Report

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***"A Model for a Liquid
Membrane Separation
Stage"***

between

**The Regents of the University of California
(The Los-Alamos National Laboratory)**

and

**The All-Russia Scientific Research Institute
of
Inorganic Materials**

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Modelling of Extractors with Short-Closed Carrier Phase

The coupled mixer-settlers having a common settling zone suggested for use to extract fission products from a conversion reactor blanket are analogues of membrane apparatuses and at a first glance in terms of hydrodynamics do not differ from conventional mixer-settlers. However, the common settling zone complicates both the design solutions and their modelling. For example, different emulsion types can result in mixers and it is not known how this fact will affect phenomena such as separation rates, disperse phase entrainment under conditions close to flooding.

For initial studies of the feasibility of the process in principle and the primary optimization of the structure of the transfer scheme one needs to have a model and a programme to calculate the statics of a multistage membrane facility of this type.

1. Modelling Statics of Multistage Membrane Facilities Based on Short-Closed Couples of Mixer-Settlers without Account for Stage Efficiency.

Consider the general schema of a single cell and a flow structure within it.

Fig. 1. General schema and flow structure in membrane module of the type of a short-closed mixer-settler couple.

a) - Top view b) - Side view

(W) - natural water flow, (D) - heavy water flow, S - extractant,
m₁, m₂ - mixers, s₁, s₂ - settlers.

Two heavy water flows enter and leave the cell; they do not mix in the settling zone while the extractant is mixed in the zone of the guaranteed separation and goes to the mixers along the recirculation paths.

At the first stage of modelling this apparatus let us assume the following: mixers are two phase reactors with ideal mixing, settlers are also two phase reactors with ideal mixing and a complete phase separation; the continuous extractant phase is mixed in the settler and enters the mixers; the concentrations of components in the phases leaving the mixer are equilibrium (the efficiency=1). The block-diagram of the cell is shown in fig.2. under those assumptions.

Fig.2. Block-diagram of a membrane cell of the two closed mixer-settler type having a common separation zone.

Natural water line:

W - magnitude of flow

x_w^f - inlet concentration of components (vector)

V_w - magnitude of external flow

α_1 - distribution coefficient (vector)

Heavy water line:

D - magnitude of flow

x_d^f - inlet concentration of components

V_d - magnitude of extractant flow

α_2 - distribution coefficient (vector)

y_m - concentration of components in organic phase of a settler

Material balance of natural water mixer.

For the sake of clarity let us consider balance equations for a single component, although the system is a multicomponent one and the values describing the concentrations are vector ones:

$$Wx_w^F + V_w y = Wx_w + V_w y_1; \quad (1.1)$$

$$y_1 = x_w \alpha_1 \quad (1.2)$$

balance of heavy water mixer

$$Dx_D^F + V_D y_m = Dx_D + V_D y_2 \quad (1.3)$$

$$y_2 = x_D \alpha_2 \quad (1.4)$$

Mixing of extractant in settling zone m_s .

$$y_1 V_w + y_2 V_D = y_m (V_w + V_D) \quad (1.5)$$

$$y_m = (y_1 V_w + y_2 V_D) / (V_w + V_D) \quad (1.5-a)$$

α_1 and α_2 being non-linear functions of x_w and x_D .

$\alpha_1 = f_1(x_w)$ and $\alpha_2 = f_2(x_D)$ are in fact equations of extraction equilibrium.

Since magnitudes x_w^F , x_D^F , x_w , x_D , y_m , α_1 , α_2 are vector ones in the number of components, the general system of non-linear equations for j component has the form of:

$$Wx_{wj}^F + V_w y_{mj} = x_{wj} (W + V_w \alpha_{1j}) \quad (1.6-1)$$

$$Dx_{Dj}^F + V_D y_{mj} = x_{Dj} (D + V_D \alpha_{2j}) \quad (1.6-2)$$

$$y_{mj} = (x_{wj} \alpha_{1j} V_w + x_{Dj} \alpha_{2j} V_D) / (V_w + V_D) \quad (1.6-3)$$

$$\alpha_{1j} = f_{1j}(x_{w1} \dots x_{wj} \dots x_{wk}) \quad (1.6-4)$$

$$\alpha_{2j} = f_{2j}(x_{D1} \dots x_{Dj} \dots x_{Dk}) \quad (1.6-5)$$

x_{wj} , x_{Dj} , y_{mj} , α_{1j} , α_{2j} are unknown and can be determined by solving the system of five equations (1.6); only the equilibrium equations are non-linear. The iteration procedure of finding the $(t+1)^{th}$ approximation from the concentrations x_{wj} , x_{Dj} is shown in fig.3. as a block diagram.

To calculate a multistage cascade where two aqueous phases move in a counter current the magnitudes of aqueous flows and concentrations x_w and x_D for each module need be determined; it is advisable to organize the iteration procedure in the following way:

1. To start the calculation of module N 1 and equate the values of inlet concentrations in the water cycle to x_w^F and to equate x_D^F to x_D of stage 2 (ϕ at the first step).

2. To perform the specific number of iterations t and without reaching the balance at stage 1 to start the calculation of stage 2.
3. Assume x_w^F for stage 2 to be equal to x_w derived at the previous step (at stage 1) and x_D^F to be equal to x_D of stage 3 and so on (0 at the first step).
4. In the calculation of the last module assume the value of x_D^F equal to the values of inlet concentrations for the heavy water cycle.
5. To start the next stage (step of iterations) of calculations with the last stage (number N).
6. To carry out the final calculation using the balance of the whole cascade and each individual module.

Thus, the "renewal" of the values of component concentrations along the module length proceeds cyclically from the first to the last one and then from the last one to the first and so on.

This procedure makes it possible to determine more reliably the behaviour of individual components in the process and choose the technological configuration (number of modules) and process conditions (phase flow ratio). Based on the above model the programme "RING" has been designed, its text, initial data and results of test calculations are given in Annex 1. For this programme one has to specify the number of membrane modules, the number of components, the magnitudes of initial flows, and component concentrations in them as well as extractant flow rates for both the cycles.

2. Modelling of Statics Taking into Account Membrane Module Efficiency.

The calculations of the established operation schedules of a cascade of membrane modules taking account of the efficiency of a stage allow a more accurate determination of all operation parameters of the facility, besides, it is also possible to determine parameters such as an emulsion type, the interface, flooding loads, microemulsion entrainment by contacting phases. The block-diagram of a cell is illustrated in fig.4.

Fig.4. Block-diagram of membrane cell,
designed on the base of cell model

The designations are the same as in fig.2.

p, r - number of ideal mixing cells describing the settling zone.

While the type of an emulsion is readily determined from the phase volume ratio, specific sophisticated calculations are needed to determine the emulsion layer thickness (and correspondingly of continuous phases).

In literature [1] the separation rate for aqueous-organic emulsions is usually given as dependent upon the thickness of its layer (in mm/s). For example, for pure TBP (type o/w) the dependence has the form [2] shown in fig.5. and is well described by simple linear equations.

However, in the majority of instances $Gd = \text{const}$ is assumed [2,3]. In this case the change of an emulsion layer thickness is proportional to time. In a general case let $Gd = Gd(l_d)$, then for any cell m_{1i} (or m_{2i}) will have an expression describing the thickness of an emulsion layer.

$$l_{vi} + l_{di} + l_{wi} = l \quad (2.1)$$

$$l_{di-1} - l_{di} = \Delta l_{di} = \tau_i Gd \quad (2.2)$$

$$Q_i = \Delta l_{di} S = \tau_i Gd S' \quad (2.3)$$

the amount of a separated emulsion

$$l_{vi} = Q_i n / S \quad (2.4)$$

$$l_{wi} = Q_i / (Sn) \quad (2.5)$$

$$\tau_1 = (V_w + W) / IS \quad (2.6)$$

The final equation for l_{di} will take the form of:

$$(V_w + W) Gd n / (IS) + (V_w + W) Gd / (ISn) + l_d = 1 \quad (2.7)$$

where Gd , as was above mentioned, is function of l_d .

Equations (2.1 - 2.7) using the method of successive approximations make it possible to determine the thickness of an emulsion layer in each cell describing a settler, and, hence, to indicate the interface in a settler. However, filling the whole settler with an emulsion or attaining the condition close to this denotes the flooding of an apparatus.

Account of the non-ideality of a stage (a module) will be taken via the efficiency η , which is determined from the deviation of the outlet concentration in the organic phase (y_1, y_2) from the equilibrium one (y_1^*, y_2^*) correspondingly for each line:

$$\eta_1 = (y_1 - y_m) / (y_1^* - y_m) \quad (2.8)$$

$$\eta_2 = (y_2 - y_m) / (y_2^* - y_m) \quad (2.9)$$

Correspondingly equations (1.2) and (1.4) take the form of:

$$y_1 = y_m + \eta_1 (x_w \alpha_1 - y_m) \quad (2.10)$$

$$y_2 = y_m + \eta_2 (x_D \alpha_2 - y_m) \quad (2.11)$$

Fig.5. Rate of separation of pure TBP dispersed in water.

Fig.6. A single ideal mixing cell describing a settler.

l_{d1} - thickness of an emulsion layer, l_v , l_w - thickness of continuous phases.

It should be noted that η_1 and η_2 values are taken for the whole membrane module, and a large number of cells describing the settling zone are needed to model the profile of a disperse wedge in the settler.

All those amendments have been realized in the programme RING1, given in Annex 1. The information needed to model hydrodynamic effects (separation rate, stage efficiency, volume of stages and so on) is introduced from a separate file, thus, the needed information flow is essentially the same as in the programme RING.

3. Modelling of Membrane Module Transient Processes.

The dynamics of a multistage apparatus were also modelled in two stages, namely, without an account for hydrodynamic effects and in a more sophisticated option, with consideration of hydrodynamic effect. In the former instance only variations in component concentrations were calculated effected by changes in the technological schedule. The following unsteady-state material balance equations will be derived:

$$\Omega_{xw} (dx_w/dt) + \Omega_{yx} (dy_1/dt) = W_{xw}^F + V_w y_m - W_{xw} - V_w y_1 \quad (3.1)$$

$$\Omega_{xD} (dx_D/dt) + \Omega_{yD} (dy_2/dt) = D_{xD}^F + V_D y_m - D_{xD} - V_D y_2 \quad (3.2)$$

An ideal mixing cell in the settling zone is described as follows:

$$\Omega_m (dy_m/dt) = y_1 V_w + y_2 V_D - y_m (V_w + V_D) \quad (3.3)$$

As the magnitudes of phase flows are assumed not to change with time the integration of the system (3.1 - 3.2) does not present any difficulties. By substituting the values of y_1 and y_2 according to 1.2 and 1.4 into the system, one has:

$$\Omega_{xw} (dx_w/dt) + \Omega_{yw} (d(x_w \alpha_1)/dt) = W x_w^F + V_m y_m - W x_w - V_w x_w \alpha_1 \quad (3.4)$$

$$\Omega_{xD} (dx_D/dt) + \Omega_{yD} (d(x_D \alpha_2)/dt) = D x_D^F + V_D y_m - D x_D - V_D x_D \alpha_2 \quad (3.5)$$

$$\Omega_m (dy_m/dt) = V_w x_w \alpha_1 + V_D x_D \alpha_2 - y_m (V_w + V_D) \quad (3.6)$$

Expand the products $x_w \alpha_1$ and $x_D \alpha_2$ in expressions 3.4 and 3.5:

$$d(x_w \alpha_1)/dt = (dx_w/dt) \alpha_1 + (d\alpha_1/dt) x_w \quad (3.7)$$

$$d(x_D \alpha_2)/dt = (dx_D/dt) \alpha_2 + (d\alpha_2/dt) x_D \quad (3.8)$$

According to the assumed flow motion direction w and D $(x_w^F)_i = (x_w)_{i-1}$, where i is the N of a module (stage) $(x_w^F)_1 = x_w^F$, $(x_D^F)_i = (x_D^F)_{i+1}$, $(x_D^F)_N = x_D^F$, respectively. Since $\alpha_1 = f(x_w)$, and $\alpha_2 = f(x_D)$, one can find $d\alpha_1/dt$ and $d\alpha_2/dt$ (as x_w and x_D change with time) and apply accordingly higher order methods of integration of differential equations compared to Euler method, however, the latter also gives fair results (here t is an integration step). Transform (3.4-3.5) using (3.7-3.8) to derive the left-hand parts of equations (3.4-3.5).

$$\Omega_{xw} (dx_w/dt) + \Omega_{yw} ((dx_w/dt) \alpha_1 + (d\alpha_1/dt) x_w) = dx_w/dt (\Omega_{xw} + \Omega_{yw} \alpha_1) + \Omega_{yw} (d\alpha_1/dt) x_w \quad (3.9)$$

$$\Omega_{xD} (dx_D/dt) + \Omega_{yD} ((dx_D/dt) \alpha_2 + (d\alpha_2/dt) x_D) = dx_D/dt (\Omega_{xD} + \Omega_{yD} \alpha_2) + \Omega_{yD} (d\alpha_2/dt) x_D \quad (3.10)$$

By applying the Euler formula to the first order differential equations of $dx(t)/dt = f(t)$ type in the simplest form $x^{t+1} = x^t + \Delta t f(t)$ for equations 3.9, 3.10, 3.3 one obtains:

$$x_w^{t+1} = x_w^t + \Delta t [W x_w^F + V_m y_m - x_w^t (W + V_w \alpha_1^t) + \Omega_{yw} (d\alpha_1/dt)^t] / (\Omega_{xw} + \Omega_{yw} \alpha_1) \quad (3.11)$$

$$x_D^{t+1} = x_D^t + \Delta t [W x_D^t + V_D y_m - x_D^t (D + V_D \alpha_2^t) + \Omega_{yD} (d\alpha_2/dt)^t] / (\Omega_{xD} + \Omega_{yD} \alpha_2) \quad (3.12)$$

$$y_m^{t+1} = y_m^t + \Delta t [V_w \alpha_1^t x_w^t + V_D \alpha_2^t x_D^t - y_m^t (V_w + V_D)] / \Omega_m \quad (3.13)$$

$$(d\alpha_1/dt)^t = (\alpha_1^t - \alpha_1^{t-1}) / \Delta t \quad (3.14)$$

$$(d\alpha_2/dt)^t = (\alpha_2^t - \alpha_2^{t-1}) / \Delta t \quad (3.15)$$

The integration by the scheme (3.11-3.15) allows a stable procedure to be obtained for finding changes in the magnitudes of x_w , x_D , y_m in an apparatus.

Since this scheme describes changes of variables in a single membrane module (step), a change-over to the description of a multistage apparatus will involve (as it is shown above) an account for the assumed direction of flow motion and the derivation of x_w^F and y_D^F values will not be difficult.

This approach to the calculation of the dynamics can be recommended in modelling start-up-shutdown processes, accumulation and washing out some components of a membrane cascade, and if backfitted a little it can be used in automated control systems.

To more accurately describe the stage (module) one should also take into account transient processes in terms of hydrodynamics, i.e., upon a step-by-step change of an inlet flow the flow rate of this phase in a stage (and correspondingly in the whole cascade) does not change at a moment but is function of time. Consider the description of hydrodynamic transient processes at stages (modules).

The description of a membrane module is based on a cell model, namely, a mixer is a single ideal mixing cell while a settler is several cells (essentially there is no backmixing); all cells being two-phase ones. Accordingly, pre-consider a complete model of an ideal mixing two-phase reactor.

Fig. 7. Ideal mixing two-phase reactor.

Ω - cell volume

V^F, W^F - inlet flows

V, W - outlet volume

It is most simple to describe a change of a flow V (or W) with time by considering it as a concentration in a two-component system, i.e., introducing two variables-relative phase volumes:

$$H_x = W/(V+W) \quad (3.16)$$

$$H_y = V/(V+W) = H_x V/W \quad (3.17)$$

Concentration changes H_x and H_y in a two component system are described by the equations:

$$\Omega(dH_x/dt) = w^F - H_x (V+W) \quad (3.18)$$

$$\Omega(dH_y/dt) = V^F - H_y (V+W) \quad (3.19)$$

Since H_x and H_y are interrelated (3.17) only equation 3.18 can be integrated.

It is a little more complex to describe cells that model the settling zone of a module. In the latter three phases are available, namely, two continuous ones and one emulsion, therefore the description of a single cell hydrodynamics is a system of three differential equations of the first order:

$$S(dl_d/dt) = E^F - E \quad (3.20)$$

$$\Omega_v(dv/dt) = V^F - V \quad (3.21)$$

$$\Omega_w(dw/dt) = W^F - W \quad (3.22)$$

the phase volumes in a cell being related as follows:

$$\Omega_v + \Omega_w + Sl_d = \Omega_s \quad (3.23)$$

here l_d is an emulsion layer thickness, S is a surface thickness of a settler (for one cell), E^F , V^F , W^F are inlet flows of emulsion, organic and aqueous phases (it is to be noted that for the first cell of a settler $E^F = V + w$, $V^F = W^F = 0$) E , V , w are outlet flows from a settler cell.

Thus, to have a full pattern of processes taking place in a cell the system of 3.18, 3.19, 3.20, 3.21, 3.22 needed to be integrated together with a description of a component distribution, i.e., 3.4, 3.5, 3.6.

Based on the above description two modelling programmes have been designed: RINGD giving the distribution of components under unsteady-state conditions without an account for hydrodynamic transient processes and RINGDI that takes into account processes of changes in phase flows, rates, separation etc. The RINGD programme is given in the Annex where also presented are the results of the calculations of a multicomponent distribution in a transmutation unit.

4. Used Data on Extraction Equilibrium.

To model a transfer process reliable equations of extraction equilibrium are needed in addition to the description of the membrane module hydrodynamics. It is to be noted that upon a distribution of elements between heavy water salt solutions and TBP the isotopic effect alters significantly the distribution pattern and it must be taken into account for more accurate calculations.

The distribution data were taken from handbooks [4,5]; table 1 shows the availability of data and distribution models for transmutation cycle components that are of interest to us; it is evident from table 1 that only a dozen of components are liable to reliable calculations, the data on which were acquired as a result of studies of an extraction stage of the spent fuel reprocessing line. The distribution values for other elements can be derived only by the interpolation of different experimental data.

Table 1 lists nitrate of the majority of elements resulting in the reactor circuit, however, in the first approximation the calculations can be carried out only for some prevailing elements that are tabulated in table 2 together with the estimated distribution coefficients for 30% TBP. The data on the element composition in a loop of the conversion reactor are taken in accordance with the calculations by Wiley Davidson that were kindly given by John A. Sullivan.

Based on the estimates of the distribution coefficients given in table 2 it is possible at the adequate confidence level to calculate both the feeding cycle and the cycle of unstable short-lived radionuclide extraction from the heavy water circuit, namely, the needed number of stages and flow ratio.

Table 1

nitrate of elements	30% TBP		100%TBP	
	data	model	data	model
U	+	+	+	+
Pu	+	+	+-	-
Np	+	+	+-	
Th	+	+	+-	
Tc	+	+	-	
Zr	+	+	+-	
Am	+-	+	+	+-
Cm	+-	-	-	-
Sr	-	-	+-	-
Ba	-	-	+-	-
Ra	-	-	-	-
Pa	-	-	+-	-
La	-	+-	+	+
Ce	-	+-	+	+
Pr	-	+-	+	+
Nd	-	+-	+	+
Sm	-	+-	+	+
Eu	-	+-	+	+
Pm	-	+-	+	+
Gd	-	+-	+	+
Tb	-	+-	+	+
Dy	-	+-	+	+
Ho	-	+-	+	+
Er	-	+-	+	+
Tu	-	+-	+	+
Yb	-	+-	+	+
Lu	-	+-	+	+
Ru	+-	-	+-	-
Rh	+-	-	+-	-
Pd	+-	-	+-	-
Ag	-	-	+-	
Cd	-	-	-	-
In	-	-	+	
Sn	-	-	-	-
Sb	-	-	-	-
Ta	-	-	+-	-
I	-	-	+	-
Xe	-	-	-	-
Cs	-	-	+-	-

+ reliable data, model

+- unreliable data, model

Table 2

Estimated Coefficients of Distribution between Aqueous Phase and 30% TBP
Calculated in the First Approximation.

element	distribution coefficient α	element	distribution coefficient α
Pu	6,5	In	0,001
Np	0,94	Sn	0,001
U	11,1	Sb	10^{-4}
Th	0,15	Ta	10^{-4}
Tc	0,07	Cs	0,015
Am	0,016	Ba	0,019
Cm	0,007	La	0,074
Sr	0,002	Ce	0,028
Y	0,01	Pr	0,041
Zr	0,09	Nd	0,050
Nb	1,10	Pm	0,053
Mo	0,010	Sm	0,077
Ru	0,3	Eu	0,105
Rh	1,13	Gd	0,108
Pd	0,07	Tb	0,202
Ag	0,01		
Cd	0,008		

5. Modelling of Process Flow Sheets.

5.1. Scheme of feeding the reactor-blanket with long-lived radionuclides.

One of the primary goals is to transfer salts of long-lived radionuclides to the reactor circuit where they are subjected to irradiation. In this work we dealt with Pu transfer to the heavy water loop and extraction of U, Pu, Np, Tc, Zr and some other elements from the reactor circuit. Let us arbitrarily designate this part of the process as a feeding cycle. The general schema of the cycle is shown in fig.8.

Fig.8. General scheme of feeding cycle.

In this instance the transfer of substances from A flow to a blanket must be maximal, i.e., the aqueous solution B leaving the extraction line shall contain the highest amount of salts. Consider the process for the initial solution 5 g/l $\text{Pu}(\text{NO}_3)_4$ and 0.3 M HNO_3 (acid is needed to suppress the hydrolysis process), the range of flow ratio variations $n_w = n_D \in [1, 5]$, while varying the number of membrane modules from 5 to 12. Also assume the concentration of Pu in the heavy water circuit under steady-state conditions to be equal to 1 g/l. The scheme of the cycle is opened as we consider the steady-state process. In actual fact the scheme will be as shown in fig.9. where the cycle comprises an evaporator that maintains the constant Pu concentration of flow A feeding the circuit (5 g/l). It is also of interest to consider the acting processes of both charging the circuit with Pu and of discharging elements from the circuit. As it was mentioned above the modelling programme to calculate the process in time had been devised and tried; however, the calculations of the process dynamics are out of the scope of this report.

Consider the possible transfer of Pu into the circuit, figs.8,9. As it is noted above the objective of the calculations was to determine the optimal ratio of flows in membrane modules with different numbers of stages. The results of the modelling are tabulated in Table 4 where the numerator is a ratio between a heavy water blanket flow and a feeding solution flow ($Q_{\text{D}_2\text{O}}/Q_{\text{H}_2\text{O}}$) and the denominator is a Pu concentration of a natural water flow leaving the membrane unit (B). The organic solution recycle assumes the ratio between an organic phase flow circulating in a membrane cell to a feeding natural water flow.

Fig.9. General scheme of feeding cycle

Table 4

Results of Feeding Circuit Calculation.

Organic phase recycle	Number of membrane modules							
	3	4	5	6	7	8	9	10
1	2,25/2,75	2,67/2,34	2,98/2,02	3,23/1,78	3,42/1,59	3,59/1,43	3,71/1,29	3,82/1,18
2	3,02/1,99	3,39/1,61	3,65/1,35	3,84/1,16	3,98/1,02	4,09/0,92	4,18/0,83	4,25/0,77
3	3,37/1,63	3,70/1,30	3,92/1,08	4,07/0,94	4,18/0,83	4,25/0,75	4,32/0,69	4,35/0,64
4	3,58/1,43	3,85/1,13	4,05/0,95	4,18/0,82	4,27/0,74	4,34/0,69	4,38/0,62	4,41/0,59
5	3,70/1,30	3,95/1,04	4,12/0,88	4,24/0,77	4,32/0,69	4,37/0,64	4,41/0,60	4,45/0,56

More full information on the distribution of components in the membrane cycle modules is given in Annex 2. It follows from the calculated data that the membrane system maintains in a stable way the specified Pu concentration of the feeding flow (1 g/l) in a wide range of ratios between heavy and natural water flows, the membrane phase recycle and the number of membrane modules. An increase of the indicated variables improves the effectiveness of Pu transfer (its concentration in flow B is lowered), however, the transfer of HNO₃ to the heavy water blanket is simultaneously increased. In

view of this schedules having lower variables are more favoured. To eliminate the transport of HNO_3 use can be made of an ion-exchange purification of a circulating membrane phase.

5.2. Modelling of Extraction of some Fission Product Elements from Reactor Circuit

The objective of this work was to determine the feasibility of using a similar counter-current cascade of membrane modules for the extraction of needed elements from the reactor circuit. The schematics of a needed element extraction does not differ from the feeding cycle illustrated in fig.9., therefore the ratios of flows in the heavy water and receiving circuits had to be determined.

However, to model the feeding schema only the conditions of Pu transfer to the reactor circuit had to be determined, in the fission product extraction cycle the elements of interest to us can be extracted at the expense of varying the cascade operation schedules. Consideration will be given to cascades composed of different numbers of membrane modules to attain variable ratios of phase flows. We shall be interested in the composition of the natural water phase at the cascade outlet. We shall only consider the most significant elements, specifically, U, Np, Pu, Cm, Am. The results of the modelling are tabulated in table 5; the comprehensive data on the distribution of the above elements along the cascade length are given in Annex 3.

Let the heavy water circuit contain 3 g/l HNO_3 , 0.1 g/l U, 1 g/l Pu and 10 mg/l of every other component. The results on the extraction of salts from the circuit are not significantly affected by the salt composition since all metals and HNO_3 are available in microquantities and do not influence to each other distribution (in principle, it is possible to calculate a cascade of modules having the constant values of the distribution coefficients, see the subprogramme EQP3 of Annex 1). Let us, e.g., take the schedule most favourable for the extraction of salts from the heavy water circuit, i.e., $Q_{\text{extractant}} / Q_{\text{water}} = 0.1$, $Q_{\text{extractant}} / Q_{\text{heavy water}} = 10$ which corresponds to the maximal transfer of salts from heavy water to the stripping natural water flow. Let us present the data on the salt extraction (%) from the heavy water loop into the product as a function of the number of membrane modules (table 5).

Table 5

Membrane Extraction of Salts (%) from Reactor Blanket
as a Function of the Number of Modules.

Component	Number of membrane modules (apparatus)							
	3	4	5	6	7	8	9	10
H	40	48	55	62	71	72	76	79
U	40	49	57	63	69	73	77	98
Pu	60	70	78	83	88	91	93	95
Np	82	89	94	96	98	99	100	100
Th	31	39	44	52	58	62	67	71
Tc	17	22	26	31	34	38	42	45
Am	4	5	7	8	10	11	12	14
La	18	23	27	32	36	40	43	46
Ce	7	10	12	14	16	18	20	22
Nd	13	16	20	23	26	30	32	35
Eu	24	30	36	43	46	50	54	58
Y	11	14	18	21	24	27	29	32
Sr	1	1	1	1	1	2	2	2
Ba	5	7	8	10	11	13	14	15
Fe	3	3	4	5	6	7	8	8
Ni	3	3	4	5	6	7	8	8
Mo	3	3	4	5	6	7	8	8
Ru	50	60	68	74	80	84	87	90
Pd	2	3	3	4	4	5	5	6
Zr	21	27	32	37	42	46	50	53

It can be concluded from the analysis of the results that the transmutation products are divided into two groups; the ones that are essentially non-transferable through a TBP membrane and the ones that are effectively extractable from a reactor loop.

Taking into account the very low concentrations of transmutation products in heavy water it is advisable to design the discharging cycle of the type depicted in fig.10.

Fig.10. General scheme of blanket discharge unit.

From the heavy water reactor loop a flow is taken away that goes to an evaporator for radionuclide concentration. The evaporator condensate after passing via the feeding unit is returned to the reactor loop. The evaporator concentrate solution is continuously circulated in the extraction-membrane unit where the major portion of Pu to be converted is extracted. After purification to remove impurities Pu is directed to the feeding unit. As non-transportable impurities are accumulated the evaporator concentrate solution is removed from the circuit to be deeply evaporated to obtain dry salts that are subsequently partitioned. This design allows a constant clean-up of the conversion reactor circuit.

References

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4. Nikolotova Z.I., Kartashova N.A., Extraction Handbook, M., Atomizdat, 1976.
5. Nikolotova Z.I., Kartashova N.A., Extraction by neutral organic compounds, M., Energoizdat, 1987.

Annex 1

The Texts of Modelling Programmes.

```

c
c*****
c
c      ***** R I N G *****
c
c      Main Module for Calculation Concentration Profile
c      in Cascade of Modules
c      Input information in File - ' INPF '
c      Output information in File - ' OUTF '
c
c      SUBROUTINES :
c      EQP1,EQP2,EQP3,EQP95 - Extraction Equilibria
c      PRPR                - Printing Module
c      I333                - Key Pressed Assembler Code
c
c      Last Correction April 1995
c      Author Vlasov V.S.,Moscow tel.(095)-1908695
c*****
c
c      Character*4 Name(50)
c      Character*70 Title
c      Dimension x1(20,50),y1(20,50),alfa1(20,50),xx1(50),al1(50),
c      *      x2(20,50),y2(20,50),alfa2(20,50),xx2(50),al2(50),
c      *      xdf0(50),xwf0(50),rmass(50),xf1(50),xf2(50),
c      *      ym(20,50),vw(20),vd(20),yf(50),ink(20),gamma(20)
c
c      Common /comp/ Name,rmass
c      Data eps/ 0.0001/
c      Data ink/1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20/
c      Data x1,y1,alfa1,x2,y2,alfa2,ym/7000*0.0001/
c      Open(1,file='inpf',access='sequential',status='old',err=101)
c      Open(3,file='outf',access='sequential',status='old',err=101)
c      Open(4,file='who',access='sequential',status='old',err=101)
c      Read(1,13) Title
c      Read(1,*)model
c      Read(1,*)n,k,Ys
c      Read(1,*) (ink(i),i=1,k)
c      Read(1,*) w
c      Write(*,*) ' Water Feed : '
c      Read (*,*) w
c      Read(1,*) (xwf0(i),i=1,k)
c      Read(1,*) d
c      Write(*,*) ' Deuterium Feed : '
c      Read (*,*) d
c      Read(1,*) (xdf0(i),i=1,k)
c
c      c.....Recycle of organic for WATER line
c      Read(1,*) (vw(i),i=1,n)
c
c      c.....Recycle of organic for DEITERIUM line
c      Read(1,*) (vd(i),i=1,n)
c      Read(4,1) (Name(i),rmass(i),i=1,20)
c
c      Write(3,13) Title
c      Write(3,2)
c      Write(3,3) n,k
c
c      c.....Output Initial Information
c
c      Write(3,4) w
c      str=float(k)/3.00
c      dlt=str - aint(str)
c      ns=int(str)

```

```

      if(dlt.gt.0.00) ns=ns+1
      Do 120 ip=1,ns
      i1=(ip-1)*3+1
      i2= ip*3
      if( ip.eq.ns) i2=k
120  Write(3,5)(name(ink(i)),xwf0(i),i=i1,i2)
      Write(3,41)
      Write(3,42)( vw(i),i=1,n)
c
      Write(3,6) d
      Do 121 ip=1,ns
      i1=(ip-1)*3+1
      i2= ip*3
      if( ip.eq.ns) i2=k
121  Write(3,5)(name(ink(i)),xdf0(i),i=i1,i2)
      Write(3,43)
      Write(3,42)( vd(i),i=1,n)
c
c.....Conversion to Molality
      Do 201 i=1,k
      Write(*,*) ink(i),name(ink(i)),rmass(ink(i))
      xwf0(i)=xwf0(i)/rmass(ink(i))
201  xdf0(i)=xdf0(i)/rmass(ink(i))
c .....
1  Format(a4,f12.4)
2  Format(/' Initial Information'/)
3  Format(2x,'Number of Apparats - ',i4/
   *      2x,'Number of Components - ',i4)
4  Format(/2x,' Water Flowrate - ',f10.4,' >>----->'/
   *      2x,' Feed Concentration in Water Line Gramm/Litre')
41 Format(2x,' Recycle of organic for WATER line')
42 Format(2x,10f8.2/2x,10f8.2)
43 Format(2x,' Recycle of organic for DEITERIUM line')
6  Format(/2x,' Deiterium Flowrate - ',f10.4,' <-----<<'/
   *      2x,' Feed Concentration in Deiterium Line Gramm/Litre')
5  Format(2x,a5,e12.4,3x,a5,e12.4,3x,a5,e12.4)
c  Write (*,7)
c  Read (*,*) Nstep
      NSTEP=1000
7  Format(' Maximum Iterations ? ---> '\)
c  Write (*,8)
c  Read (*,*) Nprin1
      NPRIN1=100
8  Format(' Printing Steps ? ---> '\)
c
c .....End I/O Initial Information
c
      joker=0
      nprin=0
      Do 119 istep=1,nstep
      nprin=nprin+1
      Do 118 i88=1,n
      i=i88
      If (joker.eq.1) i=n+1-i88
c
c .....Calculation of Feed Concentration
c
c.....x1,xfl - water line >>----->
c.....x2,xfl2 - deiterium line <-----<<
c
      Do 117 j=1,k
      If ( i.eq.1) Then
          xfl(j)=xwf0(j)

```



```

114 del=del+ABS(d*(xdf0(j)-x2(1,j)) + w*(xwf0(j)-x1(n,j)))
Write(*,11) istep,del
Call I333( newbit)
If (Newbit.eq.1) Goto 113
If (Newbit.eq.2) Goto 1181
If ( del .lt. eps) Goto 1181
If ( Nprin.lt.nprin1) Goto 119
113 Call prpr(0,n,k,ink,x1,x2)
nprin=0
119 Continue
1181 Write(*,9)
Write(3,12)
Call prpr(0,n,k,ink,x1,x2)
Call prpr(1,n,k,ink,x1,x2)
Read(*,*)
9 Format(/// ' Balance !!! '///)
Goto 700
101 Write(*,10)
10 Format(// '*** Error open File 1,3 '/')
11 Format('+', ' Iteration ',i5, ' Disbalance ',F9.5)
12 Format(// ' RESULTS OF CALCULATION'/)
13 Format(A70)
700 stop
End

```

```

SUBROUTINE EQP1(K,INK,X,ALF)
C*****
C* 30% TBP norm dodecane H 0.1-10.5 M *
C* 25 C Chi.91 *
C*****
DIMENSION X(*),ALF(*),INK(*),AR(10),XR(10),rmax(3),rmin(3)
data rmax/12.0,190.0,40.0/
data rmin/0.01,0.001,0.001/
do 10 i=1,10
ar(i)=0.0
10 xr(i)=0.0
DO 100 I=1,K
I1=INK(I)
XR(I1)=X (I)
100 continue
xr(2)=xr(2)*238.00
xr(3)=xr(3)*239.00
if(xr(1).gt.rmax(1)) xr(1)=rmax(1)
if(xr(1).lt.rmin(1)) xr(1)=rmin(1)
if(xr(2).gt.rmax(2)) xr(2)=rmax(2)
if(xr(2).lt.rmin(2)) xr(2)=rmin(2)
if(xr(3).gt.rmax(3)) xr(3)=rmax(3)
if(xr(3).lt.rmin(3)) xr(3)=rmin(3)
XH=alog(xr(1))
XU=alog(xr(2))
XPU=alog(xr(3))
DO 1000 I=1,K
I1=INK(I)
GOTO (1,2,3),I1
ar(i1)=0.0
goto 1000
1 SS=-1.766-0.1048*XU-.2992E-1*XU*XU
*-0.1173*XH**2+0.4190E-2*XH*XU*XPU-0.1036E-1*XH*XU
*+0.1014E-1*XH**2*XU-0.2617E-2*XU**3-.2615E-1*XH*XPU
*-.3590E-2*XH*XPU**2+.6585E-2*XH**2*XPU-.4245E-1*XPU
*+.5708E-2*XU*XPU+0.8007E-3*XU*XPU**2-.4886E-2*XPU**2
*-.9604E-2*XH**3+0.4015E-1*XH
if(ss.gt.10.0) ss=10.0

```

```

AR(1)=EXP(SS)
GOTO 1000
2  SS=1.847-0.1373*XU+1.088*XH-.3967E-1*XU**2-.1076*XH*XU
  *-1.561*XH**2-.1299E-1*XH*XU**2-.2563E-1*XPU+.1877E-1*XH**2*XU
  *-.7665E-1*XH*XPU-.3763E-2*XU**3+.4673E-2*XH*XU*XPU
  *-.4688E-1*XH**3-.1041E-1*XH*XPU**2+.1222E-1*XU*XPU
  *+.1433E-2*XU*XPU**2-.1021E-1*XPU**2-.1688E-2*XPU**3
  *+.4653E-3*XU**2*XPU+.2132E-2*XH**2*XPU
  if(ss.gt.10.0) ss=10.0
AR(2)=EXP(SS)
GOTO 1000
3  SS=.6351+1.343*XH-0.2185*XU-.3840E-1*XU**2-.7942E-1*XH*XU
  *-0.1146*XH*XPU+0.2348E-01*XH**2*XU-.8705E-02*XH*XU**2
  *+.05614E-02*XH*XU*XPU-.1602E-01*XH*XPU**2-.6878E-1*XH**2
  *-.2656E-02*XU**3+.1181E-01*XU*XPU+.2345E-2*XU*XPU**2
  *-.1934E-02*XPU**3+.6328E-2*XH**2*XPU-.1142E-1*XH**3
  *+.4184E-1*XPU-.3857E-2*XPU**2-.3442E-3*XU**2*XPU
  if(ss.gt.10.0) ss=10.0
AR(3)=EXP(SS)
1000 CONTINUE
DO 2000 I=1,K
  II=INK(I)
2000 ALF(I)=AR(II)
RETURN
END

SUBROUTINE EQP2(K,INK,X,ALF)
C*****
C* 30% TBP      HNO3 0.1-10.5 Mole/l *
C*
C* 20 Components *
C*****
  DIMENSION X(*),ALF(*),INK(*),AR(20),XR(20),rmax(3),rmin(3)
  data rmax/12.0,190.0,40.0/
  data rmin/0.01,0.001,0.001/
  do 200 i=1,10
    ar(i)=0.0
200  xr(i)=0.0
    DO 100 I=1,K
      II=INK(I)
      XR(II)=X (I)
100  continue
      xr(2)=xr(2)*238.00
      xr(3)=xr(3)*239.00
      if(xr(1).gt.rmax(1)) xr(1)=rmax(1)
      if(xr(1).lt.rmin(1)) xr(1)=rmin(1)
      if(xr(2).gt.rmax(2)) xr(2)=rmax(2)
      if(xr(2).lt.rmin(2)) xr(2)=rmin(2)
      if(xr(3).gt.rmax(3)) xr(3)=rmax(3)
      if(xr(3).lt.rmin(3)) xr(3)=rmin(3)
      H= XR(1)
      XH=log(xr(1))
      XU=log(xr(2))
      XPU=log(xr(3))
      DO 1000 I=1,K
        II=INK(I)
        GOTO (1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20),II
        ar(ii)=0.0
        goto 1000
c.....HNO3 Regression
1  SS=-1.766-0.1048*XU-.2992E-1*XU*XU
  *-0.1173*XH**2+.04190E-2*XH*XU*XPU-0.1036E-1*XH*XU
  *+.0.1014E-1*XH**2*XU-0.2617E-2*XU**3-.2615E-1*XH*XPU
  *-.3590E-2*XH*XPU**2+.6585E-2*XH**2*XPU-.4245E-1*XPU

```



```

*+.5708E-2*XU*XPU+0.8007E-3*XU*XPU**2-.4886E-2*XPU**2
*-.9604E-2*XH**3+0.4015E-1*XH
if(ss.gt.10.0) ss=10.0
AR(1)=EXP(SS)
GOTO 1000
c.....U6 Regression
2 SS=1.847-0.1373*XU+1.088*XH-.3967E-1*XU**2-.1076*XH*XU
*-.1561*XH**2-.1299E-1*XH*XU**2-.2563E-1*XPU+.1877E-1*XH**2*XU
*-.7665E-1*XH*XPU-.3763E-2*XU**3+.4673E-2*XH*XU*XPU
*-.4688E-1*XH**3-.1041E-1*XH*XPU**2+.1222E-1*XU*XPU
*+.1433E-2*XU*XPU**2-.1021E-1*XPU**2-.1688E-2*XPU**3
*+.4653E-3*XU**2*XPU+.2132E-2*XH**2*XPU
if(ss.gt.10.0) ss=10.0
AR(2)=EXP(SS)
GOTO 1000
c.....Pu4 Regression
3 SS=.6351+1.343*XH-0.2185*XU-.3840E-1*XU**2-.7942E-1*XH*XU
*-.0.1146*XH*XPU+0.2348E-01*XH**2*XU-.8705E-02*XH*XU**2
*+.0.5614E-02*XH*XU*XPU-.1602E-01*XH*XPU**2-.6878E-1*XH**2
*-.2656E-02*XU**3+.1181E-01*XU*XPU+.2345E-2*XU*XPU**2
*-.1934E-02*XPU**3+.6328E-2*XH**2*XPU-.1142E-1*XH**3
*+.4184E-1*XPU-.3857E-2*XPU**2-.3442E-3*XU**2*XPU
if(ss.gt.10.0) ss=10.0
AR(3)=EXP(SS)
GOTO 1000
c.....Np4 Regression
4 SS=.450*H+.30*H**2
AR(4)=SS
GOTO 1000
c.....Th4 Regression
5 SS=.10*H+.40*H**2
AR(5)=SS
GOTO 1000
c.....Tc 7 Regression
6 SS=.545*H-.45*H**2
AR(6)=SS
GOTO 1000
c.....Am 3
7 ar(7)=0.04
Goto 1000
c.....La 3
8 ar(8)=0.074
Goto 1000
c.....Ce 3
9 ar(9)=0.028
Goto 1000
c.....Nd 3
10 ar(10)=0.0500
Goto 1000
c.....Eu 3
11 ar(11)=0.1050
Goto 1000
c.....Y
12 ar(12)=0.0440
Goto 1000
c.....Sr
13 ar(13)=0.0020
Goto 1000
c.....Ba
14 ar(14)=0.019
Goto 1000
c.....Fe
15 ar(15)=0.01
Goto 1000

```

```

c.....Ni
16  ar(16)=0.01
    Goto 1000
c.....Mo
17  ar(17)= 0.0100
    Goto 1000
c.....Ru
18  ar(18)= 10.300
    Goto 1000
c.....Pd
19  ar(19)= 1.370
    Goto 1000
c.....Zr
20  ar(20)= 7.5
1000 CONTINUE
    DO 2000 I=1,K
    I1=INK(I)
2000 ALF(I)=AR(I1)
    RETURN
    END

```

SUBROUTINE EQP3(K,INK,X,ALF)

```

C*****
C*          30% TBP          *
C*          *                *
C*          20 Components    *
C*****
    DIMENSION X(*),ALF(*),INK(*),AR(20),XR(20),rmax(3),rmin(3)
    data rmax/12.0,190.0,40.0/
    data rmin/0.01,0.001,0.001/
    do 200 i=1,20
    ar(i)=0.0
200  xr(i)=0.0
    DO 100 I=1,K
    I1=INK(I)
    XR(I1)=X (I)
100  continue
    H= XR(1)
    DO 1000 I=1,K
    I1=INK(I)
    GOTO (1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20),I1
    ar(i1)=0.0
    goto 1000
c.....HNO3
1  ar(1)=0.2
    GOTO 1000
c.....U6
2  Ar(2)=11.00
    GOTO 1000
c.....Pu4
3  Ar(3)=6.95
    GOTO 1000
c.....Np4
4  SS= 0.94
    AR(4)=SS
    GOTO 1000
c.....Th4
5  SS= .150
    AR(5)=SS
    GOTO 1000
c.....Tc 7
6  SS= .07
    AR(6)=SS

```

```

FF2H=F2H*C*(1+GH*0.5)
F12H=5.36E-6*C**3*GAM(1)**4*AH20
FF12H=F12H*C*(1+2*GH)
SUM1=SUM1+FF2H
SUM2=SUM2+FF1H+FF12H
ALF(I)=F1H+F12H
GAMMA(I)=GAM(1)
GOTO 444

c.....U6 .....
2   RK= 72.*GAM(2)**3*CN2*EXP(-6.82*(T-20)/(273.+T))
    ALF(I)=RK*GMM
    RKU6=RK
    GAMMA(I)=GAM(2)
    GOTO 888

c.....Pu 4 .....
3   IS=XR(1)+XR(5)
    RK=-4.963+13.35*SQRT(IS5)-10.81*IS5+4.848*IS5**1.5
    *   -.7182*IS5**2+2.57*(XR(3))**1.6
    RK=EXP(RK)
    IF(XR(1).LT.0.4) RK=1.8*RK
    RKPU4=RK
    RKNP4=RK/4
    ALF(I)=RK*CN*GMM
    GOTO 888

c.....Np 4 .....
4   ALF(I)=RKNP4*CN*GMM
    GOTO 888

c.....Th .....
5   RK=12.46-21.98*A12+11.2*IS-1.9*A32
    RK=EXP(RK)
    ALF(I)=RK*CN4*GMM
    GOTO 888

c.....Tc .....
6   IF(IS.LE.4..AND.IS.GT.2) GTC=EXP(-.577+.1646*IS)
    IF(IS.LE.2.)GTC=GAM(4)
    IF(IS.GT.4.)GTC=EXP(-1.1+.45*IS)
    GAMMA(I)=GTC
    Goto 1000

c.....Am .....
7   rk=ri( -2.976,-0.9879,-1.276,0.2403,IS)
    Alf(i)=rk*CN3
    Goto 999

c.....La .....
8   rk=ri( -3.501,-0.3234,-1.781,0.2623,IS)
    Alf(i)=rk*CN3
    Goto 999

c.....Ce .....
9   rk=ri( -3.438,-0.08792,-1.852,0.2734,IS)
    Alf(i)=rk*CN3
    Goto 999

c.....Nd .....
10  rk=0.999
c   rk=ri( -3.463,-0.08067,-1.523,0.2344,IS)
    Alf(i)=rk*CN3
    Goto 999

c.....Eu .....
11  rk=0.1207
c   rk=ri( -3.074,-0.3138,-1.502,0.2600,IS)
    Alf(i)=rk*CN3
    Goto 999

c.....Y .....
12  rk=ri( -3.542,0.,-1.917,0.3364,IS)
    Alf(i)=rk*CN3
    Goto 999

```

```

c.....Sr .....
13  RK= ri(-3.542,-3.450,-0.00059,0.1377,IS)
    ALF(I)=RK*cn
    GOTO 888
c.....Ba .....
14  RK=0.01
c    RK= ri(-4.544,-2.342,-0.5274,-0.1880,IS)
    ALF(I)=RK*cn
    GOTO 888
c.....Fe 3
15  Rk=0.7669e-4
    Alf(i)=Rk*cn3
    Goto 999
c.....Ni 2
16  Rk=0.5e-5
    Alf(i)=rk*cn
    goto 888
c.....Mo 2
17  Rk=0.7e-4
    Alf(i)=rk*cn
    goto 888
c.....Ru 3 2 TBP
18  rk=0.2505
c    RK= ri(4.754,-2.049,-2.732,0.2954,IS)
    ALF(I)=RK*cn3
    GOTO 888
c.....Pd 2 2 TBP
19  RK= ri(3.441,-5.00,-1.791,0.4581,IS)
    ALF(I)=RK*cn
    GOTO 888
c.....Zr 4 2 TBP
20  Rk=0.1409
c    RK= ri(1.973,-1.554,-1.409,0.2347,IS)
    ALF(I)=RK*cn4
c    write(*,*) ' Rk Zr/s2',alf(i)
888  SUM1=SUM1+ALF(I)*C
    Goto 1000
999  SUM3=SUM3+ALF(I)*C
    Goto 1000
444  CONTINUE
1000 CONTINUE
    Dim(1)=Ys
    Dim(2)=1.0 + Sum2
    Dim(3)=Sum1
    Dim(4)=Sum3
    Dim(5)=0.0
    S = Zeroin(0.0,Ys,Fsum,1.e-5,Dim)
    a2=S**2
    a3=a2*S
    DO 555 I=1,K
    I1=INK(I)
    GOTO (1001,1002,1003,1004,1005,1006,1007,
*      1008,1009,1010,1011,1012,1013,1014,
*      1015,1016,1017,1018,1019,1020 ), I1
1001 ALF(I)=(F1H+2.*F12H)*S+F2H*A2
    GOTO 555
1002 ALF(I)=ALF(I)*A2/GMM
    GOTO 555
1003 ALF(I)=ALF(I)*A2/GMM
    GOTO 555
1004 ALF(I)=ALF(I)*A2/GMM
    GOTO 555
1005 ALF(I)=ALF(I)*A2/GMM
    GOTO 555

```

```

1006  GTC1=(GTC/GAM(1))**2
      RM=XR(11)/CN
      ATC=XR(1)*GTC**2*(0.0086*AH20*S+.22*AH20**2*A2+
      * 1.27*AH20**4*A2+5.*AH20*A2**2)
      CN3=CN**3
      ATU6=XR(3)*CN*A2*GAM(2)**3*GTC1*(220.+1.4E5*RM*GTC1)
      ATPU4=RKPU4*A2*GTC1*(30.+1.1E4*RM*GTC1)*XR(5)
      ATNP4=RKNP4*A2*GTC1*(157.+1.E4*RM*GTC1)*XR(8)
      ATNP6=XR(10)*CN*A2*GNP6**3*GTC1*(70.+1.E5*RM*GTC1)
      ALF(I)=ATC+ATU6+ATPU4+ATNP4+ATNP6
      GOTO 555
1007  ALF(I)=ALF(I)*A3
      Goto 555
1008  ALF(I)=ALF(I)*A3
      Goto 555
1009  ALF(I)=ALF(I)*A3
      Goto 555
1010  ALF(I)=ALF(I)*A3
      Goto 555
1011  ALF(I)=ALF(I)*A3
      Goto 555
1012  ALF(I)=ALF(I)*A3
      Goto 555
1013  ALF(I)=ALF(I)*A2
      Goto 555
1014  ALF(I)=ALF(I)*A2
      Goto 555
1015  ALF(I)=ALF(I)*A3
      Goto 555
1016  ALF(I)=ALF(I)*A2
      Goto 555
1017  ALF(I)=ALF(I)*A2
      Goto 555
1018  ALF(I)=ALF(I)*A3
      Goto 555
1019  ALF(I)=ALF(I)*A2
      Goto 555
1020  ALF(I)=ALF(I)*A2
555   CONTINUE
6666  RETURN
      END

```

```

c
c
c
c
SUBROUTINE PRPR(NFILE,N,K,INK,X1,X2)
Character * 4 Name
DIMENSION Ink(*),X1(20,*),X2(20,*),Name(50),Rmass(50)
Common /Comp/ Name,Rmass
c<<
  Do 201 i=1,n
  Do 201 j=1,k
    x1(i,j)=x1(i,j)*rmass(ink(j))
201  x2(i,j)=x2(i,j)*rmass(ink(j))
c>>
  str=float(n)/8.00
  dlt=str - aint(str)
  ns=int(str)
  if(dlt.gt.0.00) ns=ns+1
  nend=8

```

```

      if(n.le.8) nend=n
      If(Nfile.eq.1) Go TO 101
      Write(*,1)
      do 10 j=1,k
      npp=0
      nend1=nend
      Write(*,2) (i,i=1,nend1)
      Write(*,3) Name(ink(j)),(x1(i,j),i=1,nend1)
      Write(*,4)      (x2(i,j),i=1,nend1)
20  npp=npp+1
      n1=nend1+1
      nend1=nend1+8
      if(npp.eq.ns-1) nend1=n
      if(npp.ge.ns) goto 10
      Write(*,2) (i,i=n1,nend1)
      Write(*,4)      (x1(i,j),i=n1,nend1)
      Write(*,4)      (x2(i,j),i=n1,nend1)
      goto 20
10  Continue
      Write(*,5)
      Go To 102
1  Format( /      Components Concentration in Stages of Apparate'/
*      ' Upper String - Water line  >>----->' /
*      ' Down String - Deuterium line <-----<<' /
2  Format(4x,8(4x,i2,3x))
3  Format(1x,a4,10e9.3)
4  Format(5x, 10e9.3)
5  Format(/)
c
c.... Listing
c
101 Write(3,1)
      do 11 j=1,k
      nend1=nend
      npp=0
      Write(3,2) (i,i=1,nend1)
      Write(3,3) Name(ink(j)),(x1(i,j),i=1,nend1)
      Write(3,4)      (x2(i,j),i=1,nend1)
21  npp=npp+1
      n1=nend1+1
      nend1=nend1+8
      if(npp.eq.ns-1) nend1=n
      if(npp.ge.ns) goto 11
      Write(3,2) (i,i=n1,nend1)
      Write(3,4)      (x1(i,j),i=n1,nend1)
      Write(3,4)      (x2(i,j),i=n1,nend1)
      goto 21
11  Continue
      Write(3,5)
c<<      >>
102 Do 202 i=1,n
      Do 202 j=1,k
      x1(i,j)=x1(i,j)/rmass(ink(j))
202 x2(i,j)=x2(i,j)/rmass(ink(j))
c>>      >>
      RETURN
      END

```

```

.MODEL large
.CODE
      PUBLIC      i333
i333  PROC

```

```

        push    bp                ; Entry sequence - save old BP
        mov     bp,sp            ; Set stack framepointer
        les     bx,[bp+6]
        mov     ah,6h
        mov     dl,0fh
        INT     21h
        mov     cx,00h
        cmp     al,00h
        je      metend
        cmp     al,3bh
        je      m1
        jmp     m10
m1:      mov     cx,01h
        jmp     metend
m10:     cmp     al,3ch
        je      m2
        jmp     m20
m2:      mov     cx,02h
        jmp     metend
m20:     cmp     al,3dh
        je      m3
        jmp     m30
m3:      mov     cx,03h
        jmp     metend
m30:     cmp     al,3eh
        je      m4
        jmp     m40
m4:      mov     cx,04h
        jmp     metend
m40:     cmp     al,3fh
        je      m5
        jmp     m50
m5:      mov     cx,05h
        jmp     metend
m50:     cmp     al,40h
        je      m6
        jmp     m60
m6:      mov     cx,06h
        jmp     metend
m60:     cmp     al,41h
        je      m7
        jmp     m70
m7:      mov     cx,07h
        jmp     metend
m70:     cmp     al,42h
        je      m8
        jmp     m80
m8:      mov     cx,08h
        jmp     metend
m80:     cmp     al,43h
        je      m9
        jmp     m90
m9:      mov     cx,09h
        jmp     metend
m90:     cmp     al,44h
        je      mA
        jmp     metend
mA:      mov     cx,0Ah
metend:  mov     [bx],cx        ; AX
        pop     bp            ; Restore old framepointer
        ret     4             ; Exit, and restore 4 bytes of args
i333    ENDP
        END

```

FILE OF INITIAL INFORMATION
NAMED: INPF

[illegible]

Annex 2

The Results of Modelling of Scheme of feeding the reactor-blanket.

Explanation to the Tables of Results **Count-current extraction-membrane block**

Ordinary Table of Results

Modelling of Feed Cycle

Initial Information

Number of Apparatus - 3

Number of Components - 2

Water Flowrate - 1.0000

Feed Concentration in Water Line Gram/Litre

H .2000E+02 Pu .5000E+01

Recycle of organic for WATER line 1.0

Deuterium Flowrate - 2.2500

Feed Concentration in Deuterium Line Gram/Litre

H .0000E+00 Pu .0000E+00

Recycle of organic for DEUTERIUM line 1.0

RESULTS OF CALCULATION

Components Concentration in Stages of Apparatus

Upper String - water line; Down String - Deuterium line

	1	2	3
H	.189E+02	.179E+02	.170E+02
	.134E+01	.856E+00	.410E+00
Pu	.400E+01	.328E+01	.275E+01
	.100E+01	.561E+00	.239E+00

Modeling of Feed Cycle

Initial Information

Number of Apparats - 3
Number of Components - 2

Water Flowrate - 1.0000
Feed Concentration in Water Line Gramm/Litre
H .2000E+02 Pu 5000E+01
Recycle of organic for WATER line 1.0

Deiterium Flowrate - 2.2500
Feed Concentration in Deiterium Line Gramm/Litre
H .0000E+00 Pu .0000E+00
Recycle of organic for DEITERIUM line 1.0

RESULTS OF CALCULATION

Components Concentration in Stages of Apparate

Upper String - water line:Down String - Deiterium line

	1	2	3
H	.189E+02	.179E+02	.170E+02
	.134E+01	.856E+00	.410E+00
	1	2	3
Pu	.400E+01	.328E+01	.275E+01
	.100E+01	.561E+00	.239E+00

Modeling of Feed Cycle

Initial Information

Number of Apparats - 3
Number of Components - 2

Water Flowrate - 1.0000
Feed Concentration in Water Line Gramm/Litre
H .2000E+02 Pu .5000E+01
Recycle of organic for WATER line 2.0

Deiterium Flowrate - 3.0200
Feed Concentration in Deiterium Line Gramm/Litre
H .0000E+00 Pu .0000E+00
Recycle of organic for DEITERIUM line 2.0

RESULTS OF CALCULATION

Components Concentration in Stages of Apparate

Upper String - water line:Down String - Deiterium line

	1	2	3
H	.180E+02	.163E+02	.148E+02
	.171E+01	.105E+01	.483E+00
	1	2	3
Pu	.346E+01	.255E+01	.199E+01
	.100E+01	.492E+00	.189E+00

Modeling of Feed Cycle

Initial Information

Number of Apparats - 3
 Number of Components - 2

Water Flowrate - 1.0000
 Feed Concentration in Water Line Gramm/Litre
 H .2000E+02 Pu .5000E+01
 Recycle of organic for WATER line 3.0

Deiterium Flowrate - 3.3700
 Feed Concentration in Deiterium Line Gramm/Litre
 H .0000E+00 Pu .0000E+00
 Recycle of organic for DEITERIUM line 3.0

RESULTS OF CALCULATION

Components Concentration in Stages of Apparate

Upper String - water line:Down String - Deiterium line

	1	2	3
H	.172E+02	.150E+02	.132E+02
	.201E+01	.119E+01	.530E+00
	1	2	3
Pu	.312E+01	.216E+01	.163E+01
	.100E+01	.443E+00	.159E+00

Modeling of Feed Cycle

Initial Information

Number of Apparats - 3
 Number of Components - 2

Water Flowrate - 1.0000
 Feed Concentration in Water Line Gramm/Litre
 H .2000E+02 Pu .5000E+01
 Recycle of organic for WATER line 4.0

Deiterium Flowrate - 3.5800
 Feed Concentration in Deiterium Line Gramm/Litre
 H .0000E+00 Pu .0000E+00
 Recycle of organic for DEITERIUM line 4.0

RESULTS OF CALCULATION

Components Concentration in Stages of Apparate

Upper String - water line:Down String - Deiterium line

	1	2	3
H	.166E+02	.140E+02	.120E+02
	.224E+01	.128E+01	.556E+00
	1	2	3
Pu	.288E+01	.192E+01	.143E+01
	.100E+01	.408E+00	.140E+00

Modeling of Feed Cycle Initial Information

Number of Apparats - 3
Number of Components - 2

Water Flowrate - 1.0000
Feed Concentration in Water Line Gramm/Litre
H .2000E+02 Pu .5000E+01
Recycle of organic for WATER line 5.0

Deiterium Flowrate - 3.7000
Feed Concentration in Deiterium Line Gramm/Litre
H .0000E+00 Pu .0000E+00
Recycle of organic for DEITERIUM line 5.0

RESULTS OF CALCULATION

Components Concentration in Stages of Apparate
Upper String - water line:Down String - Deiterium line

	1	2	3
H	.160E+02	.131E+02	.110E+02
	.244E+01	.135E+01	.574E+00
	1	2	3
Pu	.271E+01	.176E+01	.130E+01
	.100E+01	.382E+00	.126E+00

Modeling of Feed Cycle N=4

Initial Information

Number of Apparats - 4
Number of Components - 2

Water Flowrate - 1.0000
Feed Concentration in Water Line Gramm/Litre
H .2000E+02 Pu .5000E+01
Recycle of organic for WATER line 1.0

Deiterium Flowrate - 2.6700
Feed Concentration in Deiterium Line Gramm/Litre
H .0000E+00 Pu .0000E+00
Recycle of organic for DEITERIUM line 1.0

RESULTS OF CALCULATION

Components Concentration in Stages of Apparate
Upper String - water line:Down String - Deiterium line

	1	2	3	4
H	.189E+02	.179E+02	.170E+02	.161E+02
	.145E+01	.104E+01	.662E+00	.317E+00
	1	2	3	4
Pu	.400E+01	.328E+01	.274E+01	.234E+01
	.100E+01	.627E+00	.355E+00	.153E+00

Modeling of Feed Cycle N=4
Initial Information

Number of Apparats - 4
Number of Components - 2

Water Flowrate - 1.0000
Feed Concentration in Water Line Gramm/Litre
H .2000E+02 Pu .5000E+01
Recycle of organic for WATER line 2.0

Deiterium Flowrate - 3.3900
Feed Concentration in Deiterium Line Gramm/Litre
H .0000E+00 Pu .0000E+00
Recycle of organic for DEITERIUM line 2.0

RESULTS OF CALCULATION

Components Concentration in Stages of Apparate
Upper String - water line; Down String - Deiterium line

	1	2	3	4
H	.180E+02	.163E+02	.148E+02	.136E+02
	.189E+01	.130E+01	.799E+00	.369E+00
Pu	.346E+01	.255E+01	.198E+01	.161E+01
	.100E+01	.547E+00	.279E+00	.111E+00

Modeling of Feed Cycle N=4

Initial Information

Number of Apparats - 4
Number of Components - 2

Water Flowrate - 1.0000
Feed Concentration in Water Line Gramm/Litre
H .2000E+02 Pu .5000E+01
Recycle of organic for WATER line 3.0

Deiterium Flowrate - 3.7000
Feed Concentration in Deiterium Line Gramm/Litre
H .0000E+00 Pu .0000E+00
Recycle of organic for DEITERIUM line 3.0

RESULTS OF CALCULATION

Components Concentration in Stages of Apparate
Upper String - water line; Down String - Deiterium line

	1	2	3	4
H	.172E+02	.150E+02	.132E+02	.118E+02
	.222E+01	.147E+01	.875E+00	.393E+00
Pu	.311E+01	.216E+01	.163E+01	.130E+01
	.100E+01	.493E+00	.234E+00	.891E-01

Modeling of Feed Cycle N=4

Initial Information

Number of Apparats - 4
Number of Components - 2

Water Flowrate - 1.0000
Feed Concentration in Water Line Gramm/Litre
H .2000E+02 Pu .5000E+01
Recycle of organic for WATER line 4.0

Deiterium Flowrate - 3.8500
Feed Concentration in Deiterium Line Gramm/Litre
H .0000E+00 Pu .0000E+00
Recycle of organic for DEITERIUM line 4.0

RESULTS OF CALCULATION

Components Concentration in Stages of Apparate
Upper String - water line:Down String - Deiterium line

	1	2	3	4
H	.166E+02	.140E+02	.120E+02	.104E+02
	.248E+01	.159E+01	.921E+00	.404E+00
Pu	.288E+01	.192E+01	.142E+01	.113E+01
	.100E+01	.454E+00	.204E+00	.750E-01

Modeling of Feed Cycle N=4

Initial Information

Number of Apparats - 4
Number of Components - 2

Water Flowrate - 1.0000
Feed Concentration in Water Line Gramm/Litre
H .2000E+02 Pu .5000E+01
Recycle of organic for WATER line 5.0

Deiterium Flowrate - 3.9500
Feed Concentration in Deiterium Line Gramm/Litre
H .0000E+00 Pu .0000E+00
Recycle of organic for DEITERIUM line 5.0

RESULTS OF CALCULATION

Components Concentration in Stages of Apparate
Upper String - water line:Down String - Deiterium line

	1	2	3	4
H	.160E+02	.131E+02	.110E+02	.940E+01
	.268E+01	.167E+01	.943E+00	.406E+00
Pu	.270E+01	.176E+01	.129E+01	.104E+01
	.100E+01	.423E+00	.183E+00	.657E-01

Modeling of Feed Cycle N=5

Initial Information

Number of Apparats - 5
Number of Components - 2

Water Flowrate - 1.0000
Feed Concentration in Water Line Gramm/Litre
H .2000E+02 Pu .5000E+01
Recycle of organic for WATER line 1.0

Deiterium Flowrate - 2.9800
Feed Concentration in Deiterium Line Gramm/Litre
H .0000E+00 Pu .0000E+00
Recycle of organic for DEITERIUM line 1.0

RESULTS OF CALCULATION

Components Concentration in Stages of Apparate
Upper String - water line; Down String - Deiterium line

	1	2	3	4	5
H	.189E+02	.179E+02	.170E+02	.161E+02	.154E+02
	.155E+01	.119E+01	.853E+00	.544E+00	.261E+00
Pu	.400E+01	.328E+01	.274E+01	.234E+01	.202E+01
	.100E+01	.665E+00	.422E+00	.242E+00	.105E+00

Modeling of Feed Cycle N=5

Initial Information

Number of Apparats - 5
Number of Components - 2

Water Flowrate - 1.0000
Feed Concentration in Water Line Gramm/Litre
H .2000E+02 Pu .5000E+01
Recycle of organic for WATER line 2.0

Deiterium Flowrate - 3.6500
Feed Concentration in Deiterium Line Gramm/Litre
H .0000E+00 Pu .0000E+00
Recycle of organic for DEITERIUM line 2.0

RESULTS OF CALCULATION

Components Concentration in Stages of Apparate
Upper String - water line; Down String - Deiterium line

	1	2	3	4	5
H	.180E+02	.163E+02	.149E+02	.136E+02	.125E+02
	.205E+01	.150E+01	.104E+01	.639E+00	.296E+00
Pu	.346E+01	.255E+01	.198E+01	.161E+01	.135E+01
	.100E+01	.580E+00	.331E+00	.175E+00	.718E-01

Modeling of Feed Cycle N=5

Initial Information

Number of Apparats - 5
Number of Components - 2

Water Flowrate - 1.0000
Feed Concentration in Water Line Gramm/Litre
H .2000E+02 Pu .5000E+01
Recycle of organic for WATER line 3.0

Deiterium Flowrate - 3.9200
Feed Concentration in Deiterium Line Gramm/Litre
H .0000E+00 Pu .0000E+00
Recycle of organic for DEITERIUM line 3.0

RESULTS OF CALCULATION

Components Concentration in Stages of Apparate
Upper String - water line; Down String - Deiterium line

	1	2	3	4	5
H	.172E+02	.150E+02	.133E+02	.118E+02	.106E+02
	.240E+01	.169E+01	.113E+01	.677E+00	.307E+00
	1	2	3	4	5
Pu	.311E+01	.216E+01	.162E+01	.130E+01	.108E+01
	.100E+01	.521E+00	.277E+00	.139E+00	.550E-01

Modeling of Feed Cycle N=5

Initial Information

Number of Apparats - 5
Number of Components - 2

Water Flowrate - 1.0000
Feed Concentration in Water Line Gramm/Litre
H .2000E+02 Pu .5000E+01
Recycle of organic for WATER line 4.0

Deiterium Flowrate - 4.0500
Feed Concentration in Deiterium Line Gramm/Litre
H .0000E+00 Pu .0000E+00
Recycle of organic for DEITERIUM line 4.0

RESULTS OF CALCULATION

Components Concentration in Stages of Apparate
Upper String - water line; Down String - Deiterium line

	1	2	3	4	5
H	.166E+02	.140E+02	.120E+02	.105E+02	.922E+01
	.266E+01	.182E+01	.118E+01	.691E+00	.307E+00
	1	2	3	4	5
Pu	.288E+01	.192E+01	.142E+01	.113E+01	.952E+00
	.100E+01	.477E+00	.240E+00	.116E+00	.450E-01

Modeling of Feed Cycle N=5

Initial Information

Number of Apparats - 5
Number of Components - 2

Water Flowrate - 1.0000
Feed Concentration in Water Line Gramm/Litre
H .2000E+02 Pu .5000E+01
Recycle of organic for WATER line 5.0

Deiterium Flowrate - 4.1200
Feed Concentration in Deiterium Line Gramm/Litre
H .0000E+00 Pu .0000E+00
Recycle of organic for DEITERIUM line 5.0

RESULTS OF CALCULATION

Components Concentration in Stages of Apparate

Upper String - water line: Down String - Deiterium line

	1	2	3	4	5
H	.160E+02	.131E+02	.110E+02	.942E+01	.818E+01
	.287E+01	.190E+01	.121E+01	.692E+00	.302E+00
Pu	.270E+01	.176E+01	.129E+01	.103E+01	.875E+00
	.100E+01	.446E+00	.216E+00	.102E+00	.389E-01

Modeling of Feed Cycle N=6

Initial Information

Number of Apparats - 6
Number of Components - 2

Water Flowrate - 1.0000
Feed Concentration in Water Line Gramm/Litre
H .2000E+02 Pu .5000E+01
Recycle of organic for WATER line 1.0

Deiterium Flowrate - 3.2300
Feed Concentration in Deiterium Line Gramm/Litre
H .0000E+00 Pu .0000E+00
Recycle of organic for DEITERIUM line 1.0

RESULTS OF CALCULATION

Components Concentration in Stages of Apparate

Upper String - water line: Down String - Deiterium line

	1	2	3	4	5	6
H	.189E+02	.179E+02	.170E+02	.161E+02	.154E+02	.147E+02
	.165E+01	.132E+01	.101E+01	.724E+00	.462E+00	.222E+00
Pu	.400E+01	.328E+01	.274E+01	.234E+01	.202E+01	.178E+01
	.999E+00	.690E+00	.466E+00	.300E+00	.174E+00	.767E-01

Modeling of Feed Cycle N=6

Initial Information

Number of Apparats - 6
Number of Components - 2

Water Flowrate - 1.0000
Feed Concentration in Water Line Gramm/Litre
H .2000E+02 Pu .5000E+01
Recycle of organic for WATER line 2.0

Deiterium Flowrate - 3.8400
Feed Concentration in Deiterium Line Gramm/Litre
H .0000E+00 Pu .0000E+00
Recycle of organic for DEITERIUM line 2.0

RESULTS OF CALCULATION

Components Concentration in Stages of Apparate

Upper String - water line; Down String - Deiterium line

	1	2	3	4	5	6
H	.180E+02	.163E+02	.149E+02	.136E+02	.125E+02	.116E+02
	.219E+01	.167E+01	.123E+01	.852E+00	.527E+00	.245E+00
Pu	.346E+01	.255E+01	.198E+01	.161E+01	.135E+01	.116E+01
	.100E+01	.601E+00	.364E+00	.216E+00	.118E+00	.492E-01

Modeling of Feed Cycle N=6

Initial Information

Number of Apparats - 6
Number of Components - 2

Water Flowrate - 1.0000
Feed Concentration in Water Line Gramm/Litre
H .2000E+02 Pu .5000E+01
Recycle of organic for WATER line 3.0

Deiterium Flowrate - 4.0700
Feed Concentration in Deiterium Line Gramm/Litre
H .0000E+00 Pu .0000E+00
Recycle of organic for DEITERIUM line 3.0

RESULTS OF CALCULATION

Components Concentration in Stages of Apparate

Upper String - water line; Down String - Deiterium line

	1	2	3	4	5	6
H	.172E+02	.150E+02	.133E+02	.118E+02	.106E+02	.961E+01
	.255E+01	.188E+01	.134E+01	.899E+00	.542E+00	.247E+00
Pu	.311E+01	.216E+01	.162E+01	.129E+01	.108E+01	.936E+00
	.100E+01	.537E+00	.302E+00	.169E+00	.889E-01	.362E-01

Modeling of Feed Cycle N=6

Initial Information

Number of Apparats - 6
Number of Components - 2

Water Flowrate - 1.0000
Feed Concentration in Water Line Gramm/Litre
H .2000E+02 Pu .5000E+01
Recycle of organic for WATER line 4.0

Deiterium Flowrate - 4.1800
Feed Concentration in Deiterium Line Gramm/Litre
H .0000E+00 Pu .0000E+00
Recycle of organic for DEITERIUM line 4.0

RESULTS OF CALCULATION

Components Concentration in Stages of Apparate
Upper String - water line:Down String - Deiterium line

	1	2	3	4	5	6
H	.166E+02	.140E+02	.120E+02	.105E+02	.924E+01	.823E+01
	.282E+01	.200E+01	.138E+01	.911E+00	.539E+00	.241E+00
Pu	.288E+01	.192E+01	.142E+01	.113E+01	.947E+00	.826E+00
	.100E+01	.493E+00	.263E+00	.143E+00	.732E-01	.294E-01

Modeling of Feed Cycle N=6

Initial Information

Number of Apparats - 6
Number of Components - 2

Water Flowrate - 1.0000
Feed Concentration in Water Line Gramm/Litre
H .2000E+02 Pu .5000E+01
Recycle of organic for WATER line 5.0

Deiterium Flowrate - 4.2400
Feed Concentration in Deiterium Line Gramm/Litre
H .0000E+00 Pu .0000E+00
Recycle of organic for DEITERIUM line 5.0

RESULTS OF CALCULATION

Components Concentration in Stages of Apparate
Upper String - water line:Down String - Deiterium line

	1	2	3	4	5	6
H	.160E+02	.132E+02	.111E+02	.945E+01	.820E+01	.721E+01
	.302E+01	.208E+01	.140E+01	.905E+00	.527E+00	.233E+00
Pu	.270E+01	.175E+01	.129E+01	.103E+01	.872E+00	.768E+00
	.100E+01	.458E+00	.234E+00	.124E+00	.625E-01	.248E-01

Modeling of Feed Cycle N=7

Initial Information

Number of Apparats - 7
Number of Components - 2

Water Flowrate - 1.0000
Feed Concentration in Water Line Gramm/Litre
H .2000E+02 Pu .5000E+01
Recycle of organic for WATER line 1.0

Deiterium Flowrate - 3.4200
Feed Concentration in Deiterium Line Gramm/Litre
H .0000E+00 Pu .0000E+00
Recycle of organic for DEITERIUM line 1.0

RESULTS OF CALCULATION

Components Concentration in Stages of Apparate

Upper String - water line; Down String - Deiterium line

	1	2	3	4	5	6	7
H	.189E+02	.179E+02	.170E+02	.162E+02	.154E+02	.147E+02	.140E+02
	.175E+01	.144E+01	.114E+01	.876E+00	.629E+00	.402E+00	.193E+00
Pu	.400E+01	.328E+01	.274E+01	.234E+01	.202E+01	.178E+01	.159E+01
	.100E+01	.710E+00	.498E+00	.342E+00	.223E+00	.131E+00	.581E-01

Modeling of Feed Cycle N=7

Initial Information

Number of Apparats - 7
Number of Components - 2

Water Flowrate - 1.0000
Feed Concentration in Water Line Gramm/Litre
H .2000E+02 Pu .5000E+01
Recycle of organic for WATER line 2.0

Deiterium Flowrate - 3.9800
Feed Concentration in Deiterium Line Gramm/Litre
H .0000E+00 Pu .0000E+00
Recycle of organic for DEITERIUM line 2.0

RESULTS OF CALCULATION

Components Concentration in Stages of Apparate

Upper String - water line; Down String - Deiterium line

	1	2	3	4	5	6	7
H	.180E+02	.163E+02	.149E+02	.136E+02	.125E+02	.116E+02	.108E+02
	.232E+01	.182E+01	.139E+01	.103E+01	.716E+00	.444E+00	.207E+00
Pu	.346E+01	.255E+01	.198E+01	.160E+01	.134E+01	.116E+01	.102E+01
	.100E+01	.613E+00	.385E+00	.242E+00	.147E+00	.820E-01	.350E-01

Modeling of Feed Cycle N=7

Initial Information

Number of Apparats - 7
Number of Components - 2

Water Flowrate - 1.0000
Feed Concentration in Water Line Gramm/Litre
H .2000E+02 Pu .5000E+01
Recycle of organic for WATER line 3.0

Deiterium Flowrate - 4.1800
Feed Concentration in Deiterium Line Gramm/Litre
H .0000E+00 Pu .0000E+00
Recycle of organic for DEITERIUM line 3.0

RESULTS OF CALCULATION

Components Concentration in Stages of Apparate
Upper String - water line:Down String - Deiterium line

	1	2	3	4	5	6	7
H	.173E+02	.151E+02	.133E+02	.118E+02	.106E+02	.963E+01	.878E+
	.268E+01	.203E+01	.150E+01	.108E+01	.732E+00	.445E+00	.204E+
Pu	.311E+01	.216E+01	.162E+01	.129E+01	.108E+01	.935E+00	.832E+
	.100E+01	.549E+00	.320E+00	.191E+00	.112E+00	.609E-01	.255E-

Modeling of Feed Cycle N=7

Initial Information

Number of Apparats - 7
Number of Components - 2

Water Flowrate - 1.0000
Feed Concentration in Water Line Gramm/Litre
H .2000E+02 Pu .5000E+01
Recycle of organic for WATER line 4.0

Deiterium Flowrate - 4.2700
Feed Concentration in Deiterium Line Gramm/Litre
H .0000E+00 Pu .0000E+00
Recycle of organic for DEITERIUM line 4.0

RESULTS OF CALCULATION

Components Concentration in Stages of Apparate
Upper String - water line:Down String - Deiterium line

	1	2	3	4	5	6	7
H	.166E+02	.140E+02	.121E+02	.105E+02	.926E+01	.825E+01	.742E+
	.295E+01	.215E+01	.155E+01	.109E+01	.723E+00	.432E+00	.195E+
Pu	.288E+01	.191E+01	.141E+01	.113E+01	.945E+00	.824E+00	.739E+
	.999E+00	.502E+00	.276E+00	.159E+00	.915E-01	.488E-01	.202E-

Modeling of Feed Cycle N=7

Initial Information

Number of Apparats - 7
 Number of Components - 2

Water Flowrate - 1.0000
 Feed Concentration in Water Line Gramm/Litre
 H .2000E+02 Pu .5000E+01
 Recycle of organic for WATER line 5.0

Deiterium Flowrate - 4.3200
 Feed Concentration in Deiterium Line Gramm/Litre
 H .0000E+00 Pu .0000E+00
 Recycle of organic for DEITERIUM line 5.0

RESULTS OF CALCULATION

Components Concentration in Stages of Apparate

Upper String - water line; Down String - Deiterium line

	1	2	3	4	5	6	7
H	.160E+02	.132E+02	.111E+02	.947E+01	.822E+01	.723E+01	.643E+01
	.314E+01	.222E+01	.156E+01	.107E+01	.703E+00	.414E+00	.185E+00
	1	2	3	4	5	6	7
Pu	.270E+01	.175E+01	.129E+01	.103E+01	.867E+00	.763E+00	.690E+00
	.100E+01	.468E+00	.247E+00	.139E+00	.788E-01	.417E-01	.171E-01

Modeling of Feed Cycle N=8

Initial Information

Number of Apparats - 8
Number of Components - 2

Water Flowrate - 1.0000
Feed Concentration in Water Line Gramm/Litre
H .2000E+02 Pu .5000E+01
Recycle of organic for WATER line 3.0

Deiterium Flowrate - 4.2500
Feed Concentration in Deiterium Line Gramm/Litre
H .0000E+00 Pu .0000E+00
Recycle of organic for DEITERIUM line 3.0

RESULTS OF CALCULATION

Components Concentration in Stages of Apparate

	Upper String - water line				Down String - Deiterium line			
	1	2	3	4	5	6	7	8
H	.173E+02	.151E+02	.133E+02	.119E+02	.107E+02	.964E+01	.879E+01	.806E
	.281E+01	.216E+01	.165E+01	.123E+01	.892E+00	.609E+00	.372E+00	.172E
Pu	.311E+01	.216E+01	.162E+01	.129E+01	.108E+01	.930E+00	.825E+00	.747E
	.100E+01	.560E+00	.334E+00	.207E+00	.130E+00	.789E-01	.439E-01	.187E

Modeling of Feed Cycle N=8

Initial Information

Number of Apparats - 8
Number of Components - 2

Water Flowrate - 1.0000
Feed Concentration in Water Line Gramm/Litre
H .2000E+02 Pu .5000E+01
Recycle of organic for WATER line 4.0

Deiterium Flowrate - 4.3400
Feed Concentration in Deiterium Line Gramm/Litre
H .0000E+00 Pu .0000E+00
Recycle of organic for DEITERIUM line 4.0

RESULTS OF CALCULATION

Components Concentration in Stages of Apparate

	Upper String - water line				Down String - Deiterium line			
	1	2	3	4	5	6	7	8
H	.166E+02	.140E+02	.121E+02	.105E+02	.928E+01	.827E+01	.743E+01	.674E
	.306E+01	.228E+01	.169E+01	.123E+01	.872E+00	.586E+00	.353E+00	.161E
Pu	.288E+01	.191E+01	.141E+01	.112E+01	.943E+00	.823E+00	.739E+00	.678E
	.999E+00	.509E+00	.287E+00	.172E+00	.105E+00	.629E-01	.347E-01	.147E

Modeling of Feed Cycle N=8

Initial Information

Number of Apparats - 8
 Number of Components - 2

Water Flowrate - 1.0000
 Feed Concentration in Water Line Gramm/Litre
 H .2000E+02 Pu .5000E+01
 Recycle of organic for WATER line 1.0

Deiterium Flowrate - 3.5900
 Feed Concentration in Deiterium Line Gramm/Litre
 H .0000E+00 Pu .0000E+00
 Recycle of organic for DEITERIUM line 1.0

RESULTS OF CALCULATION

Components Concentration in Stages of Apparate
 Upper String - water line; Down String - Deiterium line

	1	2	3	4	5	6	7	8
H	.189E+02	.179E+02	.170E+02	.162E+02	.154E+02	.147E+02	.140E+02	.134E
	.184E+01	.154E+01	.126E+01	.100E+01	.770E+00	.553E+00	.354E+00	.170E
Pu	.400E+01	.328E+01	.274E+01	.234E+01	.202E+01	.178E+01	.159E+01	.143E
	.100E+01	.722E+00	.520E+00	.371E+00	.257E+00	.170E+00	.100E+00	.451E

Modeling of Feed Cycle N=8

Initial Information

Number of Apparats - 8
 Number of Components - 2

Water Flowrate - 1.0000
 Feed Concentration in Water Line Gramm/Litre
 H .2000E+02 Pu .5000E+01
 Recycle of organic for WATER line 2.0

Deiterium Flowrate - 4.0900
 Feed Concentration in Deiterium Line Gramm/Litre
 H .0000E+00 Pu .0000E+00
 Recycle of organic for DEITERIUM line 2.0

RESULTS OF CALCULATION

Components Concentration in Stages of Apparate
 Upper String - water line; Down String - Deiterium line

	1	2	3	4	5	6	7	8
H	.180E+02	.163E+02	.149E+02	.136E+02	.126E+02	.116E+02	.108E+02	.101E
	.243E+01	.195E+01	.153E+01	.118E+01	.874E+00	.610E+00	.330E+00	.178E
Pu	.346E+01	.255E+01	.198E+01	.160E+01	.134E+01	.116E+01	.102E+01	.915E
	.100E+01	.623E+00	.401E+00	.262E+00	.170E+00	.106E+00	.601E-01	.260E

Modeling of Feed Cycle N=8

35

Initial Information

Number of Apparats - 8
 Number of Components - 2
 Water Flowrate - 1.0000
 Feed Concentration in Water Line Gramm/Litre
 H .2000E+02 Pu .5000E+01
 Recycle of organic for WATER line 5.0
 Deuterium Flowrate - 4.3700
 Feed Concentration in Deuterium Line Gramm/Litre
 H .0000E+00 Pu .0000E+00
 Recycle of organic for DEITERIUM line 5.0

RESULTS OF CALCULATION

Components Concentration in Stages of Apparate

Upper String - water line:Down String - Deuterium line

	1	2	3	4	5	6	7	8
H	.160E+02	.132E+02	.111E+02	.949E+01	.824E+01	.725E+01	.645E+01	.579E+01
	.325E+01	.235E+01	.170E+01	.121E+01	.846E+00	.561E+00	.334E+00	.151E+00
Pu	.270E+01	.175E+01	.128E+01	.102E+01	.864E+00	.760E+00	.688E+00	.636E+00
	.100E+01	.474E+00	.256E+00	.149E+00	.897E-01	.531E-01	.291E-01	.123E-01

Modeling of Feed Cycle N=9

Initial Information

Number of Apparats - 9
 Number of Components - 2
 Water Flowrate - 1.0000
 Feed Concentration in Water Line Gramm/Litre
 H .2000E+02 Pu .5000E+01
 Recycle of organic for WATER line 1.0
 Deuterium Flowrate - 3.7100
 Feed Concentration in Deuterium Line Gramm/Litre
 H .0000E+00 Pu .0000E+00
 Recycle of organic for DEITERIUM line 1.0

RESULTS OF CALCULATION

Components Concentration in Stages of Apparate

Upper String - water line:Down String - Deuterium line

	1	2	3	4	5	6	7	8
H	.189E+02	.179E+02	.170E+02	.162E+02	.154E+02	.147E+02	.140E+02	.134E+02
	.193E+01	.164E+01	.137E+01	.112E+01	.897E+00	.688E+00	.495E+00	.317E+00
	.128E+02							
	.153E+00							
Pu	.400E+01	.328E+01	.274E+01	.233E+01	.202E+01	.177E+01	.158E+01	.142E+01
	.100E+01	.735E+00	.540E+00	.395E+00	.285E+00	.200E+00	.133E+00	.796E-01
	.129E+01							
	.359E-01							

00E
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01

Modeling of Feed Cycle N=10

Initial Information

Number of Apparats - 10
 Number of Components - 2
 Water Flowrate - 1.0000
 Feed Concentration in Water Line Gramm/Litre
 H .2000E+02 Pu .5000E+01
 Recycle of organic for WATER line 1.
 Deiterium Flowrate - 3.8200
 Feed Concentration in Deiterium Line Gramm/Litre
 H .0000E+00 Pu .0000E+00
 Recycle of organic for DEITERIUM line 1.

RESULTS OF CALCULATION

Components Concentration in Stages of Apparate

Upper String - water line:Down String - Deiterium line

	1	2	3	4	5	6	7	8
H	.189E+02	.179E+02	.170E+02	.162E+02	.154E+02	.147E+02	.140E+02	.134E
	.201E+01	.173E+01	.147E+01	.123E+01	.101E+01	.806E+00	.618E+00	.446E
	9	10						
	.128E+02	.123E+02						
	.286E+00	.138E+00						
	1	2	3	4	5	6	7	8
Pu	.400E+01	.328E+01	.274E+01	.233E+01	.202E+01	.177E+01	.158E+01	.142E
	.100E+01	.743E+00	.554E+00	.413E+00	.306E+00	.224E+00	.159E+00	.107E
	9	10						
	.129E+01	.118E+01						
	.642E-01	.291E-01						

Modeling of Feed Cycle N=10

Initial Information

Number of Apparats - 10
 Number of Components - 2
 Water Flowrate - 1.0000
 Feed Concentration in Water Line Gramm/Litre
 H .2000E+02 Pu .5000E+01
 Recycle of organic for WATER line 2.0
 Deiterium Flowrate - 4.2500
 Feed Concentration in Deiterium Line Gramm/Litre
 H .0000E+00 Pu .0000E+00
 Recycle of organic for DEITERIUM line 2.0

RESULTS OF CALCULATION

Components Concentration in Stages of Apparate

Upper String - water line:Down String - Deiterium line

	1	2	3	4	5	6	7	8
H	.180E+02	.163E+02	.149E+02	.137E+02	.126E+02	.116E+02	.108E+02	.101E
	.262E+01	.216E+01	.176E+01	.142E+01	.113E+01	.875E+00	.654E+00	.460E
	9	10						
	.943E+01	.885E+01						
	.288E+00	.136E+00						
	1	2	3	4	5	6	7	8
Pu	.346E+01	.255E+01	.198E+01	.160E+01	.134E+01	.116E+01	.102E+01	.914E
	.999E+00	.636E+00	.422E+00	.288E+00	.199E+00	.138E+00	.935E-01	.606E
	9	10						
	.834E+00	.770E+00						
	.354E-01	.157E-01						

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Modeling of Feed Cycle N=10
Initial Information
Number of Apparats - 10
Number of Components - 2
Water Flowrate - 1.0000
Feed Concentration in Water Line Gramm/Litre
H .2000E+02 Pu .5000E+01
Recycle of organic for WATER line 3.00
Deiterium Flowrate - 4.3500
Feed Concentration in Deiterium Line Gramm/Litre
H .0000E+00 Pu .0000E+00
Recycle of organic for DEITERIUM line 3.00

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RESULTS OF CALCULATION
Components Concentration in Stages of Apparate
Upper String - water line;Down String - Deiterium line
      1      2      3      4      5      6      7      8
H .173E+02 .151E+02 .133E+02 .119E+02 .107E+02 .967E+01 .882E+01 .809E
  .301E+01 .238E+01 .188E+01 .147E+01 .114E+01 .867E+00 .635E+00 .439E
    9      10
  .746E+01 .691E+01
  .271E+00 .126E+00
      1      2      3      4      5      6      7      8
Pu .311E+01 .215E+01 .162E+01 .129E+01 .107E+01 .927E+00 .822E+00 .745E
  .100E+01 .571E+00 .351E+00 .227E+00 .151E+00 .102E+00 .675E-01 .431E
    9      10
  .686E+00 .641E+00
  .249E-01 .110E-01

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Modeling of Feed Cycle N=10
Initial Information
Number of Apparats - 10
Number of Components - 2
Water Flowrate - 1.0000
Feed Concentration in Water Line Gramm/Litre
H .2000E+02 Pu .5000E+01
Recycle of organic for WATER line 4.0
Deiterium Flowrate - 4.4100
Feed Concentration in Deiterium Line Gramm/Litre
H .0000E+00 Pu .0000E+00
Recycle of organic for DEITERIUM line 4.0

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RESULTS OF CALCULATION
Components Concentration in Stages of Apparate
Upper String - water line;Down String - Deiterium line
      1      2      3      4      5      6      7      8
H .166E+02 .141E+02 .121E+02 .106E+02 .931E+01 .830E+01 .746E+01 .676E
  .325E+01 .249E+01 .191E+01 .146E+01 .111E+01 .827E+00 .597E+00 .408E
    9      10
  .817E+01 .567E+01
  .249E+00 .115E+00
      1      2      3      4      5      6      7      8
Pu .287E+01 .191E+01 .141E+01 .112E+01 .937E+00 .816E+00 .731E+00 .669E
  .100E+01 .521E+00 .302E+00 .188E+00 .123E+00 .811E-01 .534E-01 .338E
    9      10
  .622E+00 .586E+00
  .194E-01 .852E-02

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Modeling of Feed Cycle N=10

Initial Information

Number of Apparats - 10
 Number of Components - 2

Water Flowrate - 1.0000
 Feed Concentration in Water Line Gramm/Litre
 H .2000E+02 Pu .5000E+01
 Recycle of organic for WATER line 5.0

Deiterium Flowrate - 4.4500
 Feed Concentration in Deiterium Line Gramm/Litre.
 H .0000E+00 Pu .0000E+00
 Recycle of organic for DEITERIUM line 5.0

RESULTS OF CALCULATION

Components Concentration in Stages of Apparate
 Upper String - water line:Down String - Deiterium line

	1	2	3	4	5	6	7	8
H	.161E+02	.132E+02	.111E+02	.952E+01	.827E+01	.728E+01	.648E+01	.582E
	.342E+01	.253E+01	.189E+01	.142E+01	.106E+01	.780E+00	.557E+00	.377E
	9	10						
	.527E+01	.480E+01						
	.228E+00	.104E+00						
	1	2	3	4	5	6	7	8
Pu	.270E+01	.175E+01	.128E+01	.102E+01	.860E+00	.755E+00	.682E+00	.629E
	.100E+01	.484E+00	.270E+00	.164E+00	.105E+00	.692E-01	.453E-01	.286E
	9	10						
	.590E+00	.559E+00						
	.164E-01	.719E-02						

Annex 3

The Results of Modelling of Extraction of some Fission Product Elements from Reactor Circuit.

Modeling of Outlet Cycle N=3

Initial Information

Number of Apparats - 3
 Number of Components - 20

Water Flowrate - 10.0000 >>----->
 Feed Concentration in Water Line Gramm/Litre

H	.0000E+00	U	.0000E+00	Pu	.0000E+00
Np	.0000E+00	Th	.0000E+00	Tc	.0000E+00
Am	.0000E+00	La	.0000E+00	Ce	.0000E+00
Nd	.0000E+00	Eu	.0000E+00	Y	.0000E+00
Sr	.0000E+00	Ba	.0000E+00	Fe	.0000E+00
Ni	.0000E+00	Mo	.0000E+00	Ru	.0000E+00
Pd	.0000E+00	Zr	.0000E+00		

Recycle of organic for WATER line
 1.00 1.00 1.00

Deiterium Flowrate - 1.0000 <-----<<
 Feed Concentration in Deiterium Line Gramm/Litre

H	.3000E+01	U	.1000E+00	Pu	.1000E+01
Np	.1000E-01	Th	.1000E-01	Tc	.1000E-01
Am	.1000E-01	La	.1000E-01	Ce	.1000E-01
Nd	.1000E-01	Eu	.1000E-01	Y	.1000E-01
Sr	.1000E-01	Ba	.1000E-01	Fe	.1000E-01
Ni	.1000E-01	Mo	.1000E-01	Ru	.1000E-01
Pd	.1000E-01	Zr	.1000E-01		

Recycle of organic for DEITERIUM line
 10.00 10.00 10.00

RESULTS OF CALCULATION

Components Concentration in Stages of Apparate
 Upper String - Water line >>----->
 Down String - Deiterium line <-----<<

	1	2	3
H	.329E-01	.712E-01	.116E+00
	.184E+01	.217E+01	.256E+01
U	.674E-03	.293E-02	.118E-01
	.132E-02	.512E-02	.206E-01
Pu	.397E-02	.215E-01	.994E-01
	.102E-01	.492E-01	.223E+00
Np	.145E-03	.393E-03	.816E-03
	.184E-02	.329E-02	.577E-02
Th	.925E-04	.196E-03	.312E-03
	.688E-02	.780E-02	.804E-02
Tc	.527E-04	.108E-03	.167E-03
	.833E-02	.884E-02	.941E-02
Am	.139E-04	.280E-04	.423E-04
	.958E-02	.972E-02	.986E-02
La	.551E-04	.114E-03	.175E-03
	.825E-02	.880E-02	.938E-02
Ce	.236E-04	.474E-04	.723E-04

	.928E-02	.951E-02	.975E-02
	1	2	3
Nd	.396E-04	.809E-04	.124E-03
	.876E-02	.916E-02	.957E-02
	1	2	3
Eu	.723E-04	.151E-03	.236E-03
	.764E-02	.837E-02	.915E-02
	1	2	3
Y	.354E-04	.722E-04	.110E-03
	.890E-02	.925E-02	.962E-02
	1	2	3
Sr	.181E-05	.362E-05	.543E-05
	.995E-02	.996E-02	.998E-02
	1	2	3
Ba	.164E-04	.330E-04	.499E-04
	.950E-02	.966E-02	.983E-02
	1	2	3
Fe	.884E-05	.178E-04	.267E-04
	.973E-02	.982E-02	.991E-02
	1	2	3
Ni	.884E-05	.178E-04	.267E-04
	.973E-02	.982E-02	.991E-02
	1	2	3
Mo	.884E-05	.178E-04	.267E-04
	.973E-02	.982E-02	.991E-02
	1	2	3
Ru	.133E-03	.297E-03	.500E-03
	.500E-02	.632E-02	.796E-02
	1	2	3
Pd	.624E-05	.125E-04	.188E-04
	.981E-02	.987E-02	.994E-02
	1	2	3
Zr	.643E-04	.133E-03	.207E-03
	.793E-02	.857E-02	.926E-02

Modeling of Outlet Cycle N=4

Initial Information

Number of Apparats - 4
 Number of Components - 20

Water Flowrate - 10.0000 >>----->
 Feed Concentration in Water Line Gramm/Litre

H	.0000E+00	U	.0000E+00	Pu	.0000E+00
Np	.0000E+00	Th	.0000E+00	Tc	.0000E+00
Am	.0000E+00	La	.0000E+00	Ce	.0000E+00
Nd	.0000E+00	Eu	.0000E+00	Y	.0000E+00
Sr	.0000E+00	Ba	.0000E+00	Fe	.0000E+00
Ni	.0000E+00	Mo	.0000E+00	Ru	.0000E+00
Pd	.0000E+00	Zr	.0000E+00		

Recycle of organic for WATER line
 1.00 1.00 1.00 1.00

Deiterium Flowrate - 1.0000 <-----<<
 Feed Concentration in Deiterium Line Gramm/Litre

H	.3000E+01	U	.1000E+00	Pu	.1000E+01
Np	.1000E-01	Th	.1000E-01	Tc	.1000E-01
Am	.1000E-01	La	.1000E-01	Ce	.1000E-01
Nd	.1000E-01	Eu	.1000E-01	Y	.1000E-01
Sr	.1000E-01	Ba	.1000E-01	Fe	.1000E-01
Ni	.1000E-01	Mo	.1000E-01	Ru	.1000E-01
Pd	.1000E-01	Zr	.1000E-01		

Recycle of organic for DEITERIUM line
 10.00 10.00 10.00 10.00

RESULTS OF CALCULATION

Components Concentration in Stages of Apparate

Upper String - Water line >>----->
 Down String - Deiterium line <-----<<

	1	2	3	4
H	.281E-01	.607E-01	.986E-01	.143E+00
	.157E+01	.186E+01	.218E+01	.256E+01
U	.251E-03	.981E-03	.319E-02	.119E-01
	.490E-03	.168E-02	.534E-02	.206E-01
Pu	.904E-03	.485E-02	.223E-01	.100E+00
	.233E-02	.111E-01	.499E-01	.223E+00
Np	.841E-04	.228E-03	.473E-03	.893E-03
	.107E-02	.191E-02	.335E-02	.580E-02
Th	.818E-04	.174E-03	.276E-03	.392E-03
	.608E-02	.690E-02	.782E-02	.885E-02
Tc	.496E-04	.102E-03	.157E-03	.216E-03
	.784E-02	.834E-02	.886E-02	.941E-02
Am	.137E-04	.276E-04	.417E-04	.559E-04
	.944E-02	.958E-02	.972E-02	.986E-02
La	.517E-04	.107E-03	.165E-03	.226E-03
	.774E-02	.825E-02	.880E-02	.938E-02

Ce	.230E-04	.465E-04	.705E-04	.951E-04
	.905E-02	.920E-02	.951E-02	.975E-02
	1	2	3	4
Nd	.379E-04	.774E-04	.119E-03	.161E-03
	.839E-02	.877E-02	.916E-02	.957E-02
	1	2	3	4
Eu	.662E-04	.138E-03	.216E-03	.300E-03
	.700E-02	.766E-02	.838E-02	.915E-02
	1	2	3	4
Y	.341E-04	.694E-04	.106E-03	.144E-03
	.856E-02	.890E-02	.925E-02	.962E-02
	1	2	3	4
Sr	.180E-05	.361E-05	.542E-05	.724E-05
	.993E-02	.995E-02	.996E-02	.998E-02
	1	2	3	4
Ba	.161E-04	.325E-04	.491E-04	.659E-04
	.934E-02	.950E-02	.967E-02	.983E-02
	1	2	3	4
Fe	.876E-05	.176E-04	.265E-04	.355E-04
	.965E-02	.973E-02	.982E-02	.991E-02
	1	2	3	4
Ni	.876E-05	.176E-04	.265E-04	.355E-04
	.965E-02	.973E-02	.982E-02	.991E-02
	1	2	3	4
Mo	.876E-05	.176E-04	.265E-04	.355E-04
	.965E-02	.973E-02	.982E-02	.991E-02
	1	2	3	4
Ru	.106E-03	.237E-03	.400E-03	.601E-03
	.399E-02	.505E-02	.636E-02	.799E-02
	1	2	3	4
Pd	.620E-05	.124E-04	.187E-04	.250E-04
	.975E-02	.981E-02	.987E-02	.994E-02
	1	2	3	4
Zr	.596E-04	.124E-03	.192E-03	.266E-03
	.734E-02	.794E-02	.858E-02	.926E-02

Modeling of Outlet Cycle N=5

Initial Information

Number of Apparats - 5
 Number of Components - 20

Water Flowrate - 10.0000 >>----->
 Feed Concentration in Water Line Gramm/Litre

H	.0000E+00	U	.0000E+00	Pu	.0000E+00
Np	.0000E+00	Th	.0000E+00	Tc	.0000E+00
Am	.0000E+00	La	.0000E+00	Ce	.0000E+00
Nd	.0000E+00	Eu	.0000E+00	Y	.0000E+00
Sr	.0000E+00	Ba	.0000E+00	Fe	.0000E+00
Ni	.0000E+00	Mo	.0000E+00	Ru	.0000E+00
Pd	.0000E+00	Zr	.0000E+00		

Recycle of organic for WATER line
 1.00 1.00 1.00 1.00 1.00

Deiterium Flowrate - 1.0000 <-----<<
 Feed Concentration in Deiterium Line Gramm/Litre

H	.3000E+01	U	.1000E+00	Pu	.1000E+01
Np	.1000E-01	Th	.1000E-01	Tc	.1000E-01
Am	.1000E-01	La	.1000E-01	Ce	.1000E-01
Nd	.1000E-01	Eu	.1000E-01	Y	.1000E-01
Sr	.1000E-01	Ba	.1000E-01	Fe	.1000E-01
Ni	.1000E-01	Mo	.1000E-01	Ru	.1000E-01
Pd	.1000E-01	Zr	.1000E-01		

Recycle of organic for DEITERIUM line
 10.00 10.00 10.00 10.00 10.00

RESULTS OF CALCULATION

Components Concentration in Stages of Apparate
 Upper String - Water line >>----->
 Down String - Deiterium line <-----<<

	1	2	3	4	5
H	.240E-01	.519E-01	.843E-01	.122E+00	.165E+00
	.135E+01	.159E+01	.186E+01	.219E+01	.256E+01
U	.112E-03	.419E-03	.118E-02	.336E-02	.121E-01
	.218E-03	.706E-03	.189E-02	.547E-02	.207E-01
Pu	.211E-03	.111E-02	.505E-02	.225E-01	.100E+00
	.544E-03	.254E-02	.113E-01	.500E-01	.223E+00
Np	.490E-04	.133E-03	.276E-03	.520E-03	.938E-03
	.622E-03	.111E-02	.195E-02	.338E-02	.582E-02
Th	.725E-04	.154E-03	.245E-03	.347E-03	.461E-03
	.539E-02	.611E-02	.692E-02	.783E-02	.886E-02
Tc	.467E-04	.960E-04	.148E-03	.203E-03	.262E-03
	.738E-02	.785E-02	.834E-02	.887E-02	.942E-02
Am	.135E-04	.272E-04	.411E-04	.551E-04	.694E-04
	.931E-02	.944E-02	.958E-02	.972E-02	.986E-02
La	.485E-04	.100E-03	.155E-03	.212E-03	.274E-03
	.726E-02	.775E-02	.826E-02	.881E-02	.939E-02

	1	2	3	4	5
Ce	.224E-04 .883E-02	.453E-04 .905E-02	.688E-04 .928E-02	.928E-04 .951E-02	.117E-03 .975E-02
Nd	.363E-04 .803E-02	.741E-04 .839E-02	.113E-03 .877E-02	.154E-03 .916E-02	.197E-03 .957E-02
Eu	.606E-04 .641E-02	.126E-03 .701E-02	.198E-03 .767E-02	.275E-03 .839E-02	.359E-03 .916E-02
Y	.328E-04 .824E-02	.668E-04 .857E-02	.102E-03 .891E-02	.139E-03 .926E-02	.176E-03 .962E-02
Sr	.180E-05 .991E-02	.361E-05 .993E-02	.541E-05 .995E-02	.722E-05 .996E-02	.904E-05 .998E-02
Ba	.158E-04 .918E-02	.319E-04 .934E-02	.482E-04 .950E-02	.648E-04 .967E-02	.817E-04 .983E-02
Fe	.868E-05 .956E-02	.174E-04 .965E-02	.263E-04 .973E-02	.352E-04 .982E-02	.441E-04 .991E-02
Ni	.868E-05 .956E-02	.174E-04 .965E-02	.263E-04 .973E-02	.352E-04 .982E-02	.441E-04 .991E-02
Mo	.868E-05 .956E-02	.174E-04 .965E-02	.263E-04 .973E-02	.352E-04 .982E-02	.441E-04 .991E-02
Ru	.848E-04 .319E-02	.190E-03 .404E-02	.320E-03 .509E-02	.481E-03 .639E-02	.681E-03 .800E-02
Pd	.616E-05 .969E-02	.124E-04 .975E-02	.186E-04 .981E-02	.249E-04 .987E-02	.312E-04 .994E-02
Zr	.552E-04 .680E-02	.114E-03 .736E-02	.178E-03 .795E-02	.246E-03 .859E-02	.320E-03 .927E-02

Modeling of Outlet Cycle N=6

Initial Information

Number of Apparats - 6
 Number of Components - 20

Water Flowrate - 10.0000 >>----->
 Feed Concentration in Water Line Gramm/Litre

H	.0000E+00	U	.0000E+00	Pu	.0000E+00
Np	.0000E+00	Th	.0000E+00	Tc	.0000E+00
Am	.0000E+00	La	.0000E+00	Ce	.0000E+00
Nd	.0000E+00	Eu	.0000E+00	Y	.0000E+00
Sr	.0000E+00	Ba	.0000E+00	Fe	.0000E+00
Ni	.0000E+00	Mo	.0000E+00	Ru	.0000E+00
Pd	.0000E+00	Zr	.0000E+00		

Recycle of organic for WATER line
 1.00 1.00 1.00 1.00 1.00 1.00

Deuterium Flowrate - 1.0000 <-----<<
 Feed Concentration in Deuterium Line Gramm/Litre

H	.3000E+01	U	.1000E+00	Pu	.1000E+01
Np	.1000E-01	Th	.1000E-01	Tc	.1000E-01
Am	.1000E-01	La	.1000E-01	Ce	.1000E-01
Nd	.1000E-01	Eu	.1000E-01	Y	.1000E-01
Sr	.1000E-01	Ba	.1000E-01	Fe	.1000E-01
Ni	.1000E-01	Mo	.1000E-01	Ru	.1000E-01
Pd	.1000E-01	Zr	.1000E-01		

Recycle of organic for DEUTERIUM line
 10.00 10.00 10.00 10.00 10.00 10.00

RESULTS OF CALCULATION

Components Concentration in Stages of Apparate

Upper String - Water line >>----->
 Down String - Deuterium line <-----<<

	1	2	3	4	5	6
H	.206E-01	.444E-01	.721E-01	.104E+00	.142E+00	.185E+00
	.115E+01	.136E+01	.160E+01	.187E+01	.219E+01	.257E+01
U	.554E-04	.205E-03	.545E-03	.132E-02	.347E-02	.121E-01
	.108E-03	.346E-03	.866E-03	.205E-02	.558E-02	.207E-01
Pu	.520E-04	.265E-03	.116E-02	.509E-02	.225E-01	.100E+00
	.133E-03	.599E-03	.258E-02	.113E-01	.500E-01	.223E+00
Np	.286E-04	.775E-04	.161E-03	.304E-03	.547E-03	.964E-03
	.363E-03	.649E-03	.114E-02	.197E-02	.340E-02	.584E-02
Th	.642E-04	.136E-03	.217E-03	.307E-03	.409E-03	.523E-03
	.477E-02	.542E-02	.614E-02	.694E-02	.785E-02	.886E-02
Tc	.440E-04	.905E-04	.140E-03	.192E-03	.246E-03	.304E-03
	.696E-02	.740E-02	.786E-02	.835E-02	.887E-02	.942E-02
Am	.133E-04	.268E-04	.405E-04	.544E-04	.684E-04	.826E-04
	.917E-02	.931E-02	.944E-02	.958E-02	.972E-02	.986E-02
La	.456E-04	.939E-04	.145E-03	.199E-03	.257E-03	.318E-03
	.682E-02	.728E-02	.776E-02	.827E-02	.881E-02	.939E-02

	1	2	3	4	5	6
Ce	.219E-04	.442E-04	.671E-04	.905E-04	.114E-03	.139E-03
	.861E-02	.883E-02	.905E-02	.928E-02	.952E-02	.976E-02
Nd	.348E-04	.710E-04	.109E-03	.148E-03	.189E-03	.231E-03
	.769E-02	.804E-02	.840E-02	.878E-02	.917E-02	.958E-02
Eu	.555E-04	.116E-03	.181E-03	.252E-03	.329E-03	.413E-03
	.587E-02	.643E-02	.703E-02	.769E-02	.839E-02	.916E-02
Y	.316E-04	.643E-04	.982E-04	.133E-03	.170E-03	.207E-03
	.793E-02	.824E-02	.857E-02	.891E-02	.926E-02	.962E-02
Sr	.180E-05	.360E-05	.540E-05	.721E-05	.902E-05	.108E-04
	.989E-02	.991E-02	.993E-02	.995E-02	.996E-02	.998E-02
Ba	.156E-04	.314E-04	.474E-04	.637E-04	.803E-04	.971E-04
	.903E-02	.918E-02	.934E-02	.950E-02	.967E-02	.983E-02
Fe	.860E-05	.173E-04	.260E-04	.348E-04	.437E-04	.527E-04
	.947E-02	.956E-02	.965E-02	.973E-02	.982E-02	.991E-02
Ni	.860E-05	.173E-04	.260E-04	.348E-04	.437E-04	.527E-04
	.947E-02	.956E-02	.965E-02	.973E-02	.982E-02	.991E-02
Mo	.860E-05	.173E-04	.260E-04	.348E-04	.437E-04	.527E-04
	.947E-02	.956E-02	.965E-02	.973E-02	.982E-02	.991E-02
Ru	.679E-04	.152E-03	.256E-03	.386E-03	.546E-03	.744E-03
	.256E-02	.324E-02	.408E-02	.512E-02	.642E-02	.802E-02
Pd	.612E-05	.123E-04	.185E-04	.247E-04	.310E-04	.373E-04
	.963E-02	.969E-02	.975E-02	.981E-02	.987E-02	.994E-02
Zr	.512E-04	.106E-03	.165E-03	.228E-03	.296E-03	.369E-03
	.631E-02	.682E-02	.737E-02	.796E-02	.859E-02	.927E-02

Modeling of Outlet Cycle N=7

Initial Information

Number of Apparats - 7
 Number of Components - 20

Water Flowrate - 10.0000 >>----->
 Feed Concentration in Water Line Gramm/Litre
 H .0000E+00 U .0000E+00 Pu .0000E+00
 Np .0000E+00 Th .0000E+00 Tc .0000E+00
 Am .0000E+00 La .0000E+00 Ce .0000E+00
 Nd .0000E+00 Eu .0000E+00 Y .0000E+00
 Sr .0000E+00 Ba .0000E+00 Fe .0000E+00
 Ni .0000E+00 Mo .0000E+00 Ru .0000E+00
 Pd .0000E+00 Zr .0000E+00
 Recycle of organic for WATER line
 1.00 1.00 1.00 1.00 1.00 1.00 1.00

Deuterium Flowrate - 1.0000 <-----<<
 Feed Concentration in Deuterium Line Gramm/Litre
 H .3000E+01 U .1000E+00 Pu .1000E+01
 Np .1000E-01 Th .1000E-01 Tc .1000E-01
 Am .1000E-01 La .1000E-01 Ce .1000E-01
 Nd .1000E-01 Eu .1000E-01 Y .1000E-01
 Sr .1000E-01 Ba .1000E-01 Fe .1000E-01
 Ni .1000E-01 Mo .1000E-01 Ru .1000E-01
 Pd .1000E-01 Zr .1000E-01
 Recycle of organic for DEUTERIUM line
 10.00 10.00 10.00 10.00 10.00 10.00 10.00

RESULTS OF CALCULATION

Components Concentration in Stages of Apparate
 Upper String - Water line >>----->
 Down String - Deuterium line <-----<<

	1	2	3	4	5	6	7
H	.176E-01	.380E-01	.618E-01	.893E-01	.121E+00	.158E+00	.201E+00
	.986E+00	.116E+01	.137E+01	.160E+01	.188E+01	.220E+01	.257E+01
U	.282E-04	.105E-03	.278E-03	.634E-03	.140E-02	.353E-02	.121E-01
	.550E-04	.177E-03	.438E-03	.964E-03	.212E-02	.558E-02	.207E-01
Pu	.138E-04	.667E-04	.279E-03	.117E-02	.509E-02	.225E-01	.100E+00
	.353E-04	.149E-03	.611E-03	.259E-02	.113E-01	.500E-01	.223E+00
Np	.167E-04	.453E-04	.940E-04	.177E-03	.320E-03	.563E-03	.979E-03
	.212E-03	.379E-03	.665E-03	.115E-02	.199E-02	.341E-02	.584E-02
Th	.570E-04	.121E-03	.192E-03	.273E-03	.363E-03	.464E-03	.577E-03
	.423E-02	.480E-02	.544E-02	.616E-02	.696E-02	.786E-02	.887E-02
Tc	.414E-04	.852E-04	.132E-03	.180E-03	.232E-03	.287E-03	.345E-03
	.655E-02	.697E-02	.741E-02	.787E-02	.836E-02	.888E-02	.942E-02
Am	.131E-04	.264E-04	.399E-04	.536E-04	.674E-04	.814E-04	.956E-04
	.904E-02	.918E-02	.931E-02	.944E-02	.958E-02	.972E-02	.986E-02
La	.428E-04	.882E-04	.136E-03	.187E-03	.241E-03	.299E-03	.359E-03
	.641E-02	.683E-02	.729E-02	.777E-02	.828E-02	.882E-02	.939E-02

	1	2	3	4	5	6	7
Ce	.213E-04	.431E-04	.655E-04	.883E-04	.112E-03	.136E-03	.160E-03
	.840E-02	.861E-02	.883E-02	.906E-02	.928E-02	.952E-02	.976E-02
	1	2	3	4	5	6	7
Nd	.333E-04	.680E-04	.104E-03	.142E-03	.181E-03	.221E-03	.264E-03
	.736E-02	.770E-02	.804E-02	.840E-02	.878E-02	.917E-02	.958E-02
	1	2	3	4	5	6	7
Eu	.509E-04	.106E-03	.166E-03	.231E-03	.302E-03	.378E-03	.461E-03
	.539E-02	.589E-02	.645E-02	.705E-02	.770E-02	.840E-02	.917E-02
	1	2	3	4	5	6	7
Y	.304E-04	.619E-04	.945E-04	.128E-03	.163E-03	.200E-03	.237E-03
	.763E-02	.793E-02	.825E-02	.857E-02	.891E-02	.926E-02	.962E-02
	1	2	3	4	5	6	7
Sr	.179E-05	.359E-05	.539E-05	.720E-05	.900E-05	.108E-04	.126E-04
	.987E-02	.989E-02	.991E-02	.993E-02	.995E-02	.996E-02	.998E-02
	1	2	3	4	5	6	7
Ba	.153E-04	.309E-04	.466E-04	.627E-04	.789E-04	.955E-04	.112E-03
	.888E-02	.903E-02	.919E-02	.934E-02	.950E-02	.967E-02	.983E-02
	1	2	3	4	5	6	7
Fe	.853E-05	.171E-04	.258E-04	.345E-04	.433E-04	.522E-04	.612E-04
	.939E-02	.947E-02	.956E-02	.965E-02	.973E-02	.982E-02	.991E-02
	1	2	3	4	5	6	7
Ni	.853E-05	.171E-04	.258E-04	.345E-04	.433E-04	.522E-04	.612E-04
	.939E-02	.947E-02	.956E-02	.965E-02	.973E-02	.982E-02	.991E-02
	1	2	3	4	5	6	7
Mo	.853E-05	.171E-04	.258E-04	.345E-04	.433E-04	.522E-04	.612E-04
	.939E-02	.947E-02	.956E-02	.965E-02	.973E-02	.982E-02	.991E-02
	1	2	3	4	5	6	7
Ru	.545E-04	.122E-03	.206E-03	.310E-03	.438E-03	.597E-03	.795E-03
	.205E-02	.260E-02	.328E-02	.411E-02	.515E-02	.644E-02	.803E-02
	1	2	3	4	5	6	7
Pd	.608E-05	.122E-04	.184E-04	.245E-04	.308E-04	.370E-04	.433E-04
	.957E-02	.963E-02	.969E-02	.975E-02	.981E-02	.987E-02	.994E-02
	1	2	3	4	5	6	7
Zr	.475E-04	.984E-04	.153E-03	.212E-03	.275E-03	.342E-03	.415E-03
	.585E-02	.633E-02	.684E-02	.738E-02	.797E-02	.860E-02	.928E-02

Modeling of Outlet Cycle N=8

Initial Information

Number of Apparats - 8
 Number of Components - 20

Water Flowrate - 10.0000 >>----->
 Feed Concentration in Water Line Gramm/Litre

H	.0000E+00	U	.0000E+00	Pu	.0000E+00
Np	.0000E+00	Th	.0000E+00	Tc	.0000E+00
Am	.0000E+00	La	.0000E+00	Ce	.0000E+00
Nd	.0000E+00	Eu	.0000E+00	Y	.0000E+00
Sr	.0000E+00	Ba	.0000E+00	Fe	.0000E+00
Ni	.0000E+00	Mo	.0000E+00	Ru	.0000E+00
Pd	.0000E+00	Zr	.0000E+00		

Recycle of organic for WATER line

1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
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Deiterium Flowrate - 1.0000 <-----<<
 Feed Concentration in Deiterium Line Gramm/Litre

H	.3000E+01	U	.1000E+00	Pu	.1000E+01
Np	.1000E-01	Th	.1000E-01	Tc	.1000E-01
Am	.1000E-01	La	.1000E-01	Ce	.1000E-01
Nd	.1000E-01	Eu	.1000E-01	Y	.1000E-01
Sr	.1000E-01	Ba	.1000E-01	Fe	.1000E-01
Ni	.1000E-01	Mo	.1000E-01	Ru	.1000E-01
Pd	.1000E-01	Zr	.1000E-01		

Recycle of organic for DEITERIUM line

10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
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RESULTS OF CALCULATION

Components Concentration in Stages of Apparate

Upper String - Water line >>----->
 Down String - Deiterium line <-----<<

	1	2	3	4	5	6	7	8
H	.151E-01	.326E-01	.529E-01	.765E-01	.104E+00	.136E+00	.173E+00	.215E
	.845E+00	.996E+00	.117E+01	.137E+01	.161E+01	.188E+01	.220E+01	.257E
U	.153E-04	.573E-04	.152E-03	.344E-03	.712E-03	.147E-02	.357E-02	.121E
	.298E-04	.968E-04	.241E-03	.523E-03	.106E-02	.220E-02	.562E-02	.207E
Pu	.423E-05	.188E-04	.720E-04	.283E-03	.117E-02	.508E-02	.225E-01	.100E
	.108E-04	.415E-04	.155E-03	.614E-03	.258E-02	.113E-01	.499E-01	.223E
Np	.977E-05	.265E-04	.550E-04	.104E-03	.187E-03	.329E-03	.572E-03	.988E
	.124E-03	.222E-03	.389E-03	.674E-03	.116E-02	.199E-02	.342E-02	.585E
Th	.506E-04	.107E-03	.171E-03	.242E-03	.322E-03	.411E-03	.512E-03	.624E
	.376E-02	.426E-02	.483E-02	.547E-02	.618E-02	.698E-02	.787E-02	.887E
Tc	.391E-04	.803E-04	.124E-03	.170E-03	.219E-03	.270E-03	.325E-03	.382E
	.618E-02	.657E-02	.698E-02	.742E-02	.788E-02	.837E-02	.888E-02	.942E
Am	.129E-04	.261E-04	.394E-04	.528E-04	.665E-04	.803E-04	.943E-04	.108E
	.892E-02	.904E-02	.918E-02	.931E-02	.944E-02	.958E-02	.972E-02	.986E
La	.402E-04	.828E-04	.128E-03	.176E-03	.227E-03	.281E-03	.338E-03	.398E
	.602E-02	.642E-02	.685E-02	.730E-02	.778E-02	.829E-02	.882E-02	.939E

	1	2	3	4	5	6	7	8
Ce	.208E-04	.421E-04	.639E-04	.861E-04	.109E-03	.132E-03	.156E-03	.180E-03
	.820E-02	.840E-02	.862E-02	.883E-02	.906E-02	.928E-02	.952E-02	.976E-02
Nd	.319E-04	.651E-04	.997E-04	.136E-03	.173E-03	.212E-03	.253E-03	.295E-03
	.705E-02	.737E-02	.770E-02	.805E-02	.841E-02	.878E-02	.917E-02	.958E-02
Eu	.467E-04	.974E-04	.152E-03	.212E-03	.277E-03	.347E-03	.423E-03	.506E-03
	.494E-02	.541E-02	.591E-02	.646E-02	.706E-02	.771E-02	.841E-02	.917E-02
Y	.293E-04	.596E-04	.910E-04	.123E-03	.157E-03	.192E-03	.228E-03	.266E-03
	.734E-02	.764E-02	.794E-02	.825E-02	.858E-02	.892E-02	.926E-02	.963E-02
Sr	.179E-05	.359E-05	.538E-05	.718E-05	.899E-05	.108E-04	.126E-04	.144E-04
	.986E-02	.987E-02	.989E-02	.991E-02	.993E-02	.995E-02	.996E-02	.998E-02
Ba	.151E-04	.303E-04	.459E-04	.616E-04	.776E-04	.939E-04	.110E-03	.127E-03
	.873E-02	.888E-02	.903E-02	.919E-02	.934E-02	.950E-02	.967E-02	.983E-02
Fe	.845E-05	.170E-04	.256E-04	.342E-04	.430E-04	.518E-04	.606E-04	.696E-04
	.930E-02	.939E-02	.947E-02	.956E-02	.965E-02	.973E-02	.982E-02	.991E-02
Ni	.845E-05	.170E-04	.256E-04	.342E-04	.430E-04	.518E-04	.606E-04	.696E-04
	.930E-02	.939E-02	.947E-02	.956E-02	.965E-02	.973E-02	.982E-02	.991E-02
Mo	.845E-05	.170E-04	.256E-04	.342E-04	.430E-04	.518E-04	.606E-04	.696E-04
	.930E-02	.939E-02	.947E-02	.956E-02	.965E-02	.973E-02	.982E-02	.991E-02
Ru	.438E-04	.981E-04	.165E-03	.249E-03	.352E-03	.480E-03	.639E-03	.835E-03
	.165E-02	.209E-02	.263E-02	.331E-02	.414E-02	.517E-02	.645E-02	.804E-02
Pd	.605E-05	.121E-04	.182E-04	.244E-04	.306E-04	.368E-04	.431E-04	.493E-04
	.951E-02	.957E-02	.963E-02	.969E-02	.975E-02	.981E-02	.987E-02	.994E-02
Zr	.441E-04	.913E-04	.142E-03	.197E-03	.255E-03	.318E-03	.385E-03	.457E-03
	.543E-02	.587E-02	.634E-02	.685E-02	.739E-02	.798E-02	.861E-02	.928E-02

Modeling of Outlet Cycle N=9

Initial Information

Number of Apparats - 9
 Number of Components - 20

Water Flowrate - 10.0000 >>----->
 Feed Concentration in Water Line Gramm/Litre

H	.0000E+00	U	.0000E+00	Pu	.0000E+00
Np	.0000E+00	Th	.0000E+00	Tc	.0000E+00
Am	.0000E+00	La	.0000E+00	Ce	.0000E+00
Nd	.0000E+00	Eu	.0000E+00	Y	.0000E+00
Sr	.0000E+00	Ba	.0000E+00	Fe	.0000E+00
Ni	.0000E+00	Mo	.0000E+00	Ru	.0000E+00
Pd	.0000E+00	Zr	.0000E+00		

Recycle of organic for WATER line

1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
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Deiterium Flowrate - 1.0000 <-----<<
 Feed Concentration in Deiterium Line Gramm/Litre

H	.3000E+01	U	.1000E+00	Pu	.1000E+01
Np	.1000E-01	Th	.1000E-01	Tc	.1000E-01
Am	.1000E-01	La	.1000E-01	Ce	.1000E-01
Nd	.1000E-01	Eu	.1000E-01	Y	.1000E-01
Sr	.1000E-01	Ba	.1000E-01	Fe	.1000E-01
Ni	.1000E-01	Mo	.1000E-01	Ru	.1000E-01
Pd	.1000E-01	Zr	.1000E-01		

Recycle of organic for DEITERIUM line

10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
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RESULTS OF CALCULATION

Components Concentration in Stages of Apparate

Upper String - Water line >>----->
 Down String - Deiterium line <-----<<

	1	2	3	4	5	6	7	8
H	.129E-01	.280E-01	.454E-01	.657E-01	.892E-01	.116E+00	.148E+00	.185E-01
	.725E+00	.854E+00	.100E+01	.118E+01	.138E+01	.162E+01	.189E+01	.221E-01
	.227E+00							
	.257E+01							
U	.856E-05	.323E-04	.868E-04	.197E-03	.405E-03	.784E-03	.154E-02	.363E-02
	.167E-04	.547E-04	.138E-03	.301E-03	.599E-03	.114E-02	.227E-02	.566E-02
	.122E-01							
	.207E-01							
Pu	.154E-05	.626E-05	.212E-04	.742E-04	.284E-03	.117E-02	.507E-02	.224E-02
	.390E-05	.135E-04	.444E-04	.157E-03	.613E-03	.258E-02	.112E-01	.499E-02
	.100E+00							
	.223E+00							
Np	.572E-05	.155E-04	.322E-04	.607E-04	.109E-03	.193E-03	.335E-03	.578E-03
	.726E-04	.130E-03	.227E-03	.394E-03	.679E-03	.117E-02	.200E-02	.342E-02
	.993E-03							
	.585E-02							

	1	2	3	4	5	6	7	8
Th	.449E-04 .334E-02 9 .666E-03 .888E-02	.952E-04 .379E-02 2 .666E-03 .888E-02	.152E-03 .429E-02 3 .666E-03 .888E-02	.215E-03 .485E-02 4 .666E-03 .888E-02	.286E-03 .549E-02 5 .666E-03 .888E-02	.365E-03 .619E-02 6 .666E-03 .888E-02	.454E-03 .699E-02 7 .666E-03 .888E-02	.554E-03 .788E-02 8 .666E-03 .888E-02
Tc	.368E-04 .582E-02 9 .418E-03 .943E-02	.757E-04 .619E-02 2 .418E-03 .943E-02	.117E-03 .658E-02 3 .418E-03 .943E-02	.160E-03 .699E-02 4 .418E-03 .943E-02	.206E-03 .743E-02 5 .418E-03 .943E-02	.255E-03 .789E-02 6 .418E-03 .943E-02	.306E-03 .837E-02 7 .418E-03 .943E-02	.360E-03 .888E-02 8 .418E-03 .943E-02
Am	.128E-04 .879E-02 9 .121E-03 .986E-02	.257E-04 .892E-02 2 .121E-03 .986E-02	.388E-04 .905E-02 3 .121E-03 .986E-02	.521E-04 .918E-02 4 .121E-03 .986E-02	.655E-04 .931E-02 5 .121E-03 .986E-02	.791E-04 .944E-02 6 .121E-03 .986E-02	.929E-04 .958E-02 7 .121E-03 .986E-02	.107E-03 .972E-02 8 .121E-03 .986E-02
La	.378E-04 .566E-02 9 .434E-03 .940E-02	.779E-04 .603E-02 2 .434E-03 .940E-02	.120E-03 .643E-02 3 .434E-03 .940E-02	.165E-03 .686E-02 4 .434E-03 .940E-02	.213E-03 .731E-02 5 .434E-03 .940E-02	.264E-03 .779E-02 6 .434E-03 .940E-02	.317E-03 .829E-02 7 .434E-03 .940E-02	.374E-03 .883E-02 8 .434E-03 .940E-02
Ce	.203E-04 .800E-02 9 .200E-03 .976E-02	.411E-04 .820E-02 2 .200E-03 .976E-02	.623E-04 .841E-02 3 .200E-03 .976E-02	.840E-04 .862E-02 4 .200E-03 .976E-02	.106E-03 .884E-02 5 .200E-03 .976E-02	.129E-03 .906E-02 6 .200E-03 .976E-02	.152E-03 .929E-02 7 .200E-03 .976E-02	.176E-03 .952E-02 8 .200E-03 .976E-02
Nd	.306E-04 .676E-02 9 .324E-03 .958E-02	.624E-04 .706E-02 2 .324E-03 .958E-02	.955E-04 .738E-02 3 .324E-03 .958E-02	.130E-03 .771E-02 4 .324E-03 .958E-02	.166E-03 .805E-02 5 .324E-03 .958E-02	.203E-03 .841E-02 6 .324E-03 .958E-02	.242E-03 .879E-02 7 .324E-03 .958E-02	.282E-03 .918E-02 8 .324E-03 .958E-02
Eu	.429E-04 .453E-02 9 .547E-03 .918E-02	.894E-04 .496E-02 2 .547E-03 .918E-02	.140E-03 .543E-02 3 .547E-03 .918E-02	.195E-03 .593E-02 4 .547E-03 .918E-02	.254E-03 .648E-02 5 .547E-03 .918E-02	.318E-03 .707E-02 6 .547E-03 .918E-02	.389E-03 .772E-02 7 .547E-03 .918E-02	.464E-03 .842E-02 8 .547E-03 .918E-02
Y	.282E-04 .707E-02 9 .293E-03 .963E-02	.573E-04 .735E-02 2 .293E-03 .963E-02	.876E-04 .764E-02 3 .293E-03 .963E-02	.119E-03 .795E-02 4 .293E-03 .963E-02	.151E-03 .826E-02 5 .293E-03 .963E-02	.185E-03 .858E-02 6 .293E-03 .963E-02	.220E-03 .892E-02 7 .293E-03 .963E-02	.256E-03 .927E-02 8 .293E-03 .963E-02
Sr	.179E-05 .984E-02 9 .162E-04 .998E-02	.358E-05 .986E-02 2 .162E-04 .998E-02	.537E-05 .987E-02 3 .162E-04 .998E-02	.717E-05 .989E-02 4 .162E-04 .998E-02	.897E-05 .991E-02 5 .162E-04 .998E-02	.108E-04 .993E-02 6 .162E-04 .998E-02	.126E-04 .995E-02 7 .162E-04 .998E-02	.144E-04 .996E-02 8 .162E-04 .998E-02
Ba	.148E-04 .858E-02 9 .142E-03 .983E-02	.298E-04 .873E-02 2 .142E-03 .983E-02	.451E-04 .888E-02 3 .142E-03 .983E-02	.606E-04 .903E-02 4 .142E-03 .983E-02	.763E-04 .919E-02 5 .142E-03 .983E-02	.923E-04 .935E-02 6 .142E-03 .983E-02	.109E-03 .951E-02 7 .142E-03 .983E-02	.125E-03 .967E-02 8 .142E-03 .983E-02
Fe	.838E-05 .922E-02 1	.168E-04 .930E-02 2	.253E-04 .939E-02 3	.339E-04 .947E-02 4	.426E-04 .956E-02 5	.513E-04 .965E-02 6	.601E-04 .973E-02 7	.690E-04 .982E-02 8

	9								
	.779E-04								
	.991E-02								
	1	2	3	4	5	6	7	8	
Ni	.838E-05	.168E-04	.253E-04	.339E-04	.426E-04	.513E-04	.601E-04	.690E-	
	.922E-02	.930E-02	.939E-02	.947E-02	.956E-02	.965E-02	.973E-02	.982E-	
	9								
	.779E-04								
	.991E-02								
	1	2	3	4	5	6	7	8	
Mo	.838E-05	.168E-04	.253E-04	.339E-04	.426E-04	.513E-04	.601E-04	.690E-	
	.922E-02	.930E-02	.939E-02	.947E-02	.956E-02	.965E-02	.973E-02	.982E-	
	9								
	.779E-04								
	.991E-02								
	1	2	3	4	5	6	7	8	
Ru	.353E-04	.789E-04	.133E-03	.200E-03	.283E-03	.386E-03	.514E-03	.672E-	
	.133E-02	.168E-02	.212E-02	.266E-02	.333E-02	.416E-02	.519E-02	.646E-	
	9								
	.867E-03								
	.804E-02								
	1	2	3	4	5	6	7	8	
Pd	.601E-05	.120E-04	.181E-04	.242E-04	.304E-04	.366E-04	.428E-04	.490E-	
	.945E-02	.951E-02	.957E-02	.963E-02	.969E-02	.975E-02	.981E-02	.987E-	
	9								
	.553E-04								
	.994E-02								
	1	2	3	4	5	6	7	8	
Zr	.409E-04	.848E-04	.132E-03	.182E-03	.237E-03	.295E-03	.357E-03	.424E-	
	.504E-02	.545E-02	.589E-02	.636E-02	.686E-02	.741E-02	.799E-02	.861E-	
	9								
	.496E-03								
	.928E-02								

Modeling of Outlet Cycle N=10

Initial Information

Number of Apparats - 10
 Number of Components - 20

Water Flowrate - 10.0000 >>----->
 Feed Concentration in Water Line Gramm/Litre

H	.0000E+00	U	.0000E+00	Pu	.0000E+00
Np	.0000E+00	Th	.0000E+00	Tc	.0000E+00
Am	.0000E+00	La	.0000E+00	Ce	.0000E+00
Nd	.0000E+00	Eu	.0000E+00	Y	.0000E+00
Sr	.0000E+00	Ba	.0000E+00	Fe	.0000E+00
Ni	.0000E+00	Mo	.0000E+00	Ru	.0000E+00
Pd	.0000E+00	Zr	.0000E+00		

Recycle of organic for WATER line

1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
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Deiterium Flowrate - 1.0000 <-----<<
 Feed Concentration in Deiterium Line Gramm/Litre

H	.3000E+01	U	.1000E+00	Pu	.1000E+01
Np	.1000E-01	Th	.1000E-01	Tc	.1000E-01
Am	.1000E-01	La	.1000E-01	Ce	.1000E-01
Nd	.1000E-01	Eu	.1000E-01	Y	.1000E-01
Sr	.1000E-01	Ba	.1000E-01	Fe	.1000E-01
Ni	.1000E-01	Mo	.1000E-01	Ru	.1000E-01
Pd	.1000E-01	Zr	.1000E-01		

Recycle of organic for DEITERIUM line

10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
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RESULTS OF CALCULATION

Components Concentration in Stages of Apparate

Upper String - Water line >>----->
 Down String - Deiterium line <-----<<

	1	2	3	4	5	6	7	8
H	.111E-01	.240E-01	.390E-01	.564E-01	.765E-01	.999E-01	.127E+00	.159E+00
	.622E+00	.733E+00	.862E+00	.101E+01	.119E+01	.139E+01	.162E+01	.189E+01
	.195E+00	.238E+00						
	.221E+01	.258E+01						
U	.482E-05	.183E-04	.498E-04	.114E-03	.237E-03	.454E-03	.836E-03	.159E-02
	.941E-05	.311E-04	.792E-04	.175E-03	.351E-03	.657E-03	.119E-02	.230E-02
	.365E-02	.122E-01						
	.567E-02	.207E-01						
Pu	.645E-06	.245E-05	.739E-05	.224E-04	.748E-04	.283E-03	.117E-02	.506E-02
	.163E-05	.519E-05	.150E-04	.455E-04	.157E-03	.610E-03	.257E-02	.112E-01
	.224E-01	.100E+00						
	.499E-01	.223E+00						
Np	.334E-05	.906E-05	.188E-04	.355E-04	.640E-04	.113E-03	.196E-03	.338E-03

	425E-04	759E-04	133E-03	231E-03	397E-03	682E-03	117E-02	200E-
	9	10						
	.581E-03	.996E-03						
	.342E-02	.585E-02						
Th	1	2	3	4	5	6	7	8
	.399E-04	.846E-04	.135E-03	.191E-03	.254E-03	.325E-03	.404E-03	.492E-
	.296E-02	.336E-02	.381E-02	.431E-02	.487E-02	.550E-02	.621E-02	.700E-
	9	10						
	.592E-03	.704E-03						
	.789E-02	.889E-02						
Tc	1	2	3	4	5	6	7	8
	.347E-04	.714E-04	.110E-03	.151E-03	.194E-03	.240E-03	.289E-03	.340E-
	.549E-02	.584E-02	.620E-02	.659E-02	.700E-02	.743E-02	.789E-02	.838E-
	9	10						
	.394E-03	.451E-03						
	.889E-02	.943E-02						
Am	1	2	3	4	5	6	7	8
	.126E-04	.263E-04	.383E-04	.513E-04	.646E-04	.780E-04	.916E-04	.105E-
	.866E-02	.879E-02	.892E-02	.905E-02	.918E-02	.931E-02	.945E-02	.958E-
	9	10						
	.119E-03	.134E-03						
	.972E-02	.986E-02						
La	1	2	3	4	5	6	7	8
	.355E-04	.732E-04	.113E-03	.155E-03	.200E-03	.248E-03	.298E-03	.352E-
	.532E-02	.567E-02	.605E-02	.645E-02	.687E-02	.732E-02	.779E-02	.830E-
	9	10						
	.408E-03	.468E-03						
	.833E-02	.940E-02						
Ce	1	2	3	4	5	6	7	8
	.188E-04	.401E-04	.608E-04	.820E-04	.104E-03	.126E-03	.149E-03	.172E-
	.780E-02	.800E-02	.820E-02	.841E-02	.862E-02	.884E-02	.906E-02	.929E-
	9	10						
	.195E-03	.220E-03						
	.952E-02	.976E-02						
Nd	1	2	3	4	5	6	7	8
	.293E-04	.598E-04	.915E-04	.124E-03	.159E-03	.195E-03	.232E-03	.271E-
	.647E-02	.676E-02	.707E-02	.739E-02	.772E-02	.806E-02	.842E-02	.879E-
	9	10						
	.311E-03	.353E-03						
	.918E-02	.958E-02						
Eu	1	2	3	4	5	6	7	8
	.393E-04	.820E-04	.128E-03	.179E-03	.233E-03	.292E-03	.357E-03	.426E-
	.416E-02	.455E-02	.498E-02	.544E-02	.595E-02	.649E-02	.708E-02	.773E-
	9	10						
	.502E-03	.584E-03						
	.842E-02	.918E-02						
Y	1	2	3	4	5	6	7	8
	.271E-04	.552E-04	.843E-04	.114E-03	.146E-03	.178E-03	.211E-03	.246E-
	.681E-02	.708E-02	.736E-02	.765E-02	.795E-02	.826E-02	.858E-02	.892E-
	9	10						
	.282E-03	.319E-03						
	.927E-02	.963E-02						
Sr	1	2	3	4	5	6	7	8
	.179E-05	.357E-05	.536E-05	.716E-05	.896E-05	.108E-04	.126E-04	.144E-
	.982E-02	.984E-02	.986E-02	.987E-02	.989E-02	.991E-02	.993E-02	.995E-
	9	10						
	.162E-04	.180E-04						
	.996E-02	.998E-02						
Ba	1	2	3	4	5	6	7	8
	.146E-04	.293E-04	.443E-04	.596E-04	.750E-04	.908E-04	.107E-03	.123E-
	.844E-02	.858E-02	.873E-02	.888E-02	.903E-02	.919E-02	.935E-02	.951E-
	9	10						
	.139E-03	.156E-03						

	.967E-02	.983E-02						
	1	2	3	4	5	6	7	8
Fe	.830E-05	.167E-04	.251E-04	.336E-04	.422E-04	.508E-04	.595E-04	.683E-
	.914E-02	.922E-02	.931E-02	.939E-02	.947E-02	.956E-02	.965E-02	.973E-
	9	10						
	.772E-04	.861E-04						
	.982E-02	.991E-02						
	1	2	3	4	5	6	7	8
Ni	.830E-05	.167E-04	.251E-04	.336E-04	.422E-04	.508E-04	.595E-04	.683E-
	.914E-02	.922E-02	.931E-02	.939E-02	.947E-02	.956E-02	.965E-02	.973E-
	9	10						
	.772E-04	.861E-04						
	.982E-02	.991E-02						
	1	2	3	4	5	6	7	8
Mo	.830E-05	.167E-04	.251E-04	.336E-04	.422E-04	.508E-04	.595E-04	.683E-
	.914E-02	.922E-02	.931E-02	.939E-02	.947E-02	.956E-02	.965E-02	.973E-
	9	10						
	.772E-04	.861E-04						
	.982E-02	.991E-02						
	1	2	3	4	5	6	7	8
Ru	.284E-04	.635E-04	.107E-03	.161E-03	.228E-03	.311E-03	.413E-03	.540E-
	.107E-02	.135E-02	.170E-02	.214E-02	.268E-02	.335E-02	.418E-02	.520E-
	9	10						
	.698E-03	.893E-03						
	.647E-02	.805E-02						
	1	2	3	4	5	6	7	8
Pd	.597E-05	.120E-04	.180E-04	.241E-04	.302E-04	.363E-04	.425E-04	.487E-
	.939E-02	.945E-02	.951E-02	.957E-02	.963E-02	.969E-02	.975E-02	.981E-
	9	10						
	.550E-04	.613E-04						
	.987E-02	.994E-02						
	1	2	3	4	5	6	7	8
Zr	.380E-04	.787E-04	.122E-03	.169E-03	.220E-03	.274E-03	.332E-03	.394E-
	.468E-02	.506E-02	.547E-02	.590E-02	.637E-02	.688E-02	.742E-02	.799E-
	9	10						
	.461E-03	.532E-03						
	.862E-02	.928E-02						