gHM at 20 degrees Celsius and 1 Atm and τ is the burnup in GWd/t. At 51 GWd/t, it comes: $V_{produced}$ = 1.377 cm^3-FP/g-HM. For this burnup about 5% of the gases are released in the plenum, i.e.

$$V_{released} = 0.05 \times 1.377 = 0.6885 \text{ cm}^3\text{-FP/g-HM}$$

The amount of He produced during irradiation is calculated by SCALE5.1 and is given below (Table 5.8.1) for the different MOX-UE fuels in g-He per g-HM and in cm^3-He per g-HM (1 mole of He = 24.5 liters = 24.5×10^3 cm^3 at 20 degrees Celsius and 1 Atm). It turns out that the presence of Am in the fuel brings about an increase of the Helium production at 51 GWd/t by about a factor of 2 compared to a standard MOX fuel mainly because of the higher Cm242 production. Depending on how much of this helium is released, fuel designers will need to make sure the rods internal pressure does not exceed the allowable upper limit.

Table 5.8.1. Amount of He produced during irradiation in g-He per g-HM and in cm^3-He per g-HM depending on the recycling strategy and for the 1st and 10th recycling

		g-He per g-HM		cm^3-He per g-HM	
		51 GWd/t	51 GWd/t + 10 y	51 GWd/t	51 GWd/t + 10 y
MOX-UE 10%Pu	1	2.27E-05	3.69E-05	0.139	0.226
	10	2.31E-05	4.03E-05	0.141	0.247
MOX-UE 8%PuNp	1	2.02E-05	3.40E-05	0.124	0.208
	10	2.21E-05	4.01E-05	0.135	0.246
MOX-UE 8%PuNpAm	1	5.32E-05	7.54E-05	0.326	0.462
	10	6.91E-05	1.06E-04	0.423	0.649
MOX-UE 8%PuNpAmCm	1	5.40E-05	7.71E-05	0.331	0.472
	10	7.49E-05	1.20E-04	0.459	0.735

6. CONCLUSIONS

This report presents the results of a neutronic analysis related to the homogeneous recycling of different TRU mixtures (Pu, PuNp, PuNpAm, PuNpAmCm or PuNpAmCmBkCf) in PWRs using MOX-UE fuel, i.e. MOX fuel with a U235 enriched uranium support instead of depleted uranium (0.25%) for standard MOX fuel. It focuses mainly on reactor physics issues and does not deal with other issues like economics, fuel fabrication, transportation or reprocessing that are essential to assess a system as a whole.

With this in mind, and from a neutron physics point of view, the MOX-UE approach allows to multirecycle TRU as long as U235 is available, by keeping the TRU content in the fuel constant and at a value ensuring a negative moderator **void coefficient**. Once this value is determined, the U235 enrichment of the MOX-UE fuel is adjusted in order to reach the target burnup (51 GWd/t in this study).

The calculations are carried out using the lattice physics capabilities of the SCALE5.1 code systems, i.e. the discrete-ordinates code NEWT coupled to the depletion code ORIGEN-S via the TRITON control module. Using the discrete-ordinates approximation to the transport equation on an arbitrary grid, together with a 238-group neutron cross-section library based on ENDFB-VI, NEWT provides a robust and rigorous deterministic solution for non-orthogonal configurations.

For the Pu only recycling case we chose to keep the **Pu content** equal to its first cycle value which is **10%**. For the other cases (PuNp, PuNpAm, PuNpAmCm and PuNpAmCmBkCf) we chose to lower this value in order to ensure a negative void coefficient (i.e. the loss of the coolant brings imperatively the reactor to a subcritical state). Since we consider PWRs entirely loaded with MOX-UE, and based on previous studies, we decided to limit the **TRU content** at **8%**. However, for partially loaded MOX-UE cores, i.e. containing for example only 30% or 50% of MOX-UE assemblies, the global void coefficient would be less of an issue and the TRU content in the MOX-UE assemblies could be higher but in this case the concern would lie in the power distribution between the UOX and the MOX-UE assemblies. These aspects were not considered in this study but could be interesting to tackle in the future.

The first cycle does not require any U-235 enrichment in the case of Pu recycling if the Pu content is set at 10%, hence depleted uranium can be used (0.25% U235). For the next cycles the U235 enrichment must be steadily increased because the Pu contains fewer and fewer of the fissile isotopes 239 and 241. It reaches a value equal to 90% of its asymptotic value (which is about 3.6%) after about 5 recyclings. For the 8% PuNp, 8% PuNpAm, 8% PuNpAmCm and 8% PuNpAmCmBkCf cases the necessary U235 enrichments are higher than for the 10% Pu case because there is less Pu and because the minor actinides do not fission appreciably in a PWR neutron spectrum. They are comprised between 2.3% and 3.7% for the first cycle depending on the MA that are recycled together with the Pu whereas the asymptotic values are comprised between 4.4% and 6.6%. Knowing that the U235 enrichment for the reference UOX fuel is 4.3%, the necessary MOX-UE enrichments might seem high. However, the situation is actually not as bad as it looks because the quality of the uranium at reprocessing is still very good. For example, for the PuNpAm recycling case, the necessary MOX-UE enrichment at equilibrium is about 6.6% but the reprocessed Uranium still contains about 3.95% of U235 and only 0.7% U236.

Multirecycling the entirety of the Pu, or PuNp or PuNpAm or PuNpAmCm or PuNpAmCmBkCf necessitates the use of MOX-UE fuel in respectively about 32.5%, 41%, 62% 69% and 69% of the fleet. For a 100 GWe fleet producing 800 TWhe/year it translates into MOX-UE fabrication capacities of between 625 tHM/year (Pu case) and 1325 tHM/year (PuNpAmCm and PuNpAmCmBkCf cases). Since all the fuel assemblies are reprocessed, the reprocessing capacity has to be 1920 tHM/year. Logically, multirecycling a specific element drastically reduces the amount of that element requiring disposal. However, multirecycling increases the amount of heavier elements that require disposal. However, the balance is always positive, that is to say that the decrease in the mass requiring disposal (the element being multirecycled) is always larger than the increase in the mass of heavier elements that have to be disposed of.

The impact of the different recycling strategies at the fabrication and reprocessing has been evaluated. The most important effect is related to the neutron source at the fabrication when Cm is recycled. Indeed, in the PuNpAmCm case, it is between 50 and 400 times (1st and 10th recycling) higher than that of a standard MOX-Pu fuel that can be fabricated today at MELOX for example. The neutron source of the PuNpAmCmBkCf case is similar to that of the PuNpAmCm case up to the 6th recycling (i.e. 75 years after the beginning of the first recycling), when the build-up of Cf252, even though present only in minute quantities (9 mg/tHM and 50 mg/tHM at the 6th and 10th recycling) brings about an even larger increase in the neutron source. Hence, the consequences of Cf252 build-up would start to be noticeable only 75 years after the beginning of the first recycling which leaves time to find a way to flush these few grams of Cf per ton HM if it is deemed necessary (either through chemical extraction or, since Cf252's half-life is only 2.6 years, simply by letting the fuel cool a few extra years).

The fleet multirecycling Pu at equilibrium needs about 8.5% less NatU than the reference UOX fleet. Multirecycling Pu+Np brings about an economy of only 2% compared to the reference UOX fleet whereas the Pu+Np+Am and Pu+Np+Am+Cm cases needs more NatU than the reference UOX fleet (respectively about +28% and +23%).

A preliminary assessment of the impact of recycling the RepU from the MOX-UE fuel shows a clear incentive to investigate this option further. Indeed recycling RepU significantly decreases the need for NatU. For the Pu multirecycling case, relative to the reference UOX reactor fleet, the NatU economy goes from 8.5% when RepU is not recycled to 21% when it is recycled. For the Pu+Np+Am case, the differential is even more striking: relative to the same reference UOX reactor fleet, the NatU requirement goes from about +28% to -19%. This **important information**, i.e. multirecycling Minor Actinides in a PWR fleet consumes less NatU than a UOX fleet even though the U-235 enrichment of the MOX-UE is higher than that of the reference UOX fuel, stems from the fact that the U reprocessed from the MOX-UE fuel still contains a lot of U-235.

The data presented in this report show that it would be possible to equalize TRU production and consumption in a PWR fleet with, depending on the TRU being recycled, between one third and two thirds of the fleet loaded with MOX-UE fuel. That means that if the whole fleet is loaded with MOX-UE fuel, then it becomes a net TRU burner, i.e. it can recycle its own TRU as well as some TRU coming from SNF accumulated over the past 30 years. A preliminary assessment shows that such a reactor fleet could accommodate about 12 tHM/year of Pu+Np+Am coming from the SNF legacy in addition to its own. This 100% MOX-UE fleet would need about 30% less NatU than the reference UOX fleet.

In terms of fuel performances, the presence of Am brings about an increase of the Helium production at 51 GWd/t by about a factor of 2 compared to a standard MOX fuel mainly because of the higher Cm242 production. Depending on how much of this helium is released, fuel designers will need to make sure the rods internal pressure does not exceed the allowable upper limit.

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APPENDIX 1: Pu case – Mass balances from cycle 1 to 10 as well as cycle 60

MOXUE_10Pu_025U5_1.out							
	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	1.13E-06	2.01E+01	6.81E+01	2.56E+02	2.56E+02	6.16E-01	5.39E+00
u235	2.25E+03	2.25E+03	1.20E+03	1.20E+03	-1.05E+03	-2.51E+00	-2.20E+01
u236	1.13E-06	2.68E+00	2.57E+02	2.81E+02	2.81E+02	6.75E-01	5.92E+00
u238	8.98E+05	8.98E+05	8.67E+05	8.67E+05	-3.08E+04	-7.40E+01	-6.48E+02
np237	1.13E-06	3.69E-01	1.74E+02	2.36E+02	2.36E+02	5.68E-01	4.97E+00
pu238	2.60E+03	2.58E+03	2.34E+03	2.34E+03	-2.62E+02	-6.30E-01	-5.51E+00
pu239	5.43E+04	5.43E+04	2.90E+04	2.90E+04	-2.53E+04	-6.07E+01	-5.32E+02
pu240	2.59E+04	2.59E+04	2.28E+04	2.32E+04	-2.68E+03	-6.44E+00	-5.64E+01
pu241	9.59E+03	9.13E+03	1.22E+04	7.53E+03	-2.06E+03	-4.94E+00	-4.33E+01
pu242	7.63E+03	7.63E+03	8.14E+03	8.14E+03	5.18E+02	1.24E+00	1.09E+01
pu244	5.71E-35	2.09E-12	2.01E-01	2.01E-01	2.01E-01	4.83E-04	4.24E-03
am241	1.13E-06	4.51E+02	1.34E+03	5.95E+03	5.95E+03	1.43E+01	1.25E+02
am242m	1.13E-06	1.13E-06	4.26E+01	4.05E+01	4.05E+01	9.74E-02	8.53E-01
am242	4.56E-13	1.46E-11	1.08E+00	5.23E-04	5.23E-04	1.26E-06	1.10E-05
am243	1.13E-06	1.20E-06	2.09E+03	2.09E+03	2.09E+03	5.01E+00	4.39E+01
cm242	1.13E-06	2.42E-07	1.93E+02	1.06E-01	1.06E-01	2.54E-04	2.22E-03
cm243	1.13E-06	1.11E-06	8.09E+00	6.35E+00	6.35E+00	1.52E-02	1.34E-01
cm244	1.13E-06	1.09E-06	1.16E+03	7.94E+02	7.94E+02	1.91E+00	1.67E+01
cm245	1.13E-06	1.13E-06	1.39E+02	1.39E+02	1.39E+02	3.34E-01	2.92E+00
cm246	1.13E-06	1.13E-06	8.38E+00	8.37E+00	8.37E+00	2.01E-02	1.76E-01
cm247	1.13E-06	1.13E-06	1.78E-01	1.78E-01	1.78E-01	4.27E-04	3.74E-03
cm248	1.13E-06	1.13E-06	8.89E-03	8.90E-03	8.89E-03	2.14E-05	1.87E-04
cf249	0.00E+00	2.65E-18	5.43E-05	2.27E-04	2.27E-04	5.46E-07	4.78E-06
cf250	0.00E+00	5.87E-31	3.74E-05	2.20E-05	2.20E-05	5.30E-08	4.64E-07
cf251	0.00E+00	5.28E-42	2.16E-05	2.14E-05	2.14E-05	5.14E-08	4.50E-07
cf252	0.00E+00	0.00E+00	5.99E-06	4.37E-07	4.37E-07	1.05E-09	9.20E-09
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.48E+05**	**9.48E+05**	**-5.18E+04**	**-1.24E+02**	**-1.09E+03**
TOTAL TRU	**1.00E+05**	**1.00E+05**	**7.97E+04**	**7.95E+04**	**-2.05E+04**	**-4.93E+01**	**-4.31E+02**
TOTAL PU	**1.00E+05**	**9.95E+04**	**7.45E+04**	**7.02E+04**	**-2.98E+04**	**-7.15E+01**	**-6.26E+02**
TOTAL NP	**1.13E-06**	**3.69E-01**	**1.74E+02**	**2.36E+02**	**2.36E+02**	**5.68E-01**	**4.97E+00**
TOTAL AM	**3.40E-06**	**4.51E+02**	**3.47E+03**	**8.08E+03**	**8.08E+03**	**1.94E+01**	**1.70E+02**
TOTAL CM	**7.94E-06**	**6.98E-06**	**1.51E+03**	**9.48E+02**	**9.48E+02**	**2.28E+00**	**2.00E+01**
TOTAL CF	**0.00E+00**	**2.65E-18**	**1.19E-04**	**2.71E-04**	**2.71E-04**	**6.51E-07**	**5.70E-06**

MOXUE_10Pu_191U5_2.out							
	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	1.13E-06	2.41E+01	8.38E+01	3.05E+02	3.05E+02	7.32E-01	6.42E+00
u235	1.72E+04	1.72E+04	9.30E+03	9.31E+03	-7.88E+03	-1.89E+01	-1.66E+02
u236	1.13E-06	3.21E+00	1.82E+03	1.85E+03	1.85E+03	4.44E+00	3.89E+01
u238	8.83E+05	8.83E+05	8.53E+05	8.53E+05	-2.96E+04	-7.11E+01	-6.23E+02
np237	1.13E-06	3.99E-01	3.30E+02	3.99E+02	3.99E+02	9.59E-01	8.40E+00
pu238	3.11E+03	3.09E+03	2.77E+03	2.75E+03	-3.65E+02	-8.77E-01	-7.68E+00
pu239	4.52E+04	4.52E+04	2.69E+04	2.70E+04	-1.82E+04	-4.38E+01	-3.84E+02
pu240	3.09E+04	3.09E+04	2.47E+04	2.50E+04	-5.84E+03	-1.40E+01	-1.23E+02
pu241	1.04E+04	9.89E+03	1.29E+04	7.95E+03	-2.43E+03	-5.85E+00	-5.12E+01
pu242	1.04E+04	1.04E+04	1.06E+04	1.06E+04	1.60E+02	3.84E-01	3.37E+00
pu244	5.71E-35	2.09E-12	2.18E-01	2.18E-01	2.18E-01	5.25E-04	4.60E-03
am241	1.13E-06	4.89E+02	1.48E+03	6.35E+03	6.35E+03	1.53E+01	1.34E+02
am242m	1.13E-06	1.13E-06	4.73E+01	4.50E+01	4.50E+01	1.08E-01	9.47E-01
am242	4.56E-13	1.46E-11	1.12E+00	5.80E-04	5.80E-04	1.39E-06	1.22E-05
am243	1.13E-06	1.21E-06	2.38E+03	2.38E+03	2.38E+03	5.72E+00	5.01E+01
cm242	1.13E-06	2.42E-07	2.00E+02	1.17E-01	1.17E-01	2.82E-04	2.47E-03
cm243	1.13E-06	1.11E-06	8.33E+00	6.54E+00	6.53E+00	1.57E-02	1.38E-01
cm244	1.13E-06	1.09E-06	1.25E+03	8.51E+02	8.51E+02	2.04E+00	1.79E+01
cm245	1.13E-06	1.13E-06	1.47E+02	1.47E+02	1.47E+02	3.54E-01	3.10E+00
cm246	1.13E-06	1.13E-06	8.28E+00	8.27E+00	8.27E+00	1.99E-02	1.74E-01
cm247	1.13E-06	1.13E-06	1.71E-01	1.71E-01	1.71E-01	4.12E-04	3.61E-03
cm248	1.13E-06	1.13E-06	8.01E-03	8.01E-03	8.01E-03	1.93E-05	1.69E-04
cf249	0.00E+00	2.57E-18	4.84E-05	2.00E-04	2.00E-04	4.82E-07	4.22E-06
cf250	0.00E+00	5.53E-31	3.13E-05	1.85E-05	1.85E-05	4.44E-08	3.89E-07
cf251	0.00E+00	4.92E-42	1.81E-05	1.79E-05	1.79E-05	4.31E-08	3.77E-07
cf252	0.00E+00	0.00E+00	4.74E-06	3.46E-07	3.46E-07	8.31E-10	7.28E-09
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.48E+05**	**9.48E+05**	**-5.18E+04**	**-1.25E+02**	**-1.09E+03**
TOTAL TRU	**1.00E+05**	**9.99E+04**	**8.36E+04**	**8.35E+04**	**-1.65E+04**	**-3.97E+01**	**-3.48E+02**
TOTAL PU	**1.00E+05**	**9.95E+04**	**7.78E+04**	**7.33E+04**	**-2.67E+04**	**-6.42E+01**	**-5.62E+02**
TOTAL NP	**1.13E-06**	**3.99E-01**	**3.30E+02**	**3.99E+02**	**3.99E+02**	**9.59E-01**	**8.40E+00**
TOTAL AM	**3.40E-06**	**4.89E+02**	**3.91E+03**	**8.77E+03**	**8.77E+03**	**2.11E+01**	**1.85E+02**
TOTAL CM	**7.94E-06**	**6.98E-06**	**1.61E+03**	**1.01E+03**	**1.01E+03**	**2.43E+00**	**2.13E+01**
TOTAL CF	**0.00E+00**	**2.57E-18**	**1.02E-04**	**2.37E-04**	**2.37E-04**	**5.70E-07**	**4.99E-06**

MOXUE_10Pu_265U5_3.out							
	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	1.13E-06	2.66E+01	9.32E+01	3.33E+02	3.33E+02	7.99E-01	7.00E+00
u235	2.39E+04	2.39E+04	1.31E+04	1.31E+04	-1.08E+04	-2.59E+01	-2.27E+02
u236	1.13E-06	3.32E+00	2.49E+03	2.52E+03	2.52E+03	6.05E+00	5.30E+01
u238	8.76E+05	8.76E+05	8.47E+05	8.47E+05	-2.92E+04	-7.02E+01	-6.15E+02
np237	1.13E-06	4.04E-01	3.88E+02	4.59E+02	4.58E+02	1.10E+00	9.65E+00
pu238	3.44E+03	3.42E+03	3.02E+03	2.98E+03	-4.67E+02	-1.12E+00	-9.83E+00
pu239	4.15E+04	4.15E+04	2.59E+04	2.60E+04	-1.55E+04	-3.73E+01	-3.27E+02
pu240	3.20E+04	3.20E+04	2.49E+04	2.53E+04	-6.69E+03	-1.61E+01	-1.41E+02
pu241	1.05E+04	1.00E+04	1.29E+04	7.98E+03	-2.54E+03	-6.09E+00	-5.34E+01
pu242	1.26E+04	1.26E+04	1.24E+04	1.24E+04	-2.00E+02	-4.81E-01	-4.21E+00
pu244	5.71E-35	2.09E-12	2.32E-01	2.32E-01	2.32E-01	5.57E-04	4.88E-03
am241	1.13E-06	4.95E+02	1.51E+03	6.39E+03	6.39E+03	1.54E+01	1.35E+02
am242m	1.13E-06	1.13E-06	4.81E+01	4.58E+01	4.58E+01	1.10E-01	9.65E-01
am242	4.56E-13	1.46E-11	1.11E+00	5.91E-04	5.91E-04	1.42E-06	1.24E-05
am243	1.13E-06	1.21E-06	2.58E+03	2.58E+03	2.58E+03	6.19E+00	5.42E+01
cm242	1.13E-06	2.42E-07	1.99E+02	1.19E-01	1.19E-01	2.87E-04	2.51E-03
cm243	1.13E-06	1.11E-06	8.28E+00	6.50E+00	6.49E+00	1.56E-02	1.37E-01
cm244	1.13E-06	1.09E-06	1.32E+03	8.98E+02	8.98E+02	2.16E+00	1.89E+01
cm245	1.13E-06	1.13E-06	1.55E+02	1.54E+02	1.54E+02	3.71E-01	3.25E+00
cm246	1.13E-06	1.13E-06	8.48E+00	8.47E+00	8.47E+00	2.03E-02	1.78E-01
cm247	1.13E-06	1.13E-06	1.74E-01	1.74E-01	1.74E-01	4.18E-04	3.66E-03
cm248	1.13E-06	1.13E-06	7.95E-03	7.95E-03	7.95E-03	1.91E-05	1.67E-04
cf249	0.00E+00	2.52E-18	4.77E-05	1.97E-04	1.97E-04	4.73E-07	4.14E-06
cf250	0.00E+00	5.39E-31	3.03E-05	1.79E-05	1.79E-05	4.29E-08	3.76E-07
cf251	0.00E+00	4.92E-42	1.74E-05	1.73E-05	1.73E-05	4.16E-08	3.64E-07
cf252	0.00E+00	0.00E+00	4.49E-06	3.28E-07	3.28E-07	7.87E-10	6.89E-09
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.48E+05**	**9.48E+05**	**-5.20E+04**	**-1.25E+02**	**-1.09E+03**
TOTAL TRU	**1.00E+05**	**1.00E+05**	**8.53E+04**	**8.51E+04**	**-1.49E+04**	**-3.57E+01**	**-3.13E+02**
TOTAL PU	**1.00E+05**	**9.95E+04**	**7.91E+04**	**7.46E+04**	**-2.54E+04**	**-6.11E+01**	**-5.35E+02**
TOTAL NP	**1.13E-06**	**4.04E-01**	**3.88E+02**	**4.59E+02**	**4.58E+02**	**1.10E+00**	**9.65E+00**
TOTAL AM	**3.40E-06**	**4.95E+02**	**4.14E+03**	**9.01E+03**	**9.01E+03**	**2.17E+01**	**1.90E+02**
TOTAL CM	**7.94E-06**	**6.98E-06**	**1.69E+03**	**1.07E+03**	**1.07E+03**	**2.57E+00**	**2.25E+01**
TOTAL CF	**0.00E+00**	**2.52E-18**	**9.99E-05**	**2.32E-04**	**2.32E-04**	**5.58E-07**	**4.89E-06**

MOXUE_10Pu_298U5_4.out							
	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	1.13E-06	2.81E+01	9.83E+01	3.48E+02	3.47E+02	8.35E-01	7.31E+00
u235	2.68E+04	2.68E+04	1.47E+04	1.47E+04	-1.21E+04	-2.90E+01	-2.54E+02
u236	1.13E-06	3.30E+00	2.79E+03	2.82E+03	2.82E+03	6.77E+00	5.93E+01
u238	8.73E+05	8.73E+05	8.44E+05	8.44E+05	-2.90E+04	-6.97E+01	-6.10E+02
np237	1.13E-06	4.01E-01	4.13E+02	4.83E+02	4.83E+02	1.16E+00	1.02E+01
pu238	3.64E+03	3.61E+03	3.15E+03	3.10E+03	-5.41E+02	-1.30E+00	-1.14E+01
pu239	3.98E+04	3.98E+04	2.53E+04	2.54E+04	-1.44E+04	-3.46E+01	-3.03E+02
pu240	3.18E+04	3.18E+04	2.46E+04	2.50E+04	-6.85E+03	-1.65E+01	-1.44E+02
pu241	1.04E+04	9.92E+03	1.28E+04	7.89E+03	-2.52E+03	-6.05E+00	-5.30E+01
pu242	1.44E+04	1.44E+04	1.39E+04	1.39E+04	-5.00E+02	-1.20E+00	-1.05E+01
pu244	5.71E-35	2.09E-12	2.44E-01	2.44E-01	2.44E-01	5.85E-04	5.13E-03
am241	1.13E-06	4.90E+02	1.50E+03	6.33E+03	6.33E+03	1.52E+01	1.33E+02
am242m	1.13E-06	1.13E-06	4.77E+01	4.54E+01	4.54E+01	1.09E-01	9.56E-01
am242	4.56E-13	1.46E-11	1.10E+00	5.86E-04	5.86E-04	1.41E-06	1.23E-05
am243	1.13E-06	1.22E-06	2.73E+03	2.73E+03	2.72E+03	6.55E+00	5.74E+01
cm242	1.13E-06	2.42E-07	1.96E+02	1.18E-01	1.18E-01	2.85E-04	2.49E-03
cm243	1.13E-06	1.11E-06	8.18E+00	6.42E+00	6.41E+00	1.54E-02	1.35E-01
cm244	1.13E-06	1.09E-06	1.38E+03	9.40E+02	9.40E+02	2.26E+00	1.98E+01
cm245	1.13E-06	1.13E-06	1.61E+02	1.61E+02	1.61E+02	3.87E-01	3.39E+00
cm246	1.13E-06	1.13E-06	8.80E+00	8.79E+00	8.78E+00	2.11E-02	1.85E-01
cm247	1.13E-06	1.13E-06	1.80E-01	1.80E-01	1.80E-01	4.33E-04	3.79E-03
cm248	1.13E-06	1.13E-06	8.21E-03	8.21E-03	8.21E-03	1.97E-05	1.73E-04
cf249	0.00E+00	2.51E-18	4.91E-05	2.02E-04	2.02E-04	4.86E-07	4.26E-06
cf250	0.00E+00	5.36E-31	3.10E-05	1.83E-05	1.83E-05	4.40E-08	3.86E-07
cf251	0.00E+00	4.92E-42	1.79E-05	1.77E-05	1.77E-05	4.26E-08	3.73E-07
cf252	0.00E+00	0.00E+00	4.59E-06	3.35E-07	3.35E-07	8.04E-10	7.04E-09
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.48E+05**	**9.48E+05**	**-5.20E+04**	**-1.25E+02**	**-1.09E+03**
TOTAL TRU	**1.00E+05**	**1.00E+05**	**8.61E+04**	**8.59E+04**	**-1.41E+04**	**-3.39E+01**	**-2.97E+02**
TOTAL PU	**1.00E+05**	**9.95E+04**	**7.97E+04**	**7.52E+04**	**-2.48E+04**	**-5.96E+01**	**-5.22E+02**
TOTAL NP	**1.13E-06**	**4.01E-01**	**4.13E+02**	**4.83E+02**	**4.83E+02**	**1.16E+00**	**1.02E+01**
TOTAL AM	**3.40E-06**	**4.90E+02**	**4.27E+03**	**9.10E+03**	**9.10E+03**	**2.19E+01**	**1.92E+02**
TOTAL CM	**7.94E-06**	**6.98E-06**	**1.75E+03**	**1.12E+03**	**1.12E+03**	**2.68E+00**	**2.35E+01**
TOTAL CF	**0.00E+00**	**2.51E-18**	**1.03E-04**	**2.39E-04**	**2.39E-04**	**5.74E-07**	**5.03E-06**

MOXUE_10Pu_320U5_5.out							
	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	1.13E-06	2.89E+01	1.01E+02	3.55E+02	3.55E+02	8.53E-01	7.47E+00
u235	2.88E+04	2.88E+04	1.59E+04	1.59E+04	-1.29E+04	-3.10E+01	-2.72E+02
u236	1.13E-06	3.26E+00	2.99E+03	3.01E+03	3.01E+03	7.24E+00	6.34E+01
u238	8.71E+05	8.71E+05	8.42E+05	8.42E+05	-2.88E+04	-6.92E+01	-6.06E+02
np237	1.13E-06	3.95E-01	4.28E+02	4.98E+02	4.98E+02	1.20E+00	1.05E+01
pu238	3.74E+03	3.71E+03	3.22E+03	3.16E+03	-5.86E+02	-1.41E+00	-1.23E+01
pu239	3.88E+04	3.88E+04	2.50E+04	2.51E+04	-1.38E+04	-3.31E+01	-2.90E+02
pu240	3.14E+04	3.14E+04	2.42E+04	2.46E+04	-6.77E+03	-1.63E+01	-1.43E+02
pu241	1.03E+04	9.79E+03	1.26E+04	7.79E+03	-2.48E+03	-5.95E+00	-5.21E+01
pu242	1.57E+04	1.57E+04	1.50E+04	1.50E+04	-7.40E+02	-1.78E+00	-1.56E+01
pu244	5.71E-35	2.09E-12	2.52E-01	2.52E-01	2.52E-01	6.06E-04	5.31E-03
am241	1.13E-06	4.84E+02	1.48E+03	6.25E+03	6.25E+03	1.50E+01	1.32E+02
am242m	1.13E-06	1.13E-06	4.71E+01	4.49E+01	4.49E+01	1.08E-01	9.45E-01
am242	4.56E-13	1.46E-11	1.08E+00	5.79E-04	5.79E-04	1.39E-06	1.22E-05
am243	1.13E-06	1.22E-06	2.84E+03	2.83E+03	2.83E+03	6.81E+00	5.97E+01
cm242	1.13E-06	2.42E-07	1.94E+02	1.17E-01	1.17E-01	2.81E-04	2.46E-03
cm243	1.13E-06	1.11E-06	8.06E+00	6.32E+00	6.32E+00	1.52E-02	1.33E-01
cm244	1.13E-06	1.09E-06	1.42E+03	9.72E+02	9.71E+02	2.33E+00	2.04E+01
cm245	1.13E-06	1.13E-06	1.66E+02	1.66E+02	1.65E+02	3.98E-01	3.48E+00
cm246	1.13E-06	1.13E-06	9.03E+00	9.02E+00	9.02E+00	2.17E-02	1.90E-01
cm247	1.13E-06	1.13E-06	1.84E-01	1.84E-01	1.84E-01	4.43E-04	3.88E-03
cm248	1.13E-06	1.13E-06	8.40E-03	8.41E-03	8.41E-03	2.02E-05	1.77E-04
cf249	0.00E+00	2.50E-18	5.02E-05	2.07E-04	2.07E-04	4.96E-07	4.35E-06
cf250	0.00E+00	5.32E-31	3.17E-05	1.87E-05	1.87E-05	4.49E-08	3.93E-07
cf251	0.00E+00	4.92E-42	1.82E-05	1.81E-05	1.81E-05	4.34E-08	3.80E-07
cf252	0.00E+00	0.00E+00	4.66E-06	3.40E-07	3.40E-07	8.17E-10	7.15E-09
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.48E+05**	**9.48E+05**	**-5.19E+04**	**-1.25E+02**	**-1.09E+03**
TOTAL TRU	**1.00E+05**	**9.99E+04**	**8.66E+04**	**8.64E+04**	**-1.36E+04**	**-3.26E+01**	**-2.86E+02**
TOTAL PU	**1.00E+05**	**9.95E+04**	**8.00E+04**	**7.56E+04**	**-2.44E+04**	**-5.85E+01**	**-5.13E+02**
TOTAL NP	**1.13E-06**	**3.95E-01**	**4.28E+02**	**4.98E+02**	**4.98E+02**	**1.20E+00**	**1.05E+01**
TOTAL AM	**3.40E-06**	**4.84E+02**	**4.37E+03**	**9.13E+03**	**9.13E+03**	**2.19E+01**	**1.92E+02**
TOTAL CM	**7.94E-06**	**6.98E-06**	**1.80E+03**	**1.15E+03**	**1.15E+03**	**2.77E+00**	**2.43E+01**
TOTAL CF	**0.00E+00**	**2.50E-18**	**1.05E-04**	**2.44E-04**	**2.44E-04**	**5.86E-07**	**5.13E-06**

MOXUE_10Pu_331U5_6.out							
	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	1.13E-06	2.93E+01	1.02E+02	3.58E+02	3.58E+02	8.60E-01	7.54E+00
u235	2.98E+04	2.98E+04	1.64E+04	1.64E+04	-1.34E+04	-3.22E+01	-2.82E+02
u236	1.13E-06	3.21E+00	3.09E+03	3.11E+03	3.11E+03	7.48E+00	6.55E+01
u238	8.70E+05	8.70E+05	8.41E+05	8.41E+05	-2.88E+04	-6.92E+01	-6.06E+02
np237	1.13E-06	3.90E-01	4.36E+02	5.05E+02	5.05E+02	1.21E+00	1.06E+01
pu238	3.79E+03	3.76E+03	3.25E+03	3.18E+03	-6.12E+02	-1.47E+00	-1.29E+01
pu239	3.83E+04	3.83E+04	2.47E+04	2.48E+04	-1.35E+04	-3.24E+01	-2.84E+02
pu240	3.09E+04	3.09E+04	2.38E+04	2.43E+04	-6.66E+03	-1.60E+01	-1.40E+02
pu241	1.01E+04	9.65E+03	1.25E+04	7.70E+03	-2.43E+03	-5.84E+00	-5.12E+01
pu242	1.69E+04	1.69E+04	1.59E+04	1.59E+04	-9.40E+02	-2.26E+00	-1.98E+01
pu244	5.71E-35	2.09E-12	2.60E-01	2.60E-01	2.60E-01	6.24E-04	5.47E-03
am241	1.13E-06	4.77E+02	1.46E+03	6.17E+03	6.17E+03	1.48E+01	1.30E+02
am242m	1.13E-06	1.13E-06	4.65E+01	4.42E+01	4.42E+01	1.06E-01	9.31E-01
am242	4.56E-13	1.46E-11	1.07E+00	5.71E-04	5.71E-04	1.37E-06	1.20E-05
am243	1.13E-06	1.22E-06	2.92E+03	2.92E+03	2.92E+03	7.02E+00	6.15E+01
cm242	1.13E-06	2.42E-07	1.91E+02	1.15E-01	1.15E-01	2.77E-04	2.42E-03
cm243	1.13E-06	1.11E-06	7.96E+00	6.25E+00	6.24E+00	1.50E-02	1.31E-01
cm244	1.13E-06	1.09E-06	1.46E+03	9.99E+02	9.99E+02	2.40E+00	2.10E+01
cm245	1.13E-06	1.13E-06	1.70E+02	1.70E+02	1.70E+02	4.08E-01	3.57E+00
cm246	1.13E-06	1.13E-06	9.28E+00	9.27E+00	9.27E+00	2.23E-02	1.95E-01
cm247	1.13E-06	1.13E-06	1.90E-01	1.90E-01	1.90E-01	4.56E-04	3.99E-03
cm248	1.13E-06	1.13E-06	8.67E-03	8.67E-03	8.67E-03	2.08E-05	1.82E-04
cf249	0.00E+00	2.49E-18	5.16E-05	2.13E-04	2.13E-04	5.11E-07	4.48E-06
cf250	0.00E+00	5.32E-31	3.27E-05	1.93E-05	1.93E-05	4.63E-08	4.06E-07
cf251	0.00E+00	4.92E-42	1.88E-05	1.86E-05	1.86E-05	4.48E-08	3.92E-07
cf252	0.00E+00	0.00E+00	4.82E-06	3.51E-07	3.51E-07	8.44E-10	7.39E-09
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.48E+05**	**9.48E+05**	**-5.20E+04**	**-1.25E+02**	**-1.09E+03**
TOTAL TRU	**1.00E+05**	**9.99E+04**	**8.69E+04**	**8.67E+04**	**-1.33E+04**	**-3.19E+01**	**-2.80E+02**
TOTAL PU	**1.00E+05**	**9.95E+04**	**8.02E+04**	**7.59E+04**	**-2.41E+04**	**-5.80E+01**	**-5.08E+02**
TOTAL NP	**1.13E-06**	**3.90E-01**	**4.36E+02**	**5.05E+02**	**5.05E+02**	**1.21E+00**	**1.06E+01**
TOTAL AM	**3.40E-06**	**4.77E+02**	**4.43E+03**	**9.14E+03**	**9.14E+03**	**2.20E+01**	**1.92E+02**
TOTAL CM	**7.94E-06**	**6.98E-06**	**1.84E+03**	**1.18E+03**	**1.18E+03**	**2.85E+00**	**2.49E+01**
TOTAL CF	**0.00E+00**	**2.49E-18**	**1.08E-04**	**2.51E-04**	**2.51E-04**	**6.03E-07**	**5.28E-06**

MOXUE_10Pu_339U5_7.out							
	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	1.13E-06	2.94E+01	1.03E+02	3.59E+02	3.59E+02	8.62E-01	7.55E+00
u235	3.05E+04	3.05E+04	1.68E+04	1.68E+04	-1.37E+04	-3.29E+01	-2.89E+02
u236	1.13E-06	3.17E+00	3.16E+03	3.19E+03	3.18E+03	7.65E+00	6.70E+01
u238	8.69E+05	8.69E+05	8.41E+05	8.41E+05	-2.88E+04	-6.92E+01	-6.06E+02
np237	1.13E-06	3.85E-01	4.42E+02	5.11E+02	5.10E+02	1.23E+00	1.07E+01
pu238	3.81E+03	3.78E+03	3.25E+03	3.18E+03	-6.24E+02	-1.50E+00	-1.31E+01
pu239	3.79E+04	3.79E+04	2.46E+04	2.46E+04	-1.33E+04	-3.19E+01	-2.80E+02
pu240	3.05E+04	3.05E+04	2.35E+04	2.40E+04	-6.54E+03	-1.57E+01	-1.38E+02
pu241	1.00E+04	9.54E+03	1.24E+04	7.62E+03	-2.39E+03	-5.74E+00	-5.03E+01
pu242	1.78E+04	1.78E+04	1.67E+04	1.67E+04	-1.10E+03	-2.64E+00	-2.32E+01
pu244	5.71E-35	2.09E-12	2.66E-01	2.66E-01	2.66E-01	6.38E-04	5.59E-03
am241	1.13E-06	4.72E+02	1.45E+03	6.11E+03	6.11E+03	1.47E+01	1.29E+02
am242m	1.13E-06	1.13E-06	4.59E+01	4.37E+01	4.37E+01	1.05E-01	9.19E-01
am242	4.56E-13	1.46E-11	1.06E+00	5.64E-04	5.63E-04	1.35E-06	1.19E-05
am243	1.13E-06	1.22E-06	2.99E+03	2.99E+03	2.99E+03	7.19E+00	6.30E+01
cm242	1.13E-06	2.42E-07	1.89E+02	1.14E-01	1.14E-01	2.73E-04	2.40E-03
cm243	1.13E-06	1.11E-06	7.89E+00	6.18E+00	6.18E+00	1.49E-02	1.30E-01
cm244	1.13E-06	1.09E-06	1.50E+03	1.02E+03	1.02E+03	2.45E+00	2.15E+01
cm245	1.13E-06	1.13E-06	1.73E+02	1.73E+02	1.73E+02	4.16E-01	3.64E+00
cm246	1.13E-06	1.13E-06	9.48E+00	9.47E+00	9.47E+00	2.28E-02	1.99E-01
cm247	1.13E-06	1.13E-06	1.94E-01	1.94E-01	1.94E-01	4.66E-04	4.08E-03
cm248	1.13E-06	1.13E-06	8.88E-03	8.89E-03	8.88E-03	2.13E-05	1.87E-04
cf249	0.00E+00	2.49E-18	5.29E-05	2.18E-04	2.18E-04	5.23E-07	4.58E-06
cf250	0.00E+00	5.32E-31	3.35E-05	1.98E-05	1.98E-05	4.75E-08	4.16E-07
cf251	0.00E+00	4.92E-42	1.93E-05	1.91E-05	1.91E-05	4.59E-08	4.02E-07
cf252	0.00E+00	0.00E+00	4.95E-06	3.61E-07	3.61E-07	8.67E-10	7.59E-09
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.48E+05**	**9.48E+05**	**-5.20E+04**	**-1.25E+02**	**-1.10E+03**
TOTAL TRU	**1.00E+05**	**9.99E+04**	**8.71E+04**	**8.69E+04**	**-1.31E+04**	**-3.14E+01**	**-2.75E+02**
TOTAL PU	**1.00E+05**	**9.95E+04**	**8.03E+04**	**7.60E+04**	**-2.39E+04**	**-5.75E+01**	**-5.04E+02**
TOTAL NP	**1.13E-06**	**3.85E-01**	**4.42E+02**	**5.11E+02**	**5.10E+02**	**1.23E+00**	**1.07E+01**
TOTAL AM	**3.40E-06**	**4.72E+02**	**4.48E+03**	**9.14E+03**	**9.14E+03**	**2.20E+01**	**1.92E+02**
TOTAL CM	**7.94E-06**	**6.98E-06**	**1.87E+03**	**1.21E+03**	**1.21E+03**	**2.91E+00**	**2.54E+01**
TOTAL CF	**0.00E+00**	**2.49E-18**	**1.11E-04**	**2.57E-04**	**2.57E-04**	**6.18E-07**	**5.41E-06**

MOXUE_10Pu_350U5_8.out							
	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	1.13E-06	2.94E+01	1.03E+02	3.59E+02	3.59E+02	8.62E-01	7.55E+00
u235	3.15E+04	3.15E+04	1.74E+04	1.74E+04	-1.41E+04	-3.39E+01	-2.97E+02
u236	1.13E-06	3.13E+00	3.26E+03	3.28E+03	3.28E+03	7.88E+00	6.91E+01
u238	8.68E+05	8.68E+05	8.40E+05	8.40E+05	-2.87E+04	-6.90E+01	-6.04E+02
np237	1.13E-06	3.81E-01	4.49E+02	5.17E+02	5.17E+02	1.24E+00	1.09E+01
pu238	3.81E+03	3.78E+03	3.25E+03	3.18E+03	-6.28E+02	-1.51E+00	-1.32E+01
pu239	3.76E+04	3.76E+04	2.45E+04	2.45E+04	-1.31E+04	-3.15E+01	-2.76E+02
pu240	3.02E+04	3.02E+04	2.33E+04	2.37E+04	-6.42E+03	-1.54E+01	-1.35E+02
pu241	9.92E+03	9.45E+03	1.23E+04	7.56E+03	-2.36E+03	-5.66E+00	-4.96E+01
pu242	1.85E+04	1.85E+04	1.73E+04	1.73E+04	-1.23E+03	-2.96E+00	-2.59E+01
pu244	5.71E-35	2.09E-12	2.69E-01	2.69E-01	2.69E-01	6.47E-04	5.67E-03
am241	1.13E-06	4.67E+02	1.43E+03	6.06E+03	6.06E+03	1.46E+01	1.28E+02
am242m	1.13E-06	1.13E-06	4.55E+01	4.33E+01	4.33E+01	1.04E-01	9.12E-01
am242	4.56E-13	1.46E-11	1.05E+00	5.59E-04	5.59E-04	1.34E-06	1.18E-05
am243	1.13E-06	1.23E-06	3.04E+03	3.04E+03	3.04E+03	7.31E+00	6.40E+01
cm242	1.13E-06	2.42E-07	1.88E+02	1.13E-01	1.13E-01	2.71E-04	2.38E-03
cm243	1.13E-06	1.11E-06	7.80E+00	6.12E+00	6.12E+00	1.47E-02	1.29E-01
cm244	1.13E-06	1.09E-06	1.52E+03	1.03E+03	1.03E+03	2.48E+00	2.18E+01
cm245	1.13E-06	1.13E-06	1.75E+02	1.75E+02	1.75E+02	4.20E-01	3.68E+00
cm246	1.13E-06	1.13E-06	9.56E+00	9.55E+00	9.55E+00	2.29E-02	2.01E-01
cm247	1.13E-06	1.13E-06	1.95E-01	1.95E-01	1.95E-01	4.69E-04	4.11E-03
cm248	1.13E-06	1.13E-06	8.94E-03	8.94E-03	8.94E-03	2.15E-05	1.88E-04
cf249	0.00E+00	2.48E-18	5.31E-05	2.19E-04	2.19E-04	5.26E-07	4.60E-06
cf250	0.00E+00	5.29E-31	3.36E-05	1.98E-05	1.98E-05	4.77E-08	4.18E-07
cf251	0.00E+00	4.92E-42	1.93E-05	1.92E-05	1.92E-05	4.60E-08	4.03E-07
cf252	0.00E+00	0.00E+00	4.95E-06	3.61E-07	3.61E-07	8.67E-10	7.59E-09
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.48E+05**	**9.48E+05**	**-5.20E+04**	**-1.25E+02**	**-1.10E+03**
TOTAL TRU	**1.00E+05**	**1.00E+05**	**8.74E+04**	**8.71E+04**	**-1.28E+04**	**-3.09E+01**	**-2.70E+02**
TOTAL PU	**1.00E+05**	**9.95E+04**	**8.05E+04**	**7.62E+04**	**-2.37E+04**	**-5.70E+01**	**-5.00E+02**
TOTAL NP	**1.13E-06**	**3.81E-01**	**4.49E+02**	**5.17E+02**	**5.17E+02**	**1.24E+00**	**1.09E+01**
TOTAL AM	**3.40E-06**	**4.67E+02**	**4.52E+03**	**9.14E+03**	**9.14E+03**	**2.20E+01**	**1.92E+02**
TOTAL CM	**7.94E-06**	**6.98E-06**	**1.89E+03**	**1.22E+03**	**1.22E+03**	**2.94E+00**	**2.58E+01**
TOTAL CF	**0.00E+00**	**2.48E-18**	**1.11E-04**	**2.58E-04**	**2.58E-04**	**6.20E-07**	**5.43E-06**

MOXUE_10Pu_355U5_9.out							
	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	1.13E-06	2.94E+01	1.03E+02	3.58E+02	3.57E+02	8.59E-01	7.53E+00
u235	3.19E+04	3.20E+04	1.76E+04	1.76E+04	-1.43E+04	-3.44E+01	-3.02E+02
u236	1.13E-06	3.10E+00	3.30E+03	3.33E+03	3.33E+03	7.99E+00	7.00E+01
u238	8.68E+05	8.68E+05	8.39E+05	8.39E+05	-2.87E+04	-6.90E+01	-6.04E+02
np237	1.13E-06	3.78E-01	4.53E+02	5.20E+02	5.20E+02	1.25E+00	1.10E+01
pu238	3.80E+03	3.77E+03	3.24E+03	3.17E+03	-6.29E+02	-1.51E+00	-1.32E+01
pu239	3.74E+04	3.74E+04	2.44E+04	2.44E+04	-1.30E+04	-3.12E+01	-2.74E+02
pu240	2.99E+04	2.99E+04	2.31E+04	2.35E+04	-6.34E+03	-1.52E+01	-1.33E+02
pu241	9.83E+03	9.37E+03	1.22E+04	7.51E+03	-2.33E+03	-5.59E+00	-4.90E+01
pu242	1.91E+04	1.91E+04	1.78E+04	1.78E+04	-1.32E+03	-3.17E+00	-2.78E+01
pu244	5.71E-35	2.09E-12	2.73E-01	2.73E-01	2.73E-01	6.56E-04	5.74E-03
am241	1.13E-06	4.63E+02	1.42E+03	6.02E+03	6.02E+03	1.45E+01	1.27E+02
am242m	1.13E-06	1.13E-06	4.51E+01	4.30E+01	4.30E+01	1.03E-01	9.04E-01
am242	4.56E-13	1.46E-11	1.04E+00	5.54E-04	5.54E-04	1.33E-06	1.17E-05
am243	1.13E-06	1.23E-06	3.09E+03	3.08E+03	3.08E+03	7.41E+00	6.49E+01
cm242	1.13E-06	2.42E-07	1.86E+02	1.12E-01	1.12E-01	2.69E-04	2.36E-03
cm243	1.13E-06	1.11E-06	7.75E+00	6.08E+00	6.07E+00	1.46E-02	1.28E-01
cm244	1.13E-06	1.09E-06	1.53E+03	1.05E+03	1.05E+03	2.52E+00	2.20E+01
cm245	1.13E-06	1.13E-06	1.77E+02	1.77E+02	1.77E+02	4.25E-01	3.72E+00
cm246	1.13E-06	1.13E-06	9.68E+00	9.67E+00	9.67E+00	2.32E-02	2.04E-01
cm247	1.13E-06	1.13E-06	1.98E-01	1.98E-01	1.98E-01	4.75E-04	4.16E-03
cm248	1.13E-06	1.13E-06	9.07E-03	9.07E-03	9.07E-03	2.18E-05	1.91E-04
cf249	0.00E+00	2.47E-18	5.38E-05	2.22E-04	2.22E-04	5.33E-07	4.67E-06
cf250	0.00E+00	5.29E-31	3.41E-05	2.01E-05	2.01E-05	4.84E-08	4.24E-07
cf251	0.00E+00	4.92E-42	1.96E-05	1.94E-05	1.94E-05	4.67E-08	4.09E-07
cf252	0.00E+00	0.00E+00	5.03E-06	3.67E-07	3.67E-07	8.81E-10	7.71E-09
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.48E+05**	**9.48E+05**	**-5.21E+04**	**-1.25E+02**	**-1.10E+03**
TOTAL TRU	**1.00E+05**	**9.99E+04**	**8.75E+04**	**8.73E+04**	**-1.27E+04**	**-3.05E+01**	**-2.68E+02**
TOTAL PU	**1.00E+05**	**9.95E+04**	**8.06E+04**	**7.64E+04**	**-2.36E+04**	**-5.67E+01**	**-4.97E+02**
TOTAL NP	**1.13E-06**	**3.78E-01**	**4.53E+02**	**5.20E+02**	**5.20E+02**	**1.25E+00**	**1.10E+01**
TOTAL AM	**3.40E-06**	**4.63E+02**	**4.55E+03**	**9.14E+03**	**9.14E+03**	**2.20E+01**	**1.92E+02**
TOTAL CM	**7.94E-06**	**6.98E-06**	**1.91E+03**	**1.24E+03**	**1.24E+03**	**2.98E+00**	**2.61E+01**
TOTAL CF	**0.00E+00**	**2.47E-18**	**1.13E-04**	**2.62E-04**	**2.62E-04**	**6.29E-07**	**5.51E-06**

MOXUE_10Pu_358U5_10.out							
	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	1.13E-06	2.92E+01	1.02E+02	3.56E+02	3.56E+02	8.56E-01	7.50E+00
u235	3.22E+04	3.22E+04	1.77E+04	1.78E+04	-1.45E+04	-3.47E+01	-3.04E+02
u236	1.13E-06	3.08E+00	3.33E+03	3.35E+03	3.35E+03	8.06E+00	7.06E+01
u238	8.68E+05	8.68E+05	8.39E+05	8.39E+05	-2.87E+04	-6.90E+01	-6.04E+02
np237	1.13E-06	3.76E-01	4.55E+02	5.22E+02	5.22E+02	1.25E+00	1.10E+01
pu238	3.78E+03	3.75E+03	3.23E+03	3.15E+03	-6.27E+02	-1.51E+00	-1.32E+01
pu239	3.72E+04	3.72E+04	2.43E+04	2.43E+04	-1.29E+04	-3.11E+01	-2.72E+02
pu240	2.96E+04	2.96E+04	2.29E+04	2.34E+04	-6.27E+03	-1.51E+01	-1.32E+02
pu241	9.77E+03	9.31E+03	1.21E+04	7.46E+03	-2.31E+03	-5.54E+00	-4.86E+01
pu242	1.96E+04	1.96E+04	1.82E+04	1.82E+04	-1.40E+03	-3.36E+00	-2.95E+01
pu244	5.71E-35	2.09E-12	2.76E-01	2.76E-01	2.76E-01	6.63E-04	5.81E-03
am241	1.13E-06	4.60E+02	1.41E+03	5.98E+03	5.98E+03	1.44E+01	1.26E+02
am242m	1.13E-06	1.13E-06	4.48E+01	4.26E+01	4.26E+01	1.02E-01	8.98E-01
am242	4.56E-13	1.46E-11	1.04E+00	5.50E-04	5.50E-04	1.32E-06	1.16E-05
am243	1.13E-06	1.23E-06	3.12E+03	3.12E+03	3.12E+03	7.50E+00	6.57E+01
cm242	1.13E-06	2.42E-07	1.85E+02	1.11E-01	1.11E-01	2.67E-04	2.34E-03
cm243	1.13E-06	1.11E-06	7.71E+00	6.05E+00	6.04E+00	1.45E-02	1.27E-01
cm244	1.13E-06	1.09E-06	1.55E+03	1.06E+03	1.06E+03	2.54E+00	2.23E+01
cm245	1.13E-06	1.13E-06	1.79E+02	1.79E+02	1.78E+02	4.29E-01	3.76E+00
cm246	1.13E-06	1.13E-06	9.80E+00	9.78E+00	9.78E+00	2.35E-02	2.06E-01
cm247	1.13E-06	1.13E-06	2.00E-01	2.00E-01	2.00E-01	4.81E-04	4.21E-03
cm248	1.13E-06	1.13E-06	9.20E-03	9.20E-03	9.20E-03	2.21E-05	1.94E-04
cf249	0.00E+00	2.47E-18	5.46E-05	2.25E-04	2.25E-04	5.40E-07	4.73E-06
cf250	0.00E+00	5.29E-31	3.47E-05	2.05E-05	2.05E-05	4.92E-08	4.31E-07
cf251	0.00E+00	4.92E-42	1.99E-05	1.97E-05	1.97E-05	4.74E-08	4.16E-07
cf252	0.00E+00	0.00E+00	5.12E-06	3.73E-07	3.73E-07	8.96E-10	7.85E-09
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.48E+05**	**9.48E+05**	**-5.21E+04**	**-1.25E+02**	**-1.10E+03**
TOTAL TRU	**1.00E+05**	**1.00E+05**	**8.76E+04**	**8.74E+04**	**-1.26E+04**	**-3.03E+01**	**-2.66E+02**
TOTAL PU	**1.00E+05**	**9.95E+04**	**8.06E+04**	**7.64E+04**	**-2.35E+04**	**-5.65E+01**	**-4.95E+02**
TOTAL NP	**1.13E-06**	**3.76E-01**	**4.55E+02**	**5.22E+02**	**5.22E+02**	**1.25E+00**	**1.10E+01**
TOTAL AM	**3.40E-06**	**4.60E+02**	**4.58E+03**	**9.14E+03**	**9.14E+03**	**2.20E+01**	**1.92E+02**
TOTAL CM	**7.94E-06**	**6.98E-06**	**1.93E+03**	**1.25E+03**	**1.25E+03**	**3.01E+00**	**2.64E+01**
TOTAL CF	**0.00E+00**	**2.47E-18**	**1.14E-04**	**2.65E-04**	**2.65E-04**	**6.38E-07**	**5.59E-06**

60th Pu recycling (personal communication, Sam Bays)

60th cycle from Sam's depletion Fortran using TRITON's 10th cycle XS							
	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	*1.13E-06*	2.89E+01	9.62E+01	3.45E+02	3.45E+02	8.28E-01	7.25E+00
u235	3.22E+04	3.22E+04	1.74E+04	1.74E+04	-1.48E+04	-3.56E+01	-3.12E+02
u236	*1.13E-06*	*3.06E+00*	3.39E+03	3.41E+03	3.41E+03	8.19E+00	7.18E+01
u238	8.68E+05	8.68E+05	8.39E+05	8.39E+05	-2.92E+04	-7.01E+01	-6.14E+02
np237	3.63E-05	3.70E-01	3.36E+02	3.94E+02	3.94E+02	9.48E-01	8.30E+00
pu238	3.70E+03	3.67E+03	3.15E+03	3.09E+03	-6.19E+02	-1.49E+00	-1.30E+01
pu239	3.66E+04	3.65E+04	2.36E+04	2.36E+04	-1.29E+04	-3.11E+01	-2.72E+02
pu240	2.90E+04	2.90E+04	2.24E+04	2.29E+04	-6.17E+03	-1.48E+01	-1.30E+02
pu241	9.60E+03	9.19E+03	1.19E+04	7.32E+03	-2.28E+03	-5.47E+00	-4.79E+01
pu242	2.11E+04	2.11E+04	1.93E+04	1.93E+04	-1.82E+03	-4.37E+00	-3.83E+01
pu244	*0.00E+00*	*0.00E+00*	*0.00E+00*	*0.00E+00*	0.00E+00	0.00E+00	0.00E+00
am241	6.98E+00	4.54E+02	1.35E+03	5.70E+03	5.70E+03	1.37E+01	1.20E+02
am242m	0.00E+00	1.93E-01	2.62E+01	2.50E+01	2.50E+01	6.01E-02	5.27E-01
am242	*0.00E+00*	*0.00E+00*	*0.00E+00*	*0.00E+00*	0.00E+00	0.00E+00	0.00E+00
am243	0.00E+00	1.94E+01	3.38E+03	3.38E+03	3.38E+03	8.12E+00	7.11E+01
cm242	0.00E+00	1.44E+00	1.94E+02	6.06E-02	6.06E-02	1.46E-04	1.28E-03
cm243	0.00E+00	1.23E-04	8.32E+00	6.52E+00	6.52E+00	1.57E-02	1.37E-01
cm244	0.00E+00	1.78E-02	1.72E+03	1.17E+03	1.17E+03	2.82E+00	2.47E+01
cm245	0.00E+00	3.58E-05	2.00E+02	2.00E+02	2.00E+02	4.80E-01	4.21E+00
cm246	0.00E+00	5.94E-09	1.14E+01	1.14E+01	1.14E+01	2.73E-02	2.39E-01
cm247	0.00E+00	4.62E-13	2.35E-01	2.35E-01	2.35E-01	5.65E-04	4.95E-03
cm248	0.00E+00	6.93E-17	1.10E-02	1.10E-02	1.10E-02	2.65E-05	2.32E-04
cf249	0.00E+00	1.16E-23	6.67E-05	2.70E-04	2.70E-04	6.49E-07	5.68E-06
cf250	0.00E+00	8.87E-24	4.26E-05	2.51E-05	2.51E-05	6.03E-08	5.28E-07
cf251	0.00E+00	2.57E-26	2.44E-05	2.42E-05	2.42E-05	5.81E-08	5.09E-07
cf252	0.00E+00	1.11E-29	6.35E-06	4.60E-07	4.60E-07	1.11E-09	9.69E-09
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.47E+05**	**9.47E+05**	**-5.32E+04**	**-1.28E+02**	**-1.12E+03**
TOTAL TRU	**1.00E+05**	**9.99E+04**	**8.75E+04**	**8.71E+04**	**-1.29E+04**	**-3.11E+01**	**-2.72E+02**
TOTAL PU	**1.00E+05**	**9.94E+04**	**8.03E+04**	**7.62E+04**	**-2.38E+04**	**-5.72E+01**	**-5.01E+02**
TOTAL NP	**3.63E-05**	**3.70E-01**	**3.36E+02**	**3.94E+02**	**3.94E+02**	**9.48E-01**	**8.30E+00**
TOTAL AM	**6.98E+00**	**4.73E+02**	**4.76E+03**	**9.11E+03**	**9.10E+03**	**2.19E+01**	**1.92E+02**
TOTAL CM	**0.00E+00**	**1.45E+00**	**2.14E+03**	**1.39E+03**	**1.39E+03**	**3.35E+00**	**2.93E+01**
TOTAL CF	**0.00E+00**	**2.05E-23**	**1.40E-04**	**3.20E-04**	**3.20E-04**	**7.68E-07**	**6.73E-06**

APPENDIX 2: PuNp case – Mass balances from cycle 1 to 10 as well as cycle 60

MOXUE_8PuNp_235U5_1.out							
	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	1.13E-06	1.53E+01	8.00E+01	3.53E+02	3.53E+02	8.48E-01	7.43E+00
u235	2.16E+04	2.16E+04	1.11E+04	1.11E+04	-1.05E+04	-2.53E+01	-2.22E+02
u236	1.13E-06	2.04E+00	2.34E+03	2.36E+03	2.36E+03	5.67E+00	4.97E+01
u238	8.98E+05	8.98E+05	8.68E+05	8.68E+05	-3.03E+04	-7.28E+01	-6.38E+02
np237	4.19E+03	4.19E+03	2.38E+03	2.43E+03	-1.75E+03	-4.21E+00	-3.69E+01
pu238	1.97E+03	1.96E+03	3.50E+03	3.39E+03	1.41E+03	3.40E+00	2.98E+01
pu239	4.12E+04	4.12E+04	2.32E+04	2.32E+04	-1.80E+04	-4.31E+01	-3.78E+02
pu240	1.96E+04	1.96E+04	1.72E+04	1.74E+04	-2.16E+03	-5.19E+00	-4.55E+01
pu241	7.27E+03	6.92E+03	9.82E+03	6.06E+03	-1.21E+03	-2.90E+00	-2.54E+01
pu242	5.78E+03	5.78E+03	6.27E+03	6.27E+03	4.86E+02	1.17E+00	1.02E+01
pu244	5.71E-35	2.09E-12	1.72E-01	1.72E-01	1.72E-01	4.12E-04	3.61E-03
am241	1.13E-06	3.42E+02	1.03E+03	4.74E+03	4.74E+03	1.14E+01	9.98E+01
am242m	1.13E-06	1.13E-06	3.20E+01	3.04E+01	3.04E+01	7.31E-02	6.41E-01
am242	4.56E-13	1.46E-11	8.86E-01	3.93E-04	3.93E-04	9.43E-07	8.26E-06
am243	1.13E-06	1.19E-06	1.76E+03	1.76E+03	1.76E+03	4.23E+00	3.70E+01
cm242	1.13E-06	2.42E-07	1.58E+02	7.93E-02	7.93E-02	1.91E-04	1.67E-03
cm243	1.13E-06	1.11E-06	6.46E+00	5.07E+00	5.07E+00	1.22E-02	1.07E-01
cm244	1.13E-06	1.09E-06	9.97E+02	6.81E+02	6.81E+02	1.64E+00	1.43E+01
cm245	1.13E-06	1.13E-06	1.19E+02	1.19E+02	1.19E+02	2.85E-01	2.50E+00
cm246	1.13E-06	1.13E-06	7.57E+00	7.56E+00	7.56E+00	1.82E-02	1.59E-01
cm247	1.13E-06	1.13E-06	1.58E-01	1.58E-01	1.58E-01	3.81E-04	3.33E-03
cm248	1.13E-06	1.13E-06	8.42E-03	8.42E-03	8.42E-03	2.02E-05	1.77E-04
cf249	0.00E+00	2.54E-18	4.87E-05	2.06E-04	2.06E-04	4.94E-07	4.33E-06
cf250	0.00E+00	5.95E-31	3.61E-05	2.13E-05	2.13E-05	5.12E-08	4.48E-07
cf251	0.00E+00	5.28E-42	2.04E-05	2.02E-05	2.02E-05	4.85E-08	4.25E-07
cf252	0.00E+00	0.00E+00	5.97E-06	4.35E-07	4.35E-07	1.05E-09	9.15E-09
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.48E+05**	**9.48E+05**	**-5.19E+04**	**-1.25E+02**	**-1.09E+03**
TOTAL TRU	**8.00E+04**	**8.00E+04**	**6.64E+04**	**6.61E+04**	**-1.38E+04**	**-3.32E+01**	**-2.91E+02**
TOTAL PU	**7.58E+04**	**7.54E+04**	**5.99E+04**	**5.64E+04**	**-1.94E+04**	**-4.67E+01**	**-4.09E+02**
TOTAL NP	**4.19E+03**	**4.19E+03**	**2.38E+03**	**2.43E+03**	**-1.75E+03**	**-4.21E+00**	**-3.69E+01**
TOTAL AM	**3.40E-06**	**3.42E+02**	**2.82E+03**	**6.53E+03**	**6.53E+03**	**1.57E+01**	**1.37E+02**
TOTAL CM	**7.94E-06**	**6.98E-06**	**1.29E+03**	**8.12E+02**	**8.12E+02**	**1.95E+00**	**1.71E+01**
TOTAL CF	**0.00E+00**	**2.54E-18**	**1.11E-04**	**2.48E-04**	**2.48E-04**	**5.95E-07**	**5.21E-06**
PU+NP	**8.00E+04**	**7.96E+04**	**6.23E+04**	**5.88E+04**	**-2.12E+04**	**-5.09E+01**	**-4.46E+02**

MOXUE_8PuNp_350U5_2.out							
	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	1.13E-06	3.02E+01	1.24E+02	4.76E+02	4.76E+02	1.14E+00	1.00E+01
u235	3.22E+04	3.22E+04	1.69E+04	1.69E+04	-1.53E+04	-3.67E+01	-3.21E+02
u236	1.13E-06	2.35E+00	3.42E+03	3.44E+03	3.44E+03	8.27E+00	7.24E+01
u238	8.88E+05	8.88E+05	8.58E+05	8.58E+05	-2.96E+04	-7.11E+01	-6.23E+02
np237	3.54E+03	3.54E+03	2.20E+03	2.25E+03	-1.29E+03	-3.10E+00	-2.72E+01
pu238	3.91E+03	3.88E+03	4.56E+03	4.37E+03	4.59E+02	1.10E+00	9.66E+00
pu239	3.41E+04	3.41E+04	2.18E+04	2.19E+04	-1.23E+04	-2.95E+01	-2.58E+02
pu240	2.26E+04	2.26E+04	1.79E+04	1.82E+04	-4.46E+03	-1.07E+01	-9.39E+01
pu241	7.98E+03	7.61E+03	1.02E+04	6.30E+03	-1.68E+03	-4.04E+00	-3.54E+01
pu242	7.80E+03	7.80E+03	7.99E+03	7.99E+03	1.94E+02	4.66E-01	4.08E+00
pu244	5.71E-35	2.09E-12	1.89E-01	1.89E-01	1.89E-01	4.55E-04	3.99E-03
am241	1.13E-06	3.76E+02	1.12E+03	4.98E+03	4.97E+03	1.20E+01	1.05E+02
am242m	1.13E-06	1.13E-06	3.50E+01	3.34E+01	3.34E+01	8.02E-02	7.02E-01
am242	4.56E-13	1.46E-11	9.16E-01	4.30E-04	4.30E-04	1.03E-06	9.06E-06
am243	1.13E-06	1.20E-06	2.01E+03	2.01E+03	2.01E+03	4.83E+00	4.23E+01
cm242	1.13E-06	2.42E-07	1.64E+02	8.69E-02	8.69E-02	2.09E-04	1.83E-03
cm243	1.13E-06	1.11E-06	6.77E+00	5.31E+00	5.31E+00	1.28E-02	1.12E-01
cm244	1.13E-06	1.09E-06	1.10E+03	7.48E+02	7.47E+02	1.80E+00	1.57E+01
cm245	1.13E-06	1.13E-06	1.30E+02	1.30E+02	1.30E+02	3.11E-01	2.73E+00
cm246	1.13E-06	1.13E-06	7.87E+00	7.86E+00	7.86E+00	1.89E-02	1.65E-01
cm247	1.13E-06	1.13E-06	1.62E-01	1.62E-01	1.62E-01	3.90E-04	3.42E-03
cm248	1.13E-06	1.13E-06	8.27E-03	8.28E-03	8.28E-03	1.99E-05	1.74E-04
cf249	0.00E+00	2.50E-18	4.78E-05	2.00E-04	2.00E-04	4.80E-07	4.21E-06
cf250	0.00E+00	5.79E-31	3.38E-05	1.99E-05	1.99E-05	4.79E-08	4.20E-07
cf251	0.00E+00	5.28E-42	1.91E-05	1.89E-05	1.89E-05	4.55E-08	3.98E-07
cf252	0.00E+00	0.00E+00	5.37E-06	3.91E-07	3.91E-07	9.40E-10	8.24E-09
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.48E+05**	**9.48E+05**	**-5.21E+04**	**-1.25E+02**	**-1.10E+03**
TOTAL TRU	**8.00E+04**	**8.00E+04**	**6.92E+04**	**6.88E+04**	**-1.11E+04**	**-2.68E+01**	**-2.34E+02**
TOTAL PU	**7.64E+04**	**7.60E+04**	**6.24E+04**	**5.87E+04**	**-1.78E+04**	**-4.27E+01**	**-3.74E+02**
TOTAL NP	**3.54E+03**	**3.54E+03**	**2.20E+03**	**2.25E+03**	**-1.29E+03**	**-3.10E+00**	**-2.72E+01**
TOTAL AM	**3.40E-06**	**3.76E+02**	**3.16E+03**	**7.02E+03**	**7.02E+03**	**1.69E+01**	**1.48E+02**
TOTAL CM	**7.94E-06**	**6.98E-06**	**1.40E+03**	**8.91E+02**	**8.91E+02**	**2.14E+00**	**1.87E+01**
TOTAL CF	**0.00E+00**	**2.50E-18**	**1.06E-04**	**2.39E-04**	**2.39E-04**	**5.75E-07**	**5.03E-06**
PU+NP	**8.00E+04**	**7.96E+04**	**6.46E+04**	**6.09E+04**	**-1.90E+04**	**-4.58E+01**	**-4.01E+02**

MOXUE_8PuNp_392U5_3.out							
	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	1.13E-06	3.74E+01	1.46E+02	5.35E+02	5.35E+02	1.29E+00	1.13E+01
u235	3.61E+04	3.61E+04	1.91E+04	1.91E+04	-1.70E+04	-4.08E+01	-3.58E+02
u236	1.13E-06	2.37E+00	3.81E+03	3.83E+03	3.83E+03	9.20E+00	8.06E+01
u238	8.84E+05	8.84E+05	8.54E+05	8.54E+05	-2.94E+04	-7.06E+01	-6.19E+02
np237	3.25E+03	3.25E+03	2.09E+03	2.15E+03	-1.10E+03	-2.65E+00	-2.32E+01
pu238	4.84E+03	4.80E+03	5.06E+03	4.83E+03	-6.00E+00	-1.44E-02	-1.26E-01
pu239	3.17E+04	3.17E+04	2.12E+04	2.13E+04	-1.04E+04	-2.50E+01	-2.19E+02
pu240	2.28E+04	2.28E+04	1.76E+04	1.80E+04	-4.87E+03	-1.17E+01	-1.03E+02
pu241	8.03E+03	7.66E+03	1.01E+04	6.26E+03	-1.78E+03	-4.27E+00	-3.74E+01
pu242	9.37E+03	9.37E+03	9.25E+03	9.25E+03	-1.17E+02	-2.81E-01	-2.46E+00
pu244	5.71E-35	2.09E-12	2.03E-01	2.03E-01	2.03E-01	4.88E-04	4.28E-03
am241	1.13E-06	3.78E+02	1.12E+03	4.95E+03	4.95E+03	1.19E+01	1.04E+02
am242m	1.13E-06	1.13E-06	3.52E+01	3.35E+01	3.35E+01	8.04E-02	7.05E-01
am242	4.56E-13	1.46E-11	9.09E-01	4.32E-04	4.32E-04	1.04E-06	9.09E-06
am243	1.13E-06	1.20E-06	2.18E+03	2.18E+03	2.18E+03	5.23E+00	4.58E+01
cm242	1.13E-06	2.42E-07	1.63E+02	8.72E-02	8.72E-02	2.10E-04	1.84E-03
cm243	1.13E-06	1.11E-06	6.74E+00	5.28E+00	5.28E+00	1.27E-02	1.11E-01
cm244	1.13E-06	1.09E-06	1.17E+03	8.00E+02	8.00E+02	1.92E+00	1.68E+01
cm245	1.13E-06	1.13E-06	1.38E+02	1.38E+02	1.38E+02	3.31E-01	2.90E+00
cm246	1.13E-06	1.13E-06	8.30E+00	8.29E+00	8.29E+00	1.99E-02	1.75E-01
cm247	1.13E-06	1.13E-06	1.71E-01	1.71E-01	1.71E-01	4.11E-04	3.60E-03
cm248	1.13E-06	1.13E-06	8.64E-03	8.65E-03	8.65E-03	2.08E-05	1.82E-04
cf249	0.00E+00	2.48E-18	4.99E-05	2.08E-04	2.08E-04	5.00E-07	4.38E-06
cf250	0.00E+00	5.75E-31	3.49E-05	2.06E-05	2.06E-05	4.95E-08	4.33E-07
cf251	0.00E+00	5.28E-42	1.97E-05	1.96E-05	1.96E-05	4.70E-08	4.12E-07
cf252	0.00E+00	0.00E+00	5.50E-06	4.01E-07	4.01E-07	9.63E-10	8.44E-09
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.48E+05**	**9.48E+05**	**-5.22E+04**	**-1.25E+02**	**-1.10E+03**
TOTAL TRU	**8.00E+04**	**7.99E+04**	**7.02E+04**	**6.98E+04**	**-1.02E+04**	**-2.44E+01**	**-2.14E+02**
TOTAL PU	**7.67E+04**	**7.63E+04**	**6.33E+04**	**5.96E+04**	**-1.72E+04**	**-4.12E+01**	**-3.61E+02**
TOTAL NP	**3.25E+03**	**3.25E+03**	**2.09E+03**	**2.15E+03**	**-1.10E+03**	**-2.65E+00**	**-2.32E+01**
TOTAL AM	**3.40E-06**	**3.78E+02**	**3.33E+03**	**7.16E+03**	**7.16E+03**	**1.72E+01**	**1.51E+02**
TOTAL CM	**7.94E-06**	**6.98E-06**	**1.49E+03**	**9.51E+02**	**9.51E+02**	**2.29E+00**	**2.00E+01**
TOTAL CF	**0.00E+00**	**2.48E-18**	**1.10E-04**	**2.49E-04**	**2.49E-04**	**5.97E-07**	**5.23E-06**
PU+NP	**8.00E+04**	**7.96E+04**	**6.54E+04**	**6.17E+04**	**-1.83E+04**	**-4.39E+01**	**-3.84E+02**

MOXUE_8PuNp_412U5_4.out							
	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	1.13E-06	4.09E+01	1.56E+02	5.62E+02	5.62E+02	1.35E+00	1.18E+01
u235	3.79E+04	3.79E+04	2.01E+04	2.01E+04	-1.78E+04	-4.28E+01	-3.75E+02
u236	1.13E-06	2.33E+00	4.00E+03	4.01E+03	4.01E+03	9.65E+00	8.45E+01
u238	8.82E+05	8.82E+05	8.53E+05	8.53E+05	-2.92E+04	-7.02E+01	-6.15E+02
np237	3.10E+03	3.10E+03	2.03E+03	2.09E+03	-1.01E+03	-2.43E+00	-2.13E+01
pu238	5.28E+03	5.24E+03	5.29E+03	5.04E+03	-2.39E+02	-5.74E-01	-5.03E+00
pu239	3.07E+04	3.07E+04	2.09E+04	2.10E+04	-9.67E+03	-2.32E+01	-2.04E+02
pu240	2.24E+04	2.24E+04	1.73E+04	1.76E+04	-4.80E+03	-1.15E+01	-1.01E+02
pu241	7.92E+03	7.54E+03	9.99E+03	6.16E+03	-1.75E+03	-4.21E+00	-3.69E+01
pu242	1.06E+04	1.06E+04	1.02E+04	1.02E+04	-3.80E+02	-9.13E-01	-8.00E+00
pu244	5.71E-35	2.09E-12	2.13E-01	2.13E-01	2.13E-01	5.12E-04	4.49E-03
am241	1.13E-06	3.73E+02	1.10E+03	4.88E+03	4.87E+03	1.17E+01	1.03E+02
am242m	1.13E-06	1.13E-06	3.47E+01	3.30E+01	3.30E+01	7.93E-02	6.94E-01
am242	4.56E-13	1.46E-11	8.94E-01	4.26E-04	4.26E-04	1.02E-06	8.96E-06
am243	1.13E-06	1.20E-06	2.30E+03	2.30E+03	2.29E+03	5.51E+00	4.83E+01
cm242	1.13E-06	2.42E-07	1.61E+02	8.60E-02	8.60E-02	2.07E-04	1.81E-03
cm243	1.13E-06	1.11E-06	6.63E+00	5.20E+00	5.20E+00	1.25E-02	1.09E-01
cm244	1.13E-06	1.09E-06	1.23E+03	8.38E+02	8.38E+02	2.01E+00	1.76E+01
cm245	1.13E-06	1.13E-06	1.44E+02	1.44E+02	1.44E+02	3.46E-01	3.03E+00
cm246	1.13E-06	1.13E-06	8.65E+00	8.64E+00	8.64E+00	2.08E-02	1.82E-01
cm247	1.13E-06	1.13E-06	1.78E-01	1.78E-01	1.78E-01	4.28E-04	3.75E-03
cm248	1.13E-06	1.13E-06	9.01E-03	9.01E-03	9.01E-03	2.17E-05	1.90E-04
cf249	0.00E+00	2.47E-18	5.19E-05	2.16E-04	2.16E-04	5.20E-07	4.55E-06
cf250	0.00E+00	5.73E-31	3.62E-05	2.14E-05	2.14E-05	5.14E-08	4.50E-07
cf251	0.00E+00	5.28E-42	2.05E-05	2.03E-05	2.03E-05	4.88E-08	4.27E-07
cf252	0.00E+00	0.00E+00	5.70E-06	4.16E-07	4.16E-07	9.99E-10	8.75E-09
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.48E+05**	**9.48E+05**	**-5.21E+04**	**-1.25E+02**	**-1.10E+03**
TOTAL TRU	**8.00E+04**	**7.99E+04**	**7.07E+04**	**7.03E+04**	**-9.66E+03**	**-2.32E+01**	**-2.03E+02**
TOTAL PU	**7.69E+04**	**7.65E+04**	**6.37E+04**	**6.00E+04**	**-1.68E+04**	**-4.05E+01**	**-3.55E+02**
TOTAL NP	**3.10E+03**	**3.10E+03**	**2.03E+03**	**2.09E+03**	**-1.01E+03**	**-2.43E+00**	**-2.13E+01**
TOTAL AM	**3.40E-06**	**3.73E+02**	**3.43E+03**	**7.20E+03**	**7.20E+03**	**1.73E+01**	**1.52E+02**
TOTAL CM	**7.94E-06**	**6.98E-06**	**1.55E+03**	**9.96E+02**	**9.96E+02**	**2.39E+00**	**2.10E+01**
TOTAL CF	**0.00E+00**	**2.47E-18**	**1.14E-04**	**2.58E-04**	**2.58E-04**	**6.21E-07**	**5.44E-06**
PU+NP	**8.00E+04**	**7.96E+04**	**6.57E+04**	**6.21E+04**	**-1.79E+04**	**-4.29E+01**	**-3.76E+02**

MOXUE_8PuNp_422U5_5.out							
	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	1.13E-06	4.24E+01	1.60E+02	5.74E+02	5.73E+02	1.38E+00	1.21E+01
u235	3.88E+04	3.88E+04	2.06E+04	2.06E+04	-1.83E+04	-4.39E+01	-3.85E+02
u236	1.13E-06	2.29E+00	4.09E+03	4.11E+03	4.11E+03	9.87E+00	8.65E+01
u238	8.81E+05	8.81E+05	8.52E+05	8.52E+05	-2.92E+04	-7.02E+01	-6.15E+02
np237	3.02E+03	3.02E+03	2.00E+03	2.06E+03	-9.67E+02	-2.32E+00	-2.04E+01
pu238	5.48E+03	5.44E+03	5.39E+03	5.13E+03	-3.55E+02	-8.53E-01	-7.47E+00
pu239	3.02E+04	3.02E+04	2.08E+04	2.08E+04	-9.36E+03	-2.25E+01	-1.97E+02
pu240	2.20E+04	2.20E+04	1.70E+04	1.74E+04	-4.67E+03	-1.12E+01	-9.83E+01
pu241	7.79E+03	7.42E+03	9.85E+03	6.08E+03	-1.71E+03	-4.10E+00	-3.60E+01
pu242	1.15E+04	1.15E+04	1.09E+04	1.09E+04	-5.70E+02	-1.37E+00	-1.20E+01
pu244	5.71E-35	2.09E-12	2.21E-01	2.21E-01	2.21E-01	5.30E-04	4.65E-03
am241	1.13E-06	3.67E+02	1.08E+03	4.81E+03	4.80E+03	1.15E+01	1.01E+02
am242m	1.13E-06	1.13E-06	3.41E+01	3.25E+01	3.24E+01	7.80E-02	6.83E-01
am242	4.56E-13	1.46E-11	8.81E-01	4.19E-04	4.19E-04	1.01E-06	8.81E-06
am243	1.13E-06	1.21E-06	2.38E+03	2.38E+03	2.38E+03	5.72E+00	5.01E+01
cm242	1.13E-06	2.42E-07	1.58E+02	8.46E-02	8.45E-02	2.03E-04	1.78E-03
cm243	1.13E-06	1.11E-06	6.53E+00	5.12E+00	5.12E+00	1.23E-02	1.08E-01
cm244	1.13E-06	1.09E-06	1.27E+03	8.67E+02	8.67E+02	2.08E+00	1.82E+01
cm245	1.13E-06	1.13E-06	1.49E+02	1.48E+02	1.48E+02	3.57E-01	3.12E+00
cm246	1.13E-06	1.13E-06	8.94E+00	8.93E+00	8.93E+00	2.15E-02	1.88E-01
cm247	1.13E-06	1.13E-06	1.84E-01	1.84E-01	1.84E-01	4.42E-04	3.88E-03
cm248	1.13E-06	1.13E-06	9.34E-03	9.35E-03	9.35E-03	2.25E-05	1.97E-04
cf249	0.00E+00	2.46E-18	5.38E-05	2.24E-04	2.24E-04	5.38E-07	4.72E-06
cf250	0.00E+00	5.73E-31	3.76E-05	2.22E-05	2.22E-05	5.33E-08	4.67E-07
cf251	0.00E+00	5.28E-42	2.12E-05	2.11E-05	2.11E-05	5.06E-08	4.43E-07
cf252	0.00E+00	0.00E+00	5.92E-06	4.32E-07	4.32E-07	1.04E-09	9.08E-09
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.48E+05**	**9.48E+05**	**-5.22E+04**	**-1.25E+02**	**-1.10E+03**
TOTAL TRU	**8.00E+04**	**7.99E+04**	**7.10E+04**	**7.06E+04**	**-9.38E+03**	**-2.25E+01**	**-1.98E+02**
TOTAL PU	**7.70E+04**	**7.65E+04**	**6.39E+04**	**6.03E+04**	**-1.67E+04**	**-4.00E+01**	**-3.51E+02**
TOTAL NP	**3.02E+03**	**3.02E+03**	**2.00E+03**	**2.06E+03**	**-9.67E+02**	**-2.32E+00**	**-2.04E+01**
TOTAL AM	**3.40E-06**	**3.67E+02**	**3.50E+03**	**7.22E+03**	**7.22E+03**	**1.73E+01**	**1.52E+02**
TOTAL CM	**7.94E-06**	**6.98E-06**	**1.59E+03**	**1.03E+03**	**1.03E+03**	**2.47E+00**	**2.17E+01**
TOTAL CF	**0.00E+00**	**2.46E-18**	**1.19E-04**	**2.68E-04**	**2.68E-04**	**6.43E-07**	**5.63E-06**
PU+NP	**8.00E+04**	**7.96E+04**	**6.59E+04**	**6.24E+04**	**-1.76E+04**	**-4.24E+01**	**-3.71E+02**

MOXUE_8PuNp_430U5_6.out							
	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	1.13E-06	4.30E+01	1.62E+02	5.77E+02	5.77E+02	1.39E+00	1.22E+01
u235	3.96E+04	3.96E+04	2.09E+04	2.10E+04	-1.86E+04	-4.47E+01	-3.92E+02
u236	1.13E-06	2.25E+00	4.16E+03	4.18E+03	4.18E+03	1.00E+01	8.80E+01
u238	8.80E+05	8.80E+05	8.51E+05	8.51E+05	-2.91E+04	-6.99E+01	-6.13E+02
np237	2.98E+03	2.98E+03	1.99E+03	2.04E+03	-9.39E+02	-2.26E+00	-1.98E+01
pu238	5.56E+03	5.52E+03	5.42E+03	5.16E+03	-4.08E+02	-9.80E-01	-8.59E+00
pu239	2.99E+04	2.99E+04	2.07E+04	2.07E+04	-9.19E+03	-2.21E+01	-1.93E+02
pu240	2.17E+04	2.17E+04	1.67E+04	1.71E+04	-4.54E+03	-1.09E+01	-9.56E+01
pu241	7.68E+03	7.32E+03	9.74E+03	6.01E+03	-1.67E+03	-4.01E+00	-3.51E+01
pu242	1.22E+04	1.22E+04	1.15E+04	1.15E+04	-7.20E+02	-1.73E+00	-1.52E+01
pu244	5.71E-35	2.09E-12	2.26E-01	2.26E-01	2.26E-01	5.44E-04	4.76E-03
am241	1.13E-06	3.62E+02	1.07E+03	4.75E+03	4.75E+03	1.14E+01	1.00E+02
am242m	1.13E-06	1.13E-06	3.37E+01	3.20E+01	3.20E+01	7.70E-02	6.74E-01
am242	4.56E-13	1.46E-11	8.70E-01	4.13E-04	4.13E-04	9.93E-07	8.70E-06
am243	1.13E-06	1.21E-06	2.44E+03	2.44E+03	2.44E+03	5.87E+00	5.14E+01
cm242	1.13E-06	2.42E-07	1.56E+02	8.35E-02	8.35E-02	2.01E-04	1.76E-03
cm243	1.13E-06	1.11E-06	6.45E+00	5.06E+00	5.06E+00	1.22E-02	1.07E-01
cm244	1.13E-06	1.09E-06	1.30E+03	8.88E+02	8.88E+02	2.13E+00	1.87E+01
cm245	1.13E-06	1.13E-06	1.52E+02	1.52E+02	1.52E+02	3.64E-01	3.19E+00
cm246	1.13E-06	1.13E-06	9.14E+00	9.12E+00	9.12E+00	2.19E-02	1.92E-01
cm247	1.13E-06	1.13E-06	1.88E-01	1.88E-01	1.88E-01	4.52E-04	3.96E-03
cm248	1.13E-06	1.13E-06	9.56E-03	9.57E-03	9.57E-03	2.30E-05	2.01E-04
cf249	0.00E+00	2.46E-18	5.50E-05	2.29E-04	2.29E-04	5.50E-07	4.82E-06
cf250	0.00E+00	5.72E-31	3.85E-05	2.27E-05	2.27E-05	5.45E-08	4.78E-07
cf251	0.00E+00	5.28E-42	2.17E-05	2.15E-05	2.15E-05	5.17E-08	4.53E-07
cf252	0.00E+00	0.00E+00	6.06E-06	4.41E-07	4.41E-07	1.06E-09	9.29E-09
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.48E+05**	**9.48E+05**	**-5.21E+04**	**-1.25E+02**	**-1.10E+03**
TOTAL TRU	**8.00E+04**	**7.99E+04**	**7.12E+04**	**7.08E+04**	**-9.19E+03**	**-2.21E+01**	**-1.93E+02**
TOTAL PU	**7.70E+04**	**7.66E+04**	**6.40E+04**	**6.05E+04**	**-1.65E+04**	**-3.97E+01**	**-3.48E+02**
TOTAL NP	**2.98E+03**	**2.98E+03**	**1.99E+03**	**2.04E+03**	**-9.39E+02**	**-2.26E+00**	**-1.98E+01**
TOTAL AM	**3.40E-06**	**3.62E+02**	**3.55E+03**	**7.23E+03**	**7.23E+03**	**1.74E+01**	**1.52E+02**
TOTAL CM	**7.94E-06**	**6.98E-06**	**1.62E+03**	**1.05E+03**	**1.05E+03**	**2.53E+00**	**2.22E+01**
TOTAL CF	**0.00E+00**	**2.46E-18**	**1.21E-04**	**2.74E-04**	**2.74E-04**	**6.58E-07**	**5.76E-06**
PU+NP	**8.00E+04**	**7.96E+04**	**6.60E+04**	**6.25E+04**	**-1.75E+04**	**-4.20E+01**	**-3.68E+02**

MOXUE_8PuNp_435U5_7.out							
	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	1.13E-06	4.32E+01	1.62E+02	5.78E+02	5.78E+02	1.39E+00	1.22E+01
u235	4.00E+04	4.00E+04	2.12E+04	2.12E+04	-1.88E+04	-4.52E+01	-3.96E+02
u236	1.13E-06	2.22E+00	4.21E+03	4.23E+03	4.23E+03	1.02E+01	8.90E+01
u238	8.80E+05	8.80E+05	8.51E+05	8.51E+05	-2.91E+04	-6.99E+01	-6.13E+02
np237	2.96E+03	2.96E+03	1.98E+03	2.03E+03	-9.24E+02	-2.22E+00	-1.94E+01
pu238	5.59E+03	5.54E+03	5.42E+03	5.16E+03	-4.32E+02	-1.04E+00	-9.09E+00
pu239	2.97E+04	2.97E+04	2.06E+04	2.06E+04	-9.07E+03	-2.18E+01	-1.91E+02
pu240	2.14E+04	2.14E+04	1.66E+04	1.70E+04	-4.44E+03	-1.07E+01	-9.35E+01
pu241	7.60E+03	7.24E+03	9.66E+03	5.96E+03	-1.64E+03	-3.93E+00	-3.45E+01
pu242	1.27E+04	1.27E+04	1.19E+04	1.19E+04	-8.40E+02	-2.02E+00	-1.77E+01
pu244	5.71E-35	2.09E-12	2.30E-01	2.30E-01	2.30E-01	5.54E-04	4.85E-03
am241	1.13E-06	3.58E+02	1.06E+03	4.71E+03	4.71E+03	1.13E+01	9.92E+01
am242m	1.13E-06	1.13E-06	3.33E+01	3.17E+01	3.17E+01	7.62E-02	6.67E-01
am242	4.56E-13	1.46E-11	8.63E-01	4.09E-04	4.09E-04	9.83E-07	8.61E-06
am243	1.13E-06	1.21E-06	2.49E+03	2.49E+03	2.49E+03	5.98E+00	5.24E+01
cm242	1.13E-06	2.42E-07	1.55E+02	8.26E-02	8.26E-02	1.99E-04	1.74E-03
cm243	1.13E-06	1.11E-06	6.39E+00	5.01E+00	5.01E+00	1.20E-02	1.06E-01
cm244	1.13E-06	1.09E-06	1.32E+03	9.04E+02	9.03E+02	2.17E+00	1.90E+01
cm245	1.13E-06	1.13E-06	1.54E+02	1.54E+02	1.54E+02	3.70E-01	3.24E+00
cm246	1.13E-06	1.13E-06	9.30E+00	9.28E+00	9.28E+00	2.23E-02	1.95E-01
cm247	1.13E-06	1.13E-06	1.91E-01	1.91E-01	1.91E-01	4.60E-04	4.03E-03
cm248	1.13E-06	1.13E-06	9.75E-03	9.75E-03	9.75E-03	2.34E-05	2.05E-04
cf249	0.00E+00	2.45E-18	5.60E-05	2.33E-04	2.33E-04	5.61E-07	4.91E-06
cf250	0.00E+00	5.71E-31	3.92E-05	2.32E-05	2.32E-05	5.56E-08	4.87E-07
cf251	0.00E+00	5.28E-42	2.21E-05	2.20E-05	2.20E-05	5.27E-08	4.62E-07
cf252	0.00E+00	0.00E+00	6.18E-06	4.50E-07	4.50E-07	1.08E-09	9.48E-09
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.48E+05**	**9.48E+05**	**-5.22E+04**	**-1.25E+02**	**-1.10E+03**
TOTAL TRU	**8.00E+04**	**7.99E+04**	**7.13E+04**	**7.09E+04**	**-9.04E+03**	**-2.17E+01**	**-1.90E+02**
TOTAL PU	**7.70E+04**	**7.66E+04**	**6.41E+04**	**6.06E+04**	**-1.64E+04**	**-3.95E+01**	**-3.46E+02**
TOTAL NP	**2.96E+03**	**2.96E+03**	**1.98E+03**	**2.03E+03**	**-9.24E+02**	**-2.22E+00**	**-1.94E+01**
TOTAL AM	**3.40E-06**	**3.58E+02**	**3.59E+03**	**7.23E+03**	**7.23E+03**	**1.74E+01**	**1.52E+02**
TOTAL CM	**7.94E-06**	**6.98E-06**	**1.65E+03**	**1.07E+03**	**1.07E+03**	**2.58E+00**	**2.26E+01**
TOTAL CF	**0.00E+00**	**2.45E-18**	**1.23E-04**	**2.79E-04**	**2.79E-04**	**6.70E-07**	**5.87E-06**
PU+NP	**8.00E+04**	**7.96E+04**	**6.61E+04**	**6.26E+04**	**-1.73E+04**	**-4.17E+01**	**-3.65E+02**

MOXUE_8PuNp_437U5_8.out							
	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	1.13E-06	4.32E+01	1.62E+02	5.77E+02	5.76E+02	1.39E+00	1.21E+01
u235	4.02E+04	4.02E+04	2.13E+04	2.13E+04	-1.89E+04	-4.55E+01	-3.98E+02
u236	1.13E-06	2.20E+00	4.23E+03	4.25E+03	4.25E+03	1.02E+01	8.95E+01
u238	8.80E+05	8.80E+05	8.51E+05	8.51E+05	-2.91E+04	-6.99E+01	-6.13E+02
np237	2.94E+03	2.94E+03	1.97E+03	2.02E+03	-9.15E+02	-2.20E+00	-1.93E+01
pu238	5.58E+03	5.54E+03	5.41E+03	5.14E+03	-4.40E+02	-1.06E+00	-9.26E+00
pu239	2.96E+04	2.96E+04	2.05E+04	2.06E+04	-9.01E+03	-2.17E+01	-1.90E+02
pu240	2.12E+04	2.12E+04	1.64E+04	1.68E+04	-4.38E+03	-1.05E+01	-9.22E+01
pu241	7.54E+03	7.18E+03	9.60E+03	5.92E+03	-1.61E+03	-3.88E+00	-3.40E+01
pu242	1.31E+04	1.31E+04	1.22E+04	1.22E+04	-9.20E+02	-2.21E+00	-1.94E+01
pu244	5.71E-35	2.09E-12	2.34E-01	2.34E-01	2.34E-01	5.62E-04	4.92E-03
am241	1.13E-06	3.55E+02	1.05E+03	4.68E+03	4.68E+03	1.12E+01	9.85E+01
am242m	1.13E-06	1.13E-06	3.30E+01	3.14E+01	3.14E+01	7.55E-02	6.62E-01
am242	4.56E-13	1.46E-11	8.58E-01	4.06E-04	4.05E-04	9.74E-07	8.54E-06
am243	1.13E-06	1.21E-06	2.53E+03	2.53E+03	2.53E+03	6.07E+00	5.32E+01
cm242	1.13E-06	2.42E-07	1.54E+02	8.19E-02	8.19E-02	1.97E-04	1.72E-03
cm243	1.13E-06	1.11E-06	6.36E+00	4.99E+00	4.98E+00	1.20E-02	1.05E-01
cm244	1.13E-06	1.09E-06	1.34E+03	9.17E+02	9.16E+02	2.20E+00	1.93E+01
cm245	1.13E-06	1.13E-06	1.56E+02	1.56E+02	1.56E+02	3.75E-01	3.29E+00
cm246	1.13E-06	1.13E-06	9.44E+00	9.43E+00	9.43E+00	2.27E-02	1.99E-01
cm247	1.13E-06	1.13E-06	1.95E-01	1.95E-01	1.95E-01	4.68E-04	4.10E-03
cm248	1.13E-06	1.13E-06	9.93E-03	9.94E-03	9.94E-03	2.39E-05	2.09E-04
cf249	0.00E+00	2.45E-18	5.70E-05	2.38E-04	2.38E-04	5.71E-07	5.00E-06
cf250	0.00E+00	5.72E-31	4.01E-05	2.36E-05	2.36E-05	5.68E-08	4.97E-07
cf251	0.00E+00	5.28E-42	2.26E-05	2.24E-05	2.24E-05	5.38E-08	4.72E-07
cf252	0.00E+00	0.00E+00	6.32E-06	4.61E-07	4.61E-07	1.11E-09	9.70E-09
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.48E+05**	**9.48E+05**	**-5.22E+04**	**-1.25E+02**	**-1.10E+03**
TOTAL TRU	**8.00E+04**	**7.99E+04**	**7.14E+04**	**7.10E+04**	**-8.95E+03**	**-2.15E+01**	**-1.88E+02**
TOTAL PU	**7.70E+04**	**7.66E+04**	**6.42E+04**	**6.07E+04**	**-1.64E+04**	**-3.93E+01**	**-3.44E+02**
TOTAL NP	**2.94E+03**	**2.94E+03**	**1.97E+03**	**2.02E+03**	**-9.15E+02**	**-2.20E+00**	**-1.93E+01**
TOTAL AM	**3.40E-06**	**3.55E+02**	**3.61E+03**	**7.24E+03**	**7.24E+03**	**1.74E+01**	**1.52E+02**
TOTAL CM	**7.94E-06**	**6.98E-06**	**1.67E+03**	**1.09E+03**	**1.09E+03**	**2.61E+00**	**2.29E+01**
TOTAL CF	**0.00E+00**	**2.45E-18**	**1.26E-04**	**2.84E-04**	**2.84E-04**	**6.83E-07**	**5.98E-06**
PU+NP	**8.00E+04**	**7.96E+04**	**6.61E+04**	**6.27E+04**	**-1.73E+04**	**-4.15E+01**	**-3.64E+02**

MOXUE_8PuNp_443U5_9.out							
	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	1.13E-06	4.31E+01	1.62E+02	5.75E+02	5.75E+02	1.38E+00	1.21E+01
u235	4.08E+04	4.08E+04	2.16E+04	2.16E+04	-1.92E+04	-4.60E+01	-4.03E+02
u236	1.13E-06	2.19E+00	4.29E+03	4.30E+03	4.30E+03	1.03E+01	9.06E+01
u238	8.79E+05	8.79E+05	8.50E+05	8.50E+05	-2.91E+04	-6.99E+01	-6.13E+02
np237	2.93E+03	2.93E+03	1.97E+03	2.02E+03	-9.05E+02	-2.17E+00	-1.90E+01
pu238	5.57E+03	5.53E+03	5.40E+03	5.13E+03	-4.40E+02	-1.06E+00	-9.26E+00
pu239	2.95E+04	2.95E+04	2.05E+04	2.05E+04	-8.92E+03	-2.14E+01	-1.88E+02
pu240	2.11E+04	2.11E+04	1.64E+04	1.68E+04	-4.32E+03	-1.04E+01	-9.09E+01
pu241	7.49E+03	7.14E+03	9.56E+03	5.90E+03	-1.60E+03	-3.84E+00	-3.36E+01
pu242	1.35E+04	1.35E+04	1.25E+04	1.25E+04	-9.90E+02	-2.38E+00	-2.08E+01
pu244	5.71E-35	2.09E-12	2.36E-01	2.36E-01	2.36E-01	5.66E-04	4.96E-03
am241	1.13E-06	3.53E+02	1.05E+03	4.66E+03	4.66E+03	1.12E+01	9.81E+01
am242m	1.13E-06	1.13E-06	3.29E+01	3.13E+01	3.13E+01	7.52E-02	6.59E-01
am242	4.56E-13	1.46E-11	8.53E-01	4.04E-04	4.04E-04	9.70E-07	8.50E-06
am243	1.13E-06	1.21E-06	2.55E+03	2.55E+03	2.55E+03	6.13E+00	5.37E+01
cm242	1.13E-06	2.42E-07	1.53E+02	8.16E-02	8.16E-02	1.96E-04	1.72E-03
cm243	1.13E-06	1.11E-06	6.31E+00	4.95E+00	4.95E+00	1.19E-02	1.04E-01
cm244	1.13E-06	1.09E-06	1.35E+03	9.24E+02	9.24E+02	2.22E+00	1.94E+01
cm245	1.13E-06	1.13E-06	1.57E+02	1.57E+02	1.57E+02	3.77E-01	3.30E+00
cm246	1.13E-06	1.13E-06	9.48E+00	9.47E+00	9.47E+00	2.28E-02	1.99E-01
cm247	1.13E-06	1.13E-06	1.95E-01	1.95E-01	1.95E-01	4.69E-04	4.11E-03
cm248	1.13E-06	1.13E-06	9.95E-03	9.96E-03	9.96E-03	2.39E-05	2.10E-04
cf249	0.00E+00	2.45E-18	5.71E-05	2.38E-04	2.38E-04	5.72E-07	5.01E-06
cf250	0.00E+00	5.70E-31	4.00E-05	2.36E-05	2.36E-05	5.68E-08	4.97E-07
cf251	0.00E+00	5.28E-42	2.26E-05	2.24E-05	2.24E-05	5.38E-08	4.71E-07
cf252	0.00E+00	0.00E+00	6.30E-06	4.59E-07	4.59E-07	1.10E-09	9.67E-09
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.48E+05**	**9.48E+05**	**-5.22E+04**	**-1.25E+02**	**-1.10E+03**
TOTAL TRU	**8.00E+04**	**7.99E+04**	**7.15E+04**	**7.11E+04**	**-8.83E+03**	**-2.12E+01**	**-1.86E+02**
TOTAL PU	**7.71E+04**	**7.66E+04**	**6.42E+04**	**6.08E+04**	**-1.63E+04**	**-3.91E+01**	**-3.42E+02**
TOTAL NP	**2.93E+03**	**2.93E+03**	**1.97E+03**	**2.02E+03**	**-9.05E+02**	**-2.17E+00**	**-1.90E+01**
TOTAL AM	**3.40E-06**	**3.53E+02**	**3.64E+03**	**7.24E+03**	**7.24E+03**	**1.74E+01**	**1.52E+02**
TOTAL CM	**7.94E-06**	**6.98E-06**	**1.68E+03**	**1.10E+03**	**1.10E+03**	**2.63E+00**	**2.31E+01**
TOTAL CF	**0.00E+00**	**2.45E-18**	**1.26E-04**	**2.84E-04**	**2.84E-04**	**6.83E-07**	**5.99E-06**
PU+NP	**8.00E+04**	**7.96E+04**	**6.62E+04**	**6.28E+04**	**-1.72E+04**	**-4.13E+01**	**-3.61E+02**

MOXUE_8PuNp_445U5_10.out							
	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	1.13E-06	4.30E+01	1.61E+02	5.74E+02	5.74E+02	1.38E+00	1.21E+01
u235	4.09E+04	4.09E+04	2.17E+04	2.17E+04	-1.93E+04	-4.63E+01	-4.05E+02
u236	1.13E-06	2.18E+00	4.31E+03	4.32E+03	4.32E+03	1.04E+01	9.10E+01
u238	8.79E+05	8.79E+05	8.50E+05	8.50E+05	-2.90E+04	-6.97E+01	-6.10E+02
np237	2.92E+03	2.92E+03	1.97E+03	2.02E+03	-9.01E+02	-2.17E+00	-1.90E+01
pu238	5.55E+03	5.51E+03	5.38E+03	5.12E+03	-4.39E+02	-1.05E+00	-9.24E+00
pu239	2.94E+04	2.94E+04	2.04E+04	2.05E+04	-8.89E+03	-2.14E+01	-1.87E+02
pu240	2.10E+04	2.10E+04	1.63E+04	1.67E+04	-4.28E+03	-1.03E+01	-9.01E+01
pu241	7.46E+03	7.11E+03	9.52E+03	5.87E+03	-1.58E+03	-3.80E+00	-3.33E+01
pu242	1.37E+04	1.37E+04	1.27E+04	1.27E+04	-1.04E+03	-2.50E+00	-2.19E+01
pu244	5.71E-35	2.09E-12	2.38E-01	2.38E-01	2.38E-01	5.71E-04	5.00E-03
am241	1.13E-06	3.51E+02	1.04E+03	4.64E+03	4.64E+03	1.12E+01	9.77E+01
am242m	1.13E-06	1.13E-06	3.27E+01	3.12E+01	3.11E+01	7.49E-02	6.56E-01
am242	4.56E-13	1.46E-11	8.49E-01	4.02E-04	4.02E-04	9.66E-07	8.46E-06
am243	1.13E-06	1.21E-06	2.58E+03	2.57E+03	2.57E+03	6.19E+00	5.42E+01
cm242	1.13E-06	2.42E-07	1.52E+02	8.12E-02	8.12E-02	1.95E-04	1.71E-03
cm243	1.13E-06	1.11E-06	6.29E+00	4.93E+00	4.93E+00	1.19E-02	1.04E-01
cm244	1.13E-06	1.09E-06	1.36E+03	9.31E+02	9.31E+02	2.24E+00	1.96E+01
cm245	1.13E-06	1.13E-06	1.58E+02	1.58E+02	1.58E+02	3.80E-01	3.33E+00
cm246	1.13E-06	1.13E-06	9.56E+00	9.54E+00	9.54E+00	2.29E-02	2.01E-01
cm247	1.13E-06	1.13E-06	1.97E-01	1.97E-01	1.97E-01	4.73E-04	4.14E-03
cm248	1.13E-06	1.13E-06	1.00E-02	1.01E-02	1.00E-02	2.41E-05	2.12E-04
cf249	0.00E+00	2.45E-18	5.76E-05	2.40E-04	2.40E-04	5.76E-07	5.05E-06
cf250	0.00E+00	5.70E-31	4.04E-05	2.38E-05	2.38E-05	5.73E-08	5.02E-07
cf251	0.00E+00	5.28E-42	2.28E-05	2.26E-05	2.26E-05	5.43E-08	4.76E-07
cf252	0.00E+00	0.00E+00	6.37E-06	4.64E-07	4.64E-07	1.11E-09	9.76E-09
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.48E+05**	**9.48E+05**	**-5.21E+04**	**-1.25E+02**	**-1.10E+03**
TOTAL TRU	**8.00E+04**	**7.99E+04**	**7.16E+04**	**7.12E+04**	**-8.78E+03**	**-2.11E+01**	**-1.85E+02**
TOTAL PU	**7.71E+04**	**7.67E+04**	**6.43E+04**	**6.08E+04**	**-1.62E+04**	**-3.90E+01**	**-3.42E+02**
TOTAL NP	**2.92E+03**	**2.92E+03**	**1.97E+03**	**2.02E+03**	**-9.01E+02**	**-2.17E+00**	**-1.90E+01**
TOTAL AM	**3.40E-06**	**3.51E+02**	**3.65E+03**	**7.25E+03**	**7.25E+03**	**1.74E+01**	**1.53E+02**
TOTAL CM	**7.94E-06**	**6.98E-06**	**1.69E+03**	**1.10E+03**	**1.10E+03**	**2.65E+00**	**2.32E+01**
TOTAL CF	**0.00E+00**	**2.45E-18**	**1.27E-04**	**2.87E-04**	**2.87E-04**	**6.89E-07**	**6.04E-06**
PU+NP	**8.00E+04**	**7.96E+04**	**6.62E+04**	**6.29E+04**	**-1.71E+04**	**-4.12E+01**	**-3.61E+02**

60th PuNp recycling (personal communication, Sam Bays)

60th cycle from Sam's depletion Fortran using TRITON's 10th cycle XS							
	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	*1.13E-06*	4.13E+01	1.48E+02	5.39E+02	5.39E+02	1.30E+00	1.13E+01
u235	4.09E+04	4.09E+04	2.12E+04	2.12E+04	-1.98E+04	-4.75E+01	-4.16E+02
u236	*1.13E-06*	*2.20E+00*	4.38E+03	4.40E+03	4.40E+03	1.06E+01	9.26E+01
u238	8.79E+05	8.79E+05	8.50E+05	8.50E+05	-2.96E+04	-7.11E+01	-6.23E+02
np237	2.69E+03	2.69E+03	1.72E+03	1.76E+03	-9.29E+02	-2.23E+00	-1.96E+01
pu238	5.29E+03	5.24E+03	5.09E+03	4.85E+03	-4.37E+02	-1.05E+00	-9.20E+00
pu239	2.91E+04	2.90E+04	2.00E+04	2.00E+04	-9.13E+03	-2.19E+01	-1.92E+02
pu240	2.09E+04	2.08E+04	1.61E+04	1.65E+04	-4.34E+03	-1.04E+01	-9.14E+01
pu241	7.44E+03	7.12E+03	9.44E+03	5.83E+03	-1.61E+03	-3.86E+00	-3.38E+01
pu242	1.46E+04	1.46E+04	1.33E+04	1.33E+04	-1.28E+03	-3.08E+00	-2.70E+01
pu244	*0.00E+00*	*0.00E+00*	*0.00E+00*	*0.00E+00*	0.00E+00	0.00E+00	0.00E+00
am241	5.41E+00	3.52E+02	1.01E+03	4.48E+03	4.47E+03	1.07E+01	9.42E+01
am242m	0.00E+00	1.64E-01	1.93E+01	1.85E+01	1.85E+01	4.44E-02	3.89E-01
am242	*0.00E+00*	*0.00E+00*	*0.00E+00*	*0.00E+00*	0.00E+00	0.00E+00	0.00E+00
am243	0.00E+00	1.62E+01	2.76E+03	2.76E+03	2.76E+03	6.63E+00	5.81E+01
cm242	0.00E+00	1.22E+00	1.62E+02	4.47E-02	4.47E-02	1.08E-04	9.42E-04
cm243	0.00E+00	1.05E-04	6.90E+00	5.41E+00	5.41E+00	1.30E-02	1.14E-01
cm244	0.00E+00	1.54E-02	1.50E+03	1.02E+03	1.02E+03	2.46E+00	2.16E+01
cm245	0.00E+00	3.19E-05	1.76E+02	1.76E+02	1.76E+02	4.22E-01	3.70E+00
cm246	0.00E+00	5.71E-09	1.11E+01	1.10E+01	1.10E+01	2.65E-02	2.32E-01
cm247	0.00E+00	4.50E-13	2.31E-01	2.31E-01	2.31E-01	5.54E-04	4.85E-03
cm248	0.00E+00	7.43E-17	1.20E-02	1.20E-02	1.20E-02	2.89E-05	2.53E-04
cf249	0.00E+00	1.23E-23	7.03E-05	2.88E-04	2.88E-04	6.93E-07	6.07E-06
cf250	0.00E+00	1.02E-23	4.99E-05	2.93E-05	2.93E-05	7.05E-08	6.18E-07
cf251	0.00E+00	2.99E-26	2.80E-05	2.78E-05	2.78E-05	6.68E-08	5.85E-07
cf252	0.00E+00	1.38E-29	7.96E-06	5.77E-07	5.77E-07	1.39E-09	1.22E-08
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.46E+05**	**9.46E+05**	**-5.37E+04**	**-1.29E+02**	**-1.13E+03**
TOTAL TRU	**8.00E+04**	**7.99E+04**	**7.13E+04**	**7.07E+04**	**-9.26E+03**	**-2.22E+01**	**-1.95E+02**
TOTAL PU	**7.73E+04**	**7.69E+04**	**6.39E+04**	**6.05E+04**	**-1.68E+04**	**-4.04E+01**	**-3.54E+02**
TOTAL NP	**2.69E+03**	**2.69E+03**	**1.72E+03**	**1.76E+03**	**-9.29E+02**	**-2.23E+00**	**-1.96E+01**
TOTAL AM	**5.41E+00**	**3.68E+02**	**3.79E+03**	**7.26E+03**	**7.25E+03**	**1.74E+01**	**1.53E+02**
TOTAL CM	**0.00E+00**	**1.23E+00**	**1.86E+03**	**1.22E+03**	**1.22E+03**	**2.92E+00**	**2.56E+01**
TOTAL CF	**0.00E+00**	**2.25E-23**	**1.56E-04**	**3.46E-04**	**3.46E-04**	**8.31E-07**	**7.28E-06**
PU+NP	**8.00E+04**	**7.96E+04**	**6.56E+04**	**6.23E+04**	**-1.77E+04**	**-4.26E+01**	**-3.73E+02**

APPENDIX 3: PuNpAm case – Mass balances from cycle 1 to 10 as well as cycle 60

MOXUE_8PuNpAm_369U5_1.out	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	1.13E-06	1.42E+01	9.89E+01	4.86E+02	4.86E+02	1.17E+00	1.02E+01
u235	3.39E+04	3.39E+04	1.82E+04	1.82E+04	-1.57E+04	-3.77E+01	-3.30E+02
u236	1.13E-06	1.89E+00	3.56E+03	3.58E+03	3.58E+03	8.60E+00	7.53E+01
u238	8.86E+05	8.86E+05	8.57E+05	8.57E+05	-2.94E+04	-7.06E+01	-6.19E+02
np237	3.89E+03	3.89E+03	2.43E+03	2.50E+03	-1.39E+03	-3.34E+00	-2.92E+01
pu238	1.83E+03	1.82E+03	4.83E+03	4.81E+03	2.98E+03	7.16E+00	6.27E+01
pu239	3.82E+04	3.82E+04	2.39E+04	2.39E+04	-1.43E+04	-3.43E+01	-3.01E+02
pu240	1.82E+04	1.82E+04	1.62E+04	1.66E+04	-1.55E+03	-3.72E+00	-3.26E+01
pu241	6.74E+03	6.43E+03	9.36E+03	5.77E+03	-9.70E+02	-2.33E+00	-2.04E+01
pu242	5.36E+03	5.36E+03	6.04E+03	6.04E+03	6.73E+02	1.62E+00	1.42E+01
pu244	5.71E-35	2.09E-12	1.56E-01	1.56E-01	1.56E-01	3.75E-04	3.29E-03
am241	4.53E+03	4.84E+03	2.23E+03	5.74E+03	1.22E+03	2.92E+00	2.56E+01
am242m	5.06E+00	5.04E+00	8.28E+01	7.88E+01	7.38E+01	1.77E-01	1.55E+00
am242	4.56E-13	6.50E-05	1.75E+00	1.02E-03	1.02E-03	2.44E-06	2.14E-05
am243	1.23E+03	1.23E+03	2.16E+03	2.16E+03	9.24E+02	2.22E+00	1.94E+01
cm242	1.13E-06	1.03E-02	3.69E+02	2.05E-01	2.05E-01	4.94E-04	4.32E-03
cm243	1.13E-06	1.11E-06	2.28E+01	1.79E+01	1.79E+01	4.30E-02	3.77E-01
cm244	1.13E-06	1.12E-06	1.50E+03	1.02E+03	1.02E+03	2.46E+00	2.15E+01
cm245	1.13E-06	1.13E-06	2.01E+02	2.01E+02	2.01E+02	4.83E-01	4.23E+00
cm246	1.13E-06	1.13E-06	1.43E+01	1.43E+01	1.43E+01	3.44E-02	3.01E-01
cm247	1.13E-06	1.13E-06	3.41E-01	3.41E-01	3.41E-01	8.19E-04	7.18E-03
cm248	1.13E-06	1.13E-06	1.99E-02	1.99E-02	1.99E-02	4.78E-05	4.19E-04
cf249	0.00E+00	2.51E-18	1.35E-04	5.25E-04	5.25E-04	1.26E-06	1.11E-05
cf250	0.00E+00	5.55E-31	8.89E-05	5.24E-05	5.24E-05	1.26E-07	1.10E-06
cf251	0.00E+00	4.92E-42	5.33E-05	5.29E-05	5.29E-05	1.27E-07	1.11E-06
cf252	0.00E+00	0.00E+00	1.59E-05	1.16E-06	1.16E-06	2.79E-09	2.44E-08
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.48E+05**	**9.48E+05**	**-5.21E+04**	**-1.25E+02**	**-1.10E+03**
TOTAL TRU	**8.00E+04**	**8.00E+04**	**6.93E+04**	**6.89E+04**	**-1.11E+04**	**-2.66E+01**	**-2.33E+02**
TOTAL PU	**7.03E+04**	**7.00E+04**	**6.03E+04**	**5.72E+04**	**-1.32E+04**	**-3.16E+01**	**-2.77E+02**
TOTAL NP	**3.89E+03**	**3.89E+03**	**2.43E+03**	**2.50E+03**	**-1.39E+03**	**-3.34E+00**	**-2.92E+01**
TOTAL AM	**5.77E+03**	**6.08E+03**	**4.47E+03**	**7.98E+03**	**2.21E+03**	**5.32E+00**	**4.66E+01**
TOTAL CM	**7.94E-06**	**1.03E-02**	**2.11E+03**	**1.26E+03**	**1.26E+03**	**3.02E+00**	**2.64E+01**
TOTAL CF	**0.00E+00**	**2.51E-18**	**2.93E-04**	**6.32E-04**	**6.32E-04**	**1.52E-06**	**1.33E-05**
PU+NP+AM	**8.00E+04**	**8.00E+04**	**6.72E+04**	**6.76E+04**	**-1.23E+04**	**-2.96E+01**	**-2.60E+02**

MOXUE_8PuNpAm_554U5_2.out	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	1.13E-06	3.94E+01	1.86E+02	7.67E+02	7.67E+02	1.84E+00	1.62E+01
u235	5.10E+04	5.10E+04	2.85E+04	2.85E+04	-2.25E+04	-5.39E+01	-4.73E+02
u236	1.13E-06	2.02E+00	5.16E+03	5.18E+03	5.18E+03	1.24E+01	1.09E+02
u238	8.69E+05	8.69E+05	8.41E+05	8.41E+05	-2.82E+04	-6.78E+01	-5.94E+02
np237	3.10E+03	3.11E+03	2.20E+03	2.29E+03	-8.10E+02	-1.95E+00	-1.71E+01
pu238	5.09E+03	5.05E+03	7.36E+03	7.22E+03	2.13E+03	5.12E+00	4.49E+01
pu239	2.98E+04	2.98E+04	2.24E+04	2.25E+04	-7.33E+03	-1.76E+01	-1.54E+02
pu240	1.95E+04	1.94E+04	1.59E+04	1.65E+04	-2.96E+03	-7.11E+00	-6.23E+01
pu241	6.81E+03	6.49E+03	9.24E+03	5.70E+03	-1.11E+03	-2.67E+00	-2.34E+01
pu242	6.86E+03	6.86E+03	7.30E+03	7.30E+03	4.32E+02	1.04E+00	9.09E+00
pu244	5.71E-35	2.09E-12	1.63E-01	1.63E-01	1.63E-01	3.92E-04	3.43E-03
am241	6.44E+03	6.75E+03	2.93E+03	6.39E+03	-5.10E+01	-1.23E-01	-1.07E+00
am242m	7.96E+01	7.92E+01	1.14E+02	1.09E+02	2.91E+01	6.99E-02	6.12E-01
am242	4.56E-13	1.02E-03	2.12E+00	1.40E-03	1.40E-03	3.37E-06	2.95E-05
am243	2.35E+03	2.35E+03	2.82E+03	2.81E+03	4.67E+02	1.12E+00	9.83E+00
cm242	1.13E-06	1.63E-01	4.56E+02	2.83E-01	2.83E-01	6.81E-04	5.96E-03
cm243	1.13E-06	1.11E-06	2.92E+01	2.29E+01	2.29E+01	5.49E-02	4.81E-01
cm244	1.13E-06	1.13E-06	2.02E+03	1.38E+03	1.38E+03	3.31E+00	2.90E+01
cm245	1.13E-06	1.13E-06	2.72E+02	2.72E+02	2.72E+02	6.53E-01	5.72E+00
cm246	1.13E-06	1.13E-06	1.86E+01	1.86E+01	1.86E+01	4.46E-02	3.91E-01
cm247	1.13E-06	1.13E-06	4.45E-01	4.45E-01	4.45E-01	1.07E-03	9.36E-03
cm248	1.13E-06	1.13E-06	2.51E-02	2.51E-02	2.51E-02	6.02E-05	5.27E-04
cf249	0.00E+00	2.43E-18	1.73E-04	6.56E-04	6.56E-04	1.58E-06	1.38E-05
cf250	0.00E+00	5.20E-31	1.05E-04	6.18E-05	6.18E-05	1.48E-07	1.30E-06
cf251	0.00E+00	4.92E-42	6.34E-05	6.29E-05	6.29E-05	1.51E-07	1.32E-06
cf252	0.00E+00	0.00E+00	1.78E-05	1.30E-06	1.30E-06	3.12E-09	2.73E-08
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.48E+05**	**9.48E+05**	**-5.22E+04**	**-1.25E+02**	**-1.10E+03**
TOTAL TRU	**8.00E+04**	**7.99E+04**	**7.30E+04**	**7.25E+04**	**-7.51E+03**	**-1.81E+01**	**-1.58E+02**
TOTAL PU	**6.80E+04**	**6.77E+04**	**6.22E+04**	**5.92E+04**	**-8.84E+03**	**-2.12E+01**	**-1.86E+02**
TOTAL NP	**3.10E+03**	**3.11E+03**	**2.20E+03**	**2.29E+03**	**-8.10E+02**	**-1.95E+00**	**-1.71E+01**
TOTAL AM	**8.87E+03**	**9.18E+03**	**5.86E+03**	**9.31E+03**	**4.45E+02**	**1.07E+00**	**9.37E+00**
TOTAL CM	**7.94E-06**	**1.63E-01**	**2.79E+03**	**1.69E+03**	**1.69E+03**	**4.06E+00**	**3.56E+01**
TOTAL CF	**0.00E+00**	**2.43E-18**	**3.59E-04**	**7.82E-04**	**7.82E-04**	**1.88E-06**	**1.65E-05**
PU+NP+AM	**8.00E+04**	**7.99E+04**	**7.02E+04**	**7.08E+04**	**-9.20E+03**	**-2.21E+01**	**-1.94E+02**

MOXUE_8PuNpAm_625U5_3.out							
	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	1.13E-06	5.75E+01	2.46E+02	9.49E+02	9.49E+02	2.28E+00	2.00E+01
u235	5.75E+04	5.75E+04	3.26E+04	3.26E+04	-2.49E+04	-5.99E+01	-5.25E+02
u236	1.13E-06	1.93E+00	5.75E+03	5.77E+03	5.77E+03	1.39E+01	1.21E+02
u238	8.62E+05	8.62E+05	8.35E+05	8.35E+05	-2.77E+04	-6.66E+01	-5.83E+02
np237	2.73E+03	2.74E+03	2.07E+03	2.15E+03	-5.82E+02	-1.40E+00	-1.23E+01
pu238	7.44E+03	7.38E+03	8.97E+03	8.73E+03	1.29E+03	3.10E+00	2.72E+01
pu239	2.69E+04	2.69E+04	2.19E+04	2.19E+04	-4.95E+03	-1.19E+01	-1.04E+02
pu240	1.86E+04	1.86E+04	1.50E+04	1.58E+04	-2.83E+03	-6.80E+00	-5.96E+01
pu241	6.48E+03	6.17E+03	8.86E+03	5.47E+03	-1.01E+03	-2.42E+00	-2.12E+01
pu242	7.91E+03	7.91E+03	8.06E+03	8.06E+03	1.50E+02	3.60E-01	3.16E+00
pu244	5.71E-35	2.09E-12	1.69E-01	1.69E-01	1.69E-01	4.06E-04	3.55E-03
am241	6.91E+03	7.21E+03	3.08E+03	6.39E+03	-5.20E+02	-1.25E+00	-1.09E+01
am242m	1.09E+02	1.09E+02	1.22E+02	1.16E+02	6.40E+00	1.54E-02	1.35E-01
am242	4.56E-13	1.40E-03	2.18E+00	1.49E-03	1.49E-03	3.59E-06	3.14E-05
am243	2.96E+03	2.95E+03	3.19E+03	3.19E+03	2.33E+02	5.60E-01	4.90E+00
cm242	1.13E-06	2.23E-01	4.70E+02	3.02E-01	3.01E-01	7.24E-04	6.35E-03
cm243	1.13E-06	1.11E-06	3.03E+01	2.38E+01	2.38E+01	5.72E-02	5.01E-01
cm244	1.13E-06	1.14E-06	2.30E+03	1.57E+03	1.57E+03	3.77E+00	3.31E+01
cm245	1.13E-06	1.13E-06	3.08E+02	3.07E+02	3.07E+02	7.38E-01	6.47E+00
cm246	1.13E-06	1.13E-06	2.08E+01	2.07E+01	2.07E+01	4.98E-02	4.37E-01
cm247	1.13E-06	1.13E-06	4.96E-01	4.96E-01	4.96E-01	1.19E-03	1.04E-02
cm248	1.13E-06	1.13E-06	2.78E-02	2.78E-02	2.78E-02	6.69E-05	5.86E-04
cf249	0.00E+00	2.40E-18	1.92E-04	7.25E-04	7.25E-04	1.74E-06	1.53E-05
cf250	0.00E+00	5.09E-31	1.14E-04	6.71E-05	6.71E-05	1.61E-07	1.41E-06
cf251	0.00E+00	4.92E-42	6.90E-05	6.85E-05	6.85E-05	1.65E-07	1.44E-06
cf252	0.00E+00	0.00E+00	1.91E-05	1.39E-06	1.39E-06	3.34E-09	2.93E-08
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.48E+05**	**9.48E+05**	**-5.22E+04**	**-1.25E+02**	**-1.10E+03**
TOTAL TRU	**8.00E+04**	**7.99E+04**	**7.44E+04**	**7.37E+04**	**-6.28E+03**	**-1.51E+01**	**-1.32E+02**
TOTAL PU	**6.73E+04**	**6.69E+04**	**6.28E+04**	**5.99E+04**	**-7.34E+03**	**-1.76E+01**	**-1.55E+02**
TOTAL NP	**2.73E+03**	**2.74E+03**	**2.07E+03**	**2.15E+03**	**-5.82E+02**	**-1.40E+00**	**-1.23E+01**
TOTAL AM	**9.98E+03**	**1.03E+04**	**6.39E+03**	**9.70E+03**	**-2.81E+02**	**-6.74E-01**	**-5.91E+00**
TOTAL CM	**7.94E-06**	**2.23E-01**	**3.13E+03**	**1.92E+03**	**1.92E+03**	**4.62E+00**	**4.05E+01**
TOTAL CF	**0.00E+00**	**2.40E-18**	**3.94E-04**	**8.62E-04**	**8.62E-04**	**2.07E-06**	**1.81E-05**
PU+NP+AM	**8.00E+04**	**7.99E+04**	**7.13E+04**	**7.18E+04**	**-8.21E+03**	**-1.97E+01**	**-1.73E+02**

MOXUE_8PuNpAm_651U5_4.out							
	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	1.13E-06	6.90E+01	2.83E+02	1.05E+03	1.05E+03	2.53E+00	2.22E+01
u235	5.99E+04	5.99E+04	3.40E+04	3.40E+04	-2.59E+04	-6.22E+01	-5.45E+02
u236	1.13E-06	1.83E+00	5.97E+03	5.99E+03	5.99E+03	1.44E+01	1.26E+02
u238	8.60E+05	8.60E+05	8.32E+05	8.32E+05	-2.76E+04	-6.63E+01	-5.81E+02
np237	2.55E+03	2.56E+03	1.99E+03	2.07E+03	-4.80E+02	-1.15E+00	-1.01E+01
pu238	8.92E+03	8.85E+03	9.89E+03	9.57E+03	6.56E+02	1.58E+00	1.38E+01
pu239	2.58E+04	2.58E+04	2.17E+04	2.17E+04	-4.12E+03	-9.90E+00	-8.67E+01
pu240	1.76E+04	1.76E+04	1.44E+04	1.52E+04	-2.47E+03	-5.94E+00	-5.20E+01
pu241	6.16E+03	5.87E+03	8.56E+03	5.28E+03	-8.81E+02	-2.12E+00	-1.85E+01
pu242	8.61E+03	8.61E+03	8.54E+03	8.54E+03	-7.30E+01	-1.75E-01	-1.54E+00
pu244	5.71E-35	2.09E-12	1.73E-01	1.73E-01	1.73E-01	4.16E-04	3.65E-03
am241	6.86E+03	7.14E+03	3.03E+03	6.23E+03	-6.31E+02	-1.52E+00	-1.33E+01
am242m	1.16E+02	1.16E+02	1.20E+02	1.14E+02	-2.00E+00	-4.81E-03	-4.21E-02
am242	4.56E-13	1.49E-03	2.13E+00	1.47E-03	1.47E-03	3.54E-06	3.10E-05
am243	3.31E+03	3.31E+03	3.41E+03	3.41E+03	9.50E+01	2.28E-01	2.00E+00
cm242	1.13E-06	2.37E-01	4.61E+02	2.98E-01	2.97E-01	7.15E-04	6.26E-03
cm243	1.13E-06	1.11E-06	2.99E+01	2.34E+01	2.34E+01	5.63E-02	4.93E-01
cm244	1.13E-06	1.15E-06	2.48E+03	1.69E+03	1.69E+03	4.06E+00	3.56E+01
cm245	1.13E-06	1.13E-06	3.28E+02	3.28E+02	3.28E+02	7.88E-01	6.90E+00
cm246	1.13E-06	1.13E-06	2.22E+01	2.22E+01	2.21E+01	5.32E-02	4.66E-01
cm247	1.13E-06	1.13E-06	5.31E-01	5.31E-01	5.31E-01	1.28E-03	1.12E-02
cm248	1.13E-06	1.13E-06	2.99E-02	2.99E-02	2.99E-02	7.19E-05	6.30E-04
cf249	0.00E+00	2.39E-18	2.07E-04	7.78E-04	7.78E-04	1.87E-06	1.64E-05
cf250	0.00E+00	5.06E-31	1.22E-04	7.18E-05	7.18E-05	1.73E-07	1.51E-06
cf251	0.00E+00	4.92E-42	7.39E-05	7.33E-05	7.33E-05	1.76E-07	1.54E-06
cf252	0.00E+00	0.00E+00	2.04E-05	1.48E-06	1.48E-06	3.57E-09	3.12E-08
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.47E+05**	**9.47E+05**	**-5.23E+04**	**-1.26E+02**	**-1.10E+03**
TOTAL TRU	**8.00E+04**	**7.99E+04**	**7.49E+04**	**7.41E+04**	**-5.84E+03**	**-1.40E+01**	**-1.23E+02**
TOTAL PU	**6.71E+04**	**6.68E+04**	**6.30E+04**	**6.03E+04**	**-6.89E+03**	**-1.66E+01**	**-1.45E+02**
TOTAL NP	**2.55E+03**	**2.56E+03**	**1.99E+03**	**2.07E+03**	**-4.80E+02**	**-1.15E+00**	**-1.01E+01**
TOTAL AM	**1.03E+04**	**1.06E+04**	**6.56E+03**	**9.75E+03**	**-5.38E+02**	**-1.29E+00**	**-1.13E+01**
TOTAL CM	**7.94E-06**	**2.37E-01**	**3.32E+03**	**2.07E+03**	**2.07E+03**	**4.96E+00**	**4.35E+01**
TOTAL CF	**0.00E+00**	**2.39E-18**	**4.22E-04**	**9.24E-04**	**9.24E-04**	**2.22E-06**	**1.95E-05**
PU+NP+AM	**8.00E+04**	**7.99E+04**	**7.16E+04**	**7.21E+04**	**-7.91E+03**	**-1.90E+01**	**-1.66E+02**

MOXUE_8PuNpAm_657U5_5.out							
	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	1.13E-06	7.54E+01	3.02E+02	1.11E+03	1.11E+03	2.66E+00	2.33E+01
u235	6.04E+04	6.04E+04	3.43E+04	3.43E+04	-2.62E+04	-6.28E+01	-5.50E+02
u236	1.13E-06	1.76E+00	6.03E+03	6.04E+03	6.04E+03	1.45E+01	1.27E+02
u238	8.59E+05	8.59E+05	8.32E+05	8.32E+05	-2.76E+04	-6.63E+01	-5.81E+02
np237	2.45E+03	2.47E+03	1.94E+03	2.02E+03	-4.35E+02	-1.05E+00	-9.16E+00
pu238	9.75E+03	9.68E+03	1.04E+04	9.99E+03	2.41E+02	5.79E-01	5.07E+00
pu239	2.55E+04	2.55E+04	2.16E+04	2.16E+04	-3.87E+03	-9.30E+00	-8.15E+01
pu240	1.70E+04	1.70E+04	1.40E+04	1.48E+04	-2.17E+03	-5.21E+00	-4.57E+01
pu241	5.95E+03	5.67E+03	8.36E+03	5.16E+03	-7.88E+02	-1.89E+00	-1.66E+01
pu242	9.07E+03	9.07E+03	8.84E+03	8.85E+03	-2.25E+02	-5.41E-01	-4.74E+00
pu244	5.71E-35	2.09E-12	1.77E-01	1.77E-01	1.77E-01	4.25E-04	3.72E-03
am241	6.67E+03	6.94E+03	2.93E+03	6.06E+03	-6.13E+02	-1.47E+00	-1.29E+01
am242m	1.15E+02	1.14E+02	1.16E+02	1.11E+02	-4.10E+00	-9.85E-03	-8.63E-02
am242	4.56E-13	1.47E-03	2.07E+00	1.43E-03	1.43E-03	3.43E-06	3.00E-05
am243	3.53E+03	3.53E+03	3.54E+03	3.54E+03	1.10E+01	2.64E-02	2.32E-01
cm242	1.13E-06	2.34E-01	4.49E+02	2.88E-01	2.88E-01	6.92E-04	6.06E-03
cm243	1.13E-06	1.11E-06	2.91E+01	2.28E+01	2.28E+01	5.49E-02	4.81E-01
cm244	1.13E-06	1.15E-06	2.59E+03	1.77E+03	1.77E+03	4.25E+00	3.72E+01
cm245	1.13E-06	1.13E-06	3.41E+02	3.41E+02	3.41E+02	8.20E-01	7.18E+00
cm246	1.13E-06	1.13E-06	2.32E+01	2.32E+01	2.32E+01	5.57E-02	4.88E-01
cm247	1.13E-06	1.13E-06	5.57E-01	5.57E-01	5.57E-01	1.34E-03	1.17E-02
cm248	1.13E-06	1.13E-06	3.16E-02	3.16E-02	3.16E-02	7.60E-05	6.66E-04
cf249	0.00E+00	2.39E-18	2.18E-04	8.22E-04	8.22E-04	1.97E-06	1.73E-05
cf250	0.00E+00	5.07E-31	1.29E-04	7.61E-05	7.61E-05	1.83E-07	1.60E-06
cf251	0.00E+00	4.92E-42	7.83E-05	7.77E-05	7.77E-05	1.87E-07	1.64E-06
cf252	0.00E+00	0.00E+00	2.17E-05	1.58E-06	1.58E-06	3.79E-09	3.32E-08
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.47E+05**	**9.48E+05**	**-5.23E+04**	**-1.26E+02**	**-1.10E+03**
TOTAL TRU	**8.00E+04**	**7.99E+04**	**7.51E+04**	**7.43E+04**	**-5.70E+03**	**-1.37E+01**	**-1.20E+02**
TOTAL PU	**6.72E+04**	**6.69E+04**	**6.31E+04**	**6.04E+04**	**-6.81E+03**	**-1.64E+01**	**-1.43E+02**
TOTAL NP	**2.45E+03**	**2.47E+03**	**1.94E+03**	**2.02E+03**	**-4.35E+02**	**-1.05E+00**	**-9.16E+00**
TOTAL AM	**1.03E+04**	**1.06E+04**	**6.59E+03**	**9.71E+03**	**-6.06E+02**	**-1.46E+00**	**-1.28E+01**
TOTAL CM	**7.94E-06**	**2.34E-01**	**3.43E+03**	**2.16E+03**	**2.16E+03**	**5.18E+00**	**4.54E+01**
TOTAL CF	**0.00E+00**	**2.39E-18**	**4.47E-04**	**9.77E-04**	**9.77E-04**	**2.35E-06**	**2.06E-05**
PU+NP+AM	**8.00E+04**	**7.99E+04**	**7.16E+04**	**7.21E+04**	**-7.85E+03**	**-1.89E+01**	**-1.65E+02**

MOXUE_8PuNpAm_660U5_6.out							
	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	1.13E-06	7.87E+01	3.12E+02	1.13E+03	1.13E+03	2.72E+00	2.38E+01
u235	6.07E+04	6.07E+04	3.44E+04	3.44E+04	-2.63E+04	-6.32E+01	-5.53E+02
u236	1.13E-06	1.72E+00	6.06E+03	6.07E+03	6.07E+03	1.46E+01	1.28E+02
u238	8.59E+05	8.59E+05	8.32E+05	8.32E+05	-2.76E+04	-6.63E+01	-5.81E+02
np237	2.40E+03	2.41E+03	1.91E+03	1.99E+03	-4.10E+02	-9.85E-01	-8.63E+00
pu238	1.02E+04	1.01E+04	1.06E+04	1.02E+04	0.00E+00	0.00E+00	0.00E+00
pu239	2.54E+04	2.54E+04	2.15E+04	2.16E+04	-3.79E+03	-9.11E+00	-7.98E+01
pu240	1.66E+04	1.66E+04	1.38E+04	1.46E+04	-1.98E+03	-4.76E+00	-4.17E+01
pu241	5.82E+03	5.55E+03	8.25E+03	5.09E+03	-7.30E+02	-1.75E+00	-1.54E+01
pu242	9.37E+03	9.37E+03	9.05E+03	9.05E+03	-3.25E+02	-7.81E-01	-6.84E+00
pu244	5.71E-35	2.09E-12	1.79E-01	1.79E-01	1.79E-01	4.31E-04	3.77E-03
am241	6.50E+03	6.77E+03	2.86E+03	5.95E+03	-5.58E+02	-1.34E+00	-1.17E+01
am242m	1.11E+02	1.11E+02	1.13E+02	1.08E+02	-3.40E+00	-8.17E-03	-7.16E-02
am242	4.56E-13	1.43E-03	2.03E+00	1.39E-03	1.39E-03	3.34E-06	2.93E-05
am243	3.66E+03	3.66E+03	3.63E+03	3.62E+03	-3.80E+01	-9.13E-02	-8.00E-01
cm242	1.13E-06	2.27E-01	4.38E+02	2.81E-01	2.81E-01	6.74E-04	5.91E-03
cm243	1.13E-06	1.11E-06	2.85E+01	2.23E+01	2.23E+01	5.36E-02	4.70E-01
cm244	1.13E-06	1.15E-06	2.66E+03	1.82E+03	1.81E+03	4.36E+00	3.82E+01
cm245	1.13E-06	1.13E-06	3.49E+02	3.49E+02	3.49E+02	8.38E-01	7.34E+00
cm246	1.13E-06	1.13E-06	2.38E+01	2.38E+01	2.38E+01	5.71E-02	5.01E-01
cm247	1.13E-06	1.13E-06	5.72E-01	5.72E-01	5.72E-01	1.37E-03	1.20E-02
cm248	1.13E-06	1.13E-06	3.26E-02	3.26E-02	3.26E-02	7.84E-05	6.87E-04
cf249	0.00E+00	2.38E-18	2.25E-04	8.47E-04	8.47E-04	2.04E-06	1.78E-05
cf250	0.00E+00	5.08E-31	1.33E-04	7.87E-05	7.87E-05	1.89E-07	1.66E-06
cf251	0.00E+00	4.92E-42	8.09E-05	8.03E-05	8.03E-05	1.93E-07	1.69E-06
cf252	0.00E+00	0.00E+00	2.24E-05	1.63E-06	1.63E-06	3.93E-09	3.44E-08
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.47E+05**	**9.47E+05**	**-5.23E+04**	**-1.26E+02**	**-1.10E+03**
TOTAL TRU	**8.00E+04**	**7.99E+04**	**7.52E+04**	**7.44E+04**	**-5.62E+03**	**-1.35E+01**	**-1.18E+02**
TOTAL PU	**6.73E+04**	**6.69E+04**	**6.32E+04**	**6.05E+04**	**-6.82E+03**	**-1.64E+01**	**-1.44E+02**
TOTAL NP	**2.40E+03**	**2.41E+03**	**1.91E+03**	**1.99E+03**	**-4.10E+02**	**-9.85E-01**	**-8.63E+00**
TOTAL AM	**1.03E+04**	**1.05E+04**	**6.60E+03**	**9.68E+03**	**-5.99E+02**	**-1.44E+00**	**-1.26E+01**
TOTAL CM	**7.94E-06**	**2.27E-01**	**3.50E+03**	**2.21E+03**	**2.21E+03**	**5.31E+00**	**4.65E+01**
TOTAL CF	**0.00E+00**	**2.38E-18**	**4.62E-04**	**1.01E-03**	**1.01E-03**	**2.42E-06**	**2.12E-05**
PU+NP+AM	**8.00E+04**	**7.99E+04**	**7.17E+04**	**7.21E+04**	**-7.83E+03**	**-1.88E+01**	**-1.65E+02**

MOXUE_8PuNpAm_661U5_7.out							
	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	1.13E-06	8.01E+01	3.16E+02	1.14E+03	1.14E+03	2.74E+00	2.40E+01
u235	6.08E+04	6.08E+04	3.45E+04	3.45E+04	-2.64E+04	-6.33E+01	-5.55E+02
u236	1.13E-06	1.70E+00	6.07E+03	6.08E+03	6.08E+03	1.46E+01	1.28E+02
u238	8.59E+05	8.59E+05	8.31E+05	8.31E+05	-2.76E+04	-6.63E+01	-5.81E+02
np237	2.37E+03	2.38E+03	1.90E+03	1.97E+03	-3.97E+02	-9.54E-01	-8.36E+00
pu238	1.04E+04	1.03E+04	1.06E+04	1.02E+04	-1.20E+02	-2.88E-01	-2.53E+00
pu239	2.53E+04	2.53E+04	2.15E+04	2.16E+04	-3.77E+03	-9.06E+00	-7.94E+01
pu240	1.64E+04	1.64E+04	1.37E+04	1.45E+04	-1.88E+03	-4.52E+00	-3.96E+01
pu241	5.75E+03	5.48E+03	8.19E+03	5.05E+03	-6.98E+02	-1.68E+00	-1.47E+01
pu242	9.57E+03	9.57E+03	9.18E+03	9.19E+03	-3.87E+02	-9.30E-01	-8.15E+00
pu244	5.71E-35	2.09E-12	1.81E-01	1.81E-01	1.81E-01	4.35E-04	3.81E-03
am241	6.39E+03	6.65E+03	2.81E+03	5.88E+03	-5.12E+02	-1.23E+00	-1.08E+01
am242m	1.08E+02	1.08E+02	1.11E+02	1.06E+02	-2.40E+00	-5.77E-03	-5.05E-02
am242	4.56E-13	1.39E-03	2.00E+00	1.37E-03	1.36E-03	3.28E-06	2.87E-05
am243	3.75E+03	3.74E+03	3.68E+03	3.68E+03	-6.80E+01	-1.63E-01	-1.43E+00
cm242	1.13E-06	2.21E-01	4.32E+02	2.76E-01	2.76E-01	6.63E-04	5.81E-03
cm243	1.13E-06	1.11E-06	2.80E+01	2.20E+01	2.20E+01	5.28E-02	4.62E-01
cm244	1.13E-06	1.15E-06	2.70E+03	1.84E+03	1.84E+03	4.43E+00	3.88E+01
cm245	1.13E-06	1.13E-06	3.54E+02	3.54E+02	3.54E+02	8.50E-01	7.45E+00
cm246	1.13E-06	1.13E-06	2.42E+01	2.42E+01	2.42E+01	5.81E-02	5.09E-01
cm247	1.13E-06	1.13E-06	5.82E-01	5.82E-01	5.82E-01	1.40E-03	1.22E-02
cm248	1.13E-06	1.13E-06	3.33E-02	3.33E-02	3.33E-02	7.99E-05	7.00E-04
cf249	0.00E+00	2.38E-18	2.30E-04	8.64E-04	8.64E-04	2.08E-06	1.82E-05
cf250	0.00E+00	5.08E-31	1.36E-04	8.03E-05	8.03E-05	1.93E-07	1.69E-06
cf251	0.00E+00	4.92E-42	8.26E-05	8.20E-05	8.20E-05	1.97E-07	1.73E-06
cf252	0.00E+00	0.00E+00	2.29E-05	1.67E-06	1.67E-06	4.02E-09	3.52E-08
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.47E+05**	**9.47E+05**	**-5.23E+04**	**-1.26E+02**	**-1.10E+03**
TOTAL TRU	**8.00E+04**	**7.99E+04**	**7.52E+04**	**7.44E+04**	**-5.59E+03**	**-1.34E+01**	**-1.18E+02**
TOTAL PU	**6.74E+04**	**6.70E+04**	**6.32E+04**	**6.05E+04**	**-6.85E+03**	**-1.65E+01**	**-1.44E+02**
TOTAL NP	**2.37E+03**	**2.38E+03**	**1.90E+03**	**1.97E+03**	**-3.97E+02**	**-9.54E-01**	**-8.36E+00**
TOTAL AM	**1.02E+04**	**1.05E+04**	**6.61E+03**	**9.66E+03**	**-5.82E+02**	**-1.40E+00**	**-1.23E+01**
TOTAL CM	**7.94E-06**	**2.21E-01**	**3.54E+03**	**2.24E+03**	**2.24E+03**	**5.39E+00**	**4.73E+01**
TOTAL CF	**0.00E+00**	**2.38E-18**	**4.71E-04**	**1.03E-03**	**1.03E-03**	**2.47E-06**	**2.16E-05**
PU+NP+AM	**8.00E+04**	**7.99E+04**	**7.17E+04**	**7.21E+04**	**-7.83E+03**	**-1.88E+01**	**-1.65E+02**

MOXUE_8PuNpAm_661U5_8.out							
	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	1.13E-06	8.05E+01	3.17E+02	1.14E+03	1.14E+03	2.74E+00	2.40E+01
u235	6.08E+04	6.08E+04	3.44E+04	3.44E+04	-2.64E+04	-6.34E+01	-5.55E+02
u236	1.13E-06	1.69E+00	6.07E+03	6.08E+03	6.08E+03	1.46E+01	1.28E+02
u238	8.59E+05	8.59E+05	8.31E+05	8.31E+05	-2.76E+04	-6.63E+01	-5.81E+02
np237	2.36E+03	2.37E+03	1.89E+03	1.96E+03	-3.91E+02	-9.40E-01	-8.23E+00
pu238	1.04E+04	1.03E+04	1.07E+04	1.02E+04	-1.70E+02	-4.08E-01	-3.58E+00
pu239	2.53E+04	2.53E+04	2.15E+04	2.15E+04	-3.77E+03	-9.06E+00	-7.94E+01
pu240	1.63E+04	1.63E+04	1.36E+04	1.44E+04	-1.83E+03	-4.40E+00	-3.85E+01
pu241	5.71E+03	5.45E+03	8.16E+03	5.03E+03	-6.80E+02	-1.63E+00	-1.43E+01
pu242	9.71E+03	9.71E+03	9.28E+03	9.29E+03	-4.26E+02	-1.02E+00	-8.97E+00
pu244	5.71E-35	2.09E-12	1.82E-01	1.82E-01	1.82E-01	4.38E-04	3.84E-03
am241	6.32E+03	6.58E+03	2.79E+03	5.84E+03	-4.83E+02	-1.16E+00	-1.02E+01
am242m	1.06E+02	1.06E+02	1.10E+02	1.05E+02	-1.60E+00	-3.84E-03	-3.37E-02
am242	4.56E-13	1.37E-03	1.98E+00	1.35E-03	1.35E-03	3.24E-06	2.84E-05
am243	3.80E+03	3.80E+03	3.72E+03	3.71E+03	-8.50E+01	-2.04E-01	-1.79E+00
cm242	1.13E-06	2.17E-01	4.28E+02	2.73E-01	2.73E-01	6.56E-04	5.74E-03
cm243	1.13E-06	1.11E-06	2.78E+01	2.18E+01	2.18E+01	5.23E-02	4.58E-01
cm244	1.13E-06	1.15E-06	2.73E+03	1.86E+03	1.86E+03	4.48E+00	3.92E+01
cm245	1.13E-06	1.13E-06	3.57E+02	3.57E+02	3.57E+02	8.58E-01	7.51E+00
cm246	1.13E-06	1.13E-06	2.45E+01	2.44E+01	2.44E+01	5.87E-02	5.14E-01
cm247	1.13E-06	1.13E-06	5.89E-01	5.89E-01	5.89E-01	1.42E-03	1.24E-02
cm248	1.13E-06	1.13E-06	3.37E-02	3.37E-02	3.37E-02	8.10E-05	7.10E-04
cf249	0.00E+00	2.38E-18	2.33E-04	8.76E-04	8.76E-04	2.10E-06	1.84E-05
cf250	0.00E+00	5.09E-31	1.38E-04	8.15E-05	8.15E-05	1.96E-07	1.72E-06
cf251	0.00E+00	4.92E-42	8.39E-05	8.32E-05	8.32E-05	2.00E-07	1.75E-06
cf252	0.00E+00	0.00E+00	2.33E-05	1.70E-06	1.70E-06	4.08E-09	3.58E-08
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.47E+05**	**9.47E+05**	**-5.23E+04**	**-1.26E+02**	**-1.10E+03**
TOTAL TRU	**8.00E+04**	**7.99E+04**	**7.52E+04**	**7.44E+04**	**-5.57E+03**	**-1.34E+01**	**-1.17E+02**
TOTAL PU	**6.74E+04**	**6.70E+04**	**6.32E+04**	**6.05E+04**	**-6.88E+03**	**-1.65E+01**	**-1.45E+02**
TOTAL NP	**2.36E+03**	**2.37E+03**	**1.89E+03**	**1.96E+03**	**-3.91E+02**	**-9.40E-01**	**-8.23E+00**
TOTAL AM	**1.02E+04**	**1.05E+04**	**6.61E+03**	**9.66E+03**	**-5.70E+02**	**-1.37E+00**	**-1.20E+01**
TOTAL CM	**7.94E-06**	**2.17E-01**	**3.57E+03**	**2.27E+03**	**2.27E+03**	**5.45E+00**	**4.77E+01**
TOTAL CF	**0.00E+00**	**2.38E-18**	**4.78E-04**	**1.04E-03**	**1.04E-03**	**2.50E-06**	**2.19E-05**
PU+NP+AM	**8.00E+04**	**7.99E+04**	**7.16E+04**	**7.21E+04**	**-7.84E+03**	**-1.88E+01**	**-1.65E+02**

MOXUE_8PuNpAm_661U5_9.out							
	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	1.13E-06	8.06E+01	3.17E+02	1.14E+03	1.14E+03	2.74E+00	2.40E+01
u235	6.08E+04	6.08E+04	3.44E+04	3.44E+04	-2.64E+04	-6.34E+01	-5.55E+02
u236	1.13E-06	1.68E+00	6.07E+03	6.09E+03	6.08E+03	1.46E+01	1.28E+02
u238	8.59E+05	8.59E+05	8.31E+05	8.31E+05	-2.76E+04	-6.63E+01	-5.81E+02
np237	2.35E+03	2.36E+03	1.88E+03	1.96E+03	-3.86E+02	-9.28E-01	-8.13E+00
pu238	1.04E+04	1.03E+04	1.06E+04	1.02E+04	-2.00E+02	-4.81E-01	-4.21E+00
pu239	2.53E+04	2.53E+04	2.15E+04	2.15E+04	-3.77E+03	-9.06E+00	-7.94E+01
pu240	1.62E+04	1.62E+04	1.36E+04	1.44E+04	-1.80E+03	-4.33E+00	-3.79E+01
pu241	5.70E+03	5.43E+03	8.14E+03	5.02E+03	-6.71E+02	-1.61E+00	-1.41E+01
pu242	9.81E+03	9.81E+03	9.36E+03	9.36E+03	-4.51E+02	-1.08E+00	-9.49E+00
pu244	5.71E-35	2.09E-12	1.83E-01	1.83E-01	1.83E-01	4.40E-04	3.85E-03
am241	6.28E+03	6.54E+03	2.77E+03	5.82E+03	-4.66E+02	-1.12E+00	-9.81E+00
am242m	1.05E+02	1.05E+02	1.09E+02	1.04E+02	-1.20E+00	-2.88E-03	-2.53E-02
am242	4.56E-13	1.35E-03	1.97E+00	1.34E-03	1.34E-03	3.22E-06	2.82E-05
am243	3.83E+03	3.83E+03	3.74E+03	3.74E+03	-9.60E+01	-2.31E-01	-2.02E+00
cm242	1.13E-06	2.15E-01	4.26E+02	2.71E-01	2.71E-01	6.51E-04	5.70E-03
cm243	1.13E-06	1.11E-06	2.76E+01	2.17E+01	2.17E+01	5.21E-02	4.56E-01
cm244	1.13E-06	1.16E-06	2.75E+03	1.88E+03	1.88E+03	4.51E+00	3.95E+01
cm245	1.13E-06	1.13E-06	3.60E+02	3.59E+02	3.59E+02	8.63E-01	7.56E+00
cm246	1.13E-06	1.13E-06	2.47E+01	2.46E+01	2.46E+01	5.92E-02	5.18E-01
cm247	1.13E-06	1.13E-06	5.94E-01	5.94E-01	5.94E-01	1.43E-03	1.25E-02
cm248	1.13E-06	1.13E-06	3.40E-02	3.40E-02	3.40E-02	8.18E-05	7.16E-04
cf249	0.00E+00	2.38E-18	2.35E-04	8.84E-04	8.84E-04	2.12E-06	1.86E-05
cf250	0.00E+00	5.09E-31	1.40E-04	8.23E-05	8.23E-05	1.98E-07	1.73E-06
cf251	0.00E+00	4.92E-42	8.47E-05	8.41E-05	8.41E-05	2.02E-07	1.77E-06
cf252	0.00E+00	0.00E+00	2.36E-05	1.72E-06	1.72E-06	4.13E-09	3.62E-08
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.47E+05**	**9.47E+05**	**-5.23E+04**	**-1.26E+02**	**-1.10E+03**
TOTAL TRU	**8.00E+04**	**7.99E+04**	**7.52E+04**	**7.44E+04**	**-5.56E+03**	**-1.34E+01**	**-1.17E+02**
TOTAL PU	**6.74E+04**	**6.71E+04**	**6.32E+04**	**6.05E+04**	**-6.89E+03**	**-1.66E+01**	**-1.45E+02**
TOTAL NP	**2.35E+03**	**2.36E+03**	**1.88E+03**	**1.96E+03**	**-3.86E+02**	**-9.28E-01**	**-8.13E+00**
TOTAL AM	**1.02E+04**	**1.05E+04**	**6.62E+03**	**9.66E+03**	**-5.63E+02**	**-1.35E+00**	**-1.19E+01**
TOTAL CM	**7.94E-06**	**2.15E-01**	**3.59E+03**	**2.28E+03**	**2.28E+03**	**5.49E+00**	**4.81E+01**
TOTAL CF	**0.00E+00**	**2.38E-18**	**4.83E-04**	**1.05E-03**	**1.05E-03**	**2.53E-06**	**2.21E-05**
PU+NP+AM	**8.00E+04**	**7.99E+04**	**7.17E+04**	**7.21E+04**	**-7.84E+03**	**-1.88E+01**	**-1.65E+02**

MOXUE_8PuNpAm_661U5_10.out							
	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	1.13E-06	8.04E+01	3.16E+02	1.14E+03	1.14E+03	2.73E+00	2.40E+01
u235	6.08E+04	6.08E+04	3.44E+04	3.44E+04	-2.64E+04	-6.34E+01	-5.55E+02
u236	1.13E-06	1.68E+00	6.07E+03	6.09E+03	6.09E+03	1.46E+01	1.28E+02
u238	8.59E+05	8.59E+05	8.31E+05	8.31E+05	-2.76E+04	-6.63E+01	-5.81E+02
np237	2.34E+03	2.35E+03	1.88E+03	1.96E+03	-3.84E+02	-9.23E-01	-8.08E+00
pu238	1.04E+04	1.03E+04	1.06E+04	1.02E+04	-2.00E+02	-4.81E-01	-4.21E+00
pu239	2.53E+04	2.53E+04	2.14E+04	2.15E+04	-3.77E+03	-9.06E+00	-7.94E+01
pu240	1.62E+04	1.62E+04	1.36E+04	1.44E+04	-1.79E+03	-4.30E+00	-3.77E+01
pu241	5.69E+03	5.42E+03	8.13E+03	5.02E+03	-6.67E+02	-1.60E+00	-1.40E+01
pu242	9.89E+03	9.89E+03	9.42E+03	9.42E+03	-4.68E+02	-1.12E+00	-9.85E+00
pu244	5.71E-35	2.09E-12	1.84E-01	1.84E-01	1.84E-01	4.42E-04	3.87E-03
am241	6.26E+03	6.52E+03	2.76E+03	5.80E+03	-4.56E+02	-1.10E+00	-9.60E+00
am242m	1.05E+02	1.04E+02	1.09E+02	1.04E+02	-9.00E-01	-2.16E-03	-1.89E-02
am242	4.56E-13	1.34E-03	1.96E+00	1.34E-03	1.34E-03	3.21E-06	2.81E-05
am243	3.86E+03	3.86E+03	3.76E+03	3.76E+03	-1.03E+02	-2.48E-01	-2.17E+00
cm242	1.13E-06	2.13E-01	4.25E+02	2.70E-01	2.70E-01	6.49E-04	5.68E-03
cm243	1.13E-06	1.11E-06	2.76E+01	2.16E+01	2.16E+01	5.19E-02	4.55E-01
cm244	1.13E-06	1.16E-06	2.77E+03	1.89E+03	1.89E+03	4.53E+00	3.97E+01
cm245	1.13E-06	1.13E-06	3.61E+02	3.61E+02	3.61E+02	8.67E-01	7.59E+00
cm246	1.13E-06	1.13E-06	2.48E+01	2.48E+01	2.48E+01	5.95E-02	5.21E-01
cm247	1.13E-06	1.13E-06	5.97E-01	5.97E-01	5.97E-01	1.43E-03	1.26E-02
cm248	1.13E-06	1.13E-06	3.42E-02	3.42E-02	3.42E-02	8.23E-05	7.21E-04
cf249	0.00E+00	2.38E-18	2.36E-04	8.89E-04	8.89E-04	2.14E-06	1.87E-05
cf250	0.00E+00	5.10E-31	1.41E-04	8.29E-05	8.29E-05	1.99E-07	1.74E-06
cf251	0.00E+00	4.92E-42	8.53E-05	8.46E-05	8.46E-05	2.03E-07	1.78E-06
cf252	0.00E+00	0.00E+00	2.37E-05	1.73E-06	1.73E-06	4.16E-09	3.64E-08
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.47E+05**	**9.47E+05**	**-5.23E+04**	**-1.26E+02**	**-1.10E+03**
TOTAL TRU	**8.00E+04**	**7.99E+04**	**7.53E+04**	**7.44E+04**	**-5.54E+03**	**-1.33E+01**	**-1.17E+02**
TOTAL PU	**6.74E+04**	**6.71E+04**	**6.31E+04**	**6.05E+04**	**-6.89E+03**	**-1.66E+01**	**-1.45E+02**
TOTAL NP	**2.34E+03**	**2.35E+03**	**1.88E+03**	**1.96E+03**	**-3.84E+02**	**-9.23E-01**	**-8.08E+00**
TOTAL AM	**1.02E+04**	**1.05E+04**	**6.63E+03**	**9.66E+03**	**-5.60E+02**	**-1.35E+00**	**-1.18E+01**
TOTAL CM	**7.94E-06**	**2.13E-01**	**3.60E+03**	**2.29E+03**	**2.29E+03**	**5.51E+00**	**4.83E+01**
TOTAL CF	**0.00E+00**	**2.38E-18**	**4.86E-04**	**1.06E-03**	**1.06E-03**	**2.54E-06**	**2.23E-05**
PU+NP+AM	**8.00E+04**	**7.99E+04**	**7.16E+04**	**7.21E+04**	**-7.84E+03**	**-1.88E+01**	**-1.65E+02**

60th PuNpAm recycling (personal communication, Sam Bays)

60th cycle from Sam's depletion Fortran using TRITON's 10th cycle XS							
	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	*1.13E-06*	7.96E+01	3.02E+02	1.11E+03	1.11E+03	2.66E+00	2.33E+01
u235	6.08E+04	6.07E+04	3.38E+04	3.38E+04	-2.70E+04	-6.49E+01	-5.69E+02
u236	*1.13E-06*	*1.72E+00*	6.17E+03	6.19E+03	6.19E+03	1.49E+01	1.30E+02
u238	8.59E+05	8.59E+05	8.31E+05	8.31E+05	-2.80E+04	-6.73E+01	-5.90E+02
np237	2.24E+03	2.11E+03	1.63E+03	1.69E+03	-5.41E+02	-1.30E+00	-1.14E+01
pu238	1.04E+04	1.01E+04	1.04E+04	9.99E+03	-4.53E+02	-1.09E+00	-9.54E+00
pu239	2.52E+04	2.51E+04	2.11E+04	2.11E+04	-4.10E+03	-9.85E+00	-8.63E+01
pu240	1.63E+04	1.63E+04	1.35E+04	1.44E+04	-1.84E+03	-4.41E+00	-3.86E+01
pu241	5.54E+03	5.52E+03	8.20E+03	5.06E+03	-4.72E+02	-1.13E+00	-9.93E+00
pu242	1.01E+04	1.04E+04	9.83E+03	9.83E+03	-2.24E+02	-5.39E-01	-4.72E+00
pu244	*0.00E+00*	*0.00E+00*	*0.00E+00*	*0.00E+00*	0.00E+00	0.00E+00	0.00E+00
am241	6.21E+03	6.20E+03	2.57E+03	5.50E+03	-7.06E+02	-1.70E+00	-1.49E+01
am242m	6.07E+01	6.03E+01	6.14E+01	5.86E+01	-2.09E+00	-5.02E-03	-4.40E-02
am242	*0.00E+00*	*0.00E+00*	*0.00E+00*	*0.00E+00*	0.00E+00	0.00E+00	0.00E+00
am243	3.87E+03	4.01E+03	3.89E+03	3.88E+03	1.66E+01	3.98E-02	3.49E-01
cm242	1.03E-01	1.88E+01	4.34E+02	1.42E-01	3.92E-02	9.42E-05	8.25E-04
cm243	0.00E+00	1.60E-03	2.89E+01	2.27E+01	2.27E+01	5.44E-02	4.77E-01
cm244	0.00E+00	1.33E+01	2.92E+03	1.99E+03	1.99E+03	4.79E+00	4.19E+01
cm245	0.00E+00	4.43E-03	3.83E+02	3.83E+02	3.83E+02	9.20E-01	8.06E+00
cm246	0.00E+00	3.39E-06	2.73E+01	2.73E+01	2.73E+01	6.55E-02	5.74E-01
cm247	0.00E+00	3.43E-10	6.64E-01	6.64E-01	6.64E-01	1.59E-03	1.40E-02
cm248	0.00E+00	6.67E-14	3.88E-02	3.88E-02	3.88E-02	9.33E-05	8.17E-04
cf249	0.00E+00	1.51E-20	2.73E-04	1.01E-03	1.01E-03	2.43E-06	2.13E-05
cf250	0.00E+00	1.15E-20	1.64E-04	9.62E-05	9.62E-05	2.31E-07	2.03E-06
cf251	0.00E+00	4.27E-23	9.89E-05	9.82E-05	9.82E-05	2.36E-07	2.07E-06
cf252	0.00E+00	3.16E-26	2.79E-05	2.03E-06	2.03E-06	4.87E-09	4.26E-08
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.46E+05**	**9.46E+05**	**-5.36E+04**	**-1.29E+02**	**-1.13E+03**
TOTAL TRU	**7.99E+04**	**7.99E+04**	**7.50E+04**	**7.40E+04**	**-5.89E+03**	**-1.41E+01**	**-1.24E+02**
TOTAL PU	**6.76E+04**	**6.75E+04**	**6.31E+04**	**6.05E+04**	**-7.08E+03**	**-1.70E+01**	**-1.49E+02**
TOTAL NP	**2.24E+03**	**2.11E+03**	**1.63E+03**	**1.69E+03**	**-5.41E+02**	**-1.30E+00**	**-1.14E+01**
TOTAL AM	**1.01E+04**	**1.03E+04**	**6.52E+03**	**9.44E+03**	**-6.91E+02**	**-1.66E+00**	**-1.45E+01**
TOTAL CM	**1.03E-01**	**3.21E+01**	**3.80E+03**	**2.43E+03**	**2.43E+03**	**5.83E+00**	**5.11E+01**
TOTAL CF	**0.00E+00**	**2.66E-20**	**5.64E-04**	**1.21E-03**	**1.21E-03**	**2.90E-06**	**2.54E-05**
PU+NP+AM	**7.99E+04**	**7.99E+04**	**7.12E+04**	**7.16E+04**	**-8.31E+03**	**-2.00E+01**	**-1.75E+02**

APPENDIX 4: PuNpAmCm case – Mass balances from cycle 1 to 10 as well as cycle 60

MOXUE_8PuNpAmCm_366U5_1.out							
	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	1.13E-06	1.41E+01	9.85E+01	4.84E+02	4.83E+02	1.16E+00	1.02E+01
u235	3.37E+04	3.37E+04	1.81E+04	1.81E+04	-1.56E+04	-3.75E+01	-3.29E+02
u236	1.13E-06	1.88E+00	3.54E+03	3.56E+03	3.55E+03	8.54E+00	7.48E+01
u238	8.86E+05	8.86E+05	8.57E+05	8.57E+05	-2.94E+04	-7.06E+01	-6.19E+02
np237	3.87E+03	3.87E+03	2.41E+03	2.48E+03	-1.38E+03	-3.33E+00	-2.91E+01
pu238	1.82E+03	1.81E+03	4.81E+03	4.79E+03	2.97E+03	7.13E+00	6.25E+01
pu239	3.80E+04	3.80E+04	2.37E+04	2.38E+04	-1.42E+04	-3.42E+01	-2.99E+02
pu240	1.81E+04	1.81E+04	1.61E+04	1.67E+04	-1.45E+03	-3.48E+00	-3.05E+01
pu241	6.71E+03	6.39E+03	9.33E+03	5.76E+03	-9.53E+02	-2.29E+00	-2.01E+01
pu242	5.34E+03	5.34E+03	6.01E+03	6.01E+03	6.77E+02	1.63E+00	1.43E+01
pu244	2.40E-31	8.74E-09	1.56E-01	1.56E-01	1.56E-01	3.75E-04	3.29E-03
am241	4.51E+03	4.81E+03	2.21E+03	5.72E+03	1.21E+03	2.91E+00	2.55E+01
am242m	5.04E+00	5.01E+00	8.21E+01	7.81E+01	7.31E+01	1.76E-01	1.54E+00
am242	4.56E-13	6.47E-05	1.74E+00	1.01E-03	1.01E-03	2.42E-06	2.12E-05
am243	1.23E+03	1.23E+03	2.15E+03	2.15E+03	9.23E+02	2.22E+00	1.94E+01
cm242	1.22E-02	1.29E-02	3.67E+02	2.04E-01	1.91E-01	4.60E-04	4.03E-03
cm243	3.74E+00	3.65E+00	2.34E+01	1.84E+01	1.46E+01	3.52E-02	3.08E-01
cm244	3.61E+02	3.48E+02	1.69E+03	1.15E+03	7.93E+02	1.90E+00	1.67E+01
cm245	3.53E+01	3.53E+01	2.57E+02	2.57E+02	2.22E+02	5.33E-01	4.67E+00
cm246	4.50E+00	4.50E+00	2.82E+01	2.82E+01	2.37E+01	5.69E-02	4.98E-01
cm247	6.16E-02	6.16E-02	1.08E+00	1.08E+00	1.01E+00	2.44E-03	2.14E-02
cm248	4.75E-03	4.75E-03	1.17E-01	1.17E-01	1.13E-01	2.70E-04	2.37E-03
bk249	0.00E+00	0.00E+00	3.08E-03	1.13E-06	1.13E-06	2.72E-09	2.39E-08
cf249	0.00E+00	1.05E-14	1.73E-03	4.71E-03	4.71E-03	1.13E-05	9.92E-05
cf250	0.00E+00	2.34E-27	1.02E-03	5.98E-04	5.98E-04	1.44E-06	1.26E-05
cf251	0.00E+00	2.40E-38	7.11E-04	7.05E-04	7.05E-04	1.69E-06	1.48E-05
cf252	0.00E+00	0.00E+00	3.25E-04	2.37E-05	2.37E-05	5.69E-08	4.99E-07
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.48E+05**	**9.48E+05**	**-5.21E+04**	**-1.25E+02**	**-1.10E+03**
TOTAL TRU	**8.00E+04**	**8.00E+04**	**6.92E+04**	**6.89E+04**	**-1.11E+04**	**-2.67E+01**	**-2.34E+02**
TOTAL PU	**7.00E+04**	**6.97E+04**	**6.00E+04**	**5.70E+04**	**-1.30E+04**	**-3.12E+01**	**-2.73E+02**
TOTAL NP	**3.87E+03**	**3.87E+03**	**2.41E+03**	**2.48E+03**	**-1.38E+03**	**-3.33E+00**	**-2.91E+01**
TOTAL AM	**5.74E+03**	**6.04E+03**	**4.45E+03**	**7.94E+03**	**2.21E+03**	**5.31E+00**	**4.65E+01**
TOTAL CM	**4.05E+02**	**3.91E+02**	**2.37E+03**	**1.46E+03**	**1.05E+03**	**2.53E+00**	**2.22E+01**
TOTAL CF	**0.00E+00**	**1.05E-14**	**3.78E-03**	**6.04E-03**	**6.04E-03**	**1.45E-05**	**1.27E-04**

MOXUE_8PuNpAmCm_540U5_2.out							
	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	1.13E-06	3.90E+01	1.84E+02	7.57E+02	7.57E+02	1.82E+00	1.59E+01
u235	4.97E+04	4.97E+04	2.76E+04	2.76E+04	-2.21E+04	-5.31E+01	-4.65E+02
u236	1.13E-06	1.99E+00	5.06E+03	5.08E+03	5.08E+03	1.22E+01	1.07E+02
u238	8.70E+05	8.70E+05	8.42E+05	8.42E+05	-2.83E+04	-6.80E+01	-5.96E+02
np237	3.02E+03	3.03E+03	2.15E+03	2.23E+03	-7.90E+02	-1.90E+00	-1.66E+01
pu238	5.04E+03	5.00E+03	7.26E+03	7.13E+03	2.08E+03	5.01E+00	4.38E+01
pu239	2.91E+04	2.91E+04	2.20E+04	2.21E+04	-7.01E+03	-1.68E+01	-1.48E+02
pu240	1.92E+04	1.92E+04	1.57E+04	1.65E+04	-2.65E+03	-6.37E+00	-5.58E+01
pu241	6.69E+03	6.37E+03	9.14E+03	5.64E+03	-1.05E+03	-2.52E+00	-2.20E+01
pu242	6.75E+03	6.75E+03	7.20E+03	7.20E+03	4.45E+02	1.07E+00	9.37E+00
pu244	5.94E-30	2.17E-07	1.63E-01	1.63E-01	1.63E-01	3.93E-04	3.44E-03
am241	6.34E+03	6.65E+03	2.85E+03	6.28E+03	-6.70E+01	-1.61E-01	-1.41E+00
am242m	7.88E+01	7.84E+01	1.11E+02	1.05E+02	2.64E+01	6.34E-02	5.55E-01
am242	4.56E-13	1.01E-03	2.09E+00	1.36E-03	1.36E-03	3.26E-06	2.86E-05
am243	2.32E+03	2.32E+03	2.79E+03	2.79E+03	4.66E+02	1.12E+00	9.81E+00
cm242	2.05E-01	2.04E-01	4.50E+02	2.74E-01	6.89E-02	1.66E-04	1.45E-03
cm243	1.89E+01	1.84E+01	3.26E+01	2.55E+01	6.64E+00	1.60E-02	1.40E-01
cm244	1.20E+03	1.16E+03	2.69E+03	1.84E+03	6.33E+02	1.52E+00	1.33E+01
cm245	2.62E+02	2.62E+02	4.89E+02	4.88E+02	2.26E+02	5.44E-01	4.76E+00
cm246	2.88E+01	2.88E+01	8.67E+01	8.66E+01	5.78E+01	1.39E-01	1.22E+00
cm247	1.08E+00	1.08E+00	4.76E+00	4.76E+00	3.68E+00	8.84E-03	7.74E-02
cm248	1.18E-01	1.18E-01	7.46E-01	7.49E-01	6.31E-01	1.52E-03	1.33E-02
cf249	0.00E+00	2.53E-13	1.40E-02	3.49E-02	3.49E-02	8.38E-05	7.34E-04
cf250	0.00E+00	5.51E-26	6.62E-03	3.90E-03	3.90E-03	9.38E-06	8.21E-05
cf251	0.00E+00	5.64E-37	5.70E-03	5.66E-03	5.66E-03	1.36E-05	1.19E-04
cf252	0.00E+00	0.00E+00	3.63E-03	2.65E-04	2.65E-04	6.36E-07	5.57E-06
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.48E+05**	**9.48E+05**	**-5.22E+04**	**-1.25E+02**	**-1.10E+03**
TOTAL TRU	**8.00E+04**	**7.99E+04**	**7.29E+04**	**7.24E+04**	**-7.62E+03**	**-1.83E+01**	**-1.60E+02**
TOTAL PU	**6.67E+04**	**6.64E+04**	**6.13E+04**	**5.85E+04**	**-8.18E+03**	**-1.97E+01**	**-1.72E+02**
TOTAL NP	**3.02E+03**	**3.03E+03**	**2.15E+03**	**2.23E+03**	**-7.90E+02**	**-1.90E+00**	**-1.66E+01**
TOTAL AM	**8.74E+03**	**9.04E+03**	**5.75E+03**	**9.17E+03**	**4.25E+02**	**1.02E+00**	**8.95E+00**
TOTAL CM	**1.51E+03**	**1.47E+03**	**3.76E+03**	**2.44E+03**	**9.28E+02**	**2.23E+00**	**1.95E+01**
TOTAL CF	**0.00E+00**	**2.53E-13**	**2.99E-02**	**4.47E-02**	**4.47E-02**	**1.07E-04**	**9.41E-04**

MOXUE_8PuNpAmCm_600U5_3.out							
	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	1.13E-06	5.65E+01	2.40E+02	9.25E+02	9.25E+02	2.22E+00	1.95E+01
u235	5.52E+04	5.52E+04	3.09E+04	3.09E+04	-2.43E+04	-5.84E+01	-5.12E+02
u236	1.13E-06	1.90E+00	5.58E+03	5.60E+03	5.59E+03	1.34E+01	1.18E+02
u238	8.65E+05	8.65E+05	8.37E+05	8.37E+05	-2.80E+04	-6.73E+01	-5.89E+02
np237	2.60E+03	2.61E+03	1.97E+03	2.06E+03	-5.42E+02	-1.30E+00	-1.14E+01
pu238	7.30E+03	7.24E+03	8.74E+03	8.51E+03	1.21E+03	2.90E+00	2.54E+01
pu239	2.57E+04	2.57E+04	2.12E+04	2.12E+04	-4.43E+03	-1.06E+01	-9.32E+01
pu240	1.82E+04	1.83E+04	1.48E+04	1.58E+04	-2.39E+03	-5.74E+00	-5.03E+01
pu241	6.28E+03	5.98E+03	8.73E+03	5.38E+03	-8.95E+02	-2.15E+00	-1.88E+01
pu242	7.71E+03	7.71E+03	7.88E+03	7.88E+03	1.73E+02	4.16E-01	3.64E+00
pu244	3.78E-29	1.38E-06	1.70E-01	1.70E-01	1.70E-01	4.07E-04	3.57E-03
am241	6.70E+03	6.99E+03	2.93E+03	6.19E+03	-5.10E+02	-1.23E+00	-1.07E+01
am242m	1.06E+02	1.05E+02	1.15E+02	1.09E+02	3.60E+00	8.65E-03	7.58E-02
am242	4.56E-13	1.36E-03	2.12E+00	1.41E-03	1.41E-03	3.39E-06	2.97E-05
am243	2.90E+03	2.90E+03	3.14E+03	3.13E+03	2.32E+02	5.57E-01	4.88E+00
cm242	2.75E-01	2.74E-01	4.58E+02	2.85E-01	9.30E-03	2.23E-05	1.96E-04
cm243	2.59E+01	2.53E+01	3.50E+01	2.74E+01	1.52E+00	3.65E-03	3.20E-02
cm244	1.87E+03	1.80E+03	3.38E+03	2.30E+03	4.33E+02	1.04E+00	9.11E+00
cm245	4.92E+02	4.92E+02	6.57E+02	6.56E+02	1.65E+02	3.95E-01	3.46E+00
cm246	8.70E+01	8.70E+01	1.69E+02	1.69E+02	8.19E+01	1.97E-01	1.72E+00
cm247	4.77E+00	4.77E+00	1.19E+01	1.19E+01	7.11E+00	1.71E-02	1.50E-01
cm248	7.50E-01	7.50E-01	2.54E+00	2.56E+00	1.81E+00	4.34E-03	3.80E-02
cf249	0.00E+00	1.59E-12	5.68E-02	1.32E-01	1.32E-01	3.18E-04	2.78E-03
cf250	0.00E+00	3.47E-25	2.53E-02	1.49E-02	1.49E-02	3.59E-05	3.14E-04
cf251	0.00E+00	3.54E-36	2.31E-02	2.29E-02	2.29E-02	5.50E-05	4.82E-04
cf252	0.00E+00	0.00E+00	1.64E-02	1.19E-03	1.19E-03	2.87E-06	2.51E-05
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.47E+05**	**9.48E+05**	**-5.23E+04**	**-1.26E+02**	**-1.10E+03**
TOTAL TRU	**8.00E+04**	**7.99E+04**	**7.42E+04**	**7.35E+04**	**-6.46E+03**	**-1.55E+01**	**-1.36E+02**
TOTAL PU	**6.52E+04**	**6.49E+04**	**6.13E+04**	**5.89E+04**	**-6.33E+03**	**-1.52E+01**	**-1.33E+02**
TOTAL NP	**2.60E+03**	**2.61E+03**	**1.97E+03**	**2.06E+03**	**-5.42E+02**	**-1.30E+00**	**-1.14E+01**
TOTAL AM	**9.71E+03**	**1.00E+04**	**6.18E+03**	**9.44E+03**	**-2.74E+02**	**-6.59E-01**	**-5.78E+00**
TOTAL CM	**2.48E+03**	**2.41E+03**	**4.71E+03**	**3.17E+03**	**6.90E+02**	**1.66E+00**	**1.45E+01**
TOTAL CF	**0.00E+00**	**1.59E-12**	**1.22E-01**	**1.71E-01**	**1.71E-01**	**4.12E-04**	**3.61E-03**

MOXUE_8PuNpAmCm_613U5_4.out							
	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	1.13E-06	6.69E+01	2.72E+02	1.01E+03	1.01E+03	2.44E+00	2.13E+01
u235	5.64E+04	5.64E+04	3.15E+04	3.15E+04	-2.49E+04	-5.99E+01	-5.25E+02
u236	1.13E-06	1.80E+00	5.71E+03	5.72E+03	5.72E+03	1.37E+01	1.20E+02
u238	8.63E+05	8.63E+05	8.35E+05	8.35E+05	-2.80E+04	-6.73E+01	-5.89E+02
np237	2.37E+03	2.38E+03	1.86E+03	1.94E+03	-4.29E+02	-1.03E+00	-9.03E+00
pu238	8.66E+03	8.59E+03	9.52E+03	9.21E+03	5.53E+02	1.33E+00	1.16E+01
pu239	2.43E+04	2.43E+04	2.08E+04	2.08E+04	-3.49E+03	-8.39E+00	-7.35E+01
pu240	1.73E+04	1.74E+04	1.42E+04	1.53E+04	-1.97E+03	-4.73E+00	-4.15E+01
pu241	5.93E+03	5.65E+03	8.41E+03	5.19E+03	-7.38E+02	-1.77E+00	-1.55E+01
pu242	8.31E+03	8.31E+03	8.28E+03	8.28E+03	-3.50E+01	-8.41E-02	-7.37E-01
pu244	1.29E-28	4.70E-06	1.75E-01	1.75E-01	1.75E-01	4.20E-04	3.68E-03
am241	6.56E+03	6.83E+03	2.82E+03	5.97E+03	-5.89E+02	-1.42E+00	-1.24E+01
am242m	1.10E+02	1.09E+02	1.11E+02	1.05E+02	-4.50E+00	-1.08E-02	-9.47E-02
am242	4.56E-13	1.41E-03	2.05E+00	1.36E-03	1.36E-03	3.26E-06	2.86E-05
am243	3.23E+03	3.23E+03	3.33E+03	3.33E+03	9.60E+01	2.31E-01	2.02E+00
cm242	2.86E-01	2.85E-01	4.45E+02	2.74E-01	-1.16E-02	-2.79E-05	-2.44E-04
cm243	2.77E+01	2.71E+01	3.47E+01	2.72E+01	-5.30E-01	-1.27E-03	-1.12E-02
cm244	2.33E+03	2.25E+03	3.84E+03	2.62E+03	2.84E+02	6.82E-01	5.98E+00
cm245	6.59E+02	6.59E+02	7.65E+02	7.64E+02	1.05E+02	2.52E-01	2.21E+00
cm246	1.69E+02	1.69E+02	2.64E+02	2.64E+02	9.45E+01	2.27E-01	1.99E+00
cm247	1.19E+01	1.19E+01	2.20E+01	2.20E+01	1.01E+01	2.42E-02	2.12E-01
cm248	2.56E+00	2.56E+00	6.07E+00	6.11E+00	3.56E+00	8.54E-03	7.48E-02
cf249	0.00E+00	5.42E-12	1.51E-01	3.38E-01	3.38E-01	8.13E-04	7.12E-03
cf250	0.00E+00	1.19E-24	6.56E-02	3.87E-02	3.87E-02	9.30E-05	8.15E-04
cf251	0.00E+00	1.22E-35	6.16E-02	6.12E-02	6.12E-02	1.47E-04	1.29E-03
cf252	0.00E+00	0.00E+00	4.74E-02	3.45E-03	3.45E-03	8.29E-06	7.27E-05
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.47E+05**	**9.47E+05**	**-5.23E+04**	**-1.26E+02**	**-1.10E+03**
TOTAL TRU	**8.00E+04**	**7.99E+04**	**7.46E+04**	**7.39E+04**	**-6.11E+03**	**-1.47E+01**	**-1.29E+02**
TOTAL PU	**6.45E+04**	**6.42E+04**	**6.11E+04**	**5.88E+04**	**-5.68E+03**	**-1.36E+01**	**-1.20E+02**
TOTAL NP	**2.37E+03**	**2.38E+03**	**1.86E+03**	**1.94E+03**	**-4.29E+02**	**-1.03E+00**	**-9.03E+00**
TOTAL AM	**9.90E+03**	**1.02E+04**	**6.27E+03**	**9.40E+03**	**-4.97E+02**	**-1.20E+00**	**-1.05E+01**
TOTAL CM	**3.20E+03**	**3.12E+03**	**5.37E+03**	**3.70E+03**	**4.96E+02**	**1.19E+00**	**1.05E+01**
TOTAL CF	**0.00E+00**	**5.42E-12**	**3.26E-01**	**4.42E-01**	**4.42E-01**	**1.06E-03**	**9.29E-03**

MOXUE_8PuNpAmCm_615U5_5.out							
	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	1.13E-06	7.23E+01	2.87E+02	1.05E+03	1.05E+03	2.53E+00	2.21E+01
u235	5.66E+04	5.66E+04	3.15E+04	3.15E+04	-2.51E+04	-6.03E+01	-5.28E+02
u236	1.13E-06	1.74E+00	5.74E+03	5.75E+03	5.75E+03	1.38E+01	1.21E+02
u238	8.63E+05	8.63E+05	8.35E+05	8.35E+05	-2.79E+04	-6.70E+01	-5.87E+02
np237	2.24E+03	2.25E+03	1.79E+03	1.87E+03	-3.68E+02	-8.84E-01	-7.75E+00
pu238	9.35E+03	9.28E+03	9.84E+03	9.49E+03	1.46E+02	3.51E-01	3.07E+00
pu239	2.37E+04	2.37E+04	2.05E+04	2.06E+04	-3.14E+03	-7.55E+00	-6.61E+01
pu240	1.67E+04	1.68E+04	1.38E+04	1.51E+04	-1.66E+03	-3.99E+00	-3.49E+01
pu241	5.70E+03	5.43E+03	8.22E+03	5.07E+03	-6.31E+02	-1.52E+00	-1.33E+01
pu242	8.69E+03	8.69E+03	8.51E+03	8.51E+03	-1.72E+02	-4.13E-01	-3.62E+00
pu244	3.08E-28	1.12E-05	1.78E-01	1.79E-01	1.79E-01	4.29E-04	3.76E-03
am241	6.31E+03	6.57E+03	2.70E+03	5.78E+03	-5.33E+02	-1.28E+00	-1.12E+01
am242m	1.06E+02	1.05E+02	1.06E+02	1.01E+02	-5.10E+00	-1.23E-02	-1.07E-01
am242	4.56E-13	1.36E-03	1.98E+00	1.30E-03	1.30E-03	3.12E-06	2.73E-05
am243	3.42E+03	3.42E+03	3.44E+03	3.44E+03	1.60E+01	3.84E-02	3.37E-01
cm242	2.75E-01	2.74E-01	4.30E+02	2.62E-01	-1.31E-02	-3.15E-05	-2.76E-04
cm243	2.75E+01	2.68E+01	3.37E+01	2.64E+01	-1.08E+00	-2.60E-03	-2.27E-02
cm244	2.65E+03	2.55E+03	4.13E+03	2.82E+03	1.74E+02	4.18E-01	3.66E+00
cm245	7.67E+02	7.67E+02	8.31E+02	8.30E+02	6.37E+01	1.53E-01	1.34E+00
cm246	2.64E+02	2.64E+02	3.62E+02	3.62E+02	9.77E+01	2.35E-01	2.06E+00
cm247	2.20E+01	2.20E+01	3.40E+01	3.40E+01	1.20E+01	2.89E-02	2.53E-01
cm248	6.11E+00	6.11E+00	1.16E+01	1.17E+01	5.57E+00	1.34E-02	1.17E-01
cf249	0.00E+00	1.30E-11	3.10E-01	6.76E-01	6.76E-01	1.63E-03	1.42E-02
cf250	0.00E+00	2.87E-24	1.33E-01	7.83E-02	7.83E-02	1.88E-04	1.65E-03
cf251	0.00E+00	2.93E-35	1.27E-01	1.26E-01	1.26E-01	3.03E-04	2.65E-03
cf252	0.00E+00	0.00E+00	1.03E-01	7.50E-03	7.50E-03	1.80E-05	1.58E-04
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.48E+05**	**9.48E+05**	**-5.22E+04**	**-1.25E+02**	**-1.10E+03**
TOTAL TRU	**8.00E+04**	**7.99E+04**	**7.47E+04**	**7.40E+04**	**-5.99E+03**	**-1.44E+01**	**-1.26E+02**
TOTAL PU	**6.42E+04**	**6.39E+04**	**6.09E+04**	**5.87E+04**	**-5.46E+03**	**-1.31E+01**	**-1.15E+02**
TOTAL NP	**2.24E+03**	**2.25E+03**	**1.79E+03**	**1.87E+03**	**-3.68E+02**	**-8.84E-01**	**-7.75E+00**
TOTAL AM	**9.84E+03**	**1.01E+04**	**6.25E+03**	**9.32E+03**	**-5.22E+02**	**-1.25E+00**	**-1.10E+01**
TOTAL CM	**3.73E+03**	**3.63E+03**	**5.83E+03**	**4.08E+03**	**3.52E+02**	**8.46E-01**	**7.41E+00**
TOTAL CF	**0.00E+00**	**1.30E-11**	**6.72E-01**	**8.88E-01**	**8.88E-01**	**2.13E-03**	**1.87E-02**

MOXUE_8PuNpAmCm_616U5_6.out							
	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	1.13E-06	7.45E+01	2.93E+02	1.06E+03	1.06E+03	2.55E+00	2.24E+01
u235	5.67E+04	5.67E+04	3.15E+04	3.15E+04	-2.52E+04	-6.06E+01	-5.30E+02
u236	1.13E-06	1.71E+00	5.75E+03	5.77E+03	5.77E+03	1.39E+01	1.21E+02
u238	8.63E+05	8.63E+05	8.35E+05	8.35E+05	-2.79E+04	-6.70E+01	-5.87E+02
np237	2.16E+03	2.17E+03	1.75E+03	1.82E+03	-3.33E+02	-8.00E-01	-7.01E+00
pu238	9.63E+03	9.56E+03	9.93E+03	9.56E+03	-6.60E+01	-1.59E-01	-1.39E+00
pu239	2.34E+04	2.34E+04	2.04E+04	2.05E+04	-2.99E+03	-7.18E+00	-6.29E+01
pu240	1.64E+04	1.65E+04	1.36E+04	1.49E+04	-1.48E+03	-3.56E+00	-3.12E+01
pu241	5.57E+03	5.31E+03	8.12E+03	5.01E+03	-5.65E+02	-1.36E+00	-1.19E+01
pu242	8.91E+03	8.91E+03	8.65E+03	8.66E+03	-2.58E+02	-6.20E-01	-5.43E+00
pu244	5.88E-28	2.15E-05	1.81E-01	1.81E-01	1.81E-01	4.35E-04	3.81E-03
am241	6.12E+03	6.37E+03	2.62E+03	5.66E+03	-4.57E+02	-1.10E+00	-9.62E+00
am242m	1.01E+02	1.00E+02	1.02E+02	9.72E+01	-3.68E+00	-8.84E-03	-7.75E-02
am242	4.56E-13	1.30E-03	1.93E+00	1.25E-03	1.25E-03	3.01E-06	2.64E-05
am243	3.53E+03	3.53E+03	3.50E+03	3.50E+03	-2.90E+01	-6.97E-02	-6.10E-01
cm242	2.63E-01	2.62E-01	4.18E+02	2.53E-01	-9.50E-03	-2.28E-05	-2.00E-04
cm243	2.67E+01	2.60E+01	3.27E+01	2.57E+01	-1.00E+00	-2.40E-03	-2.10E-02
cm244	2.85E+03	2.74E+03	4.32E+03	2.95E+03	9.90E+01	2.38E-01	2.08E+00
cm245	8.33E+02	8.33E+02	8.71E+02	8.71E+02	3.77E+01	9.06E-02	7.94E-01
cm246	3.62E+02	3.62E+02	4.58E+02	4.57E+02	9.51E+01	2.29E-01	2.00E+00
cm247	3.40E+01	3.40E+01	4.69E+01	4.69E+01	1.29E+01	3.11E-02	2.72E-01
cm248	1.17E+01	1.17E+01	1.90E+01	1.92E+01	7.52E+00	1.81E-02	1.58E-01
cf249	0.00E+00	2.47E-11	5.35E-01	1.15E+00	1.15E+00	2.76E-03	2.42E-02
cf250	0.00E+00	5.51E-24	2.27E-01	1.34E-01	1.34E-01	3.21E-04	2.81E-03
cf251	0.00E+00	5.62E-35	2.20E-01	2.18E-01	2.18E-01	5.24E-04	4.59E-03
cf252	0.00E+00	0.00E+00	1.85E-01	1.34E-02	1.34E-02	3.23E-05	2.83E-04
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.48E+05**	**9.48E+05**	**-5.22E+04**	**-1.25E+02**	**-1.10E+03**
TOTAL TRU	**8.00E+04**	**7.99E+04**	**7.48E+04**	**7.41E+04**	**-5.93E+03**	**-1.42E+01**	**-1.25E+02**
TOTAL PU	**6.40E+04**	**6.37E+04**	**6.07E+04**	**5.86E+04**	**-5.36E+03**	**-1.29E+01**	**-1.13E+02**
TOTAL NP	**2.16E+03**	**2.17E+03**	**1.75E+03**	**1.82E+03**	**-3.33E+02**	**-8.00E-01**	**-7.01E+00**
TOTAL AM	**9.75E+03**	**1.00E+04**	**6.23E+03**	**9.26E+03**	**-4.90E+02**	**-1.18E+00**	**-1.03E+01**
TOTAL CM	**4.11E+03**	**4.01E+03**	**6.16E+03**	**4.36E+03**	**2.51E+02**	**6.04E-01**	**5.29E+00**
TOTAL CF	**0.00E+00**	**2.47E-11**	**1.17E+00**	**1.51E+00**	**1.51E+00**	**3.64E-03**	**3.19E-02**

MOXUE_8PuNpAmCm_616U5_7.out							
	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	1.13E-06	7.50E+01	2.94E+02	1.06E+03	1.06E+03	2.55E+00	2.24E+01
u235	5.67E+04	5.67E+04	3.14E+04	3.14E+04	-2.52E+04	-6.06E+01	-5.31E+02
u236	1.13E-06	1.69E+00	5.76E+03	5.77E+03	5.77E+03	1.39E+01	1.21E+02
u238	8.63E+05	8.63E+05	8.35E+05	8.35E+05	-2.79E+04	-6.70E+01	-5.87E+02
np237	2.11E+03	2.12E+03	1.72E+03	1.80E+03	-3.13E+02	-7.52E-01	-6.59E+00
pu238	9.70E+03	9.62E+03	9.91E+03	9.54E+03	-1.58E+02	-3.80E-01	-3.33E+00
pu239	2.33E+04	2.33E+04	2.03E+04	2.04E+04	-2.92E+03	-7.02E+00	-6.15E+01
pu240	1.63E+04	1.64E+04	1.35E+04	1.49E+04	-1.40E+03	-3.36E+00	-2.95E+01
pu241	5.51E+03	5.25E+03	8.07E+03	4.98E+03	-5.28E+02	-1.27E+00	-1.11E+01
pu242	9.05E+03	9.05E+03	8.74E+03	8.75E+03	-3.05E+02	-7.33E-01	-6.42E+00
pu244	9.67E-28	3.53E-05	1.82E-01	1.82E-01	1.82E-01	4.38E-04	3.84E-03
am241	6.00E+03	6.25E+03	2.57E+03	5.59E+03	-4.01E+02	-9.64E-01	-8.44E+00
am242m	9.76E+01	9.71E+01	1.00E+02	9.52E+01	-2.39E+00	-5.74E-03	-5.03E-02
am242	4.56E-13	1.25E-03	1.90E+00	1.23E-03	1.23E-03	2.95E-06	2.58E-05
am243	3.59E+03	3.59E+03	3.54E+03	3.54E+03	-5.40E+01	-1.30E-01	-1.14E+00
cm242	2.54E-01	2.53E-01	4.11E+02	2.48E-01	-6.20E-03	-1.49E-05	-1.31E-04
cm243	2.59E+01	2.53E+01	3.21E+01	2.52E+01	-7.50E-01	-1.80E-03	-1.58E-02
cm244	2.97E+03	2.86E+03	4.43E+03	3.02E+03	5.10E+01	1.23E-01	1.07E+00
cm245	8.73E+02	8.73E+02	8.96E+02	8.95E+02	2.17E+01	5.21E-02	4.57E-01
cm246	4.58E+02	4.58E+02	5.48E+02	5.47E+02	8.92E+01	2.14E-01	1.88E+00
cm247	4.69E+01	4.69E+01	5.99E+01	6.00E+01	1.30E+01	3.13E-02	2.74E-01
cm248	1.92E+01	1.92E+01	2.81E+01	2.84E+01	9.18E+00	2.21E-02	1.93E-01
cf249	0.00E+00	4.07E-11	8.19E-01	1.74E+00	1.74E+00	4.17E-03	3.66E-02
cf250	0.00E+00	9.09E-24	3.45E-01	2.03E-01	2.03E-01	4.89E-04	4.28E-03
cf251	0.00E+00	9.25E-35	3.37E-01	3.35E-01	3.35E-01	8.04E-04	7.04E-03
cf252	0.00E+00	0.00E+00	2.90E-01	2.12E-02	2.12E-02	5.08E-05	4.45E-04
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.48E+05**	**9.48E+05**	**-5.22E+04**	**-1.25E+02**	**-1.10E+03**
TOTAL TRU	**8.00E+04**	**7.99E+04**	**7.49E+04**	**7.41E+04**	**-5.90E+03**	**-1.42E+01**	**-1.24E+02**
TOTAL PU	**6.38E+04**	**6.36E+04**	**6.05E+04**	**5.85E+04**	**-5.31E+03**	**-1.28E+01**	**-1.12E+02**
TOTAL NP	**2.11E+03**	**2.12E+03**	**1.72E+03**	**1.80E+03**	**-3.13E+02**	**-7.52E-01**	**-6.59E+00**
TOTAL AM	**9.69E+03**	**9.93E+03**	**6.22E+03**	**9.23E+03**	**-4.57E+02**	**-1.10E+00**	**-9.63E+00**
TOTAL CM	**4.39E+03**	**4.28E+03**	**6.40E+03**	**4.58E+03**	**1.83E+02**	**4.41E-01**	**3.86E+00**
TOTAL CF	**0.00E+00**	**4.07E-11**	**1.79E+00**	**2.30E+00**	**2.30E+00**	**5.52E-03**	**4.83E-02**

MOXUE_8PuNpAmCm_612U5_8.out							
	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	1.13E-06	7.48E+01	2.92E+02	1.06E+03	1.06E+03	2.54E+00	2.22E+01
u235	5.63E+04	5.63E+04	3.11E+04	3.11E+04	-2.52E+04	-6.04E+01	-5.29E+02
u236	1.13E-06	1.69E+00	5.73E+03	5.74E+03	5.74E+03	1.38E+01	1.21E+02
u238	8.64E+05	8.64E+05	8.36E+05	8.36E+05	-2.80E+04	-6.73E+01	-5.89E+02
np237	2.08E+03	2.09E+03	1.71E+03	1.78E+03	-3.03E+02	-7.28E-01	-6.38E+00
pu238	9.67E+03	9.60E+03	9.85E+03	9.48E+03	-1.90E+02	-4.57E-01	-4.00E+00
pu239	2.32E+04	2.32E+04	2.02E+04	2.03E+04	-2.89E+03	-6.94E+00	-6.08E+01
pu240	1.62E+04	1.63E+04	1.35E+04	1.49E+04	-1.35E+03	-3.24E+00	-2.84E+01
pu241	5.47E+03	5.22E+03	8.04E+03	4.96E+03	-5.13E+02	-1.23E+00	-1.08E+01
pu242	9.14E+03	9.14E+03	8.81E+03	8.81E+03	-3.30E+02	-7.93E-01	-6.95E+00
pu244	1.43E-27	5.22E-05	1.83E-01	1.84E-01	1.84E-01	4.43E-04	3.88E-03
am241	5.93E+03	6.17E+03	2.54E+03	5.55E+03	-3.77E+02	-9.06E-01	-7.94E+00
am242m	9.56E+01	9.51E+01	9.84E+01	9.37E+01	-1.86E+00	-4.47E-03	-3.92E-02
am242	4.56E-13	1.23E-03	1.88E+00	1.21E-03	1.21E-03	2.91E-06	2.54E-05
am243	3.63E+03	3.63E+03	3.56E+03	3.56E+03	-6.70E+01	-1.61E-01	-1.41E+00
cm242	2.49E-01	2.48E-01	4.08E+02	2.44E-01	-4.70E-03	-1.13E-05	-9.89E-05
cm243	2.55E+01	2.49E+01	3.18E+01	2.49E+01	-5.30E-01	-1.27E-03	-1.12E-02
cm244	3.05E+03	2.93E+03	4.50E+03	3.07E+03	2.40E+01	5.77E-02	5.05E-01
cm245	8.97E+02	8.97E+02	9.10E+02	9.09E+02	1.15E+01	2.76E-02	2.42E-01
cm246	5.47E+02	5.47E+02	6.30E+02	6.29E+02	8.23E+01	1.98E-01	1.73E+00
cm247	6.00E+01	6.00E+01	7.25E+01	7.25E+01	1.26E+01	3.03E-02	2.65E-01
cm248	2.84E+01	2.84E+01	3.85E+01	3.89E+01	1.05E+01	2.52E-02	2.21E-01
cf249	0.00E+00	6.02E-11	1.15E+00	2.42E+00	2.42E+00	5.81E-03	5.09E-02
cf250	0.00E+00	1.35E-23	4.83E-01	2.85E-01	2.85E-01	6.84E-04	5.99E-03
cf251	0.00E+00	1.38E-34	4.75E-01	4.71E-01	4.71E-01	1.13E-03	9.92E-03
cf252	0.00E+00	0.00E+00	4.18E-01	3.04E-02	3.04E-02	7.31E-05	6.41E-04
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.48E+05**	**9.48E+05**	**-5.22E+04**	**-1.26E+02**	**-1.10E+03**
TOTAL TRU	**8.00E+04**	**7.99E+04**	**7.49E+04**	**7.41E+04**	**-5.88E+03**	**-1.41E+01**	**-1.24E+02**
TOTAL PU	**6.36E+04**	**6.34E+04**	**6.03E+04**	**5.84E+04**	**-5.27E+03**	**-1.27E+01**	**-1.11E+02**
TOTAL NP	**2.08E+03**	**2.09E+03**	**1.71E+03**	**1.78E+03**	**-3.03E+02**	**-7.28E-01**	**-6.38E+00**
TOTAL AM	**9.65E+03**	**9.90E+03**	**6.20E+03**	**9.20E+03**	**-4.46E+02**	**-1.07E+00**	**-9.39E+00**
TOTAL CM	**4.61E+03**	**4.49E+03**	**6.59E+03**	**4.75E+03**	**1.40E+02**	**3.37E-01**	**2.95E+00**
TOTAL CF	**0.00E+00**	**6.02E-11**	**2.53E+00**	**3.21E+00**	**3.21E+00**	**7.70E-03**	**6.75E-02**

MOXUE_8PuNpAmCm_612U5_9.out							
	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	1.13E-06	7.44E+01	2.91E+02	1.05E+03	1.05E+03	2.52E+00	2.21E+01
u235	5.63E+04	5.63E+04	3.11E+04	3.11E+04	-2.52E+04	-6.05E+01	-5.30E+02
u236	1.13E-06	1.69E+00	5.73E+03	5.75E+03	5.75E+03	1.38E+01	1.21E+02
u238	8.64E+05	8.64E+05	8.36E+05	8.36E+05	-2.80E+04	-6.73E+01	-5.89E+02
np237	2.07E+03	2.07E+03	1.70E+03	1.77E+03	-2.95E+02	-7.09E-01	-6.21E+00
pu238	9.62E+03	9.54E+03	9.79E+03	9.42E+03	-1.95E+02	-4.69E-01	-4.10E+00
pu239	2.31E+04	2.31E+04	2.01E+04	2.02E+04	-2.86E+03	-6.87E+00	-6.02E+01
pu240	1.62E+04	1.63E+04	1.34E+04	1.48E+04	-1.34E+03	-3.22E+00	-2.82E+01
pu241	5.45E+03	5.20E+03	8.02E+03	4.95E+03	-5.03E+02	-1.21E+00	-1.06E+01
pu242	9.20E+03	9.20E+03	8.85E+03	8.85E+03	-3.48E+02	-8.36E-01	-7.33E+00
pu244	1.96E-27	7.15E-05	1.84E-01	1.85E-01	1.85E-01	4.45E-04	3.90E-03
am241	5.88E+03	6.13E+03	2.52E+03	5.53E+03	-3.55E+02	-8.53E-01	-7.47E+00
am242m	9.41E+01	9.36E+01	9.76E+01	9.29E+01	-1.15E+00	-2.76E-03	-2.42E-02
am242	4.56E-13	1.21E-03	1.87E+00	1.20E-03	1.20E-03	2.88E-06	2.52E-05
am243	3.65E+03	3.65E+03	3.58E+03	3.58E+03	-7.50E+01	-1.80E-01	-1.58E+00
cm242	2.45E-01	2.44E-01	4.05E+02	2.42E-01	-2.90E-03	-6.97E-06	-6.10E-05
cm243	2.52E+01	2.46E+01	3.16E+01	2.48E+01	-4.50E-01	-1.08E-03	-9.47E-03
cm244	3.10E+03	2.98E+03	4.55E+03	3.10E+03	3.00E+00	7.21E-03	6.31E-02
cm245	9.11E+02	9.11E+02	9.18E+02	9.18E+02	6.30E+00	1.51E-02	1.33E-01
cm246	6.30E+02	6.30E+02	7.05E+02	7.04E+02	7.45E+01	1.79E-01	1.57E+00
cm247	7.26E+01	7.26E+01	8.44E+01	8.44E+01	1.18E+01	2.85E-02	2.49E-01
cm248	3.89E+01	3.89E+01	4.97E+01	5.02E+01	1.14E+01	2.73E-02	2.39E-01
cf249	0.00E+00	8.24E-11	1.52E+00	3.17E+00	3.17E+00	7.61E-03	6.67E-02
cf250	0.00E+00	1.85E-23	6.34E-01	3.74E-01	3.74E-01	8.98E-04	7.87E-03
cf251	0.00E+00	1.89E-34	6.27E-01	6.22E-01	6.22E-01	1.49E-03	1.31E-02
cf252	0.00E+00	0.00E+00	5.59E-01	4.07E-02	4.07E-02	9.79E-05	8.57E-04
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.48E+05**	**9.48E+05**	**-5.22E+04**	**-1.26E+02**	**-1.10E+03**
TOTAL TRU	**8.00E+04**	**7.99E+04**	**7.49E+04**	**7.41E+04**	**-5.86E+03**	**-1.41E+01**	**-1.23E+02**
TOTAL PU	**6.35E+04**	**6.33E+04**	**6.02E+04**	**5.83E+04**	**-5.25E+03**	**-1.26E+01**	**-1.10E+02**
TOTAL NP	**2.07E+03**	**2.07E+03**	**1.70E+03**	**1.77E+03**	**-2.95E+02**	**-7.09E-01**	**-6.21E+00**
TOTAL AM	**9.63E+03**	**9.87E+03**	**6.20E+03**	**9.20E+03**	**-4.31E+02**	**-1.04E+00**	**-9.08E+00**
TOTAL CM	**4.78E+03**	**4.66E+03**	**6.74E+03**	**4.88E+03**	**1.07E+02**	**2.56E-01**	**2.24E+00**
TOTAL CF	**0.00E+00**	**8.24E-11**	**3.34E+00**	**4.20E+00**	**4.20E+00**	**1.01E-02**	**8.85E-02**

MOXUE_8PuNpAmCm_612U5_10.out							
	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	1.13E-06	7.39E+01	2.89E+02	1.04E+03	1.04E+03	2.51E+00	2.20E+01
u235	5.63E+04	5.63E+04	3.11E+04	3.11E+04	-2.52E+04	-6.05E+01	-5.30E+02
u236	1.13E-06	1.68E+00	5.73E+03	5.75E+03	5.75E+03	1.38E+01	1.21E+02
u238	8.64E+05	8.64E+05	8.36E+05	8.36E+05	-2.80E+04	-6.73E+01	-5.89E+02
np237	2.05E+03	2.06E+03	1.69E+03	1.76E+03	-2.90E+02	-6.97E-01	-6.10E+00
pu238	9.56E+03	9.48E+03	9.73E+03	9.37E+03	-1.87E+02	-4.49E-01	-3.94E+00
pu239	2.30E+04	2.30E+04	2.01E+04	2.02E+04	-2.83E+03	-6.80E+00	-5.96E+01
pu240	1.62E+04	1.63E+04	1.34E+04	1.48E+04	-1.34E+03	-3.22E+00	-2.82E+01
pu241	5.44E+03	5.19E+03	8.01E+03	4.95E+03	-4.98E+02	-1.20E+00	-1.05E+01
pu242	9.24E+03	9.24E+03	8.88E+03	8.89E+03	-3.59E+02	-8.63E-01	-7.56E+00
pu244	2.53E-27	9.24E-05	1.85E-01	1.86E-01	1.86E-01	4.47E-04	3.91E-03
am241	5.86E+03	6.10E+03	2.51E+03	5.51E+03	-3.44E+02	-8.27E-01	-7.24E+00
am242m	9.33E+01	9.28E+01	9.71E+01	9.25E+01	-8.30E-01	-1.99E-03	-1.75E-02
am242	4.56E-13	1.20E-03	1.86E+00	1.19E-03	1.19E-03	2.87E-06	2.51E-05
am243	3.67E+03	3.67E+03	3.59E+03	3.59E+03	-7.90E+01	-1.90E-01	-1.66E+00
cm242	2.43E-01	2.42E-01	4.04E+02	2.41E-01	-2.10E-03	-5.05E-06	-4.42E-05
cm243	2.50E+01	2.44E+01	3.15E+01	2.47E+01	-3.60E-01	-8.65E-04	-7.58E-03
cm244	3.13E+03	3.01E+03	4.58E+03	3.12E+03	-7.00E+00	-1.68E-02	-1.47E-01
cm245	9.20E+02	9.20E+02	9.24E+02	9.23E+02	2.80E+00	6.73E-03	5.89E-02
cm246	7.05E+02	7.05E+02	7.72E+02	7.72E+02	6.70E+01	1.61E-01	1.41E+00
cm247	8.44E+01	8.44E+01	9.53E+01	9.53E+01	1.09E+01	2.62E-02	2.30E-01
cm248	5.02E+01	5.02E+01	6.15E+01	6.21E+01	1.19E+01	2.85E-02	2.49E-01
cf249	0.00E+00	1.06E-10	1.90E+00	3.95E+00	3.95E+00	9.50E-03	8.32E-02
cf250	0.00E+00	2.40E-23	7.93E-01	4.67E-01	4.67E-01	1.12E-03	9.84E-03
cf251	0.00E+00	2.44E-34	7.87E-01	7.81E-01	7.81E-01	1.88E-03	1.64E-02
cf252	0.00E+00	0.00E+00	7.09E-01	5.17E-02	5.17E-02	1.24E-04	1.09E-03
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.48E+05**	**9.48E+05**	**-5.22E+04**	**-1.26E+02**	**-1.10E+03**
TOTAL TRU	**8.00E+04**	**7.99E+04**	**7.49E+04**	**7.42E+04**	**-5.84E+03**	**-1.40E+01**	**-1.23E+02**
TOTAL PU	**6.34E+04**	**6.32E+04**	**6.01E+04**	**5.82E+04**	**-5.21E+03**	**-1.25E+01**	**-1.10E+02**
TOTAL NP	**2.05E+03**	**2.06E+03**	**1.69E+03**	**1.76E+03**	**-2.90E+02**	**-6.97E-01**	**-6.10E+00**
TOTAL AM	**9.62E+03**	**9.86E+03**	**6.20E+03**	**9.19E+03**	**-4.24E+02**	**-1.02E+00**	**-8.92E+00**
TOTAL CM	**4.91E+03**	**4.79E+03**	**6.86E+03**	**5.00E+03**	**8.52E+01**	**2.05E-01**	**1.79E+00**
TOTAL CF	**0.00E+00**	**1.06E-10**	**4.19E+00**	**5.25E+00**	**5.25E+00**	**1.26E-02**	**1.11E-01**

60th PuNpAmCm recycling (personal communication, Sam Bays)

60th cycle from Sam's depletion Fortran using TRITON's 10th cycle XS							
	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	*1.13E-06*	7.13E+01	2.69E+02	9.94E+02	9.94E+02	2.39E+00	2.09E+01
u235	5.63E+04	5.62E+04	3.05E+04	3.06E+04	-2.57E+04	-6.19E+01	-5.42E+02
u236	*1.13E-06*	*1.70E+00*	5.82E+03	5.84E+03	5.84E+03	1.40E+01	1.23E+02
u238	8.64E+05	8.64E+05	8.35E+05	8.35E+05	-2.85E+04	-6.84E+01	-5.99E+02
np237	1.79E+03	1.79E+03	1.43E+03	1.49E+03	-2.97E+02	-7.14E-01	-6.25E+00
pu238	9.12E+03	9.05E+03	9.32E+03	8.99E+03	-1.39E+02	-3.34E-01	-2.93E+00
pu239	2.27E+04	2.27E+04	1.97E+04	1.97E+04	-2.92E+03	-7.02E+00	-6.15E+01
pu240	1.62E+04	1.63E+04	1.33E+04	1.48E+04	-1.39E+03	-3.34E+00	-2.93E+01
pu241	5.45E+03	5.22E+03	7.99E+03	4.94E+03	-5.12E+02	-1.23E+00	-1.08E+01
pu242	9.52E+03	9.52E+03	9.11E+03	9.11E+03	-4.10E+02	-9.85E-01	-8.63E+00
pu244	*0.00E+00*	*0.00E+00*	*0.00E+00*	*0.00E+00*	0.00E+00	0.00E+00	0.00E+00
am241	5.53E+03	5.74E+03	2.32E+03	5.18E+03	-3.50E+02	-8.40E-01	-7.36E+00
am242m	5.22E+01	5.34E+01	5.42E+01	5.18E+01	-3.84E-01	-9.22E-04	-8.08E-03
am242	*0.00E+00*	*0.00E+00*	*0.00E+00*	*0.00E+00*	0.00E+00	0.00E+00	0.00E+00
am243	3.73E+03	3.73E+03	3.64E+03	3.64E+03	-9.40E+01	-2.26E-01	-1.98E+00
cm242	1.26E-01	1.83E+01	4.08E+02	1.26E-01	-9.30E-04	-2.23E-06	-1.96E-05
cm243	2.56E+01	2.48E+01	3.22E+01	2.53E+01	-2.78E-01	-6.67E-04	-5.85E-03
cm244	3.25E+03	3.14E+03	4.73E+03	3.23E+03	-2.59E+01	-6.22E-02	-5.45E-01
cm245	9.44E+02	9.43E+02	9.42E+02	9.42E+02	-2.72E+00	-6.53E-03	-5.72E-02
cm246	1.33E+03	1.33E+03	1.33E+03	1.33E+03	-3.40E-01	-8.17E-04	-7.16E-03
cm247	1.88E+02	1.88E+02	1.88E+02	1.88E+02	-5.00E-03	-1.20E-05	-1.05E-04
cm248	2.30E+02	2.30E+02	2.27E+02	2.30E+02	0.00E+00	0.00E+00	0.00E+00
cf249	0.00E+00	4.31E-04	7.59E+00	1.53E+01	1.53E+01	3.68E-02	3.23E-01
cf250	0.00E+00	3.38E-04	3.18E+00	1.87E+00	1.87E+00	4.49E-03	3.93E-02
cf251	0.00E+00	1.41E-05	3.19E+00	3.16E+00	3.16E+00	7.60E-03	6.65E-02
cf252	0.00E+00	3.12E-08	3.12E+00	2.26E-01	2.26E-01	5.43E-04	4.75E-03
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.47E+05**	**9.46E+05**	**-5.35E+04**	**-1.29E+02**	**-1.13E+03**
TOTAL TRU	**8.00E+04**	**7.99E+04**	**7.48E+04**	**7.39E+04**	**-6.12E+03**	**-1.47E+01**	**-1.29E+02**
TOTAL PU	**6.29E+04**	**6.27E+04**	**5.95E+04**	**5.76E+04**	**-5.37E+03**	**-1.29E+01**	**-1.13E+02**
TOTAL NP	**1.79E+03**	**1.79E+03**	**1.43E+03**	**1.49E+03**	**-2.97E+02**	**-7.14E-01**	**-6.25E+00**
TOTAL AM	**9.32E+03**	**9.52E+03**	**6.01E+03**	**8.87E+03**	**-4.44E+02**	**-1.07E+00**	**-9.35E+00**
TOTAL CM	**5.97E+03**	**5.87E+03**	**7.86E+03**	**5.94E+03**	**-2.92E+01**	**-7.03E-02**	**-6.15E-01**
TOTAL CF	**0.00E+00**	**7.84E-04**	**1.71E+01**	**2.06E+01**	**2.06E+01**	**4.95E-02**	**4.33E-01**
PU+NP+AM+CI	**8.00E+04**	**7.99E+04**	**7.48E+04**	**7.39E+04**	**-6.14E+03**	**-1.48E+01**	**-1.29E+02**

APPENDIX 5: PuNpAmCmBkCf case – Mass balances from cycle 1 to 10 as well as cycle 60

MOXUE_8PuNpAmCmCf_366U5_1.out							
	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	1.13E-06	1.41E+01	9.85E+01	4.84E+02	4.83E+02	1.16E+00	1.02E+01
u235	3.37E+04	3.37E+04	1.81E+04	1.81E+04	-1.56E+04	-3.75E+01	-3.29E+02
u236	1.13E-06	1.88E+00	3.54E+03	3.56E+03	3.55E+03	8.54E+00	7.48E+01
u238	8.86E+05	8.86E+05	8.57E+05	8.57E+05	-2.94E+04	-7.06E+01	-6.19E+02
np237	3.87E+03	3.87E+03	2.41E+03	2.48E+03	-1.38E+03	-3.33E+00	-2.91E+01
pu238	1.82E+03	1.81E+03	4.81E+03	4.79E+03	2.97E+03	7.13E+00	6.25E+01
pu239	3.80E+04	3.80E+04	2.37E+04	2.38E+04	-1.42E+04	-3.42E+01	-2.99E+02
pu240	1.81E+04	1.81E+04	1.61E+04	1.67E+04	-1.45E+03	-3.48E+00	-3.05E+01
pu241	6.71E+03	6.39E+03	9.33E+03	5.76E+03	-9.53E+02	-2.29E+00	-2.01E+01
pu242	5.34E+03	5.34E+03	6.01E+03	6.01E+03	6.77E+02	1.63E+00	1.43E+01
pu244	2.40E-31	8.74E-09	1.56E-01	1.56E-01	1.56E-01	3.75E-04	3.29E-03
am241	4.51E+03	4.81E+03	2.21E+03	5.72E+03	1.21E+03	2.91E+00	2.55E+01
am242m	5.04E+00	5.01E+00	8.21E+01	7.81E+01	7.31E+01	1.76E-01	1.54E+00
am242	4.56E-13	6.47E-05	1.74E+00	1.01E-03	1.01E-03	2.42E-06	2.12E-05
am243	1.23E+03	1.23E+03	2.15E+03	2.15E+03	9.23E+02	2.22E+00	1.94E+01
cm242	1.22E-02	1.29E-02	3.67E+02	2.04E-01	1.91E-01	4.60E-04	4.03E-03
cm243	3.74E+00	3.65E+00	2.34E+01	1.84E+01	1.46E+01	3.52E-02	3.08E-01
cm244	3.61E+02	3.48E+02	1.69E+03	1.15E+03	7.93E+02	1.90E+00	1.67E+01
cm245	3.53E+01	3.53E+01	2.57E+02	2.57E+02	2.22E+02	5.33E-01	4.67E+00
cm246	4.50E+00	4.50E+00	2.82E+01	2.82E+01	2.37E+01	5.69E-02	4.98E-01
cm247	6.16E-02	6.16E-02	1.08E+00	1.08E+00	1.01E+00	2.44E-03	2.14E-02
cm248	4.75E-03	4.75E-03	1.17E-01	1.17E-01	1.13E-01	2.70E-04	2.37E-03
bk249	0.00E+00	0.00E+00	3.08E-03	1.13E-06	1.13E-06	2.72E-09	2.39E-08
cf249	0.00E+00	1.05E-14	1.73E-03	4.71E-03	4.71E-03	1.13E-05	9.92E-05
cf250	0.00E+00	2.34E-27	1.02E-03	5.98E-04	5.98E-04	1.44E-06	1.26E-05
cf251	0.00E+00	2.40E-38	7.11E-04	7.05E-04	7.05E-04	1.69E-06	1.48E-05
cf252	0.00E+00	0.00E+00	3.25E-04	2.37E-05	2.37E-05	5.69E-08	4.99E-07
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.48E+05**	**9.48E+05**	**-5.21E+04**	**-1.25E+02**	**-1.10E+03**
TOTAL TRU	**8.00E+04**	**8.00E+04**	**6.92E+04**	**6.89E+04**	**-1.11E+04**	**-2.67E+01**	**-2.34E+02**
TOTAL PU	**7.00E+04**	**6.97E+04**	**6.00E+04**	**5.70E+04**	**-1.30E+04**	**-3.12E+01**	**-2.73E+02**
TOTAL NP	**3.87E+03**	**3.87E+03**	**2.41E+03**	**2.48E+03**	**-1.38E+03**	**-3.33E+00**	**-2.91E+01**
TOTAL AM	**5.74E+03**	**6.04E+03**	**4.45E+03**	**7.94E+03**	**2.21E+03**	**5.31E+00**	**4.65E+01**
TOTAL CM	**4.05E+02**	**3.91E+02**	**2.37E+03**	**1.46E+03**	**1.05E+03**	**2.53E+00**	**2.22E+01**
TOTAL CF	**0.00E+00**	**1.05E-14**	**3.78E-03**	**6.04E-03**	**6.04E-03**	**1.45E-05**	**1.27E-04**

MOXUE_8PuNpAmCmCf_540U5_2.out							
	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	1.13E-06	3.90E+01	1.84E+02	7.57E+02	7.57E+02	1.82E+00	1.59E+01
u235	4.97E+04	4.97E+04	2.76E+04	2.76E+04	-2.21E+04	-5.31E+01	-4.65E+02
u236	1.13E-06	1.99E+00	5.06E+03	5.08E+03	5.08E+03	1.22E+01	1.07E+02
u238	8.70E+05	8.70E+05	8.42E+05	8.42E+05	-2.83E+04	-6.80E+01	-5.96E+02
np237	3.02E+03	3.03E+03	2.15E+03	2.23E+03	-7.90E+02	-1.90E+00	-1.66E+01
pu238	5.04E+03	5.00E+03	7.26E+03	7.13E+03	2.08E+03	5.01E+00	4.38E+01
pu239	2.91E+04	2.91E+04	2.20E+04	2.21E+04	-7.01E+03	-1.68E+01	-1.48E+02
pu240	1.92E+04	1.92E+04	1.57E+04	1.65E+04	-2.65E+03	-6.37E+00	-5.58E+01
pu241	6.69E+03	6.37E+03	9.14E+03	5.64E+03	-1.05E+03	-2.52E+00	-2.20E+01
pu242	6.75E+03	6.75E+03	7.20E+03	7.20E+03	4.45E+02	1.07E+00	9.37E+00
pu244	5.94E-30	2.17E-07	1.63E-01	1.63E-01	1.63E-01	3.93E-04	3.44E-03
am241	6.34E+03	6.65E+03	2.85E+03	6.28E+03	-6.70E+01	-1.61E-01	-1.41E+00
am242m	7.88E+01	7.84E+01	1.11E+02	1.05E+02	2.64E+01	6.34E-02	5.55E-01
am242	4.56E-13	1.01E-03	2.09E+00	1.36E-03	1.36E-03	3.26E-06	2.86E-05
am243	2.32E+03	2.32E+03	2.79E+03	2.79E+03	4.66E+02	1.12E+00	9.81E+00
cm242	2.05E-01	2.04E-01	4.50E+02	2.74E-01	6.89E-02	1.66E-04	1.45E-03
cm243	1.89E+01	1.84E+01	3.26E+01	2.55E+01	6.64E+00	1.60E-02	1.40E-01
cm244	1.20E+03	1.16E+03	2.69E+03	1.84E+03	6.33E+02	1.52E+00	1.33E+01
cm245	2.62E+02	2.62E+02	4.89E+02	4.88E+02	2.26E+02	5.44E-01	4.76E+00
cm246	2.88E+01	2.88E+01	8.67E+01	8.66E+01	5.78E+01	1.39E-01	1.22E+00
cm247	1.08E+00	1.08E+00	4.76E+00	4.76E+00	3.68E+00	8.84E-03	7.74E-02
cm248	1.18E-01	1.18E-01	7.46E-01	7.49E-01	6.31E-01	1.52E-03	1.33E-02
bk249	1.13E-06	5.14E-07	2.16E-02	7.97E-06	6.84E-06	1.64E-08	1.44E-07
cf249	4.71E-03	4.71E-03	1.58E-02	3.68E-02	3.21E-02	7.71E-05	6.75E-04
cf250	5.98E-04	5.68E-04	8.01E-03	4.72E-03	4.12E-03	9.90E-06	8.68E-05
cf251	7.05E-04	7.04E-04	6.24E-03	6.19E-03	5.49E-03	1.32E-05	1.16E-04
cf252	2.37E-05	1.82E-05	3.49E-03	2.55E-04	2.31E-04	5.55E-07	4.86E-06
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.48E+05**	**9.48E+05**	**-5.22E+04**	**-1.25E+02**	**-1.10E+03**
TOTAL TRU	**8.00E+04**	**7.99E+04**	**7.29E+04**	**7.24E+04**	**-7.62E+03**	**-1.83E+01**	**-1.60E+02**
TOTAL PU	**6.67E+04**	**6.64E+04**	**6.13E+04**	**5.85E+04**	**-8.18E+03**	**-1.97E+01**	**-1.72E+02**
TOTAL NP	**3.02E+03**	**3.03E+03**	**2.15E+03**	**2.23E+03**	**-7.90E+02**	**-1.90E+00**	**-1.66E+01**
TOTAL AM	**8.74E+03**	**9.04E+03**	**5.75E+03**	**9.17E+03**	**4.25E+02**	**1.02E+00**	**8.95E+00**
TOTAL CM	**1.51E+03**	**1.47E+03**	**3.76E+03**	**2.44E+03**	**9.28E+02**	**2.23E+00**	**1.95E+01**
TOTAL CF	**6.04E-03**	**6.00E-03**	**3.36E-02**	**4.79E-02**	**4.19E-02**	**1.01E-04**	**8.82E-04**

MOXUE_8PuNpAmCmCf_600U5_3.out							
	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	1.13E-06	5.65E+01	2.40E+02	9.25E+02	9.25E+02	2.22E+00	1.95E+01
u235	5.52E+04	5.52E+04	3.09E+04	3.09E+04	-2.43E+04	-5.84E+01	-5.12E+02
u236	1.13E-06	1.90E+00	5.58E+03	5.60E+03	5.59E+03	1.34E+01	1.18E+02
u238	8.65E+05	8.65E+05	8.37E+05	8.37E+05	-2.80E+04	-6.73E+01	-5.89E+02
np237	2.60E+03	2.61E+03	1.97E+03	2.06E+03	-5.42E+02	-1.30E+00	-1.14E+01
pu238	7.30E+03	7.24E+03	8.74E+03	8.51E+03	1.21E+03	2.90E+00	2.54E+01
pu239	2.57E+04	2.57E+04	2.12E+04	2.12E+04	-4.43E+03	-1.06E+01	-9.32E+01
pu240	1.82E+04	1.83E+04	1.48E+04	1.58E+04	-2.39E+03	-5.74E+00	-5.03E+01
pu241	6.28E+03	5.98E+03	8.73E+03	5.38E+03	-8.95E+02	-2.15E+00	-1.88E+01
pu242	7.71E+03	7.71E+03	7.88E+03	7.88E+03	1.73E+02	4.16E-01	3.64E+00
pu244	3.78E-29	1.38E-06	1.70E-01	1.70E-01	1.70E-01	4.07E-04	3.57E-03
am241	6.70E+03	6.99E+03	2.93E+03	6.19E+03	-5.10E+02	-1.23E+00	-1.07E+01
am242m	1.06E+02	1.05E+02	1.15E+02	1.09E+02	3.60E+00	8.65E-03	7.58E-02
am242	4.56E-13	1.36E-03	2.12E+00	1.41E-03	1.41E-03	3.39E-06	2.97E-05
am243	2.90E+03	2.90E+03	3.14E+03	3.13E+03	2.32E+02	5.57E-01	4.88E+00
cm242	2.75E-01	2.74E-01	4.58E+02	2.85E-01	9.30E-03	2.23E-05	1.96E-04
cm243	2.59E+01	2.53E+01	3.50E+01	2.74E+01	1.52E+00	3.65E-03	3.20E-02
cm244	1.87E+03	1.80E+03	3.38E+03	2.30E+03	4.33E+02	1.04E+00	9.11E+00
cm245	4.92E+02	4.92E+02	6.57E+02	6.56E+02	1.65E+02	3.95E-01	3.46E+00
cm246	8.70E+01	8.70E+01	1.69E+02	1.69E+02	8.19E+01	1.97E-01	1.72E+00
cm247	4.77E+00	4.77E+00	1.19E+01	1.19E+01	7.11E+00	1.71E-02	1.50E-01
cm248	7.49E-01	7.50E-01	2.54E+00	2.56E+00	1.81E+00	4.34E-03	3.80E-02
bk249	7.97E-06	3.62E-06	7.81E-02	2.88E-05	2.08E-05	5.01E-08	4.38E-07
cf249	3.68E-02	3.67E-02	6.67E-02	1.42E-01	1.05E-01	2.53E-04	2.22E-03
cf250	4.72E-03	4.48E-03	3.13E-02	1.85E-02	1.38E-02	3.31E-05	2.90E-04
cf251	6.19E-03	6.19E-03	2.61E-02	2.59E-02	1.97E-02	4.74E-05	4.15E-04
cf252	2.55E-04	1.96E-04	1.69E-02	1.23E-03	9.78E-04	2.35E-06	2.06E-05
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.47E+05**	**9.48E+05**	**-5.23E+04**	**-1.26E+02**	**-1.10E+03**
TOTAL TRU	**8.00E+04**	**7.99E+04**	**7.42E+04**	**7.35E+04**	**-6.46E+03**	**-1.55E+01**	**-1.36E+02**
TOTAL PU	**6.52E+04**	**6.49E+04**	**6.13E+04**	**5.89E+04**	**-6.33E+03**	**-1.52E+01**	**-1.33E+02**
TOTAL NP	**2.60E+03**	**2.61E+03**	**1.97E+03**	**2.06E+03**	**-5.42E+02**	**-1.30E+00**	**-1.14E+01**
TOTAL AM	**9.71E+03**	**1.00E+04**	**6.18E+03**	**9.44E+03**	**-2.74E+02**	**-6.59E-01**	**-5.78E+00**
TOTAL CM	**2.48E+03**	**2.41E+03**	**4.71E+03**	**3.17E+03**	**6.90E+02**	**1.66E+00**	**1.45E+01**
TOTAL CF	**4.79E-02**	**4.76E-02**	**1.41E-01**	**1.88E-01**	**1.40E-01**	**3.36E-04**	**2.94E-03**

MOXUE_8PuNpAmCmCf_613U5_4.out							
	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	1.13E-06	6.69E+01	2.72E+02	1.01E+03	1.01E+03	2.44E+00	2.13E+01
u235	5.64E+04	5.64E+04	3.15E+04	3.15E+04	-2.49E+04	-5.99E+01	-5.25E+02
u236	1.13E-06	1.80E+00	5.71E+03	5.72E+03	5.72E+03	1.37E+01	1.20E+02
u238	8.63E+05	8.63E+05	8.35E+05	8.35E+05	-2.80E+04	-6.73E+01	-5.89E+02
np237	2.37E+03	2.38E+03	1.86E+03	1.94E+03	-4.29E+02	-1.03E+00	-9.03E+00
pu238	8.66E+03	8.59E+03	9.52E+03	9.21E+03	5.53E+02	1.33E+00	1.16E+01
pu239	2.43E+04	2.43E+04	2.08E+04	2.08E+04	-3.49E+03	-8.39E+00	-7.35E+01
pu240	1.73E+04	1.74E+04	1.42E+04	1.53E+04	-1.97E+03	-4.73E+00	-4.15E+01
pu241	5.93E+03	5.65E+03	8.41E+03	5.19E+03	-7.38E+02	-1.77E+00	-1.55E+01
pu242	8.31E+03	8.31E+03	8.28E+03	8.28E+03	-3.50E+01	-8.41E-02	-7.37E-01
pu244	1.29E-28	4.70E-06	1.75E-01	1.75E-01	1.75E-01	4.20E-04	3.68E-03
am241	6.56E+03	6.83E+03	2.82E+03	5.97E+03	-5.89E+02	-1.42E+00	-1.24E+01
am242m	1.10E+02	1.09E+02	1.11E+02	1.05E+02	-4.50E+00	-1.08E-02	-9.47E-02
am242	4.56E-13	1.41E-03	2.05E+00	1.36E-03	1.36E-03	3.26E-06	2.86E-05
am243	3.23E+03	3.23E+03	3.33E+03	3.33E+03	9.60E+01	2.31E-01	2.02E+00
cm242	2.86E-01	2.85E-01	4.45E+02	2.74E-01	-1.16E-02	-2.79E-05	-2.44E-04
cm243	2.77E+01	2.71E+01	3.47E+01	2.72E+01	-5.30E-01	-1.27E-03	-1.12E-02
cm244	2.33E+03	2.25E+03	3.84E+03	2.62E+03	2.84E+02	6.82E-01	5.98E+00
cm245	6.59E+02	6.59E+02	7.65E+02	7.64E+02	1.05E+02	2.52E-01	2.21E+00
cm246	1.69E+02	1.69E+02	2.64E+02	2.64E+02	9.45E+01	2.27E-01	1.99E+00
cm247	1.19E+01	1.19E+01	2.20E+01	2.20E+01	1.01E+01	2.42E-02	2.12E-01
cm248	2.56E+00	2.56E+00	6.08E+00	6.12E+00	3.56E+00	8.56E-03	7.50E-02
bk249	2.88E-05	1.31E-05	1.94E-01	7.15E-05	4.27E-05	1.03E-07	8.99E-07
cf249	1.42E-01	1.42E-01	1.82E-01	3.69E-01	2.27E-01	5.44E-04	4.77E-03
cf250	1.85E-02	1.75E-02	8.22E-02	4.85E-02	3.00E-02	7.20E-05	6.31E-04
cf251	2.59E-02	2.59E-02	7.14E-02	7.08E-02	4.49E-02	1.08E-04	9.45E-04
cf252	1.23E-03	9.49E-04	5.18E-02	3.78E-03	2.54E-03	6.11E-06	5.36E-05
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.47E+05**	**9.47E+05**	**-5.23E+04**	**-1.26E+02**	**-1.10E+03**
TOTAL TRU	**8.00E+04**	**7.99E+04**	**7.46E+04**	**7.39E+04**	**-6.11E+03**	**-1.47E+01**	**-1.29E+02**
TOTAL PU	**6.45E+04**	**6.42E+04**	**6.11E+04**	**5.88E+04**	**-5.68E+03**	**-1.36E+01**	**-1.20E+02**
TOTAL NP	**2.37E+03**	**2.38E+03**	**1.86E+03**	**1.94E+03**	**-4.29E+02**	**-1.03E+00**	**-9.03E+00**
TOTAL AM	**9.90E+03**	**1.02E+04**	**6.27E+03**	**9.40E+03**	**-4.97E+02**	**-1.20E+00**	**-1.05E+01**
TOTAL CM	**3.20E+03**	**3.12E+03**	**5.37E+03**	**3.70E+03**	**4.97E+02**	**1.19E+00**	**1.05E+01**
TOTAL CF	**1.88E-01**	**1.86E-01**	**3.87E-01**	**4.92E-01**	**3.04E-01**	**7.30E-04**	**6.40E-03**

MOXUE_8PuNpAmCmCf_615U5_5.out							
	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	1.13E-06	7.23E+01	2.87E+02	1.05E+03	1.05E+03	2.53E+00	2.21E+01
u235	5.66E+04	5.66E+04	3.15E+04	3.15E+04	-2.51E+04	-6.03E+01	-5.28E+02
u236	1.13E-06	1.74E+00	5.74E+03	5.75E+03	5.75E+03	1.38E+01	1.21E+02
u238	8.63E+05	8.63E+05	8.35E+05	8.35E+05	-2.79E+04	-6.70E+01	-5.87E+02
np237	2.24E+03	2.25E+03	1.79E+03	1.87E+03	-3.68E+02	-8.84E-01	-7.75E+00
pu238	9.35E+03	9.28E+03	9.84E+03	9.49E+03	1.46E+02	3.51E-01	3.07E+00
pu239	2.37E+04	2.37E+04	2.05E+04	2.06E+04	-3.14E+03	-7.55E+00	-6.61E+01
pu240	1.67E+04	1.68E+04	1.38E+04	1.51E+04	-1.66E+03	-3.99E+00	-3.49E+01
pu241	5.70E+03	5.43E+03	8.22E+03	5.07E+03	-6.31E+02	-1.52E+00	-1.33E+01
pu242	8.69E+03	8.69E+03	8.51E+03	8.51E+03	-1.72E+02	-4.13E-01	-3.62E+00
pu244	3.08E-28	1.13E-05	1.78E-01	1.79E-01	1.79E-01	4.29E-04	3.76E-03
am241	6.31E+03	6.57E+03	2.70E+03	5.78E+03	-5.32E+02	-1.28E+00	-1.12E+01
am242m	1.06E+02	1.05E+02	1.06E+02	1.01E+02	-5.10E+00	-1.23E-02	-1.07E-01
am242	4.56E-13	1.36E-03	1.98E+00	1.30E-03	1.30E-03	3.12E-06	2.73E-05
am243	3.42E+03	3.42E+03	3.44E+03	3.44E+03	1.60E+01	3.84E-02	3.37E-01
cm242	2.75E-01	2.74E-01	4.30E+02	2.62E-01	-1.31E-02	-3.15E-05	-2.76E-04
cm243	2.75E+01	2.68E+01	3.37E+01	2.64E+01	-1.08E+00	-2.60E-03	-2.27E-02
cm244	2.65E+03	2.55E+03	4.13E+03	2.82E+03	1.74E+02	4.18E-01	3.66E+00
cm245	7.67E+02	7.67E+02	8.31E+02	8.30E+02	6.37E+01	1.53E-01	1.34E+00
cm246	2.64E+02	2.64E+02	3.62E+02	3.62E+02	9.77E+01	2.35E-01	2.06E+00
cm247	2.20E+01	2.20E+01	3.40E+01	3.40E+01	1.20E+01	2.89E-02	2.53E-01
cm248	6.12E+00	6.12E+00	1.16E+01	1.17E+01	5.60E+00	1.35E-02	1.18E-01
bk249	7.15E-05	3.24E-05	3.80E-01	1.40E-04	6.87E-05	1.65E-07	1.45E-06
cf249	3.69E-01	3.68E-01	3.80E-01	7.46E-01	3.77E-01	9.06E-04	7.94E-03
cf250	4.85E-02	4.60E-02	1.67E-01	9.87E-02	5.03E-02	1.21E-04	1.06E-03
cf251	7.08E-02	7.07E-02	1.49E-01	1.48E-01	7.73E-02	1.86E-04	1.63E-03
cf252	3.78E-03	2.91E-03	1.18E-01	8.57E-03	4.80E-03	1.15E-05	1.01E-04
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.48E+05**	**9.48E+05**	**-5.22E+04**	**-1.25E+02**	**-1.10E+03**
TOTAL TRU	**8.00E+04**	**7.99E+04**	**7.48E+04**	**7.40E+04**	**-5.99E+03**	**-1.44E+01**	**-1.26E+02**
TOTAL PU	**6.42E+04**	**6.39E+04**	**6.09E+04**	**5.87E+04**	**-5.46E+03**	**-1.31E+01**	**-1.15E+02**
TOTAL NP	**2.24E+03**	**2.25E+03**	**1.79E+03**	**1.87E+03**	**-3.68E+02**	**-8.84E-01**	**-7.75E+00**
TOTAL AM	**9.84E+03**	**1.01E+04**	**6.25E+03**	**9.32E+03**	**-5.21E+02**	**-1.25E+00**	**-1.10E+01**
TOTAL CM	**3.73E+03**	**3.63E+03**	**5.83E+03**	**4.08E+03**	**3.52E+02**	**8.46E-01**	**7.41E+00**
TOTAL CF	**4.92E-01**	**4.88E-01**	**8.14E-01**	**1.00E+00**	**5.09E-01**	**1.22E-03**	**1.07E-02**

MOXUE_8PuNpAmCmCf_616U5_6.out							
	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	1.13E-06	7.45E+01	2.93E+02	1.06E+03	1.06E+03	2.55E+00	2.24E+01
u235	5.67E+04	5.67E+04	3.15E+04	3.15E+04	-2.52E+04	-6.06E+01	-5.30E+02
u236	1.13E-06	1.71E+00	5.75E+03	5.77E+03	5.77E+03	1.39E+01	1.21E+02
u238	8.63E+05	8.63E+05	8.35E+05	8.35E+05	-2.79E+04	-6.70E+01	-5.87E+02
np237	2.16E+03	2.17E+03	1.75E+03	1.82E+03	-3.33E+02	-8.00E-01	-7.01E+00
pu238	9.63E+03	9.56E+03	9.93E+03	9.56E+03	-6.60E+01	-1.59E-01	-1.39E+00
pu239	2.34E+04	2.34E+04	2.04E+04	2.05E+04	-2.99E+03	-7.18E+00	-6.29E+01
pu240	1.64E+04	1.65E+04	1.36E+04	1.49E+04	-1.48E+03	-3.56E+00	-3.12E+01
pu241	5.57E+03	5.31E+03	8.12E+03	5.01E+03	-5.65E+02	-1.36E+00	-1.19E+01
pu242	8.91E+03	8.91E+03	8.65E+03	8.66E+03	-2.58E+02	-6.20E-01	-5.43E+00
pu244	5.90E-28	2.16E-05	1.81E-01	1.81E-01	1.81E-01	4.35E-04	3.81E-03
am241	6.12E+03	6.37E+03	2.62E+03	5.66E+03	-4.56E+02	-1.10E+00	-9.60E+00
am242m	1.01E+02	1.00E+02	1.02E+02	9.72E+01	-3.67E+00	-8.82E-03	-7.73E-02
am242	4.56E-13	1.30E-03	1.93E+00	1.25E-03	1.25E-03	3.01E-06	2.64E-05
am243	3.53E+03	3.53E+03	3.50E+03	3.50E+03	-2.90E+01	-6.97E-02	-6.10E-01
cm242	2.63E-01	2.62E-01	4.18E+02	2.53E-01	-9.40E-03	-2.26E-05	-1.98E-04
cm243	2.67E+01	2.60E+01	3.27E+01	2.57E+01	-1.00E+00	-2.40E-03	-2.10E-02
cm244	2.85E+03	2.74E+03	4.32E+03	2.95E+03	9.90E+01	2.38E-01	2.08E+00
cm245	8.33E+02	8.33E+02	8.71E+02	8.71E+02	3.77E+01	9.06E-02	7.94E-01
cm246	3.62E+02	3.62E+02	4.58E+02	4.57E+02	9.51E+01	2.29E-01	2.00E+00
cm247	3.40E+01	3.40E+01	4.69E+01	4.69E+01	1.29E+01	3.11E-02	2.72E-01
cm248	1.17E+01	1.17E+01	1.91E+01	1.93E+01	7.57E+00	1.82E-02	1.59E-01
bk249	1.40E-04	6.36E-05	6.36E-01	2.35E-04	9.46E-05	2.27E-07	1.99E-06
cf249	7.46E-01	7.44E-01	6.66E-01	1.28E+00	5.32E-01	1.28E-03	1.12E-02
cf250	9.87E-02	9.36E-02	2.88E-01	1.70E-01	7.11E-02	1.71E-04	1.50E-03
cf251	1.48E-01	1.48E-01	2.61E-01	2.59E-01	1.11E-01	2.67E-04	2.34E-03
cf252	8.57E-03	6.60E-03	2.18E-01	1.59E-02	7.32E-03	1.76E-05	1.54E-04
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.48E+05**	**9.48E+05**	**-5.22E+04**	**-1.25E+02**	**-1.10E+03**
TOTAL TRU	**8.00E+04**	**7.99E+04**	**7.48E+04**	**7.41E+04**	**-5.93E+03**	**-1.42E+01**	**-1.25E+02**
TOTAL PU	**6.40E+04**	**6.37E+04**	**6.07E+04**	**5.86E+04**	**-5.36E+03**	**-1.29E+01**	**-1.13E+02**
TOTAL NP	**2.16E+03**	**2.17E+03**	**1.75E+03**	**1.82E+03**	**-3.33E+02**	**-8.00E-01**	**-7.01E+00**
TOTAL AM	**9.75E+03**	**1.00E+04**	**6.23E+03**	**9.26E+03**	**-4.89E+02**	**-1.17E+00**	**-1.03E+01**
TOTAL CM	**4.11E+03**	**4.01E+03**	**6.16E+03**	**4.37E+03**	**2.51E+02**	**6.04E-01**	**5.29E+00**
TOTAL CF	**1.00E+00**	**9.93E-01**	**1.43E+00**	**1.72E+00**	**7.22E-01**	**1.73E-03**	**1.52E-02**

MOXUE_8PuNpAmCmCf_616U5_7.out							
	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	1.13E-06	7.50E+01	2.94E+02	1.06E+03	1.06E+03	2.55E+00	2.24E+01
u235	5.67E+04	5.67E+04	3.14E+04	3.14E+04	-2.52E+04	-6.06E+01	-5.31E+02
u236	1.13E-06	1.69E+00	5.76E+03	5.77E+03	5.77E+03	1.39E+01	1.21E+02
u238	8.63E+05	8.63E+05	8.35E+05	8.35E+05	-2.79E+04	-6.70E+01	-5.87E+02
np237	2.11E+03	2.12E+03	1.72E+03	1.80E+03	-3.12E+02	-7.50E-01	-6.57E+00
pu238	9.70E+03	9.62E+03	9.91E+03	9.54E+03	-1.58E+02	-3.80E-01	-3.33E+00
pu239	2.33E+04	2.33E+04	2.03E+04	2.04E+04	-2.92E+03	-7.02E+00	-6.15E+01
pu240	1.63E+04	1.64E+04	1.35E+04	1.49E+04	-1.40E+03	-3.36E+00	-2.95E+01
pu241	5.51E+03	5.25E+03	8.07E+03	4.98E+03	-5.28E+02	-1.27E+00	-1.11E+01
pu242	9.05E+03	9.05E+03	8.74E+03	8.74E+03	-3.06E+02	-7.35E-01	-6.44E+00
pu244	9.72E-28	3.55E-05	1.82E-01	1.82E-01	1.82E-01	4.38E-04	3.84E-03
am241	6.00E+03	6.25E+03	2.57E+03	5.59E+03	-4.01E+02	-9.64E-01	-8.44E+00
am242m	9.76E+01	9.71E+01	1.00E+02	9.52E+01	-2.39E+00	-5.74E-03	-5.03E-02
am242	4.56E-13	1.25E-03	1.90E+00	1.23E-03	1.23E-03	2.95E-06	2.58E-05
am243	3.59E+03	3.59E+03	3.54E+03	3.54E+03	-5.30E+01	-1.27E-01	-1.12E+00
cm242	2.54E-01	2.53E-01	4.11E+02	2.48E-01	-6.20E-03	-1.49E-05	-1.31E-04
cm243	2.59E+01	2.53E+01	3.21E+01	2.52E+01	-7.50E-01	-1.80E-03	-1.58E-02
cm244	2.97E+03	2.86E+03	4.43E+03	3.02E+03	5.10E+01	1.23E-01	1.07E+00
cm245	8.73E+02	8.73E+02	8.96E+02	8.95E+02	2.17E+01	5.21E-02	4.57E-01
cm246	4.58E+02	4.58E+02	5.48E+02	5.47E+02	8.93E+01	2.15E-01	1.88E+00
cm247	4.69E+01	4.69E+01	6.00E+01	6.00E+01	1.30E+01	3.13E-02	2.74E-01
cm248	1.93E+01	1.93E+01	2.83E+01	2.86E+01	9.28E+00	2.23E-02	1.95E-01
bk249	2.35E-04	1.07E-04	9.54E-01	3.52E-04	1.17E-04	2.82E-07	2.47E-06
cf249	1.28E+00	1.28E+00	1.03E+00	1.95E+00	6.72E-01	1.61E-03	1.41E-02
cf250	1.70E-01	1.61E-01	4.41E-01	2.60E-01	8.99E-02	2.16E-04	1.89E-03
cf251	2.59E-01	2.59E-01	4.05E-01	4.02E-01	1.42E-01	3.42E-04	3.00E-03
cf252	1.59E-02	1.22E-02	3.52E-01	2.56E-02	9.75E-03	2.34E-05	2.05E-04
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.48E+05**	**9.48E+05**	**-5.22E+04**	**-1.25E+02**	**-1.10E+03**
TOTAL TRU	**8.00E+04**	**7.99E+04**	**7.49E+04**	**7.41E+04**	**-5.90E+03**	**-1.42E+01**	**-1.24E+02**
TOTAL PU	**6.38E+04**	**6.36E+04**	**6.05E+04**	**5.85E+04**	**-5.31E+03**	**-1.28E+01**	**-1.12E+02**
TOTAL NP	**2.11E+03**	**2.12E+03**	**1.72E+03**	**1.80E+03**	**-3.12E+02**	**-7.50E-01**	**-6.57E+00**
TOTAL AM	**9.68E+03**	**9.93E+03**	**6.22E+03**	**9.23E+03**	**-4.56E+02**	**-1.10E+00**	**-9.61E+00**
TOTAL CM	**4.39E+03**	**4.28E+03**	**6.40E+03**	**4.58E+03**	**1.84E+02**	**4.41E-01**	**3.86E+00**
TOTAL CF	**1.72E+00**	**1.71E+00**	**2.23E+00**	**2.64E+00**	**9.14E-01**	**2.20E-03**	**1.92E-02**

MOXUE_8PuNpAmCmCf_612U5_8.out							
	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	1.13E-06	7.48E+01	2.92E+02	1.06E+03	1.06E+03	2.54E+00	2.22E+01
u235	5.63E+04	5.63E+04	3.11E+04	3.11E+04	-2.52E+04	-6.04E+01	-5.29E+02
u236	1.13E-06	1.69E+00	5.73E+03	5.74E+03	5.74E+03	1.38E+01	1.21E+02
u238	8.64E+05	8.64E+05	8.36E+05	8.36E+05	-2.80E+04	-6.73E+01	-5.89E+02
np237	2.08E+03	2.09E+03	1.71E+03	1.78E+03	-3.03E+02	-7.28E-01	-6.38E+00
pu238	9.67E+03	9.60E+03	9.85E+03	9.48E+03	-1.90E+02	-4.57E-01	-4.00E+00
pu239	2.32E+04	2.32E+04	2.02E+04	2.03E+04	-2.89E+03	-6.94E+00	-6.08E+01
pu240	1.62E+04	1.63E+04	1.35E+04	1.49E+04	-1.35E+03	-3.24E+00	-2.84E+01
pu241	5.47E+03	5.22E+03	8.04E+03	4.96E+03	-5.12E+02	-1.23E+00	-1.08E+01
pu242	9.14E+03	9.14E+03	8.80E+03	8.81E+03	-3.31E+02	-7.95E-01	-6.97E+00
pu244	1.44E-27	5.25E-05	1.83E-01	1.84E-01	1.84E-01	4.43E-04	3.88E-03
am241	5.93E+03	6.17E+03	2.54E+03	5.55E+03	-3.77E+02	-9.06E-01	-7.94E+00
am242m	9.56E+01	9.51E+01	9.84E+01	9.37E+01	-1.86E+00	-4.47E-03	-3.92E-02
am242	4.56E-13	1.23E-03	1.88E+00	1.21E-03	1.21E-03	2.91E-06	2.54E-05
am243	3.63E+03	3.63E+03	3.56E+03	3.56E+03	-6.70E+01	-1.61E-01	-1.41E+00
cm242	2.49E-01	2.48E-01	4.08E+02	2.44E-01	-4.80E-03	-1.15E-05	-1.01E-04
cm243	2.55E+01	2.49E+01	3.18E+01	2.49E+01	-5.30E-01	-1.27E-03	-1.12E-02
cm244	3.05E+03	2.93E+03	4.50E+03	3.07E+03	2.40E+01	5.77E-02	5.05E-01
cm245	8.97E+02	8.97E+02	9.10E+02	9.09E+02	1.15E+01	2.76E-02	2.42E-01
cm246	5.47E+02	5.47E+02	6.30E+02	6.30E+02	8.23E+01	1.98E-01	1.73E+00
cm247	6.00E+01	6.00E+01	7.26E+01	7.26E+01	1.26E+01	3.03E-02	2.65E-01
cm248	2.86E+01	2.86E+01	3.88E+01	3.92E+01	1.06E+01	2.56E-02	2.24E-01
bk249	3.52E-04	1.60E-04	1.32E+00	4.88E-04	1.36E-04	3.26E-07	2.85E-06
cf249	1.95E+00	1.95E+00	1.47E+00	2.74E+00	7.85E-01	1.89E-03	1.65E-02
cf250	2.60E-01	2.46E-01	6.20E-01	3.65E-01	1.06E-01	2.54E-04	2.22E-03
cf251	4.02E-01	4.01E-01	5.75E-01	5.70E-01	1.69E-01	4.05E-04	3.55E-03
cf252	2.56E-02	1.97E-02	5.16E-01	3.76E-02	1.20E-02	2.88E-05	2.52E-04
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.48E+05**	**9.48E+05**	**-5.22E+04**	**-1.26E+02**	**-1.10E+03**
TOTAL TRU	**8.00E+04**	**7.99E+04**	**7.48E+04**	**7.41E+04**	**-5.88E+03**	**-1.41E+01**	**-1.24E+02**
TOTAL PU	**6.36E+04**	**6.34E+04**	**6.03E+04**	**5.84E+04**	**-5.27E+03**	**-1.27E+01**	**-1.11E+02**
TOTAL NP	**2.08E+03**	**2.09E+03**	**1.71E+03**	**1.78E+03**	**-3.03E+02**	**-7.28E-01**	**-6.38E+00**
TOTAL AM	**9.65E+03**	**9.90E+03**	**6.20E+03**	**9.20E+03**	**-4.46E+02**	**-1.07E+00**	**-9.39E+00**
TOTAL CM	**4.61E+03**	**4.49E+03**	**6.59E+03**	**4.75E+03**	**1.41E+02**	**3.38E-01**	**2.96E+00**
TOTAL CF	**2.64E+00**	**2.61E+00**	**3.18E+00**	**3.71E+00**	**1.07E+00**	**2.57E-03**	**2.25E-02**

MOXUE_8PuNpAmCmCf_612U5_9.out							
	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	1.13E-06	7.44E+01	2.91E+02	1.05E+03	1.05E+03	2.52E+00	2.21E+01
u235	5.63E+04	5.63E+04	3.11E+04	3.11E+04	-2.52E+04	-6.05E+01	-5.30E+02
u236	1.13E-06	1.69E+00	5.73E+03	5.75E+03	5.75E+03	1.38E+01	1.21E+02
u238	8.64E+05	8.64E+05	8.36E+05	8.36E+05	-2.80E+04	-6.73E+01	-5.89E+02
np237	2.07E+03	2.07E+03	1.70E+03	1.77E+03	-2.95E+02	-7.09E-01	-6.21E+00
pu238	9.62E+03	9.54E+03	9.79E+03	9.42E+03	-1.95E+02	-4.69E-01	-4.10E+00
pu239	2.31E+04	2.31E+04	2.01E+04	2.02E+04	-2.86E+03	-6.87E+00	-6.02E+01
pu240	1.62E+04	1.63E+04	1.34E+04	1.48E+04	-1.34E+03	-3.22E+00	-2.82E+01
pu241	5.45E+03	5.20E+03	8.02E+03	4.95E+03	-5.03E+02	-1.21E+00	-1.06E+01
pu242	9.20E+03	9.20E+03	8.85E+03	8.85E+03	-3.48E+02	-8.36E-01	-7.33E+00
pu244	1.98E-27	7.21E-05	1.84E-01	1.85E-01	1.85E-01	4.45E-04	3.90E-03
am241	5.88E+03	6.13E+03	2.52E+03	5.53E+03	-3.55E+02	-8.53E-01	-7.47E+00
am242m	9.41E+01	9.36E+01	9.76E+01	9.29E+01	-1.15E+00	-2.76E-03	-2.42E-02
am242	4.56E-13	1.21E-03	1.87E+00	1.20E-03	1.20E-03	2.88E-06	2.52E-05
am243	3.65E+03	3.65E+03	3.58E+03	3.58E+03	-7.50E+01	-1.80E-01	-1.58E+00
cm242	2.45E-01	2.44E-01	4.05E+02	2.42E-01	-2.90E-03	-6.97E-06	-6.10E-05
cm243	2.52E+01	2.46E+01	3.16E+01	2.48E+01	-4.50E-01	-1.08E-03	-9.47E-03
cm244	3.10E+03	2.98E+03	4.55E+03	3.10E+03	3.00E+00	7.21E-03	6.31E-02
cm245	9.11E+02	9.11E+02	9.19E+02	9.18E+02	6.40E+00	1.54E-02	1.35E-01
cm246	6.30E+02	6.30E+02	7.05E+02	7.05E+02	7.46E+01	1.79E-01	1.57E+00
cm247	7.26E+01	7.26E+01	8.44E+01	8.44E+01	1.19E+01	2.85E-02	2.49E-01
cm248	3.92E+01	3.92E+01	5.02E+01	5.08E+01	1.16E+01	2.78E-02	2.44E-01
bk249	4.88E-04	2.21E-04	1.72E+00	6.36E-04	1.48E-04	3.56E-07	3.12E-06
cf249	2.74E+00	2.73E+00	1.95E+00	3.61E+00	8.71E-01	2.09E-03	1.83E-02
cf250	3.65E-01	3.47E-01	8.18E-01	4.82E-01	1.17E-01	2.80E-04	2.46E-03
cf251	5.70E-01	5.70E-01	7.64E-01	7.58E-01	1.87E-01	4.50E-04	3.94E-03
cf252	3.76E-02	2.90E-02	7.02E-01	5.12E-02	1.35E-02	3.25E-05	2.85E-04
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.48E+05**	**9.48E+05**	**-5.22E+04**	**-1.26E+02**	**-1.10E+03**
TOTAL TRU	**8.00E+04**	**7.99E+04**	**7.49E+04**	**7.41E+04**	**-5.86E+03**	**-1.41E+01**	**-1.23E+02**
TOTAL PU	**6.35E+04**	**6.33E+04**	**6.02E+04**	**5.83E+04**	**-5.25E+03**	**-1.26E+01**	**-1.10E+02**
TOTAL NP	**2.07E+03**	**2.07E+03**	**1.70E+03**	**1.77E+03**	**-2.95E+02**	**-7.09E-01**	**-6.21E+00**
TOTAL AM	**9.63E+03**	**9.87E+03**	**6.20E+03**	**9.20E+03**	**-4.31E+02**	**-1.04E+00**	**-9.08E+00**
TOTAL CM	**4.78E+03**	**4.66E+03**	**6.74E+03**	**4.88E+03**	**1.07E+02**	**2.57E-01**	**2.25E+00**
TOTAL CF	**3.71E+00**	**3.68E+00**	**4.23E+00**	**4.90E+00**	**1.19E+00**	**2.86E-03**	**2.50E-02**

MOXUE_8PuNpAmCmCf_612U5_10.out							
	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	1.13E-06	7.39E+01	2.89E+02	1.04E+03	1.04E+03	2.51E+00	2.20E+01
u235	5.63E+04	5.63E+04	3.11E+04	3.11E+04	-2.52E+04	-6.05E+01	-5.30E+02
u236	1.13E-06	1.68E+00	5.73E+03	5.75E+03	5.75E+03	1.38E+01	1.21E+02
u238	8.64E+05	8.64E+05	8.36E+05	8.36E+05	-2.80E+04	-6.73E+01	-5.89E+02
np237	2.05E+03	2.06E+03	1.69E+03	1.76E+03	-2.89E+02	-6.94E-01	-6.08E+00
pu238	9.56E+03	9.48E+03	9.73E+03	9.37E+03	-1.86E+02	-4.47E-01	-3.92E+00
pu239	2.30E+04	2.30E+04	2.01E+04	2.02E+04	-2.83E+03	-6.80E+00	-5.96E+01
pu240	1.62E+04	1.63E+04	1.34E+04	1.48E+04	-1.34E+03	-3.22E+00	-2.82E+01
pu241	5.44E+03	5.19E+03	8.01E+03	4.95E+03	-4.98E+02	-1.20E+00	-1.05E+01
pu242	9.24E+03	9.24E+03	8.88E+03	8.88E+03	-3.60E+02	-8.65E-01	-7.58E+00
pu244	2.56E-27	9.34E-05	1.85E-01	1.86E-01	1.86E-01	4.47E-04	3.91E-03
am241	5.86E+03	6.10E+03	2.51E+03	5.51E+03	-3.44E+02	-8.27E-01	-7.24E+00
am242m	9.33E+01	9.29E+01	9.72E+01	9.25E+01	-8.10E-01	-1.95E-03	-1.71E-02
am242	4.56E-13	1.20E-03	1.86E+00	1.19E-03	1.19E-03	2.87E-06	2.51E-05
am243	3.67E+03	3.67E+03	3.59E+03	3.59E+03	-8.00E+01	-1.92E-01	-1.68E+00
cm242	2.43E-01	2.42E-01	4.04E+02	2.41E-01	-2.10E-03	-5.05E-06	-4.42E-05
cm243	2.50E+01	2.44E+01	3.15E+01	2.47E+01	-3.60E-01	-8.65E-04	-7.58E-03
cm244	3.13E+03	3.01E+03	4.57E+03	3.12E+03	-7.00E+00	-1.68E-02	-1.47E-01
cm245	9.20E+02	9.20E+02	9.24E+02	9.23E+02	2.80E+00	6.73E-03	5.89E-02
cm246	7.05E+02	7.05E+02	7.73E+02	7.72E+02	6.71E+01	1.61E-01	1.41E+00
cm247	8.44E+01	8.44E+01	9.53E+01	9.53E+01	1.09E+01	2.62E-02	2.30E-01
cm248	5.08E+01	5.08E+01	6.21E+01	6.29E+01	1.21E+01	2.91E-02	2.55E-01
bk249	6.36E-04	2.88E-04	2.14E+00	7.92E-04	1.56E-04	3.74E-07	3.28E-06
cf249	3.61E+00	3.60E+00	2.47E+00	4.53E+00	9.23E-01	2.22E-03	1.94E-02
cf250	4.82E-01	4.57E-01	1.03E+00	6.06E-01	1.24E-01	2.97E-04	2.61E-03
cf251	7.58E-01	7.57E-01	9.65E-01	9.57E-01	2.00E-01	4.80E-04	4.20E-03
cf252	5.11E-02	3.94E-02	9.02E-01	6.58E-02	1.46E-02	3.52E-05	3.08E-04
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.48E+05**	**9.48E+05**	**-5.22E+04**	**-1.26E+02**	**-1.10E+03**
TOTAL TRU	**8.00E+04**	**7.99E+04**	**7.49E+04**	**7.41E+04**	**-5.84E+03**	**-1.40E+01**	**-1.23E+02**
TOTAL PU	**6.34E+04**	**6.32E+04**	**6.01E+04**	**5.82E+04**	**-5.21E+03**	**-1.25E+01**	**-1.10E+02**
TOTAL NP	**2.05E+03**	**2.06E+03**	**1.69E+03**	**1.76E+03**	**-2.89E+02**	**-6.94E-01**	**-6.08E+00**
TOTAL AM	**9.62E+03**	**9.86E+03**	**6.20E+03**	**9.19E+03**	**-4.25E+02**	**-1.02E+00**	**-8.94E+00**
TOTAL CM	**4.91E+03**	**4.80E+03**	**6.86E+03**	**5.00E+03**	**8.56E+01**	**2.06E-01**	**1.80E+00**
TOTAL CF	**4.90E+00**	**4.85E+00**	**5.36E+00**	**6.16E+00**	**1.26E+00**	**3.03E-03**	**2.65E-02**

60th PuNpAmCmCf recycling (personal communication, Sam Bays)

60th cycle from Sam's depletion Fortran using TRITON's 10th cycle XS							
	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	*1.13E-06*	7.13E+01	2.69E+02	9.93E+02	9.93E+02	2.39E+00	2.09E+01
u235	5.63E+04	5.62E+04	3.05E+04	3.05E+04	-2.58E+04	-6.19E+01	-5.42E+02
u236	*1.13E-06*	*1.70E+00*	5.82E+03	5.84E+03	5.84E+03	1.40E+01	1.23E+02
u238	8.64E+05	8.64E+05	8.35E+05	8.35E+05	-2.85E+04	-6.84E+01	-6.00E+02
np237	1.78E+03	1.79E+03	1.43E+03	1.49E+03	-2.97E+02	-7.13E-01	-6.24E+00
pu238	9.12E+03	9.04E+03	9.31E+03	8.98E+03	-1.39E+02	-3.34E-01	-2.92E+00
pu239	2.27E+04	2.26E+04	1.97E+04	1.97E+04	-2.92E+03	-7.01E+00	-6.14E+01
pu240	1.62E+04	1.63E+04	1.33E+04	1.48E+04	-1.39E+03	-3.34E+00	-2.92E+01
pu241	5.45E+03	5.22E+03	7.99E+03	4.94E+03	-5.11E+02	-1.23E+00	-1.08E+01
pu242	9.51E+03	9.51E+03	9.10E+03	9.10E+03	-4.09E+02	-9.84E-01	-8.62E+00
pu244	*0.00E+00*	*0.00E+00*	*0.00E+00*	*0.00E+00*	0.00E+00	0.00E+00	0.00E+00
am241	5.53E+03	5.73E+03	2.31E+03	5.18E+03	-3.49E+02	-8.39E-01	-7.35E+00
am242m	5.21E+01	5.33E+01	5.42E+01	5.18E+01	-3.83E-01	-9.21E-04	-8.06E-03
am242	*0.00E+00*	*0.00E+00*	*0.00E+00*	*0.00E+00*	0.00E+00	0.00E+00	0.00E+00
am243	3.73E+03	3.73E+03	3.64E+03	3.63E+03	-9.39E+01	-2.26E-01	-1.98E+00
cm242	1.26E-01	1.83E+01	4.08E+02	1.25E-01	-9.28E-04	-2.23E-06	-1.95E-05
cm243	2.55E+01	2.48E+01	3.22E+01	2.53E+01	-2.77E-01	-6.66E-04	-5.83E-03
cm244	3.25E+03	3.14E+03	4.73E+03	3.22E+03	-2.59E+01	-6.21E-02	-5.44E-01
cm245	9.44E+02	9.43E+02	9.42E+02	9.42E+02	-2.71E+00	-6.52E-03	-5.71E-02
cm246	1.34E+03	1.34E+03	1.34E+03	1.34E+03	-3.50E-01	-8.41E-04	-7.37E-03
cm247	1.89E+02	1.89E+02	1.89E+02	1.89E+02	-5.00E-03	-1.20E-05	-1.05E-04
cm248	2.42E+02	2.42E+02	2.38E+02	2.42E+02	-1.00E-03	-2.40E-06	-2.10E-05
bk249	2.95E-03	1.82E-01	8.38E+00	2.98E-03	3.56E-05	8.55E-08	7.49E-07
cf249	1.83E+01	1.81E+01	1.03E+01	1.83E+01	5.00E-04	1.20E-06	1.05E-05
cf250	2.51E+00	2.36E+00	4.27E+00	2.51E+00	2.01E-03	4.83E-06	4.23E-05
cf251	4.06E+00	4.02E+00	4.10E+00	4.06E+00	5.00E-05	1.20E-07	1.05E-06
cf252	3.12E-01	2.67E-01	4.32E+00	3.13E-01	1.24E-03	2.97E-06	2.60E-05
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.47E+05**	**9.46E+05**	**-5.35E+04**	**-1.29E+02**	**-1.13E+03**
TOTAL TRU	**8.00E+04**	**7.99E+04**	**7.48E+04**	**7.39E+04**	**-6.13E+03**	**-1.47E+01**	**-1.29E+02**
TOTAL PU	**6.29E+04**	**6.27E+04**	**5.94E+04**	**5.75E+04**	**-5.36E+03**	**-1.29E+01**	**-1.13E+02**
TOTAL NP	**1.78E+03**	**1.79E+03**	**1.43E+03**	**1.49E+03**	**-2.97E+02**	**-7.13E-01**	**-6.24E+00**
TOTAL AM	**9.31E+03**	**9.51E+03**	**6.00E+03**	**8.87E+03**	**-4.43E+02**	**-1.07E+00**	**-9.33E+00**
TOTAL CM	**5.99E+03**	**5.89E+03**	**7.87E+03**	**5.96E+03**	**-2.92E+01**	**-7.02E-02**	**-6.15E-01**
TOTAL CF	**2.52E+01**	**2.48E+01**	**2.30E+01**	**2.52E+01**	**3.80E-03**	**9.12E-06**	**7.99E-05**
PU+NP+AM+CM	**8.00E+04**	**7.99E+04**	**7.47E+04**	**7.38E+04**	**-6.13E+03**	**-1.47E+01**	**-1.29E+02**

APPENDIX 6

Isotopic data used to calculate the consequences at fabrication and reprocessing

The Table below presents the specific alpha, beta and gamma powers as well as the neutron sources expressed respectively in Watt per gram of the isotope or neutrons per sec. and per gram of the isotope.

	P-ALPHA W/g	P-BETA W/g	P-GAM W/g	S-NEUT n/s/g
PU240	7.04E-03	1.49E-05	1.83E-06	1.18E+03
PU242				1.71E+03
PU238	5.66E-01	1.13E-03	1.57E-04	1.75E+04
PU241		3.19E-03		
CM244	2.82E+00	4.13E-03	6.23E-04	1.08E+07
AM243			6.74E-05	
AM241	1.13E-01	7.97E-04	5.72E-04	2.96E+03
CM245			9.53E-05	
CM243		4.04E-02	3.87E-02	
CF250				1.10E+10
CF252				2.30E+12

NB: The neutron sources take into account the (α,n) reactions on Oxygen in the MOX-UE fuels. This reaction accounts for about 85% of the neutron source of Pu238, 15% of Pu240 and 100% of Am241. For the other isotopes in the table, the neutron sources mainly come from spontaneous fissions.

/A5.1/ A. Tsilanizara, C.M. Diop *et al.*, “DARWIN: an evolution code system for a large range of applications”, *J. Nucl. Sci. Technol.* 37 (2000), p. 845

APPENDIX 7

A preliminary assessment of the impact of multirecycling RepU from MOX-UE fuel back into MOX-UE reactors

A penalizing approach was used in order to quantify the build up of U234 and U236 when RepU from MOX-UE is recycled back into MOX-UE reactors. Indeed, we considered that the RepU was re-enriched and that in the process the relative proportions of U234, U235 and U236 were not modified. The re-enriched RepU is then blended with the same mass of enriched uranium coming from NatU. Figure A6.1 says the same thing in a graphical form and using actual numbers. It is a conservative approach because it leads to a faster increase of the U234 and U236 contents than the other approaches shown in the Figures A6.2 and A6.3.

Indeed, with the blending option 1 shown in Figure A6.1 the re-enriched RepU (the 200 kg) contains more U234 and U236 than the original RepU (respectively 0.15% and 0.1% for U234 and 0.75% and 0.5% for U236). For the other approaches (blending options 2 and 3) the re-enriched RepU contains always less U234 and U236 than the original RepU because it is blended with another batch of enriched U coming from NatU (i.e. without U236) in order to reach the desired enrichment. As far as the TRU recycling the same approach as presented in Section 3 was used.

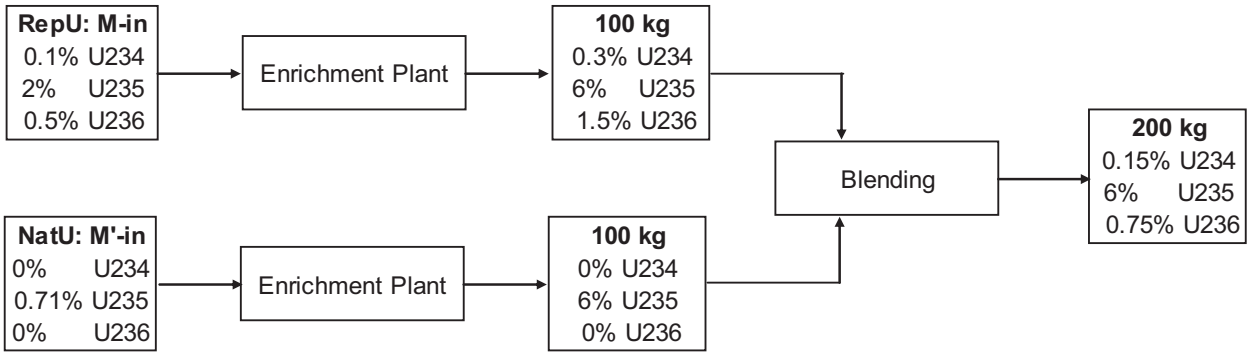

Figure A6.1. Example illustrating blending option 1 considered to estimate the build up of U234 and U236 (re-enrichment of RepU).

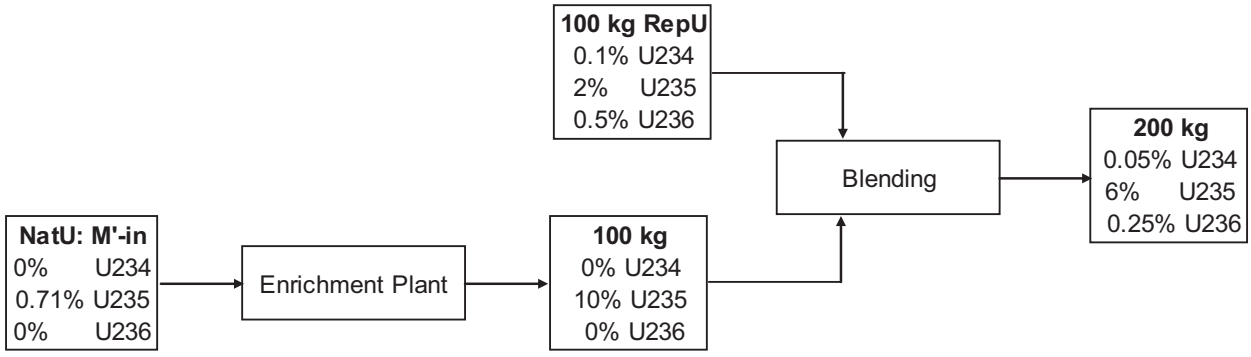

Figure A6.2. Example illustrating blending option 2 (no re-enrichment of RepU)

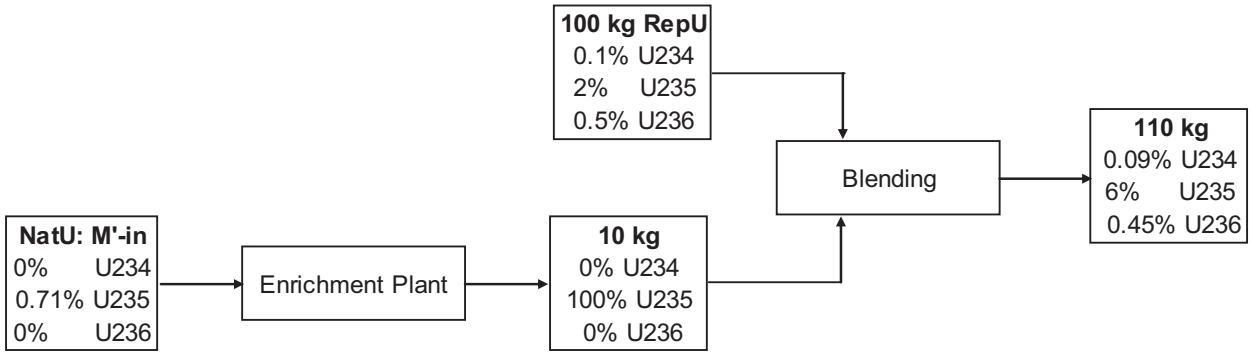

Figure A6.3. Example illustrating blending option 3. (no re-enrichment of RepU)

The evolution of the uranium isotopic composition at the fabrication and reprocessing stages with the number of recycling is presented in Table A6.1 with blending option 1 (i.e. the most penalizing in terms of U234 and U236 build up) and for the Pu and Pu+Np+Am cases. As before, the enrichments are calculated so that the MOX-UE fuels reach the target burnup of 51 GWd/t. This table shows that the enrichments will stabilize at respectively about 4.2% and 8.2% for the Pu and Pu+Np+Am cases compared with about 3.6% and 6.6% when RepU is not recycled (cf. Table 5.1.1). At the 6th recycling, the U236 contents are respectively equal to about 1% and 2% for the Pu and Pu+Np+Am cases.

Table A6.1. Evolution of the Uranium isotopic composition (expressed in %) of the MOX-UE fuel at the fabrication and reprocessing stages

Pu	F1	R1	F2	R2	F3	R3	F4	R4	F5	R5
U234		0.029		0.035	0.047	0.069	0.070	0.088	0.081	0.098
U235	**0.250**	0.139	**1.910**	1.077	**2.878**	1.678	**3.420**	2.023	**3.746**	2.234
U236		0.032		0.214	0.285	0.559	0.570	0.867	0.803	1.114

PuNpAm	F1	R1	F2	R2	F3	R3	F4	R4	F5	R5
U234		0.055	0.080	0.141	0.139	0.209	0.181	0.260	0.213	0.297
U235	**3.690**	2.076	**5.974**	3.603	**7.084**	4.399	**7.635**	4.805	**7.901**	5.003
U236		0.407	0.586	1.157	1.137	1.779	1.544	2.220	1.825	2.516

Table A6.1. Continued

Pu	F6	R6
U234	0.086	0.104
U235	**3.941**	2.358
U236	0.983	1.300

PuNpAm	F6	R6
U234	0.240	0.327
U235	**8.082**	5.142
U236	2.033	2.734

The Tables A6.2 and A6.3 present the TRU mass balances for, respectively, the Pu and Pu+Np+Am cases with blending option 1 (i.e. the most penalizing in terms of U234 and U236 build up). For the Pu recycling case, the reactor burns less Pu (ΔPu less negative) and produces more Np (ΔNp more positive) compared with the case where RepU is not recycled. For the 6th recycle the ΔPu are equal to, respectively, -55.1 kg/TWhe and -58.0 kg/TWhe depending on whether RepU is recycled or not. For Np, the values are respectively +3.40 kg/TWhe and +1.21 kg/TWhe. The impact on Am and Cm is more limited. The same is true for the Pu+Np+Am case.

The supporting ratio (the percentage of MOX-UE reactors necessary to accommodate the TRU produced by the UOX reactors) is barely impacted for the Pu case whereas for the Pu+Np+Am case it is substantially higher, i.e. about 74% compared with about 62% when RepU is not recycled.

Table A6.2. Pu recycling case – Evolution of TRU mass balances with recycling number.

	U-235 (%)	Pu content (%)	ΔPu (kg/TWhe)	ΔNp (kg/TWhe)	ΔAm (kg/TWhe)	ΔCm (kg/TWhe)
Réf. UOX	4.3	-	+27.2	+1.50	+2.23	+0.158
Cycle 1	0.25	10	-71.5	+0.568	+19.4	+2.28
Cycle 2	1.91	10	-64.2	+0.959	+21.1	+2.43
Cycle 3	2.88	10	-59.9	+1.90	+21.7	+2.51
Cycle 4	3.42	10	-57.5	+2.60	+21.9	+2.58
Cycle 5	3.75	10	-56.1	+3.07	+21.9	+2.63
Cycle 6	3.94	10	-55.1	+3.40	+21.9	+2.67

Table A6.3. Pu+Np+Am recycling case – Evolution of TRU mass balances with recycling number

	U-235 (%)	Pu+Np+Am content (%)	ΔPu (kg/TWhe)	ΔNp (kg/TWhe)	ΔAm (kg/TWhe)	ΔCm (kg/TWhe)
Réf. UOX	4.3	-	+27.2	+1.50	+2.23	+0.158
Cycle 1	3.69	7.03+0.39+0.58 = 8	-31.6	-3.34	5.32	3.02
Cycle 2	5.97	6.80+0.31+0.89 = 8	-20.0	-0.562	1.32	3.96
Cycle 3	7.08	6.67+0.33+1.00 = 8	-14.8	0.342	-0.378	4.40
Cycle 4	7.63	6.60+0.37+1.03 = 8	-12.2	0.500	-1.05	4.63
Cycle 5	7.90	6.56+0.42+1.02 = 8	-10.8	0.382	-1.23	4.75
Cycle 6	8.08	6.53+0.46+1.01 = 8	-10.0	0.226	-1.21	4.79

The Tables below present the detail of the mass balances for the different recyclings and for the Pu and Pu+Np+Am cases. For the Pu case, RepU is recycled after the 2nd recycling, since the first recycling uses depleted uranium (0.25% U235) as a matrix. For the Pu+Np+Am case, it is recycled right away after the 1st recycling.

MOXUE_10Pu_288U5_RepU_3.out							
	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	4.24E+02	4.51E+02	3.45E+02	5.94E+02	1.70E+02	4.08E-01	3.57E+00
u235	2.59E+04	2.59E+04	1.45E+04	1.45E+04	-1.14E+04	-2.75E+01	-2.41E+02
u236	2.57E+03	2.57E+03	4.79E+03	4.82E+03	2.25E+03	5.40E+00	4.73E+01
u238	8.71E+05	8.71E+05	8.42E+05	8.42E+05	-2.89E+04	-6.94E+01	-6.08E+02
np237	1.13E-06	4.04E-01	7.17E+02	7.90E+02	7.90E+02	1.90E+00	1.66E+01
pu238	3.44E+03	3.42E+03	3.14E+03	3.09E+03	-3.59E+02	-8.63E-01	-7.56E+00
pu239	4.15E+04	4.15E+04	2.62E+04	2.63E+04	-1.52E+04	-3.66E+01	-3.20E+02
pu240	3.20E+04	3.20E+04	2.50E+04	2.54E+04	-6.60E+03	-1.59E+01	-1.39E+02
pu241	1.05E+04	1.00E+04	1.29E+04	7.99E+03	-2.52E+03	-6.06E+00	-5.31E+01
pu242	1.26E+04	1.26E+04	1.24E+04	1.24E+04	-2.30E+02	-5.53E-01	-4.84E+00
pu244	5.71E-35	2.09E-12	2.28E-01	2.28E-01	2.28E-01	5.47E-04	4.79E-03
am241	1.13E-06	4.95E+02	1.53E+03	6.42E+03	6.42E+03	1.54E+01	1.35E+02
am242m	1.13E-06	1.13E-06	4.87E+01	4.64E+01	4.64E+01	1.11E-01	9.76E-01
am242	4.56E-13	1.46E-11	1.10E+00	5.98E-04	5.98E-04	1.44E-06	1.26E-05
am243	1.13E-06	1.21E-06	2.56E+03	2.56E+03	2.56E+03	6.15E+00	5.39E+01
cm242	1.13E-06	2.42E-07	1.97E+02	1.21E-01	1.21E-01	2.90E-04	2.54E-03
cm243	1.13E-06	1.11E-06	8.17E+00	6.40E+00	6.40E+00	1.54E-02	1.35E-01
cm244	1.13E-06	1.09E-06	1.29E+03	8.80E+02	8.80E+02	2.12E+00	1.85E+01
cm245	1.13E-06	1.13E-06	1.51E+02	1.51E+02	1.51E+02	3.63E-01	3.18E+00
cm246	1.13E-06	1.13E-06	8.10E+00	8.09E+00	8.09E+00	1.94E-02	1.70E-01
cm247	1.13E-06	1.13E-06	1.65E-01	1.65E-01	1.65E-01	3.96E-04	3.46E-03
cm248	1.13E-06	1.13E-06	7.40E-03	7.40E-03	7.40E-03	1.78E-05	1.56E-04
cf249	0.00E+00	2.51E-18	4.43E-05	1.83E-04	1.83E-04	4.39E-07	3.84E-06
cf250	0.00E+00	5.28E-31	2.76E-05	1.63E-05	1.63E-05	3.91E-08	3.43E-07
cf251	0.00E+00	4.92E-42	1.59E-05	1.58E-05	1.58E-05	3.79E-08	3.32E-07
cf252	0.00E+00	0.00E+00	4.03E-06	2.94E-07	2.94E-07	7.05E-10	6.18E-09
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.48E+05**	**9.48E+05**	**-5.20E+04**	**-1.25E+02**	**-1.09E+03**
TOTAL TRU	**1.00E+05**	**1.00E+05**	**8.61E+04**	**8.59E+04**	**-1.41E+04**	**-3.38E+01**	**-2.96E+02**
TOTAL PU	**1.00E+05**	**9.95E+04**	**7.96E+04**	**7.51E+04**	**-2.49E+04**	**-5.99E+01**	**-5.25E+02**
TOTAL NP	**1.13E-06**	**4.04E-01**	**7.17E+02**	**7.90E+02**	**7.90E+02**	**1.90E+00**	**1.66E+01**
TOTAL AM	**3.40E-06**	**4.95E+02**	**4.14E+03**	**9.02E+03**	**9.02E+03**	**2.17E+01**	**1.90E+02**
TOTAL CM	**7.94E-06**	**6.98E-06**	**1.65E+03**	**1.05E+03**	**1.05E+03**	**2.51E+00**	**2.20E+01**
TOTAL CF	**0.00E+00**	**2.51E-18**	**9.19E-05**	**2.15E-04**	**2.15E-04**	**5.17E-07**	**4.53E-06**

MOXUE_10Pu_342U5_RepU_4.out							
	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	6.32E+02	6.61E+02	4.85E+02	7.54E+02	1.23E+02	2.94E-01	2.58E+00
u235	3.08E+04	3.08E+04	1.74E+04	1.74E+04	-1.34E+04	-3.21E+01	-2.81E+02
u236	5.13E+03	5.13E+03	7.44E+03	7.47E+03	2.34E+03	5.62E+00	4.93E+01
u238	8.63E+05	8.63E+05	8.35E+05	8.35E+05	-2.84E+04	-6.82E+01	-5.98E+02
np237	1.13E-06	3.99E-01	1.01E+03	1.08E+03	1.08E+03	2.60E+00	2.27E+01
pu238	3.73E+03	3.70E+03	3.43E+03	3.35E+03	-3.87E+02	-9.30E-01	-8.15E+00
pu239	3.98E+04	3.98E+04	2.59E+04	2.59E+04	-1.39E+04	-3.34E+01	-2.92E+02
pu240	3.18E+04	3.18E+04	2.48E+04	2.51E+04	-6.66E+03	-1.60E+01	-1.40E+02
pu241	1.04E+04	9.89E+03	1.28E+04	7.91E+03	-2.47E+03	-5.94E+00	-5.20E+01
pu242	1.43E+04	1.43E+04	1.37E+04	1.37E+04	-5.40E+02	-1.30E+00	-1.14E+01
pu244	5.71E-35	2.09E-12	2.35E-01	2.35E-01	2.35E-01	5.64E-04	4.94E-03
am241	1.13E-06	4.89E+02	1.53E+03	6.37E+03	6.37E+03	1.53E+01	1.34E+02
am242m	1.13E-06	1.13E-06	4.87E+01	4.63E+01	4.63E+01	1.11E-01	9.75E-01
am242	4.56E-13	1.46E-11	1.08E+00	5.98E-04	5.98E-04	1.44E-06	1.26E-05
am243	1.13E-06	1.21E-06	2.69E+03	2.68E+03	2.68E+03	6.45E+00	5.65E+01
cm242	1.13E-06	2.42E-07	1.92E+02	1.21E-01	1.21E-01	2.90E-04	2.54E-03
cm243	1.13E-06	1.11E-06	7.95E+00	6.23E+00	6.23E+00	1.50E-02	1.31E-01
cm244	1.13E-06	1.09E-06	1.32E+03	9.04E+02	9.04E+02	2.17E+00	1.90E+01
cm245	1.13E-06	1.13E-06	1.54E+02	1.54E+02	1.54E+02	3.70E-01	3.24E+00
cm246	1.13E-06	1.13E-06	8.07E+00	8.05E+00	8.05E+00	1.94E-02	1.70E-01
cm247	1.13E-06	1.13E-06	1.62E-01	1.62E-01	1.62E-01	3.90E-04	3.41E-03
cm248	1.13E-06	1.13E-06	7.17E-03	7.17E-03	7.17E-03	1.72E-05	1.51E-04
cf249	0.00E+00	2.47E-18	4.27E-05	1.75E-04	1.75E-04	4.21E-07	3.69E-06
cf250	0.00E+00	5.13E-31	2.61E-05	1.54E-05	1.54E-05	3.70E-08	3.24E-07
cf251	0.00E+00	4.92E-42	1.50E-05	1.49E-05	1.49E-05	3.58E-08	3.14E-07
cf252	0.00E+00	0.00E+00	3.73E-06	2.72E-07	2.72E-07	6.53E-10	5.72E-09
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.48E+05**	**9.48E+05**	**-5.20E+04**	**-1.25E+02**	**-1.09E+03**
TOTAL TRU	**1.00E+05**	**9.99E+04**	**8.76E+04**	**8.73E+04**	**-1.27E+04**	**-3.05E+01**	**-2.67E+02**
TOTAL PU	**1.00E+05**	**9.95E+04**	**8.06E+04**	**7.60E+04**	**-2.39E+04**	**-5.75E+01**	**-5.04E+02**
TOTAL NP	**1.13E-06**	**3.99E-01**	**1.01E+03**	**1.08E+03**	**1.08E+03**	**2.60E+00**	**2.27E+01**
TOTAL AM	**3.40E-06**	**4.89E+02**	**4.26E+03**	**9.10E+03**	**9.10E+03**	**2.19E+01**	**1.91E+02**
TOTAL CM	**7.94E-06**	**6.98E-06**	**1.69E+03**	**1.07E+03**	**1.07E+03**	**2.58E+00**	**2.26E+01**
TOTAL CF	**0.00E+00**	**2.47E-18**	**8.75E-05**	**2.06E-04**	**2.06E-04**	**4.95E-07**	**4.34E-06**

MOXUE_10Pu_375U5_RepU_5.out							
	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	7.30E+02	7.61E+02	5.56E+02	8.42E+02	1.11E+02	2.68E-01	2.34E+00
u235	3.37E+04	3.37E+04	1.92E+04	1.92E+04	-1.45E+04	-3.49E+01	-3.05E+02
u236	7.23E+03	7.23E+03	9.55E+03	9.58E+03	2.35E+03	5.65E+00	4.95E+01
u238	8.58E+05	8.58E+05	8.30E+05	8.30E+05	-2.81E+04	-6.75E+01	-5.91E+02
np237	1.13E-06	3.93E-01	1.20E+03	1.28E+03	1.28E+03	3.07E+00	2.69E+01
pu238	3.97E+03	3.94E+03	3.65E+03	3.55E+03	-4.25E+02	-1.02E+00	-8.95E+00
pu239	3.89E+04	3.89E+04	2.57E+04	2.57E+04	-1.32E+04	-3.17E+01	-2.78E+02
pu240	3.13E+04	3.13E+04	2.44E+04	2.48E+04	-6.54E+03	-1.57E+01	-1.38E+02
pu241	1.02E+04	9.72E+03	1.27E+04	7.81E+03	-2.39E+03	-5.75E+00	-5.04E+01
pu242	1.56E+04	1.56E+04	1.48E+04	1.48E+04	-7.80E+02	-1.87E+00	-1.64E+01
pu244	5.71E-35	2.09E-12	2.40E-01	2.40E-01	2.40E-01	5.78E-04	5.06E-03
am241	1.13E-06	4.81E+02	1.51E+03	6.29E+03	6.29E+03	1.51E+01	1.32E+02
am242m	1.13E-06	1.13E-06	4.82E+01	4.59E+01	4.59E+01	1.10E-01	9.66E-01
am242	4.56E-13	1.46E-11	1.05E+00	5.92E-04	5.92E-04	1.42E-06	1.25E-05
am243	1.13E-06	1.22E-06	2.78E+03	2.78E+03	2.77E+03	6.67E+00	5.84E+01
cm242	1.13E-06	2.42E-07	1.88E+02	1.20E-01	1.20E-01	2.87E-04	2.52E-03
cm243	1.13E-06	1.11E-06	7.76E+00	6.08E+00	6.08E+00	1.46E-02	1.28E-01
cm244	1.13E-06	1.09E-06	1.35E+03	9.23E+02	9.23E+02	2.22E+00	1.94E+01
cm245	1.13E-06	1.13E-06	1.57E+02	1.57E+02	1.57E+02	3.76E-01	3.30E+00
cm246	1.13E-06	1.13E-06	8.09E+00	8.08E+00	8.08E+00	1.94E-02	1.70E-01
cm247	1.13E-06	1.13E-06	1.62E-01	1.62E-01	1.62E-01	3.89E-04	3.41E-03
cm248	1.13E-06	1.13E-06	7.09E-03	7.09E-03	7.09E-03	1.70E-05	1.49E-04
cf249	0.00E+00	2.45E-18	4.21E-05	1.73E-04	1.73E-04	4.15E-07	3.64E-06
cf250	0.00E+00	5.05E-31	2.55E-05	1.50E-05	1.50E-05	3.61E-08	3.16E-07
cf251	0.00E+00	4.22E-42	1.47E-05	1.46E-05	1.46E-05	3.50E-08	3.06E-07
cf252	0.00E+00	0.00E+00	3.60E-06	2.63E-07	2.63E-07	6.31E-10	5.53E-09
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.48E+05**	**9.48E+05**	**-5.20E+04**	**-1.25E+02**	**-1.09E+03**
TOTAL TRU	**1.00E+05**	**9.99E+04**	**8.84E+04**	**8.81E+04**	**-1.18E+04**	**-2.85E+01**	**-2.49E+02**
TOTAL PU	**1.00E+05**	**9.95E+04**	**8.11E+04**	**7.66E+04**	**-2.33E+04**	**-5.61E+01**	**-4.91E+02**
TOTAL NP	**1.13E-06**	**3.93E-01**	**1.20E+03**	**1.28E+03**	**1.28E+03**	**3.07E+00**	**2.69E+01**
TOTAL AM	**3.40E-06**	**4.81E+02**	**4.34E+03**	**9.11E+03**	**9.11E+03**	**2.19E+01**	**1.92E+02**
TOTAL CM	**7.94E-06**	**6.98E-06**	**1.71E+03**	**1.09E+03**	**1.09E+03**	**2.63E+00**	**2.30E+01**
TOTAL CF	**0.00E+00**	**2.45E-18**	**8.58E-05**	**2.03E-04**	**2.03E-04**	**4.87E-07**	**4.26E-06**

MOXUE_10Pu_394U5_RepU_6.out							
	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	7.77E+02	8.09E+02	5.93E+02	8.90E+02	1.13E+02	2.72E-01	2.38E+00
u235	3.55E+04	3.55E+04	2.03E+04	2.03E+04	-1.52E+04	-3.65E+01	-3.20E+02
u236	8.84E+03	8.85E+03	1.12E+04	1.12E+04	2.33E+03	5.59E+00	4.90E+01
u238	8.55E+05	8.55E+05	8.27E+05	8.27E+05	-2.79E+04	-6.70E+01	-5.87E+02
np237	1.13E-06	3.86E-01	1.34E+03	1.42E+03	1.41E+03	3.40E+00	2.98E+01
pu238	4.15E+03	4.12E+03	3.81E+03	3.69E+03	-4.61E+02	-1.11E+00	-9.70E+00
pu239	3.84E+04	3.84E+04	2.55E+04	2.56E+04	-1.28E+04	-3.08E+01	-2.69E+02
pu240	3.08E+04	3.08E+04	2.40E+04	2.45E+04	-6.38E+03	-1.53E+01	-1.34E+02
pu241	1.00E+04	9.57E+03	1.25E+04	7.71E+03	-2.33E+03	-5.59E+00	-4.90E+01
pu242	1.66E+04	1.66E+04	1.56E+04	1.56E+04	-9.70E+02	-2.33E+00	-2.04E+01
pu244	5.71E-35	2.09E-12	2.45E-01	2.45E-01	2.45E-01	5.89E-04	5.16E-03
am241	1.13E-06	4.73E+02	1.50E+03	6.22E+03	6.22E+03	1.49E+01	1.31E+02
am242m	1.13E-06	1.13E-06	4.76E+01	4.54E+01	4.53E+01	1.09E-01	9.55E-01
am242	4.56E-13	1.46E-11	1.04E+00	5.85E-04	5.85E-04	1.41E-06	1.23E-05
am243	1.13E-06	1.22E-06	2.85E+03	2.84E+03	2.84E+03	6.83E+00	5.99E+01
cm242	1.13E-06	2.42E-07	1.85E+02	1.18E-01	1.18E-01	2.84E-04	2.49E-03
cm243	1.13E-06	1.11E-06	7.61E+00	5.97E+00	5.97E+00	1.43E-02	1.26E-01
cm244	1.13E-06	1.09E-06	1.38E+03	9.40E+02	9.40E+02	2.26E+00	1.98E+01
cm245	1.13E-06	1.13E-06	1.59E+02	1.59E+02	1.59E+02	3.82E-01	3.34E+00
cm246	1.13E-06	1.13E-06	8.16E+00	8.15E+00	8.15E+00	1.96E-02	1.72E-01
cm247	1.13E-06	1.13E-06	1.63E-01	1.63E-01	1.63E-01	3.91E-04	3.43E-03
cm248	1.13E-06	1.13E-06	7.11E-03	7.11E-03	7.11E-03	1.71E-05	1.50E-04
cf249	0.00E+00	2.44E-18	4.21E-05	1.73E-04	1.73E-04	4.15E-07	3.63E-06
cf250	0.00E+00	5.00E-31	2.54E-05	1.50E-05	1.50E-05	3.59E-08	3.15E-07
cf251	0.00E+00	4.22E-42	1.46E-05	1.45E-05	1.45E-05	3.48E-08	3.05E-07
cf252	0.00E+00	0.00E+00	3.57E-06	2.60E-07	2.60E-07	6.25E-10	5.48E-09
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.48E+05**	**9.48E+05**	**-5.20E+04**	**-1.25E+02**	**-1.09E+03**
TOTAL TRU	**1.00E+05**	**9.99E+04**	**8.89E+04**	**8.87E+04**	**-1.13E+04**	**-2.72E+01**	**-2.38E+02**
TOTAL PU	**1.00E+05**	**9.95E+04**	**8.15E+04**	**7.70E+04**	**-2.29E+04**	**-5.51E+01**	**-4.83E+02**
TOTAL NP	**1.13E-06**	**3.86E-01**	**1.34E+03**	**1.42E+03**	**1.41E+03**	**3.40E+00**	**2.98E+01**
TOTAL AM	**3.40E-06**	**4.73E+02**	**4.39E+03**	**9.11E+03**	**9.11E+03**	**2.19E+01**	**1.92E+02**
TOTAL CM	**7.94E-06**	**6.98E-06**	**1.74E+03**	**1.11E+03**	**1.11E+03**	**2.67E+00**	**2.34E+01**
TOTAL CF	**0.00E+00**	**2.44E-18**	**8.56E-05**	**2.02E-04**	**2.02E-04**	**4.86E-07**	**4.26E-06**

MOXUE_8PuNpAm_597U5_RepU_2.out							
	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	7.32E+02	7.71E+02	6.42E+02	1.23E+03	5.03E+02	1.21E+00	1.06E+01
u235	5.50E+04	5.50E+04	3.15E+04	3.15E+04	-2.35E+04	-5.64E+01	-4.94E+02
u236	5.39E+03	5.39E+03	1.01E+04	1.01E+04	4.72E+03	1.13E+01	9.93E+01
u238	8.59E+05	8.59E+05	8.31E+05	8.31E+05	-2.76E+04	-6.63E+01	-5.81E+02
np237	3.10E+03	3.11E+03	2.77E+03	2.86E+03	-2.34E+02	-5.62E-01	-4.93E+00
pu238	5.09E+03	5.05E+03	7.52E+03	7.37E+03	2.27E+03	5.46E+00	4.79E+01
pu239	2.98E+04	2.98E+04	2.28E+04	2.28E+04	-6.96E+03	-1.67E+01	-1.47E+02
pu240	1.95E+04	1.94E+04	1.60E+04	1.66E+04	-2.90E+03	-6.97E+00	-6.10E+01
pu241	6.81E+03	6.49E+03	9.25E+03	5.71E+03	-1.11E+03	-2.66E+00	-2.33E+01
pu242	6.86E+03	6.86E+03	7.25E+03	7.25E+03	3.83E+02	9.20E-01	8.06E+00
pu244	5.71E-35	2.09E-12	1.57E-01	1.57E-01	1.57E-01	3.78E-04	3.31E-03
am241	6.44E+03	6.75E+03	3.03E+03	6.50E+03	5.50E+01	1.32E-01	1.16E+00
am242m	7.96E+01	7.92E+01	1.19E+02	1.13E+02	3.38E+01	8.12E-02	7.11E-01
am242	4.56E-13	1.02E-03	2.11E+00	1.46E-03	1.46E-03	3.52E-06	3.08E-05
am243	2.35E+03	2.35E+03	2.81E+03	2.81E+03	4.62E+02	1.11E+00	9.72E+00
cm242	1.13E-06	1.63E-01	4.52E+02	2.96E-01	2.95E-01	7.10E-04	6.22E-03
cm243	1.13E-06	1.11E-06	2.87E+01	2.25E+01	2.25E+01	5.40E-02	4.73E-01
cm244	1.13E-06	1.13E-06	1.97E+03	1.34E+03	1.34E+03	3.23E+00	2.83E+01
cm245	1.13E-06	1.13E-06	2.66E+02	2.66E+02	2.65E+02	6.38E-01	5.59E+00
cm246	1.13E-06	1.13E-06	1.74E+01	1.74E+01	1.74E+01	4.18E-02	3.66E-01
cm247	1.13E-06	1.13E-06	4.10E-01	4.10E-01	4.10E-01	9.86E-04	8.63E-03
cm248	1.13E-06	1.13E-06	2.24E-02	2.24E-02	2.24E-02	5.39E-05	4.72E-04
cf249	0.00E+00	2.40E-18	1.54E-04	5.83E-04	5.83E-04	1.40E-06	1.23E-05
cf250	0.00E+00	4.98E-31	9.02E-05	5.32E-05	5.32E-05	1.28E-07	1.12E-06
cf251	0.00E+00	4.22E-42	5.47E-05	5.43E-05	5.43E-05	1.30E-07	1.14E-06
cf252	0.00E+00	0.00E+00	1.49E-05	1.09E-06	1.09E-06	2.61E-09	2.28E-08
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.48E+05**	**9.48E+05**	**-5.22E+04**	**-1.25E+02**	**-1.10E+03**
TOTAL TRU	**8.00E+04**	**7.99E+04**	**7.42E+04**	**7.36E+04**	**-6.34E+03**	**-1.52E+01**	**-1.34E+02**
TOTAL PU	**6.80E+04**	**6.77E+04**	**6.27E+04**	**5.97E+04**	**-8.31E+03**	**-2.00E+01**	**-1.75E+02**
TOTAL NP	**3.10E+03**	**3.11E+03**	**2.77E+03**	**2.86E+03**	**-2.34E+02**	**-5.62E-01**	**-4.93E+00**
TOTAL AM	**8.87E+03**	**9.18E+03**	**5.97E+03**	**9.42E+03**	**5.51E+02**	**1.32E+00**	**1.16E+01**
TOTAL CM	**7.94E-06**	**1.63E-01**	**2.73E+03**	**1.65E+03**	**1.65E+03**	**3.96E+00**	**3.47E+01**
TOTAL CF	**0.00E+00**	**2.40E-18**	**3.14E-04**	**6.92E-04**	**6.92E-04**	**1.66E-06**	**1.46E-05**
PU+NP+AM	**8.00E+04**	**7.99E+04**	**7.15E+04**	**7.20E+04**	**-7.99E+03**	**-1.92E+01**	**-1.68E+02**

MOXUE_8PuNpAm_708U5_RepU_3.out							
	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	1.28E+03	1.34E+03	1.08E+03	1.82E+03	5.46E+02	1.31E+00	1.15E+01
u235	6.52E+04	6.52E+04	3.84E+04	3.84E+04	-2.68E+04	-6.44E+01	-5.64E+02
u236	1.05E+04	1.05E+04	1.55E+04	1.55E+04	5.05E+03	1.21E+01	1.06E+02
u238	8.43E+05	8.43E+05	8.16E+05	8.16E+05	-2.68E+04	-6.44E+01	-5.64E+02
np237	3.25E+03	3.26E+03	3.30E+03	3.39E+03	1.43E+02	3.44E-01	3.01E+00
pu238	7.55E+03	7.49E+03	9.52E+03	9.23E+03	1.68E+03	4.03E+00	3.53E+01
pu239	2.67E+04	2.67E+04	2.24E+04	2.24E+04	-4.26E+03	-1.02E+01	-8.97E+01
pu240	1.84E+04	1.84E+04	1.50E+04	1.57E+04	-2.70E+03	-6.49E+00	-5.68E+01
pu241	6.38E+03	6.08E+03	8.80E+03	5.43E+03	-9.51E+02	-2.29E+00	-2.00E+01
pu242	7.78E+03	7.78E+03	7.87E+03	7.87E+03	8.50E+01	2.04E-01	1.79E+00
pu244	5.71E-35	2.09E-12	1.57E-01	1.57E-01	1.57E-01	3.78E-04	3.31E-03
am241	6.95E+03	7.24E+03	3.26E+03	6.55E+03	-3.98E+02	-9.56E-01	-8.38E+00
am242m	1.14E+02	1.13E+02	1.31E+02	1.25E+02	1.07E+01	2.57E-02	2.25E-01
am242	4.56E-13	1.46E-03	2.16E+00	1.61E-03	1.61E-03	3.86E-06	3.38E-05
am243	2.93E+03	2.93E+03	3.16E+03	3.16E+03	2.30E+02	5.53E-01	4.84E+00
cm242	1.13E-06	2.33E-01	4.64E+02	3.25E-01	3.25E-01	7.80E-04	6.84E-03
cm243	1.13E-06	1.11E-06	2.95E+01	2.31E+01	2.31E+01	5.55E-02	4.86E-01
cm244	1.13E-06	1.14E-06	2.19E+03	1.50E+03	1.50E+03	3.59E+00	3.15E+01
cm245	1.13E-06	1.13E-06	2.93E+02	2.93E+02	2.93E+02	7.05E-01	6.17E+00
cm246	1.13E-06	1.13E-06	1.84E+01	1.84E+01	1.84E+01	4.42E-02	3.87E-01
cm247	1.13E-06	1.13E-06	4.28E-01	4.28E-01	4.28E-01	1.03E-03	9.01E-03
cm248	1.13E-06	1.13E-06	2.28E-02	2.28E-02	2.28E-02	5.48E-05	4.80E-04
cf249	0.00E+00	2.34E-18	1.56E-04	5.85E-04	5.85E-04	1.41E-06	1.23E-05
cf250	0.00E+00	4.70E-31	8.72E-05	5.14E-05	5.14E-05	1.24E-07	1.08E-06
cf251	0.00E+00	4.22E-42	5.30E-05	5.26E-05	5.26E-05	1.26E-07	1.11E-06
cf252	0.00E+00	0.00E+00	1.38E-05	1.01E-06	1.01E-06	2.42E-09	2.12E-08
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.47E+05**	**9.47E+05**	**-5.23E+04**	**-1.26E+02**	**-1.10E+03**
TOTAL TRU	**8.00E+04**	**7.99E+04**	**7.64E+04**	**7.57E+04**	**-4.33E+03**	**-1.04E+01**	**-9.12E+01**
TOTAL PU	**6.67E+04**	**6.64E+04**	**6.35E+04**	**6.06E+04**	**-6.15E+03**	**-1.48E+01**	**-1.29E+02**
TOTAL NP	**3.25E+03**	**3.26E+03**	**3.30E+03**	**3.39E+03**	**1.43E+02**	**3.44E-01**	**3.01E+00**
TOTAL AM	**9.99E+03**	**1.03E+04**	**6.56E+03**	**9.84E+03**	**-1.57E+02**	**-3.78E-01**	**-3.31E+00**
TOTAL CM	**7.94E-06**	**2.33E-01**	**3.00E+03**	**1.83E+03**	**1.83E+03**	**4.40E+00**	**3.86E+01**
TOTAL CF	**0.00E+00**	**2.34E-18**	**3.10E-04**	**6.90E-04**	**6.90E-04**	**1.66E-06**	**1.45E-05**
PU+NP+AM	**8.00E+04**	**7.99E+04**	**7.34E+04**	**7.38E+04**	**-6.16E+03**	**-1.48E+01**	**-1.30E+02**

MOXUE_8PuNpAm_763U5_RepU_4.out							
	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	1.67E+03	1.74E+03	1.41E+03	2.26E+03	5.91E+02	1.42E+00	1.24E+01
u235	7.02E+04	7.02E+04	4.18E+04	4.18E+04	-2.84E+04	-6.82E+01	-5.98E+02
u236	1.42E+04	1.42E+04	1.93E+04	1.93E+04	5.13E+03	1.23E+01	1.08E+02
u238	8.34E+05	8.34E+05	8.07E+05	8.07E+05	-2.63E+04	-6.32E+01	-5.54E+02
np237	3.69E+03	3.70E+03	3.81E+03	3.90E+03	2.08E+02	5.00E-01	4.38E+00
pu238	9.37E+03	9.30E+03	1.10E+04	1.06E+04	1.20E+03	2.89E+00	2.53E+01
pu239	2.53E+04	2.53E+04	2.22E+04	2.22E+04	-3.10E+03	-7.45E+00	-6.53E+01
pu240	1.71E+04	1.71E+04	1.41E+04	1.48E+04	-2.25E+03	-5.41E+00	-4.74E+01
pu241	5.95E+03	5.67E+03	8.38E+03	5.17E+03	-7.77E+02	-1.87E+00	-1.64E+01
pu242	8.28E+03	8.28E+03	8.15E+03	8.15E+03	-1.35E+02	-3.24E-01	-2.84E+00
pu244	5.71E-35	2.09E-12	1.57E-01	1.57E-01	1.57E-01	3.77E-04	3.31E-03
am241	6.90E+03	7.17E+03	3.24E+03	6.37E+03	-5.27E+02	-1.27E+00	-1.11E+01
am242m	1.25E+02	1.24E+02	1.31E+02	1.25E+02	1.00E-01	2.40E-04	2.10E-03
am242	4.56E-13	1.61E-03	2.11E+00	1.61E-03	1.61E-03	3.88E-06	3.40E-05
am243	3.26E+03	3.26E+03	3.35E+03	3.35E+03	9.20E+01	2.21E-01	1.94E+00
cm242	1.13E-06	2.55E-01	4.52E+02	3.26E-01	3.26E-01	7.83E-04	6.86E-03
cm243	1.13E-06	1.11E-06	2.87E+01	2.25E+01	2.25E+01	5.41E-02	4.74E-01
cm244	1.13E-06	1.14E-06	2.31E+03	1.58E+03	1.58E+03	3.79E+00	3.32E+01
cm245	1.13E-06	1.13E-06	3.07E+02	3.07E+02	3.07E+02	7.38E-01	6.46E+00
cm246	1.13E-06	1.13E-06	1.89E+01	1.89E+01	1.89E+01	4.54E-02	3.97E-01
cm247	1.13E-06	1.13E-06	4.37E-01	4.37E-01	4.37E-01	1.05E-03	9.20E-03
cm248	1.13E-06	1.13E-06	2.31E-02	2.31E-02	2.31E-02	5.55E-05	4.86E-04
cf249	0.00E+00	2.30E-18	1.57E-04	5.88E-04	5.88E-04	1.41E-06	1.24E-05
cf250	0.00E+00	4.57E-31	8.63E-05	5.09E-05	5.09E-05	1.22E-07	1.07E-06
cf251	0.00E+00	4.22E-42	5.24E-05	5.20E-05	5.20E-05	1.25E-07	1.10E-06
cf252	0.00E+00	0.00E+00	1.34E-05	9.79E-07	9.79E-07	2.35E-09	2.06E-08
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.47E+05**	**9.47E+05**	**-5.23E+04**	**-1.26E+02**	**-1.10E+03**
TOTAL TRU	**8.00E+04**	**7.99E+04**	**7.74E+04**	**7.66E+04**	**-3.36E+03**	**-8.07E+00**	**-7.07E+01**
TOTAL PU	**6.60E+04**	**6.57E+04**	**6.38E+04**	**6.09E+04**	**-5.06E+03**	**-1.22E+01**	**-1.07E+02**
TOTAL NP	**3.69E+03**	**3.70E+03**	**3.81E+03**	**3.90E+03**	**2.08E+02**	**5.00E-01**	**4.38E+00**
TOTAL AM	**1.03E+04**	**1.05E+04**	**6.73E+03**	**9.85E+03**	**-4.35E+02**	**-1.05E+00**	**-9.15E+00**
TOTAL CM	**7.94E-06**	**2.55E-01**	**3.12E+03**	**1.93E+03**	**1.93E+03**	**4.63E+00**	**4.06E+01**
TOTAL CF	**0.00E+00**	**2.30E-18**	**3.10E-04**	**6.92E-04**	**6.92E-04**	**1.66E-06**	**1.46E-05**
PU+NP+AM	**8.00E+04**	**7.99E+04**	**7.43E+04**	**7.47E+04**	**-5.29E+03**	**-1.27E+01**	**-1.11E+02**

MOXUE_8PuNpAm_790U5_RepU_5.out							
	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	1.96E+03	2.05E+03	1.66E+03	2.59E+03	6.23E+02	1.50E+00	1.31E+01
u235	7.27E+04	7.27E+04	4.35E+04	4.35E+04	-2.91E+04	-7.00E+01	-6.13E+02
u236	1.68E+04	1.68E+04	2.19E+04	2.19E+04	5.11E+03	1.23E+01	1.08E+02
u238	8.28E+05	8.28E+05	8.02E+05	8.02E+05	-2.61E+04	-6.27E+01	-5.49E+02
np237	4.16E+03	4.17E+03	4.22E+03	4.32E+03	1.59E+02	3.82E-01	3.35E+00
pu238	1.07E+04	1.06E+04	1.20E+04	1.15E+04	8.40E+02	2.02E+00	1.77E+01
pu239	2.48E+04	2.48E+04	2.21E+04	2.22E+04	-2.58E+03	-6.20E+00	-5.43E+01
pu240	1.60E+04	1.60E+04	1.35E+04	1.42E+04	-1.84E+03	-4.42E+00	-3.87E+01
pu241	5.62E+03	5.35E+03	8.07E+03	4.98E+03	-6.39E+02	-1.54E+00	-1.35E+01
pu242	8.50E+03	8.50E+03	8.22E+03	8.22E+03	-2.80E+02	-6.73E-01	-5.89E+00
pu244	5.71E-35	2.09E-12	1.56E-01	1.56E-01	1.56E-01	3.76E-04	3.29E-03
am241	6.67E+03	6.93E+03	3.14E+03	6.15E+03	-5.17E+02	-1.24E+00	-1.09E+01
am242m	1.25E+02	1.25E+02	1.28E+02	1.22E+02	-3.70E+00	-8.89E-03	-7.79E-02
am242	4.56E-13	1.61E-03	2.02E+00	1.57E-03	1.57E-03	3.77E-06	3.30E-05
am243	3.43E+03	3.43E+03	3.44E+03	3.44E+03	7.00E+00	1.68E-02	1.47E-01
cm242	1.13E-06	2.56E-01	4.35E+02	3.17E-01	3.17E-01	7.62E-04	6.67E-03
cm243	1.13E-06	1.11E-06	2.76E+01	2.16E+01	2.16E+01	5.20E-02	4.55E-01
cm244	1.13E-06	1.15E-06	2.38E+03	1.62E+03	1.62E+03	3.90E+00	3.41E+01
cm245	1.13E-06	1.13E-06	3.14E+02	3.14E+02	3.14E+02	7.55E-01	6.61E+00
cm246	1.13E-06	1.13E-06	1.92E+01	1.92E+01	1.92E+01	4.60E-02	4.03E-01
cm247	1.13E-06	1.13E-06	4.42E-01	4.42E-01	4.42E-01	1.06E-03	9.31E-03
cm248	1.13E-06	1.13E-06	2.34E-02	2.34E-02	2.34E-02	5.62E-05	4.92E-04
cf249	0.00E+00	2.29E-18	1.59E-04	5.93E-04	5.93E-04	1.43E-06	1.25E-05
cf250	0.00E+00	4.51E-31	8.64E-05	5.10E-05	5.10E-05	1.23E-07	1.07E-06
cf251	0.00E+00	4.22E-42	5.26E-05	5.21E-05	5.21E-05	1.25E-07	1.10E-06
cf252	0.00E+00	0.00E+00	1.34E-05	9.74E-07	9.74E-07	2.34E-09	2.05E-08
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.47E+05**	**9.47E+05**	**-5.24E+04**	**-1.26E+02**	**-1.10E+03**
TOTAL TRU	**8.00E+04**	**7.99E+04**	**7.80E+04**	**7.71E+04**	**-2.88E+03**	**-6.91E+00**	**-6.06E+01**
TOTAL PU	**6.56E+04**	**6.53E+04**	**6.39E+04**	**6.11E+04**	**-4.50E+03**	**-1.08E+01**	**-9.47E+01**
TOTAL NP	**4.16E+03**	**4.17E+03**	**4.22E+03**	**4.32E+03**	**1.59E+02**	**3.82E-01**	**3.35E+00**
TOTAL AM	**1.02E+04**	**1.05E+04**	**6.71E+03**	**9.71E+03**	**-5.14E+02**	**-1.23E+00**	**-1.08E+01**
TOTAL CM	**7.94E-06**	**2.56E-01**	**3.17E+03**	**1.98E+03**	**1.98E+03**	**4.75E+00**	**4.16E+01**
TOTAL CF	**0.00E+00**	**2.29E-18**	**3.11E-04**	**6.97E-04**	**6.97E-04**	**1.68E-06**	**1.47E-05**
PU+NP+AM	**8.00E+04**	**7.99E+04**	**7.48E+04**	**7.51E+04**	**-4.85E+03**	**-1.17E+01**	**-1.02E+02**

MOXUE_8PuNpAm_808U5_RepU_6.out							
	Fab	BOI (Fab.+1y)	EOI (51 GWj/t)	EOI + 10ans	Delta (g)	Delta (kg/TWe.h)	Delta (kg/GWe.y)
u234	2.21E+03	2.30E+03	1.86E+03	2.85E+03	6.38E+02	1.53E+00	1.34E+01
u235	7.43E+04	7.43E+04	4.47E+04	4.47E+04	-2.96E+04	-7.11E+01	-6.23E+02
u236	1.87E+04	1.87E+04	2.38E+04	2.38E+04	5.09E+03	1.22E+01	1.07E+02
u238	8.25E+05	8.25E+05	7.99E+05	7.99E+05	-2.59E+04	-6.22E+01	-5.45E+02
np237	4.55E+03	4.56E+03	4.55E+03	4.65E+03	9.40E+01	2.26E-01	1.98E+00
pu238	1.16E+04	1.16E+04	1.28E+04	1.22E+04	5.80E+02	1.39E+00	1.22E+01
pu239	2.45E+04	2.45E+04	2.22E+04	2.22E+04	-2.30E+03	-5.53E+00	-4.84E+01
pu240	1.53E+04	1.53E+04	1.30E+04	1.37E+04	-1.54E+03	-3.70E+00	-3.24E+01
pu241	5.39E+03	5.13E+03	7.85E+03	4.85E+03	-5.41E+02	-1.30E+00	-1.14E+01
pu242	8.55E+03	8.55E+03	8.18E+03	8.18E+03	-3.68E+02	-8.84E-01	-7.75E+00
pu244	5.71E-35	2.09E-12	1.55E-01	1.55E-01	1.55E-01	3.72E-04	3.26E-03
am241	6.43E+03	6.67E+03	3.04E+03	5.98E+03	-4.54E+02	-1.09E+00	-9.56E+00
am242m	1.22E+02	1.21E+02	1.24E+02	1.18E+02	-3.80E+00	-9.13E-03	-8.00E-02
am242	4.56E-13	1.57E-03	1.95E+00	1.53E-03	1.52E-03	3.66E-06	3.21E-05
am243	3.51E+03	3.51E+03	3.47E+03	3.47E+03	-4.60E+01	-1.11E-01	-9.68E-01
cm242	1.13E-06	2.49E-01	4.19E+02	3.08E-01	3.08E-01	7.40E-04	6.48E-03
cm243	1.13E-06	1.11E-06	2.65E+01	2.08E+01	2.08E+01	4.99E-02	4.37E-01
cm244	1.13E-06	1.15E-06	2.40E+03	1.64E+03	1.63E+03	3.93E+00	3.44E+01
cm245	1.13E-06	1.13E-06	3.17E+02	3.16E+02	3.16E+02	7.60E-01	6.66E+00
cm246	1.13E-06	1.13E-06	1.92E+01	1.92E+01	1.91E+01	4.60E-02	4.03E-01
cm247	1.13E-06	1.13E-06	4.41E-01	4.41E-01	4.41E-01	1.06E-03	9.28E-03
cm248	1.13E-06	1.13E-06	2.33E-02	2.33E-02	2.33E-02	5.59E-05	4.90E-04
cf249	0.00E+00	2.27E-18	1.58E-04	5.89E-04	5.89E-04	1.42E-06	1.24E-05
cf250	0.00E+00	4.46E-31	8.54E-05	5.04E-05	5.04E-05	1.21E-07	1.06E-06
cf251	0.00E+00	3.87E-42	5.19E-05	5.15E-05	5.15E-05	1.24E-07	1.08E-06
cf252	0.00E+00	0.00E+00	1.31E-05	9.57E-07	9.57E-07	2.30E-09	2.01E-08
TOTAL NL	**1.00E+06**	**1.00E+06**	**9.47E+05**	**9.47E+05**	**-5.24E+04**	**-1.26E+02**	**-1.10E+03**
TOTAL TRU	**8.00E+04**	**7.99E+04**	**7.84E+04**	**7.74E+04**	**-2.59E+03**	**-6.22E+00**	**-5.45E+01**
TOTAL PU	**6.54E+04**	**6.50E+04**	**6.40E+04**	**6.12E+04**	**-4.17E+03**	**-1.00E+01**	**-8.78E+01**
TOTAL NP	**4.55E+03**	**4.56E+03**	**4.55E+03**	**4.65E+03**	**9.40E+01**	**2.26E-01**	**1.98E+00**
TOTAL AM	**1.01E+04**	**1.03E+04**	**6.64E+03**	**9.56E+03**	**-5.04E+02**	**-1.21E+00**	**-1.06E+01**
TOTAL CM	**7.94E-06**	**2.49E-01**	**3.18E+03**	**1.99E+03**	**1.99E+03**	**4.79E+00**	**4.19E+01**
TOTAL CF	**0.00E+00**	**2.27E-18**	**3.09E-04**	**6.92E-04**	**6.92E-04**	**1.66E-06**	**1.46E-05**
PU+NP+AM	**8.00E+04**	**7.99E+04**	**7.52E+04**	**7.54E+04**	**-4.58E+03**	**-1.10E+01**	**-9.64E+01**