INTERIM REPORT
PARAMETRIC STUDIES OF TRITIUM
SEPARATION CASCADES

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SUMMARY

Computer programs are now in place which can be used to calculate parametric effects in ideal cascade separations of tritium-hydrogen. Typical output for the program is given in Appendix C. Calculations of total flow and separative duty have been made as a function of decontamination factors and enrichment factors for a range of separation constants (α 's). Summary results for all cases calculated are in Appendix B. Plant shapes (head-to-product flow ratios versus stage number) have also been calculated.

In addition, an initial investigation of the simultaneous separation of naturally occurring deuterium has been carried out. The deuterium separation was calculated in the same fashion as suggested by Ribnikov and Pupezin.⁽¹⁾ The deuterium calculations are done assuming that an ideal cascade for tritium is also ideal for deuterium at the same time (i.e., constant heads separation factor, equal concentrations for both streams fed to a stage).

The results show that the total flow (which is indicative of cascade power consumption) for tritium-hydrogen changes very rapidly with separation constant, from >3000 to about 200 moles/mole feed for a separation constant less than 2 for decontamination factors (DF) between 10^4 and 10^8 . The change in total flow with separation factor is very small for separation factors above 2. Total flow at a given enrichment factor is relatively insensitive to feed concentration from 4×10^{-11} to 1×10^{-8} . A dramatic difference is observed between the effect of DF and the effect of enrichment factor or plant shape: A change in DF at a given enrichment factor results in a reduction of the number of stripping stages with no change in the recycle ratios of the plant. A change in enrichment factor for a given DF has an overall, large impact on plant shape and size. Increasing enrichment factors results in large increase of pumping and capital costs, while DF mainly affects capital costs. A check on the assumptions used for deuterium predictions indicates that the assumption is not very accurate. More sophisticated handling of H, D, T is indicated.

The interim conclusions are:

- Unless there is great advantage to producing tritiated D_2O , high enrichment factors are not recommended because of high capital and operating expense. A maximum enrichment factor of 10^2 is indicated.
- Large DF's do not instill large penalties in plant design (10^6 or 10^8 may not be unreasonable).
- Incremental increases of separation constants above ≈ 5 result in rapidly diminishing incremental decreases of the number of stages (capital cost) and in the total flow (operation cost) (see Figures 2 and 5).
- A more sophisticated treatment of the deuterium-tritium interaction is needed. The results of a more detailed analysis may alter some of the above conclusions.

INTRODUCTION

These parametric studies are a part of the tritium fixation task which is concerned with removal of tritium from fuel processing waste waters and disposal of the removed tritium. One objective of the tritium fixation task is to define a system for removing tritium from processing water to levels below the MPC so that the water can be returned to general water supplies without hazard from the presence of tritium. The parametric studies are concerned with the effects of various parameters on the design of multi-stage cascades for the separation of tritium from the hydrogen and deuterium in the waste water.

The basic choices for tritium separation and disposal are:

1. Produce a tritiated heavy water product which could be recycled to heavy water reactors for use as a moderator/coolant. This water could be used for other controlled purposes where the presence of tritium would not produce a hazard.
2. Separate the tritium in a relatively large volume, low concentration product stream (i.e., enrichment factor) and store the tritiated water for a suitable decay period (the half-life of tritium is 12.3 yr).
3. Separate the tritium in a low volume stream containing a high concentration of tritium and provide storage or fixation of that liquid for a suitable decay period.
4. Follow the enrichment of the heavy water stream with a further separation of tritium from deuterium so that the deuterium water could be used as a contamination free heavy water. The tritium could be disposed of as a highly concentrated, low volume mixture.

In all the cases above the stripping factor remains the same, dictated by MPC requirements. The disposal use scheme of the separation cascade product is an important consideration in the design of the cascade. The results of this study provide a general picture of the effects of various parameters on the design of the cascade. The results can be used a) to compare methods for separation and b) as input to deciding tritium

disposal technique. Since disposal scheme and cascade design interact, both should be considered together.

The basic goals of the first parametric studies were a) to examine the relative affects of decontamination factor, enrichment factor and concentration levels on the tritium separation cascade; b) produce generalized curves so that the basic parametric effects could be readily examined; and c) examine the importance of simultaneous deuterium separation. The extent to which multi-component type calculations must be carried out to provide sufficient plant design information for various conditions should be determined.

ECONOMIC INDICES

Certain quantities are useful in describing a multi-stage isotope separations cascade since they bear a direct relation to the economics of the plant. Table 1 shows the key quantities and their significance. Equations for these quantities are given in Appendix A.

TABLE 1

<u>Quantity</u>	<u>Description</u>	<u>Significance</u>
Total Stages, n	No. of separative limits in the plant	Capital investment
Total Flow,* J	Total internal circulation of material	Power consumption, operating cost, capital investment for pumping hardware
Separative Duty,* D	Analogous to heat duty of an evaporator	Operating cost
Plant Shop	Head to product flow ratio vs stage number	Total indication of plant size and characteristics

$$*Total\ flow = \left(\frac{\beta+1}{\beta-1} \right) x \text{ (separative duty)}$$

where β = heads separation factor

In the case of tritium separations where the mole fractions are small it can be shown that $x_F/x_P \approx P/F$ and the separative duty depends only on enrichment factor. The separative duty reduces to

$$D = \ln \frac{x_F}{x_W}$$

(as derived in Appendix A) and does not change with decontamination factor.

Since total flow depends only on separative duty and head separation factor, it is therefore independent of DF as long as $x_F/x_P \approx \frac{P}{F}$ applies. Large changes of DF (over many decades) will show some mild sensitivity of total flow to DF.

Total flow and number of stages are the two important indices of plant cost and represent operating and capital cost, respectively.

HYDROGEN-TRITIUM SEPARATIONS

The summary results for all calculated cases are given in Appendix B. Typical complete output for one case is shown in Appendix C. Detailed output for all calculated cases has been obtained and the range of cases studied provides a complete file which can be used as a ready guide in comparing process alternatives. If additional cases are required, they can readily be calculated in a few seconds with the existing computer program.

TOTAL FLOW

Figures 1 and 2 show a plot of the total flow in an ideal cascade as a function of the separation constant or tritium-hydrogen at three decontamination factors. Figure 1 shows the low range for the separation constant from 1 to 3; Figure 2 shows the high range of the separation constant from 3 to 18. Many processes under consideration fall into the range between 1 and 2. In this range it can be seen from Figure 1 that the total flow is very strongly dependent upon the value of the separation constant. Beyond a value of 2 or 3 the separation constant becomes much less important in determining the value of the total flow and the decontamination factor becomes more important. In all cases, the relative insensitivity of total flow to DF is proven by the results. For high separation constants the approximation $x_F/x_P \approx P/F$ breaks down. The curves in Figures 1 and 2 are general for any tritium-hydrogen separation cascade at the decontamination factors shown. The results are relatively insensitive to the value of the feed mole fraction as can be seen in Figure 3, and are therefore reasonably general for wide range of feed conditions.

SEPARATIVE DUTY

The general equation for separative duty (Equation A-10) as a function of decontamination factor is plotted in Figure 4. The points which are used to produce Figure 4 were generated from detailed calculations of the ideal cascades for the various decontamination factors.

FIGURE 1. Total Flow Versus Separation Constant for Tritium Cascades - Low Range

FIGURE 2. Total Flow Versus Separation Constant for Tritium Cascades - High Range

FIGURE 3. Effect of Enrichment Factor on Total Flow

FIGURE 4. Separative Duty as a Function of DF

NUMBER OF STAGES

Figure 5 is an example of the effect of the separation constant on the number stages in the stripping and enriching sections. The conditions for the case in Figure 5 were the feed product and waste concentration given by Lin⁽²⁾ as expected typical values. Note that beyond a separation constant of 4 or 5, the total number of stages in the cascade changes slowly with increasing separation constant. In the lower range (from 1 to 4) the number of stages required changes rapidly with separation constant in the region below $\alpha = 4$. The trend is the same in the stripping and enriching sections. An increase in the value of the separation constant in the low range is much more beneficial for reducing the number of stages than an increase in the high range.

PLANT SHAPES

The plant shape (head-to-product flow rate ratio profile) is strongly affected by the changes of the various parameters in the system. Figures 6 and 7 demonstrate the effect of an increase in the separation constant for a given set of external stream flows and concentrations. An increase in the separation constant from 2 to 10 results in a decrease of the number of stages, especially the number of stripping stages in the plant. Furthermore, the ratio of head-to-product flow is reduced throughout the plant for an increased separation constant. The number of stages in the enriching section is reduced from 13 to 4, while the number of stages in the stripping section is reduced from 23 to 7.

Figure 8 shows the effect of the decontamination factor on the shape of the cascade. A factor of 10^4 change in decontamination factor is shown. The basic shape of the two plants is the same but the lower decontamination factor plant is reduced in height as if a constant head-to-product flow ratio section was removed from the stripping section of the plant.

The difference between the two plants for different decontamination factors is in sharp contrast with the difference produced for a change in enrichment factor at constant decontamination factor. The effect of

FIGURE 5. Effect of Separation Constant on Number of Stages

FIGURE 6. Plant Shape for Low Separation Constant

FIGURE 7. Plant Shape for High Separation Constant

FIGURE 8. Effect of DF on Plant Shape

enrichment factor is shown in Figure 9. Note that, in addition to a truncation, there is an extreme narrowing of the shape of the plant and reduction in the flow rate ratios throughout the plant for the lower enrichment factor. The total effect of the reduction enrichment factor on the area of the plant shape curve is much greater for a given change of enrichment factor than for a change in decontamination factor. A much higher penalty in terms of capital investment and power consumption would be expected for high enrichment factors as compared to high decontamination factors. Unless an important use for a highly enriched tritium stream is apparent, high enrichment factors should be avoided. High decontamination factors are tolerable.

FIGURE 9. Effect of Enrichment Factor on Plant Shape

EFFECT OF DEUTERIUM

Methods for calculating interstage flow and other pertinent parameters in cascade separation plants are restricted in ideal cascade theory to two component systems. When separating tritium from water, the separation of naturally-occurring deuterium is a coincident phenomena which cannot be ignored. The nature of the simultaneous deuterium separation in a tritium separation cascade is an important part of the tritium separation problem. The effect of deuterium on the plant design for a given set of plant requirements needs to be determined, and an assessment of the minimum complexity of calculations needed to obtain the desired information is required.

Work done by Ribnikov and Pupezin at the Boris Kidric Institute⁽¹⁾ included an EPA study of simultaneous deuterium separation in a tritium cascade. Estimates were made of the deuterium concentration in the product stream as a function of the tritium enrichment factor. They showed how the overhead separation factor for tritium and deuterium could be related. If we define a function of the separation factor as

$$f(\beta) = \frac{(\beta+1)}{(\beta-1)\ln \beta} \quad (1)$$

it can be shown that the ratio of this function for deuterium and tritium is approximately constant over a wide range of separation constants.⁽¹⁾ This provides a means for predicting the relative separation constants for deuterium and tritium in the same cascade. The deuterium separation as a function of tritium enrichment factor was calculated assuming that the ideal cascade for tritium was also ideal for the deuterium (i.e., that the interstage flow calculated for the tritium cascade was identical to the interstage flow and an ideal deuterium cascade having the same end point conditions). The deuterium product concentration can then be related to the tritium end points by

$$y_p = \frac{y_F \left(\frac{x_p}{x_F} \right)^{0.714}}{1 + y_F \left(\frac{x_p}{x_F} \right)^{0.714}} \quad (2)$$

The deuterium concentration in the product as a function of tritium enrichment factor is shown in Figure 10, which is similar to a figure in the Ribnikov and Pupezin report. No comment was made in the EPA report as to the validity of the assumption that deuterium and tritium cascades are ideal for the same conditions. To check this assumption the following procedure was used in this study:

- (1) A tritium ideal cascade was designed for a given set of conditions and the deuterium product concentration was calculated from Equation 2.
- (2) The feed and product concentration for deuterium along with the flow rates for product, waste and feed were used as inputs to design an ideal cascade for deuterium.
- (3) The plant's shape for the deuterium ideal cascade was compared to the plant shape for the tritium cascade.

The tritium and deuterium ideal cascades would have the same inner-stage flow for a given number of stages if the assumption was valid. Then the two plant shapes should be about the same. Figures 11 and 12 show comparisons of the tritium and deuterium cascades for both a low separation constant (2.3 for deuterium and 3.2 for tritium) and a high separation constant (10 for tritium and 5.2 for deuterium). Figures 11 and 12 show the assumption of ideal cascades simultaneously for tritium and deuterium does not hold up well over a range of separation constants of interest. Figure 10 would be a very rough approximation of the

FIGURE 10. Deuterium Separation in Tritium Cascades

FIGURE 11. Interstage Flow for Deuterium and Tritium Ideal Cascades at Low Separation Constant

FIGURE 12. Interstage Flow for Deuterium and Tritium Ideal Cascades at High Separation Constant

deuterium separation actually taking place in the tritium cascade. A rigorous calculation of the deuterium separation would be done by calculating stage-to-stage the deuterium concentration levels in the cascade. More general cascade equations should be used to calculate the deuterium separation which accompanies tritium separation.

CONTINUED PARAMETRIC STUDIES

The next stage of the parametric studies should involve a more rigorous look of the effect of deuterium on the tritium cascades. The benefit of such a calculation would be to define a maximum for the enrichment factor of the tritium cascade since the enrichment factor increase taxes the cascade by making it work to separate deuterium. The presence of high quantities of deuterium in the enrichment and stripping sections result in a dilution of the tritium isotopically in deuterium so that a multi-component separation of a deuterium-tritium hydrogen complex from the basic hydrogen water becomes the nature of the separation problem. In the next phase of the calculations we will concentrate on finding efficient means of predicting deuterium-tritium simultaneous separations and defining the extent of the need for a multi-component treatment. In addition, economic evaluations of key processes based on separative duty and total flow calculations will be made.

NOMENCLATURE

D = separative duty, moles/mole feed

F = feed rate (1 mole basis)

J = total molar flow rate in the entire cascade moles/mole feed

J_p' = total molar heads flow rate in enriching section

J_p'' = total molar tails flow rate in enriching section

J_W' = total molar heads flow rate in stripping section

J_W'' = total molar tails flow rate in stripping section

N = number of stages in cascade

N_W = number of stages in stripping section

P = product rate (moles/mole feed)

W = waste rate (moles/mole feed)

x = atom fraction of desired isotope

x_F = atom fraction in cascade feed

x_p = atom fraction in cascade product

x_W = atom fraction in cascade waste

α = separation constant (or stage separation factor)

β = heads separation constant

Superscripts

' = stage heads stream

" = stage tails stream

Subscripts

F = cascade feed

i = stage number in enriching section counted from waste end of cascade

j = stage number in stripping section counted from waste end of cascade

P = cascade product

W = cascade waste

APPENDIX A

IDEAL CASCADE THEORY

IDEAL CASCADE THEORY

The calculations in this study are based on the theory of ideal multi-stage cascades as described in Benedict and Pigford.⁽³⁾ The ideal cascade equations apply readily to the separation of one isotope from another, but are not applicable to a true, multi-component case.

The ideal cascade is defined as multi-stage cascade in which the head separation factor (β) is a constant throughout the cascade and the heads stream and tails stream fed to a given stage have the same composition. The head separation factor in an ideal cascade can be defined as the square root of the separation constant (α).

IDEAL CASCADE EQUATIONS

The number of stages in the stripping section of an ideal cascade can be described by

$$n_W = \frac{\ln \frac{x_F(1-x_W)}{(1-x_F)x_W}}{\ln \beta} - 1 \quad (A-1)$$

Similarly, the number of stages in the enrichment section (the total number of stages minus the number of stripping stages) is given by

$$n - n_W = \frac{\ln \frac{x_P(1-x_F)}{(1-x_P)x_F}}{\ln \beta} \quad (A-2)$$

The design of a multi-stage separations plant is vividly described by the reflux ratio in the stripping and enriching sections. The reflux ratio in the enriching section is defined by

$$\frac{L''_{i+1}}{P} = \frac{1}{\beta-1} \left[x_p(1 - \beta^{i-n}) + (1 - x_p) \beta (\beta^{n-i}-1) \right] \quad (A-3)$$

and the reflux ratio in the stripping section is defined by

$$\frac{L'_j}{W} = \frac{1}{\beta-1} \left[x_W \beta (\beta^j - 1) + (1 - x_W) (1 - \beta^{-j}) \right] \quad (A-4)$$

These quantities are normally standardized to a ratio of heads flow to product flow in the entire cascade. The plot of the heads-to-product ratio as a function of stage number is called the plant shape. The area inside the plant shape is indicative of the cost of the separation.

Also of interest in describing the plant, is the total heads and tails flow rate in the stripping and enriching sections of the plant. This provides a measure of the relative pumping power required in the enriching and stripping section for movement of enriched or waste streams and provides a clear picture of the flow design and distribution of the plant. The total heads flow rate in the stripping section is defined by

$$J'_W = \frac{W}{\beta-1} \left\{ [1 - x_W(\beta + 1)] \frac{\ln \frac{x_F(1-x_W)}{x_W(1-x_F)}}{\ln \beta} + \frac{-\beta(x_F-x_W)(1-2x_F)}{(\beta-1)x_F(1-x_F)} \right\} \quad (A-5)$$

Similarly, the total tails flow rate to the stripping section is given by Equation A-6 and the total tails flow rate in the enriching section is given by Equation A-7.

$$J_W'' = \frac{W}{\beta-1} \left\{ [\beta - x_W (\beta + 1)] \frac{\ln \frac{x_F(1-x_W)}{x_W(1-x_F)}}{\ln \beta} - \frac{(x_F - x_W)[\beta^2 - (\beta^2 + 1)x_F]}{(\beta-1)x_F(1-x_F)} \right\} \quad (A-6)$$

$$J_P'' = \frac{P}{\beta-1} \left\{ \frac{[x_P(\beta+1) - \beta] \ln \frac{x_P(1-x_F)}{x_F(1-x_P)}}{\ln \beta} + \frac{(x_P - x_F)[\beta^2 - (\beta^2 + 1)x_F]}{x_F(1-x_F)(\beta-1)} \right\} \quad (A-7)$$

The heads flow rate in the enriching section is

$$J_P' = \frac{P}{\beta-1} \left\{ \frac{[x_P(\beta+1) - 1] \ln \frac{x_P(1-x_F)}{x_F(1-x_P)}}{\ln \beta} + \beta \frac{(x_P - x_F)(1 - 2x_F)}{x_F(1-x_F)(\beta-1)} \right\} \quad (A-8)$$

A useful quantity of characterizing the entire cascade is the total flow rate. The total flow rate can be given in terms of external flow rates and compositions and head separation factor. The relationship for total flow rate is

$$J = \frac{\beta+1}{(\beta-1)\ln\beta} \left[W(2x_W - 1) \ln \frac{x_W}{1-x_W} + P(2x_P - 1) \ln \frac{x_P}{1-x_P} - F(2x_F - 1) \ln \frac{x_F}{1-x_F} \right] \quad (A-9)$$

The total flow rate is indicative of the total pumping requirements of the cascade and would be an index of the power requirements of the cascade plant. The term in brackets of the total flow rate is called the separative duty. The separative duty is analogous to the heat duty of an evaporator or flash vaporizer and represents an index of plant operating cost. The separative duty is independent of the separation constant, and therefore independent of the heads separation factor. The flow rates and compositions of the inlet and outlet streams of the cascade determine the value of the separative duty of the cascade.

SIMPLIFICATIONS FOR TRITIUM SEPARATION

In the calculations for tritium separation cascades the value of the mole or atom fractions, x , is generally much less than 1, so that terms containing the value $1 - x$ can be replaced by 1. This greatly simplifies the equations as they are described above. It follows that the ratio of the feed concentration to product concentration is approximately equal to the ratio of the product flow rate to the feed flow rate. This is a convenient relationship between product-to-feed flow rate ratio and enrichment factor. The separative duty term in Equation A-9 reduces to a simple

form when the approximation of $(1 - x) = 1$ and $(2x - 1) = 1$. The resultant approximation yields the following general expression for separative duty in tritium cascades.

$$D = \ln \frac{x_F}{x_W} \quad . \quad (A-10)$$

The quantity, x_F/x_W , is referred to in this report as the decontamination factor (DF). Separative duty is therefore directly dependent on the decontamination factor and independent of all other parameters (such as enrichment factor) for all normal tritium cascade situations. Note, however, that other cost sensitive quantities such as total flow and number of stages are strongly dependent on enrichment factor and separation constant.

APPENDIX B

SUMMARY OF RESULTS

TABLES B-1 THROUGH B-6
EFFECTS OF CONCENTRATION, DF,
ENRICHMENT FACTOR

Table B-1

X1	X2	X3	A	P	W	N	T	D
1.0E-08	1.0E-07	1.0E-12	1.1000	1.0E-01	9.0E-01	240	7.1E+03	8.1E+00
1.0E-08	1.0E-07	1.0E-12	1.2000	1.0E-01	9.0E-01	125	1.9E+03	8.1E+00
1.0E-08	1.0E-07	1.0E-12	1.3000	1.0E-01	9.0E-01	86	9.4E+02	8.1E+00
1.0E-08	1.0E-07	1.0E-12	1.4000	1.0E-01	9.0E-01	66	5.7E+02	8.1E+00
1.0E-08	1.0E-07	1.0E-12	1.5000	1.0E-01	9.0E-01	55	3.9E+02	8.1E+00
1.0E-08	1.0E-07	1.0E-12	1.6000	1.0E-01	9.0E-01	47	2.9E+02	8.1E+00
1.0E-08	1.0E-07	1.0E-12	1.7000	1.0E-01	9.0E-01	41	2.3E+02	8.1E+00
1.0E-08	1.0E-07	1.0E-12	1.8000	1.0E-01	9.0E-01	37	1.8E+02	8.1E+00
1.0E-08	1.0E-07	1.0E-12	1.9000	1.0E-01	9.0E-01	34	1.6E+02	8.1E+00
1.0E-08	1.0E-07	1.0E-12	2.0000	1.0E-01	9.0E-01	31	1.4E+02	8.1E+00
1.0E-08	1.0E-07	1.0E-12	2.1000	1.0E-01	9.0E-01	29	1.2E+02	8.1E+00
1.0E-08	1.0E-07	2.0E-13	1.1000	1.0E-01	9.0E-01	274	8.4E+03	9.5E+00
1.0E-08	1.0E-07	2.0E-13	1.2000	1.0E-01	9.0E-01	142	2.3E+03	9.5E+00
1.0E-08	1.0E-07	2.0E-13	1.3000	1.0E-01	9.0E-01	98	1.1E+03	9.5E+00
1.0E-08	1.0E-07	2.0E-13	1.4000	1.0E-01	9.0E-01	76	6.7E+02	9.5E+00
1.0E-08	1.0E-07	2.0E-13	1.5000	1.0E-01	9.0E-01	63	4.6E+02	9.5E+00
1.0E-08	1.0E-07	2.0E-13	1.6000	1.0E-01	9.0E-01	54	3.5E+02	9.5E+00
1.0E-08	1.0E-07	2.0E-13	1.7000	1.0E-01	9.0E-01	47	2.7E+02	9.5E+00
1.0E-08	1.0E-07	2.0E-13	1.8000	1.0E-01	9.0E-01	42	2.7E+02	9.5E+00
1.0E-08	1.0E-07	2.0E-13	1.9000	1.0E-01	9.0E-01	39	1.9E+02	9.5E+00
1.0E-08	1.0E-07	2.0E-13	2.0000	1.0E-01	9.0E-01	36	1.6E+02	9.5E+00
1.0E-08	1.0E-07	2.0E-13	2.1000	1.0E-01	9.0E-01	34	1.4E+02	9.5E+00
1.0E-08	1.0E-07	4.0E-14	1.1000	1.0E-01	9.0E-01	307	9.7E+03	1.1E+01
1.0E-08	1.0E-07	4.0E-14	1.2000	1.0E-01	9.0E-01	160	2.6E+03	1.1E+01
1.0E-08	1.0E-07	4.0E-14	1.3000	1.0E-01	9.0E-01	110	1.3E+03	1.1E+01
1.0E-08	1.0E-07	4.0E-14	1.4000	1.0E-01	9.0E-01	85	7.8E+02	1.1E+01
1.0E-08	1.0E-07	4.0E-14	1.5000	1.0E-01	9.0E-01	71	5.3E+02	1.1E+01
1.0E-08	1.0E-07	4.0E-14	1.6000	1.0E-01	9.0E-01	60	4.0E+02	1.1E+01
1.0E-08	1.0E-07	4.0E-14	1.7000	1.0E-01	9.0E-01	53	3.1E+02	1.1E+01
1.0E-08	1.0E-07	4.0E-14	1.8000	1.0E-01	9.0E-01	48	2.6E+02	1.1E+01
1.0E-08	1.0E-07	4.0E-14	1.9000	1.0E-01	9.0E-01	44	2.1E+02	1.1E+01
1.0E-08	1.0E-07	4.0E-14	2.0000	1.0E-01	9.0E-01	40	1.8E+02	1.1E+01
1.0E-08	1.0E-07	4.0E-14	2.1000	1.0E-01	9.0E-01	38	1.6E+02	1.1E+01
1.0E-08	1.0E-07	8.0E-15	1.1000	1.0E-01	9.0E-01	341	1.1E+04	1.2E+01
1.0E-08	1.0E-07	8.0E-15	1.2000	1.0E-01	9.0E-01	177	3.0E+03	1.2E+01
1.0E-08	1.0E-07	8.0E-15	1.3000	1.0E-01	9.0E-01	123	1.4E+03	1.2E+01
1.0E-08	1.0E-07	8.0E-15	1.4000	1.0E-01	9.0E-01	95	8.8E+02	1.2E+01
1.0E-08	1.0E-07	8.0E-15	1.5000	1.0E-01	9.0E-01	79	6.1E+02	1.2E+01
1.0E-08	1.0E-07	8.0E-15	1.6000	1.0E-01	9.0E-01	67	4.5E+02	1.2E+01
1.0E-08	1.0E-07	8.0E-15	1.7000	1.0E-01	9.0E-01	59	3.5E+02	1.2E+01
1.0E-08	1.0E-07	8.0E-15	1.8000	1.0E-01	9.0E-01	53	2.9E+02	1.2E+01
1.0E-08	1.0E-07	8.0E-15	1.9000	1.0E-01	9.0E-01	49	2.4E+02	1.2E+01
1.0E-08	1.0E-07	8.0E-15	2.0000	1.0E-01	9.0E-01	45	2.1E+02	1.2E+01
1.0E-08	1.0E-07	8.0E-15	2.1000	1.0E-01	9.0E-01	42	1.8E+02	1.2E+01
1.0E-08	1.0E-07	1.0E-12	1.0070	1.0E-01	9.0E-01	3299	1.3E+06	8.1E+00
1.0E-08	1.0E-07	1.0E-12	1.0500	1.0E-01	9.0E-01	470	2.7E+04	8.1E+00
1.0E-08	1.0E-07	1.0E-12	1.2900	1.0E-01	9.0E-01	89	9.9E+02	8.1E+00

Table B-2

X1	X2	X3	A	P	W	N	T	D
1.0E-08	1.0E-07	1.0E-12	1.0200	1.0E-01	9.0E-01	1161	1.6E+05	8.1E+00
1.0E-08	1.0E-07	2.0E-13	1.0070	1.0E-01	9.0E-01	3791	1.5E+06	9.5E+00
1.0E-08	1.0E-07	2.0E-13	1.0500	1.0E-01	9.0E-01	536	3.2E+04	9.5E+00
1.0E-08	1.0E-07	2.0E-13	1.2900	1.0E-01	9.0E-01	101	1.2E+03	9.5E+00
1.0E-08	1.0E-07	2.0E-13	1.0200	1.0E-01	9.0E-01	1323	1.9E+05	9.5E+00
1.0E-08	1.0E-07	4.0E-14	1.0070	1.0E-01	9.0E-01	4222	1.8E+06	1.1E+01
1.0E-08	1.0E-07	4.0E-14	1.0500	1.0E-01	9.0E-01	602	3.6E+04	1.1E+01
1.0E-08	1.0E-07	4.0E-14	1.2900	1.0E-01	9.0E-01	114	1.4E+03	1.1E+01
1.0E-08	1.0E-07	4.0E-14	1.0200	1.0E-01	9.0E-01	1486	2.2E+05	1.1E+01
1.0E-08	1.0E-07	8.0E-15	1.0070	1.0E-01	9.0E-01	4684	2.0E+06	1.2E+01
1.0E-08	1.0E-07	8.0E-15	1.0500	1.0E-01	9.0E-01	668	4.2E+04	1.2E+01
1.0E-08	1.0E-07	8.0E-15	1.2900	1.0E-01	9.0E-01	127	1.5E+03	1.2E+01
1.0E-08	1.0E-07	8.0E-15	1.0200	1.0E-01	9.0E-01	1648	2.5E+05	1.2E+01
1.0E-08	1.0E-07	1.0E-12	1.0040	1.0E-01	9.0E-01	5766	4.0E+06	8.1E+00
1.0E-08	1.0E-07	1.0E-12	1.0050	1.0E-01	9.0E-01	4615	2.6E+06	8.1E+00
1.0E-08	1.0E-07	1.0E-12	1.0600	1.0E-01	9.0E-01	394	1.9E+04	8.1E+00
1.0E-08	1.0E-07	1.0E-12	1.0100	1.0E-01	9.0E-01	2312	6.5E+05	8.1E+00
1.0E-08	1.0E-07	2.0E-13	1.0040	1.0E-01	9.0E-01	6572	4.8E+06	9.5E+00
1.0E-08	1.0E-07	2.0E-13	1.0050	1.0E-01	9.0E-01	5260	3.1E+06	9.5E+00
1.0E-08	1.0E-07	2.0E-13	1.0600	1.0E-01	9.0E-01	449	2.2E+04	9.5E+00
1.0E-08	1.0E-07	2.0E-13	1.0100	1.0E-01	9.0E-01	2635	7.7E+05	9.5E+00
1.0E-08	1.0E-07	4.0E-14	1.0040	1.0E-01	9.0E-01	7379	5.5E+06	1.1E+01
1.0E-08	1.0E-07	4.0E-14	1.0050	1.0E-01	9.0E-01	5906	3.5E+06	1.1E+01
1.0E-08	1.0E-07	4.0E-14	1.0600	1.0E-01	9.0E-01	504	2.6E+04	1.1E+01
1.0E-08	1.0E-07	4.0E-14	1.0100	1.0E-01	9.0E-01	2959	8.9E+05	1.1E+01
1.0E-08	1.0E-07	5.0E-18	1.0040	1.0E-01	9.0E-01	8185	6.2E+06	1.1E+01
1.0E-08	1.0E-07	5.0E-18	1.0050	1.0E-01	9.0E-01	6551	4.0E+06	1.1E+01
1.0E-08	1.0E-07	5.0E-18	1.0600	1.0E-01	9.0E-01	559	2.9E+04	1.1E+01
1.0E-08	1.0E-07	5.0E-18	1.0100	1.0E-01	9.0E-01	3282	1.0E+06	1.1E+01

Table B-3

X1	X2	X3	A	P	W	N	T	D
1.0E-08	1.0E-04	1.0E-12	1.1000	1.0E-04	1.0E+00	385	8.1E+03	9.2E+00
1.0E-08	1.0E-04	1.0E-12	1.2000	1.0E-04	1.0E+00	201	2.2E+03	9.2E+00
1.0E-08	1.0E-04	1.0E-12	1.3000	1.0E-04	1.0E+00	139	1.1E+03	9.2E+00
1.0E-08	1.0E-04	1.0E-12	1.4000	1.0E-04	1.0E+00	107	6.5E+02	9.2E+00
1.0E-08	1.0E-04	1.0E-12	1.5000	1.0E-04	1.0E+00	89	4.5E+02	9.2E+00
1.0E-08	1.0E-04	1.0E-12	1.6000	1.0E-04	1.0E+00	77	3.4E+02	9.2E+00
1.0E-08	1.0E-04	1.0E-12	1.7000	1.0E-04	1.0E+00	67	2.6E+02	9.2E+00
1.0E-08	1.0E-04	1.0E-12	1.8000	1.0E-04	1.0E+00	61	2.1E+02	9.2E+00
1.0E-08	1.0E-04	1.0E-12	1.9000	1.0E-04	1.0E+00	55	1.8E+02	9.2E+00
1.0E-08	1.0E-04	1.0E-12	2.0000	1.0E-04	1.0E+00	51	1.5E+02	9.2E+00
1.0E-08	1.0E-04	1.0E-12	2.1000	1.0E-04	1.0E+00	47	1.4E+02	9.2E+00
1.0E-08	1.0E-04	2.0E-13	1.1000	1.0E-04	1.0E+00	419	9.5E+03	1.1E+01
1.0E-08	1.0E-04	2.0E-13	1.2000	1.0E-04	1.0E+00	218	2.6E+03	1.1E+01
1.0E-08	1.0E-04	2.0E-13	1.3000	1.0E-04	1.0E+00	151	1.3E+03	1.1E+01
1.0E-08	1.0E-04	2.0E-13	1.4000	1.0E-04	1.0E+00	117	7.7E+02	1.1E+01
1.0E-08	1.0E-04	2.0E-13	1.5000	1.0E-04	1.0E+00	97	5.3E+02	1.1E+01
1.0E-08	1.0E-04	2.0E-13	1.6000	1.0E-04	1.0E+00	84	3.9E+02	1.1E+01
1.0E-08	1.0E-04	2.0E-13	1.7000	1.0E-04	1.0E+00	73	3.1E+02	1.1E+01
1.0E-08	1.0E-04	2.0E-13	1.8000	1.0E-04	1.0E+00	66	2.5E+02	1.1E+01
1.0E-08	1.0E-04	2.0E-13	1.9000	1.0E-04	1.0E+00	60	2.1E+02	1.1E+01
1.0E-08	1.0E-04	2.0E-13	2.0000	1.0E-04	1.0E+00	56	1.8E+02	1.1E+01
1.0E-08	1.0E-04	2.0E-13	2.1000	1.0E-04	1.0E+00	52	1.6E+02	1.1E+01
1.0E-08	1.0E-04	4.0E-14	1.1000	1.0E-04	1.0E+00	452	1.1E+04	1.2E+01
1.0E-08	1.0E-04	4.0E-14	1.2000	1.0E-04	1.0E+00	236	3.0E+03	1.2E+01
1.0E-08	1.0E-04	4.0E-14	1.3000	1.0E-04	1.0E+00	163	1.4E+03	1.2E+01
1.0E-08	1.0E-04	4.0E-14	1.4000	1.0E-04	1.0E+00	126	8.8E+02	1.2E+01
1.0E-08	1.0E-04	4.0E-14	1.5000	1.0E-04	1.0E+00	105	6.1E+02	1.2E+01
1.0E-08	1.0E-04	4.0E-14	1.6000	1.0E-04	1.0E+00	90	4.5E+02	1.2E+01
1.0E-08	1.0E-04	4.0E-14	1.7000	1.0E-04	1.0E+00	79	3.6E+02	1.2E+01
1.0E-08	1.0E-04	4.0E-14	1.8000	1.0E-04	1.0E+00	72	2.9E+02	1.2E+01
1.0E-08	1.0E-04	4.0E-14	1.9000	1.0E-04	1.0E+00	65	2.4E+02	1.2E+01
1.0E-08	1.0E-04	4.0E-14	2.0000	1.0E-04	1.0E+00	60	2.1E+02	1.2E+01
1.0E-08	1.0E-04	4.0E-14	2.1000	1.0E-04	1.0E+00	56	1.8E+02	1.2E+01

Table B-4

X1	X2	X3	A	P	W	N	T	D
1.0E-08	1.0E-04	1.0E-12	3.000	1.0E-04	1.0E+00	31	6.3E+01	9.2E+00
1.0E-08	1.0E-04	1.0E-12	4.000	1.0E-04	1.0E+00	25	4.0E+01	9.2E+00
1.0E-08	1.0E-04	1.0E-12	5.000	1.0E-04	1.0E+00	21	3.0E+01	9.2E+00
1.0E-08	1.0E-04	1.0E-12	6.000	1.0E-04	1.0E+00	19	2.4E+01	9.2E+00
1.0E-08	1.0E-04	1.0E-12	7.000	1.0E-04	1.0E+00	17	2.1E+01	9.2E+00
1.0E-08	1.0E-04	1.0E-12	8.000	1.0E-04	1.0E+00	15	1.9E+01	9.2E+00
1.0E-08	1.0E-04	1.0E-12	9.000	1.0E-04	1.0E+00	15	1.7E+01	9.2E+00
1.0E-08	1.0E-04	1.0E-12	10.000	1.0E-04	1.0E+00	15	1.5E+01	9.2E+00
1.0E-08	1.0E-04	2.0E-13	3.000	1.0E-04	1.0E+00	34	7.3E+01	1.1E+01
1.0E-08	1.0E-04	2.0E-13	4.000	1.0E-04	1.0E+00	27	4.7E+01	1.1E+01
1.0E-08	1.0E-04	2.0E-13	5.000	1.0E-04	1.0E+00	23	3.5E+01	1.1E+01
1.0E-08	1.0E-04	2.0E-13	6.000	1.0E-04	1.0E+00	21	2.9E+01	1.1E+01
1.0E-08	1.0E-04	2.0E-13	7.000	1.0E-04	1.0E+00	19	2.5E+01	1.1E+01
1.0E-08	1.0E-04	2.0E-13	8.000	1.0E-04	1.0E+00	17	2.2E+01	1.1E+01
1.0E-08	1.0E-04	2.0E-13	9.000	1.0E-04	1.0E+00	16	2.0E+01	1.1E+01
1.0E-08	1.0E-04	2.0E-13	10.000	1.0E-04	1.0E+00	16	1.8E+01	1.1E+01
1.0E-08	1.0E-04	4.0E-14	3.000	1.0E-04	1.0E+00	37	8.4E+01	1.2E+01
1.0E-08	1.0E-04	4.0E-14	4.000	1.0E-04	1.0E+00	29	5.4E+01	1.2E+01
1.0E-08	1.0E-04	4.0E-14	5.000	1.0E-04	1.0E+00	25	4.0E+01	1.2E+01
1.0E-08	1.0E-04	4.0E-14	6.000	1.0E-04	1.0E+00	22	3.3E+01	1.2E+01
1.0E-08	1.0E-04	4.0E-14	7.000	1.0E-04	1.0E+00	20	2.8E+01	1.2E+01
1.0E-08	1.0E-04	4.0E-14	8.000	1.0E-04	1.0E+00	18	2.5E+01	1.2E+01
1.0E-08	1.0E-04	4.0E-14	9.000	1.0E-04	1.0E+00	18	2.3E+01	1.2E+01
1.0E-08	1.0E-04	4.0E-14	10.000	1.0E-04	1.0E+00	17	2.1E+01	1.2E+01
1.0E-08	1.0E-04	8.0E-15	3.000	1.0E-04	1.0E+00	40	9.5E+01	1.4E+01
1.0E-08	1.0E-04	8.0E-15	4.000	1.0E-04	1.0E+00	32	6.1E+01	1.4E+01
1.0E-08	1.0E-04	8.0E-15	5.000	1.0E-04	1.0E+00	27	4.6E+01	1.4E+01
1.0E-08	1.0E-04	8.0E-15	6.000	1.0E-04	1.0E+00	24	3.7E+01	1.4E+01
1.0E-08	1.0E-04	8.0E-15	7.000	1.0E-04	1.0E+00	22	3.2E+01	1.4E+01
1.0E-08	1.0E-04	8.0E-15	8.000	1.0E-04	1.0E+00	20	2.8E+01	1.4E+01
1.0E-08	1.0E-04	8.0E-15	9.000	1.0E-04	1.0E+00	19	2.6E+01	1.4E+01
1.0E-08	1.0E-04	8.0E-15	10.000	1.0E-04	1.0E+00	19	2.3E+01	1.4E+01

Table B-5

X1	X2	X3	A	P	W	N	T	D
1.0E-10	1.0E-04	1.0E-12	1.1000	9.9E-07	1.0E+00	384	4.1E+03	4.6E+00
1.0E-10	1.0E-04	1.0E-12	1.2000	9.9E-07	1.0E+00	200	1.1E+03	4.6E+00
1.0E-10	1.0E-04	1.0E-12	1.3000	9.9E-07	1.0E+00	139	5.4E+02	4.6E+00
1.0E-10	1.0E-04	1.0E-12	1.4000	9.9E-07	1.0E+00	108	3.3E+02	4.6E+00
1.0E-10	1.0E-04	1.0E-12	1.5000	9.9E-07	1.0E+00	89	2.2E+02	4.6E+00
1.0E-10	1.0E-04	1.0E-12	1.6000	9.9E-07	1.0E+00	76	1.7E+02	4.6E+00
1.0E-10	1.0E-04	1.0E-12	1.7000	9.9E-07	1.0E+00	68	1.3E+02	4.6E+00
1.0E-10	1.0E-04	1.0E-12	1.8000	9.9E-07	1.0E+00	61	1.1E+02	4.6E+00
1.0E-10	1.0E-04	1.0E-12	1.9000	9.9E-07	1.0E+00	56	9.0E+01	4.6E+00
1.0E-10	1.0E-04	1.0E-12	2.0000	9.9E-07	1.0E+00	51	7.7E+01	4.6E+00
1.0E-10	1.0E-04	1.0E-12	2.1000	9.9E-07	1.0E+00	48	6.8E+01	4.6E+00
1.0E-10	1.0E-04	2.0E-13	1.1000	9.9E-07	1.0E+00	419	5.5E+03	6.2E+00
1.0E-10	1.0E-04	2.0E-13	1.2000	9.9E-07	1.0E+00	218	1.5E+03	6.2E+00
1.0E-10	1.0E-04	2.0E-13	1.3000	9.9E-07	1.0E+00	151	7.2E+02	6.2E+00
1.0E-10	1.0E-04	2.0E-13	1.4000	9.9E-07	1.0E+00	117	4.4E+02	6.2E+00
1.0E-10	1.0E-04	2.0E-13	1.5000	9.9E-07	1.0E+00	97	3.0E+02	6.2E+00
1.0E-10	1.0E-04	2.0E-13	1.6000	9.9E-07	1.0E+00	83	2.3E+02	6.2E+00
1.0E-10	1.0E-04	2.0E-13	1.7000	9.9E-07	1.0E+00	74	1.8E+02	6.2E+00
1.0E-10	1.0E-04	2.0E-13	1.8000	9.9E-07	1.0E+00	67	1.4E+02	6.2E+00
1.0E-10	1.0E-04	2.0E-13	1.9000	9.9E-07	1.0E+00	61	1.2E+02	6.2E+00
1.0E-10	1.0E-04	2.0E-13	2.0000	9.9E-07	1.0E+00	55	1.0E+02	6.2E+00
1.0E-10	1.0E-04	2.0E-13	2.1000	9.9E-07	1.0E+00	52	9.1E+01	6.2E+00
1.0E-10	1.0E-04	4.0E-14	1.1000	9.9E-07	1.0E+00	453	6.9E+03	7.8E+00
1.0E-10	1.0E-04	4.0E-14	1.2000	9.9E-07	1.0E+00	235	1.9E+03	7.8E+00
1.0E-10	1.0E-04	4.0E-14	1.3000	9.9E-07	1.0E+00	163	9.1E+02	7.8E+00
1.0E-10	1.0E-04	4.0E-14	1.4000	9.9E-07	1.0E+00	127	5.5E+02	7.8E+00
1.0E-10	1.0E-04	4.0E-14	1.5000	9.9E-07	1.0E+00	105	3.8E+02	7.8E+00
1.0E-10	1.0E-04	4.0E-14	1.6000	9.9E-07	1.0E+00	90	2.8E+02	7.8E+00
1.0E-10	1.0E-04	4.0E-14	1.7000	9.9E-07	1.0E+00	80	2.2E+02	7.8E+00
1.0E-10	1.0E-04	4.0E-14	1.8000	9.9E-07	1.0E+00	72	1.8E+02	7.8E+00
1.0E-10	1.0E-04	4.0E-14	1.9000	9.9E-07	1.0E+00	66	1.5E+02	7.8E+00
1.0E-10	1.0E-04	4.0E-14	2.0000	9.9E-07	1.0E+00	60	1.3E+02	7.8E+00
1.0E-10	1.0E-04	4.0E-14	2.1000	9.9E-07	1.0E+00	57	1.2E+02	7.8E+00

Table B-6

X1	X2	X3	A	P	W	N	T	D
1.0E-10	1.0E-04	1.0E-12	3.000	9.9E-07	1.0E+00	32	3.1E+01	4.6E+00
1.0E-10	1.0E-04	1.0E-12	4.000	9.9E-07	1.0E+00	24	2.0E+01	4.6E+00
1.0E-10	1.0E-04	1.0E-12	5.000	9.9E-07	1.0E+00	21	1.5E+01	4.6E+00
1.0E-10	1.0E-04	1.0E-12	6.000	9.9E-07	1.0E+00	19	1.2E+01	4.6E+00
1.0E-10	1.0E-04	1.0E-12	7.000	9.9E-07	1.0E+00	17	1.0E+01	4.6E+00
1.0E-10	1.0E-04	1.0E-12	8.000	9.9E-07	1.0E+00	16	9.3E+00	4.6E+00
1.0E-10	1.0E-04	1.0E-12	9.000	9.9E-07	1.0E+00	15	8.4E+00	4.6E+00
1.0E-10	1.0E-04	1.0E-12	10.000	9.9E-07	1.0E+00	15	7.7E+00	4.6E+00
1.0E-10	1.0E-04	2.0E-13	3.000	9.9E-07	1.0E+00	35	4.2E+01	6.2E+00
1.0E-10	1.0E-04	2.0E-13	4.000	9.9E-07	1.0E+00	26	2.7E+01	6.2E+00
1.0E-10	1.0E-04	2.0E-13	5.000	9.9E-07	1.0E+00	23	2.0E+01	6.2E+00
1.0E-10	1.0E-04	2.0E-13	6.000	9.9E-07	1.0E+00	20	1.7E+01	6.2E+00
1.0E-10	1.0E-04	2.0E-13	7.000	9.9E-07	1.0E+00	19	1.4E+01	6.2E+00
1.0E-10	1.0E-04	2.0E-13	8.000	9.9E-07	1.0E+00	17	1.3E+01	6.2E+00
1.0E-10	1.0E-04	2.0E-13	9.000	9.9E-07	1.0E+00	16	1.1E+01	6.2E+00
1.0E-10	1.0E-04	2.0E-13	10.000	9.9E-07	1.0E+00	16	1.0E+01	6.2E+00
1.0E-10	1.0E-04	4.0E-14	3.000	9.9E-07	1.0E+00	38	5.3E+01	7.8E+00
1.0E-10	1.0E-04	4.0E-14	4.000	9.9E-07	1.0E+00	29	3.4E+01	7.8E+00
1.0E-10	1.0E-04	4.0E-14	5.000	9.9E-07	1.0E+00	25	2.5E+01	7.8E+00
1.0E-10	1.0E-04	4.0E-14	6.000	9.9E-07	1.0E+00	22	2.1E+01	7.8E+00
1.0E-10	1.0E-04	4.0E-14	7.000	9.9E-07	1.0E+00	21	1.8E+01	7.8E+00
1.0E-10	1.0E-04	4.0E-14	8.000	9.9E-07	1.0E+00	19	1.6E+01	7.8E+00
1.0E-10	1.0E-04	4.0E-14	9.000	9.9E-07	1.0E+00	18	1.4E+01	7.8E+00
1.0E-10	1.0E-04	4.0E-14	10.000	9.9E-07	1.0E+00	17	1.3E+01	7.8E+00
1.0E-10	1.0E-04	8.0E-15	3.000	9.9E-07	1.0E+00	41	6.4E+01	9.4E+00
1.0E-10	1.0E-04	8.0E-15	4.000	9.9E-07	1.0E+00	31	4.1E+01	9.4E+00
1.0E-10	1.0E-04	8.0E-15	5.000	9.9E-07	1.0E+00	27	3.1E+01	9.4E+00
1.0E-10	1.0E-04	8.0E-15	6.000	9.9E-07	1.0E+00	24	2.5E+01	9.4E+00
1.0E-10	1.0E-04	8.0E-15	7.000	9.9E-07	1.0E+00	22	2.1E+01	9.4E+00
1.0E-10	1.0E-04	8.0E-15	8.000	9.9E-07	1.0E+00	21	1.9E+01	9.4E+00
1.0E-10	1.0E-04	8.0E-15	9.000	9.9E-07	1.0E+00	19	1.7E+01	9.4E+00
1.0E-10	1.0E-04	8.0E-15	10.000	9.9E-07	1.0E+00	19	1.6E+01	9.4E+00

TABLES B-7 THROUGH B-11

SIMULTANEOUS DEUTERIUM SEPARATION

Table B-7

X1	X2	X3	A	P	N	T	A1	Y2
.10E-07	.10E-03	.10E-11	2.000	1.0E-04	51	1.5E+02	1.641	.97E-01
.10E-07	.10E-03	.10E-11	4.000	1.0E-04	25	4.0E+01	2.692	.97E-01
.10E-07	.10E-03	.10E-11	6.000	1.0E-04	19	2.4E+01	3.596	.97E-01
.10E-07	.10E-03	.10E-11	8.000	1.0E-04	15	1.9E+01	4.416	.97E-01
.10E-07	.10E-03	.10E-11	10.000	1.0E-04	15	1.5E+01	5.180	.97E-01
.10E-07	.10E-03	.10E-11	12.000	1.0E-04	13	1.3E+01	5.900	.97E-01
.10E-07	.10E-03	.10E-11	14.000	1.0E-04	11	1.2E+01	6.587	.97E-01
.10E-07	.10E-03	.10E-11	16.000	1.0E-04	11	1.1E+01	7.246	.97E-01
.10E-07	.10E-03	.10E-11	18.000	1.0E-04	11	1.0E+01	7.882	.97E-01
.10E-07	.10E-03	.10E-11	20.000	1.0E-04	11	9.7E+00	8.498	.97E-01
.10E-07	.10E-03	.10E-11	22.000	1.0E-04	9	9.2E+00	9.097	.97E-01
.10E-07	.32E-04	.10E-11	2.000	3.2E-04	48	1.5E+02	1.641	.45E-01
.10E-07	.32E-04	.10E-11	4.000	3.2E-04	23	4.0E+01	2.692	.45E-01
.10E-07	.32E-04	.10E-11	6.000	3.2E-04	17	2.4E+01	3.596	.45E-01
.10E-07	.32E-04	.10E-11	8.000	3.2E-04	14	1.9E+01	4.416	.45E-01
.10E-07	.32E-04	.10E-11	10.000	3.2E-04	14	1.5E+01	5.180	.45E-01
.10E-07	.32E-04	.10E-11	12.000	3.2E-04	12	1.3E+01	5.900	.45E-01
.10E-07	.32E-04	.10E-11	14.000	3.2E-04	11	1.2E+01	6.587	.45E-01
.10E-07	.32E-04	.10E-11	16.000	3.2E-04	10	1.1E+01	7.246	.45E-01
.10E-07	.32E-04	.10E-11	18.000	3.2E-04	10	1.0E+01	7.882	.45E-01
.10E-07	.32E-04	.10E-11	20.000	3.2E-04	10	9.7E+00	8.498	.45E-01
.10E-07	.32E-04	.10E-11	22.000	3.2E-04	9	9.2E+00	9.097	.45E-01
.10E-07	.10E-04	.10E-11	2.000	1.0E-03	44	1.5E+02	1.641	.20E-01
.10E-07	.10E-04	.10E-11	4.000	1.0E-03	21	4.0E+01	2.692	.20E-01
.10E-07	.10E-04	.10E-11	6.000	1.0E-03	16	2.4E+01	3.596	.20E-01
.10E-07	.10E-04	.10E-11	8.000	1.0E-03	13	1.9E+01	4.416	.20E-01
.10E-07	.10E-04	.10E-11	10.000	1.0E-03	13	1.5E+01	5.180	.20E-01
.10E-07	.10E-04	.10E-11	12.000	1.0E-03	11	1.3E+01	5.900	.20E-01
.10E-07	.10E-04	.10E-11	14.000	1.0E-03	10	1.2E+01	6.587	.20E-01
.10E-07	.10E-04	.10E-11	16.000	1.0E-03	9	1.1E+01	7.246	.20E-01
.10E-07	.10E-04	.10E-11	18.000	1.0E-03	9	1.0E+01	7.882	.20E-01
.10E-07	.10E-04	.10E-11	20.000	1.0E-03	9	9.7E+00	8.498	.20E-01
.10E-07	.10E-04	.10E-11	22.000	1.0E-03	8	9.2E+00	9.097	.20E-01
.10E-07	.32E-05	.10E-11	2.000	3.2E-03	41	1.5E+02	1.641	.91E-02
.10E-07	.32E-05	.10E-11	4.000	3.2E-03	20	4.0E+01	2.692	.91E-02
.10E-07	.32E-05	.10E-11	6.000	3.2E-03	15	2.4E+01	3.596	.91E-02
.10E-07	.32E-05	.10E-11	8.000	3.2E-03	12	1.8E+01	4.416	.91E-02
.10E-07	.32E-05	.10E-11	10.000	3.2E-03	12	1.5E+01	5.180	.91E-02
.10E-07	.32E-05	.10E-11	12.000	3.2E-03	10	1.3E+01	5.900	.91E-02
.10E-07	.32E-05	.10E-11	14.000	3.2E-03	9	1.2E+01	6.587	.91E-02
.10E-07	.32E-05	.10E-11	16.000	3.2E-03	9	1.1E+01	7.246	.91E-02
.10E-07	.32E-05	.10E-11	18.000	3.2E-03	8	1.0E+01	7.882	.91E-02
.10E-07	.32E-05	.10E-11	20.000	3.2E-03	8	9.6E+00	8.498	.91E-02
.10E-07	.32E-05	.10E-11	22.000	3.2E-03	7	9.1E+00	9.097	.91E-02
.10E-07	.10E-05	.10E-11	2.000	1.0E-02	38	1.5E+02	1.641	.40E-02
.10E-07	.10E-05	.10E-11	4.000	1.0E-02	18	3.9E+01	2.692	.40E-02
.10E-07	.10E-05	.10E-11	6.000	1.0E-02	14	2.4E+01	3.596	.40E-02
.10E-07	.10E-05	.10E-11	8.000	1.0E-02	11	1.8E+01	4.416	.40E-02
.10E-07	.10E-05	.10E-11	10.000	1.0E-02	11	1.5E+01	5.180	.40E-02
.10E-07	.10E-05	.10E-11	12.000	1.0E-02	9	1.3E+01	5.900	.40E-02

Table B-7 (Continued)

X1	X2	X3	A	P	N	T	A1	Y2
.10E-07	.10E-05	.10E-11	14.000	1.0E-02	8	1.2E+01	6.587	.40E-02
.10E-07	.10E-05	.10E-11	16.000	1.0E-02	8	1.1E+01	7.246	.40E-02
.10E-07	.10E-05	.10E-11	18.000	1.0E-02	8	1.0E+01	7.882	.40E-02
.10E-07	.10E-05	.10E-11	20.000	1.0E-02	8	9.5E+00	8.498	.40E-02
.10E-07	.10E-05	.10E-11	22.000	1.0E-02	6	9.1E+00	9.097	.40E-02
.10E-07	.32E-06	.10E-11	2.000	3.2E-02	34	1.5E+02	1.641	.18E-02
.10E-07	.32E-06	.10E-11	4.000	3.2E-02	16	3.8E+01	2.692	.18E-02
.10E-07	.32E-06	.10E-11	6.000	3.2E-02	12	2.3E+01	3.596	.18E-02
.10E-07	.32E-06	.10E-11	8.000	3.2E-02	10	1.8E+01	4.416	.18E-02
.10E-07	.32E-06	.10E-11	10.000	3.2E-02	10	1.5E+01	5.180	.18E-02
.10E-07	.32E-06	.10E-11	12.000	3.2E-02	8	1.3E+01	5.900	.18E-02
.10E-07	.32E-06	.10E-11	14.000	3.2E-02	7	1.2E+01	6.587	.18E-02
.10E-07	.32E-06	.10E-11	16.000	3.2E-02	7	1.1E+01	7.246	.18E-02
.10E-07	.32E-06	.10E-11	18.000	3.2E-02	7	9.9E+00	7.882	.18E-02
.10E-07	.32E-06	.10E-11	20.000	3.2E-02	7	9.3E+00	8.498	.18E-02
.10E-07	.32E-06	.10E-11	22.000	3.2E-02	6	8.8E+00	9.097	.18E-02
.10E-07	.10E-06	.10E-11	2.000	1.0E-01	31	1.4E+02	1.641	.78E-03
.10E-07	.10E-06	.10E-11	4.000	1.0E-01	15	3.5E+01	2.692	.78E-03
.10E-07	.10E-06	.10E-11	6.000	1.0E-01	11	2.1E+01	3.596	.78E-03
.10E-07	.10E-06	.10E-11	8.000	1.0E-01	9	1.6E+01	4.416	.78E-03
.10E-07	.10E-06	.10E-11	10.000	1.0E-01	9	1.3E+01	5.180	.78E-03
.10E-07	.10E-06	.10E-11	12.000	1.0E-01	7	1.2E+01	5.900	.78E-03
.10E-07	.10E-06	.10E-11	14.000	1.0E-01	6	1.1E+01	6.587	.78E-03
.10E-07	.10E-06	.10E-11	16.000	1.0E-01	6	9.7E+00	7.246	.78E-03
.10E-07	.10E-06	.10E-11	18.000	1.0E-01	6	9.0E+00	7.882	.78E-03
.10E-07	.10E-06	.10E-11	20.000	1.0E-01	6	8.5E+00	8.498	.78E-03
.10E-07	.10E-06	.10E-11	22.000	1.0E-01	5	8.0E+00	9.097	.78E-03
.10E-07	.32E-07	.10E-11	2.000	3.2E-01	28	1.0E+02	1.641	.34E-03
.10E-07	.32E-07	.10E-11	4.000	3.2E-01	13	2.6E+01	2.692	.34E-03
.10E-07	.32E-07	.10E-11	6.000	3.2E-01	10	1.6E+01	3.596	.34E-03
.10E-07	.32E-07	.10E-11	8.000	3.2E-01	8	1.2E+01	4.416	.34E-03
.10E-07	.32E-07	.10E-11	10.000	3.2E-01	8	9.9E+00	5.180	.34E-03
.10E-07	.32E-07	.10E-11	12.000	3.2E-01	7	8.7E+00	5.900	.34E-03
.10E-07	.32E-07	.10E-11	14.000	3.2E-01	6	7.8E+00	6.587	.34E-03
.10E-07	.32E-07	.10E-11	16.000	3.2E-01	6	7.1E+00	7.246	.34E-03
.10E-07	.32E-07	.10E-11	18.000	3.2E-01	6	6.6E+00	7.882	.34E-03
.10E-07	.32E-07	.10E-11	20.000	3.2E-01	6	6.2E+00	8.498	.34E-03
.10E-07	.32E-07	.10E-11	22.000	3.2E-01	5	5.9E+00	9.097	.34E-03

Table B-8

X1	X2	X3	A	P	N	T	A1	Y2
.10E-07	.10E-03	.10E-13	2.000	1.0E-04	64	2.3E+02	1.641	.97E-01
.10E-07	.10E-03	.10E-13	4.000	1.0E-04	31	6.0E+01	2.692	.97E-01
.10E-07	.10E-03	.10E-13	6.000	1.0E-04	24	3.7E+01	3.596	.97E-01
.10E-07	.10E-03	.10E-13	8.000	1.0E-04	20	2.8E+01	4.416	.97E-01
.10E-07	.10E-03	.10E-13	10.000	1.0E-04	19	2.3E+01	5.180	.97E-01
.10E-07	.10E-03	.10E-13	12.000	1.0E-04	17	2.0E+01	5.900	.97E-01
.10E-07	.10E-03	.10E-13	14.000	1.0E-04	15	1.8E+01	6.587	.97E-01
.10E-07	.10E-03	.10E-13	16.000	1.0E-04	14	1.7E+01	7.246	.97E-01
.10E-07	.10E-03	.10E-13	18.000	1.0E-04	14	1.5E+01	7.882	.97E-01
.10E-07	.10E-03	.10E-13	20.000	1.0E-04	14	1.5E+01	8.498	.97E-01
.10E-07	.10E-03	.10E-13	22.000	1.0E-04	12	1.4E+01	9.097	.97E-01
.10E-07	.32E-04	.10E-13	2.000	3.2E-04	61	2.3E+02	1.641	.45E-01
.10E-07	.32E-04	.10E-13	4.000	3.2E-04	29	6.0E+01	2.692	.45E-01
.10E-07	.32E-04	.10E-13	6.000	3.2E-04	22	3.7E+01	3.596	.45E-01
.10E-07	.32E-04	.10E-13	8.000	3.2E-04	19	2.8E+01	4.416	.45E-01
.10E-07	.32E-04	.10E-13	10.000	3.2E-04	18	2.3E+01	5.180	.45E-01
.10E-07	.32E-04	.10E-13	12.000	3.2E-04	16	2.0E+01	5.900	.45E-01
.10E-07	.32E-04	.10E-13	14.000	3.2E-04	15	1.8E+01	6.587	.45E-01
.10E-07	.32E-04	.10E-13	16.000	3.2E-04	13	1.7E+01	7.246	.45E-01
.10E-07	.32E-04	.10E-13	18.000	3.2E-04	13	1.5E+01	7.882	.45E-01
.10E-07	.32E-04	.10E-13	20.000	3.2E-04	13	1.5E+01	8.498	.45E-01
.10E-07	.32E-04	.10E-13	22.000	3.2E-04	12	1.4E+01	9.097	.45E-01
.10E-07	.10E-04	.10E-13	2.000	1.0E-03	57	2.3E+02	1.641	.20E-01
.10E-07	.10E-04	.10E-13	4.000	1.0E-03	27	6.0E+01	2.692	.20E-01
.10E-07	.10E-04	.10E-13	6.000	1.0E-03	21	3.7E+01	3.596	.20E-01
.10E-07	.10E-04	.10E-13	8.000	1.0E-03	18	2.8E+01	4.416	.20E-01
.10E-07	.10E-04	.10E-13	10.000	1.0E-03	17	2.3E+01	5.180	.20E-01
.10E-07	.10E-04	.10E-13	12.000	1.0E-03	15	2.0E+01	5.900	.20E-01
.10E-07	.10E-04	.10E-13	14.000	1.0E-03	14	1.8E+01	6.587	.20E-01
.10E-07	.10E-04	.10E-13	16.000	1.0E-03	12	1.7E+01	7.246	.20E-01
.10E-07	.10E-04	.10E-13	18.000	1.0E-03	12	1.5E+01	7.882	.20E-01
.10E-07	.10E-04	.10E-13	20.000	1.0E-03	12	1.5E+01	8.498	.20E-01
.10E-07	.10E-04	.10E-13	22.000	1.0E-03	11	1.4E+01	9.097	.20E-01
.10E-07	.32E-05	.10E-13	2.000	3.2E-03	54	2.3E+02	1.641	.91E-02
.10E-07	.32E-05	.10E-13	4.000	3.2E-03	26	6.0E+01	2.692	.91E-02
.10E-07	.32E-05	.10E-13	6.000	3.2E-03	20	3.7E+01	3.596	.91E-02
.10E-07	.32E-05	.10E-13	8.000	3.2E-03	17	2.8E+01	4.416	.91E-02
.10E-07	.32E-05	.10E-13	10.000	3.2E-03	16	2.3E+01	5.180	.91E-02
.10E-07	.32E-05	.10E-13	12.000	3.2E-03	14	2.0E+01	5.900	.91E-02
.10E-07	.32E-05	.10E-13	14.000	3.2E-03	13	1.8E+01	6.587	.91E-02
.10E-07	.32E-05	.10E-13	16.000	3.2E-03	12	1.7E+01	7.246	.91E-02
.10E-07	.32E-05	.10E-13	18.000	3.2E-03	11	1.5E+01	7.882	.91E-02
.10E-07	.32E-05	.10E-13	20.000	3.2E-03	11	1.4E+01	8.498	.91E-02
.10E-07	.32E-05	.10E-13	22.000	3.2E-03	10	1.4E+01	9.097	.91E-02
.10E-07	.10E-05	.10E-13	2.000	1.0E-02	51	2.3E+02	1.641	.40E-02
.10E-07	.10E-05	.10E-13	4.000	1.0E-02	24	5.9E+01	2.692	.40E-02
.10E-07	.10E-05	.10E-13	6.000	1.0E-02	19	3.6E+01	3.596	.40E-02
.10E-07	.10E-05	.10E-13	8.000	1.0E-02	16	2.7E+01	4.416	.40E-02
.10E-07	.10E-05	.10E-13	10.000	1.0E-02	15	2.3E+01	5.180	.40E-02
.10E-07	.10E-05	.10E-13	12.000	1.0E-02	13	2.0E+01	5.900	.40E-02

Table B-8 (Continued)

X1	X2	X3	A	P	N	T	A1	Y2
.10E-07	.10E-05	.10E-13	14.000	1.0E-02	12	1.8E+01	6.587	.40E-02
.10E-07	.10E-05	.10E-13	16.000	1.0E-02	11	1.6E+01	7.246	.40E-02
.10E-07	.10E-05	.10E-13	18.000	1.0E-02	11	1.5E+01	7.882	.40E-02
.10E-07	.10E-05	.10E-13	20.000	1.0E-02	11	1.4E+01	8.498	.40E-02
.10E-07	.10E-05	.10E-13	22.000	1.0E-02	9	1.4E+01	9.097	.40E-02
.10E-07	.32E-06	.10E-13	2.000	3.2E-02	47	2.2E+02	1.641	.18E-02
.10E-07	.32E-06	.10E-13	4.000	3.2E-02	22	5.7E+01	2.692	.18E-02
.10E-07	.32E-06	.10E-13	6.000	3.2E-02	17	3.5E+01	3.596	.18E-02
.10E-07	.32E-06	.10E-13	8.000	3.2E-02	15	2.7E+01	4.416	.18E-02
.10E-07	.32E-06	.10E-13	10.000	3.2E-02	14	2.2E+01	5.180	.18E-02
.10E-07	.32E-06	.10E-13	12.000	3.2E-02	12	1.9E+01	5.900	.18E-02
.10E-07	.32E-06	.10E-13	14.000	3.2E-02	11	1.7E+01	6.587	.18E-02
.10E-07	.32E-06	.10E-13	16.000	3.2E-02	10	1.6E+01	7.246	.18E-02
.10E-07	.32E-06	.10E-13	18.000	3.2E-02	10	1.5E+01	7.882	.18E-02
.10E-07	.32E-06	.10E-13	20.000	3.2E-02	10	1.4E+01	8.498	.18E-02
.10E-07	.32E-06	.10E-13	22.000	3.2E-02	9	1.3E+01	9.097	.18E-02
.10E-07	.10E-06	.10E-13	2.000	1.0E-01	44	2.1E+02	1.641	.78E-03
.10E-07	.10E-06	.10E-13	4.000	1.0E-01	21	5.3E+01	2.692	.78E-03
.10E-07	.10E-06	.10E-13	6.000	1.0E-01	16	3.2E+01	3.596	.78E-03
.10E-07	.10E-06	.10E-13	8.000	1.0E-01	14	2.5E+01	4.416	.78E-03
.10E-07	.10E-06	.10E-13	10.000	1.0E-01	13	2.0E+01	5.180	.78E-03
.10E-07	.10E-06	.10E-13	12.000	1.0E-01	11	1.8E+01	5.900	.78E-03
.10E-07	.10E-06	.10E-13	14.000	1.0E-01	10	1.6E+01	6.587	.78E-03
.10E-07	.10E-06	.10E-13	16.000	1.0E-01	9	1.5E+01	7.246	.78E-03
.10E-07	.10E-06	.10E-13	18.000	1.0E-01	9	1.4E+01	7.882	.78E-03
.10E-07	.10E-06	.10E-13	20.000	1.0E-01	9	1.3E+01	8.498	.78E-03
.10E-07	.10E-06	.10E-13	22.000	1.0E-01	8	1.2E+01	9.097	.78E-03
.10E-07	.32E-07	.10E-13	2.000	3.2E-01	41	1.5E+02	1.641	.34E-03
.10E-07	.32E-07	.10E-13	4.000	3.2E-01	19	3.9E+01	2.692	.34E-03
.10E-07	.32E-07	.10E-13	6.000	3.2E-01	15	2.4E+01	3.596	.34E-03
.10E-07	.32E-07	.10E-13	8.000	3.2E-01	13	1.8E+01	4.416	.34E-03
.10E-07	.32E-07	.10E-13	10.000	3.2E-01	12	1.5E+01	5.180	.34E-03
.10E-07	.32E-07	.10E-13	12.000	3.2E-01	11	1.3E+01	5.900	.34E-03
.10E-07	.32E-07	.10E-13	14.000	3.2E-01	10	1.2E+01	6.587	.34E-03
.10E-07	.32E-07	.10E-13	16.000	3.2E-01	9	1.1E+01	7.246	.34E-03
.10E-07	.32E-07	.10E-13	18.000	3.2E-01	9	1.0E+01	7.882	.34E-03
.10E-07	.32E-07	.10E-13	20.000	3.2E-01	9	9.6E+00	8.498	.34E-03
.10E-07	.32E-07	.10E-13	22.000	3.2E-01	8	9.1E+00	9.097	.34E-03

Table B-9

X1	X2	X3	A	P	N	T	A1	Y2
.10E-07	.10E-03	.10E-15	2.000	1.0E-04	78	3.1E+02	1.641	.97E-01
.10E-07	.10E-03	.10E-15	4.000	1.0E-04	38	8.0E+01	2.692	.97E-01
.10E-07	.10E-03	.10E-15	6.000	1.0E-04	29	4.9E+01	3.596	.97E-01
.10E-07	.10E-03	.10E-15	8.000	1.0E-04	24	3.7E+01	4.416	.97E-01
.10E-07	.10E-03	.10E-15	10.000	1.0E-04	23	3.1E+01	5.180	.97E-01
.10E-07	.10E-03	.10E-15	12.000	1.0E-04	20	2.7E+01	5.900	.97E-01
.10E-07	.10E-03	.10E-15	14.000	1.0E-04	18	2.4E+01	6.587	.97E-01
.10E-07	.10E-03	.10E-15	16.000	1.0E-04	18	2.2E+01	7.246	.97E-01
.10E-07	.10E-03	.10E-15	18.000	1.0E-04	17	2.1E+01	7.882	.97E-01
.10E-07	.10E-03	.10E-15	20.000	1.0E-04	17	1.9E+01	8.498	.97E-01
.10E-07	.10E-03	.10E-15	22.000	1.0E-04	15	1.8E+01	9.097	.97E-01
.10E-07	.32E-04	.10E-15	2.000	3.2E-04	75	3.1E+02	1.641	.45E-01
.10E-07	.32E-04	.10E-15	4.000	3.2E-04	36	8.0E+01	2.692	.45E-01
.10E-07	.32E-04	.10E-15	6.000	3.2E-04	27	4.9E+01	3.596	.45E-01
.10E-07	.32E-04	.10E-15	8.000	3.2E-04	23	3.7E+01	4.416	.45E-01
.10E-07	.32E-04	.10E-15	10.000	3.2E-04	22	3.1E+01	5.180	.45E-01
.10E-07	.32E-04	.10E-15	12.000	3.2E-04	19	2.7E+01	5.900	.45E-01
.10E-07	.32E-04	.10E-15	14.000	3.2E-04	18	2.4E+01	6.587	.45E-01
.10E-07	.32E-04	.10E-15	16.000	3.2E-04	17	2.2E+01	7.246	.45E-01
.10E-07	.32E-04	.10E-15	18.000	3.2E-04	16	2.1E+01	7.882	.45E-01
.10E-07	.32E-04	.10E-15	20.000	3.2E-04	16	1.9E+01	8.498	.45E-01
.10E-07	.32E-04	.10E-15	22.000	3.2E-04	15	1.8E+01	9.097	.45E-01
.10E-07	.10E-04	.10E-15	2.000	1.0E-03	71	3.1E+02	1.641	.20E-01
.10E-07	.10E-04	.10E-15	4.000	1.0E-03	34	8.0E+01	2.692	.20E-01
.10E-07	.10E-04	.10E-15	6.000	1.0E-03	26	4.9E+01	3.596	.20E-01
.10E-07	.10E-04	.10E-15	8.000	1.0E-03	22	3.7E+01	4.416	.20E-01
.10E-07	.10E-04	.10E-15	10.000	1.0E-03	21	3.1E+01	5.180	.20E-01
.10E-07	.10E-04	.10E-15	12.000	1.0E-03	18	2.7E+01	5.900	.20E-01
.10E-07	.10E-04	.10E-15	14.000	1.0E-03	17	2.4E+01	6.587	.20E-01
.10E-07	.10E-04	.10E-15	16.000	1.0E-03	16	2.2E+01	7.246	.20E-01
.10E-07	.10E-04	.10E-15	18.000	1.0E-03	15	2.1E+01	7.882	.20E-01
.10E-07	.10E-04	.10E-15	20.000	1.0E-03	15	1.9E+01	8.498	.20E-01
.10E-07	.10E-04	.10E-15	22.000	1.0E-03	14	1.8E+01	9.097	.20E-01
.10E-07	.32E-05	.10E-15	2.000	3.2E-03	68	3.1E+02	1.641	.91E-02
.10E-07	.32E-05	.10E-15	4.000	3.2E-03	33	7.9E+01	2.692	.91E-02
.10E-07	.32E-05	.10E-15	6.000	3.2E-03	25	4.9E+01	3.596	.91E-02
.10E-07	.32E-05	.10E-15	8.000	3.2E-03	21	3.7E+01	4.416	.91E-02
.10E-07	.32E-05	.10E-15	10.000	3.2E-03	20	3.1E+01	5.180	.91E-02
.10E-07	.32E-05	.10E-15	12.000	3.2E-03	17	2.7E+01	5.900	.91E-02
.10E-07	.32E-05	.10E-15	14.000	3.2E-03	16	2.4E+01	6.587	.91E-02
.10E-07	.32E-05	.10E-15	16.000	3.2E-03	16	2.2E+01	7.246	.91E-02
.10E-07	.32E-05	.10E-15	18.000	3.2E-03	14	2.1E+01	7.882	.91E-02
.10E-07	.32E-05	.10E-15	20.000	3.2E-03	14	1.9E+01	8.498	.91E-02
.10E-07	.32E-05	.10E-15	22.000	3.2E-03	13	1.8E+01	9.097	.91E-02
.10E-07	.10E-05	.10E-15	2.000	1.0E-02	65	3.1E+02	1.641	.40E-02

Table B-9 (Continued)

X1	X2	X3	A	P	N	T	A1	Y2
.10E-07	.10E-05	.10E-15	4.000	1.0E-02	31	7.9E+01	2.692	.40E-02
.10E-07	.10E-05	.10E-15	6.000	1.0E-02	24	4.8E+01	3.596	.40E-02
.10E-07	.10E-05	.10E-15	8.000	1.0E-02	20	3.7E+01	4.416	.40E-02
.10E-07	.10E-05	.10E-15	10.000	1.0E-02	19	3.0E+01	5.180	.40E-02
.10E-07	.10E-05	.10E-15	12.000	1.0E-02	16	2.7E+01	5.900	.40E-02
.10E-07	.10E-05	.10E-15	14.000	1.0E-02	15	2.4E+01	6.587	.40E-02
.10E-07	.10E-05	.10E-15	16.000	1.0E-02	15	2.2E+01	7.246	.40E-02
.10E-07	.10E-05	.10E-15	18.000	1.0E-02	14	2.0E+01	7.882	.40E-02
.10E-07	.10E-05	.10E-15	20.000	1.0E-02	14	1.9E+01	8.498	.40E-02
.10E-07	.10E-05	.10E-15	22.000	1.0E-02	12	1.8E+01	9.097	.40E-02
.10E-07	.32E-06	.10E-15	2.000	3.2E-02	61	3.0E+02	1.641	.18E-02
.10E-07	.32E-06	.10E-15	4.000	3.2E-02	29	7.7E+01	2.692	.18E-02
.10E-07	.32E-06	.10E-15	6.000	3.2E-02	22	4.7E+01	3.596	.18E-02
.10E-07	.32E-06	.10E-15	8.000	3.2E-02	19	3.6E+01	4.416	.18E-02
.10E-07	.32E-06	.10E-15	10.000	3.2E-02	18	3.0E+01	5.180	.18E-02
.10E-07	.32E-06	.10E-15	12.000	3.2E-02	15	2.6E+01	5.900	.18E-02
.10E-07	.32E-06	.10E-15	14.000	3.2E-02	14	2.3E+01	6.587	.18E-02
.10E-07	.32E-06	.10E-15	16.000	3.2E-02	14	2.1E+01	7.246	.18E-02
.10E-07	.32E-06	.10E-15	18.000	3.2E-02	13	2.0E+01	7.882	.18E-02
.10E-07	.32E-06	.10E-15	20.000	3.2E-02	13	1.9E+01	8.498	.18E-02
.10E-07	.32E-06	.10E-15	22.000	3.2E-02	12	1.8E+01	9.097	.18E-02
.10E-07	.10E-06	.10E-15	2.000	1.0E-01	58	2.7E+02	1.641	.78E-03
.10E-07	.10E-06	.10E-15	4.000	1.0E-01	28	7.1E+01	2.692	.78E-03
.10E-07	.10E-06	.10E-15	6.000	1.0E-01	21	4.3E+01	3.596	.78E-03
.10E-07	.10E-06	.10E-15	8.000	1.0E-01	18	3.3E+01	4.416	.78E-03
.10E-07	.10E-06	.10E-15	10.000	1.0E-01	17	2.7E+01	5.180	.78E-03
.10E-07	.10E-06	.10E-15	12.000	1.0E-01	14	2.4E+01	5.900	.78E-03
.10E-07	.10E-06	.10E-15	14.000	1.0E-01	13	2.1E+01	6.587	.78E-03
.10E-07	.10E-06	.10E-15	16.000	1.0E-01	13	2.0E+01	7.246	.78E-03
.10E-07	.10E-06	.10E-15	18.000	1.0E-01	12	1.8E+01	7.882	.78E-03
.10E-07	.10E-06	.10E-15	20.000	1.0E-01	12	1.7E+01	8.498	.78E-03
.10E-07	.10E-06	.10E-15	22.000	1.0E-01	11	1.6E+01	9.097	.78E-03
.10E-07	.32E-07	.10E-15	2.000	3.2E-01	55	2.1E+02	1.641	.34E-03
.10E-07	.32E-07	.10E-15	4.000	3.2E-01	26	5.3E+01	2.692	.34E-03
.10E-07	.32E-07	.10E-15	6.000	3.2E-01	20	3.2E+01	3.596	.34E-03
.10E-07	.32E-07	.10E-15	8.000	3.2E-01	17	2.5E+01	4.416	.34E-03
.10E-07	.32E-07	.10E-15	10.000	3.2E-01	16	2.0E+01	5.180	.34E-03
.10E-07	.32E-07	.10E-15	12.000	3.2E-01	14	1.8E+01	5.900	.34E-03
.10E-07	.32E-07	.10E-15	14.000	3.2E-01	13	1.6E+01	6.587	.34E-03
.10E-07	.32E-07	.10E-15	16.000	3.2E-01	13	1.5E+01	7.246	.34E-03
.10E-07	.32E-07	.10E-15	18.000	3.2E-01	12	1.4E+01	7.882	.34E-03
.10E-07	.32E-07	.10E-15	20.000	3.2E-01	12	1.3E+01	8.498	.34E-03
.10E-07	.32E-07	.10E-15	22.000	3.2E-01	11	1.2E+01	9.097	.34E-03

Table B-10

X1	X2	X3	A	P	N	T	A1	Y2
.10E-07	.10E-03	.10E-11	1.200	1.0E-04	201	2.2E+03	1.139	.97E-01
.10E-07	.10E-03	.10E-11	1.400	1.0E-04	107	6.5E+02	1.272	.97E-01
.10E-07	.10E-03	.10E-11	1.600	1.0E-04	77	3.4E+02	1.399	.97E-01
.10E-07	.10E-03	.10E-11	1.800	1.0E-04	61	2.1E+02	1.522	.97E-01
.10E-07	.10E-03	.10E-11	2.000	1.0E-04	51	1.5E+02	1.641	.97E-01
.10E-07	.10E-03	.10E-11	2.200	1.0E-04	45	1.2E+02	1.756	.97E-01
.10E-07	.10E-03	.10E-11	2.400	1.0E-04	41	9.8E+01	1.869	.97E-01
.10E-07	.10E-03	.10E-11	2.600	1.0E-04	37	8.2E+01	1.979	.97E-01
.10E-07	.10E-03	.10E-11	2.800	1.0E-04	33	7.1E+01	2.086	.97E-01
.10E-07	.10E-03	.10E-11	3.000	1.0E-04	31	6.3E+01	2.192	.97E-01
.10E-07	.10E-03	.10E-11	3.200	1.0E-04	29	5.6E+01	2.295	.97E-01
.10E-07	.10E-03	.32E-12	1.200	1.0E-04	213	2.5E+03	1.139	.97E-01
.10E-07	.10E-03	.32E-12	1.400	1.0E-04	114	7.3E+02	1.272	.97E-01
.10E-07	.10E-03	.32E-12	1.600	1.0E-04	82	3.8E+02	1.399	.97E-01
.10E-07	.10E-03	.32E-12	1.800	1.0E-04	65	2.4E+02	1.522	.97E-01
.10E-07	.10E-03	.32E-12	2.000	1.0E-04	54	1.7E+02	1.641	.97E-01
.10E-07	.10E-03	.32E-12	2.200	1.0E-04	48	1.4E+02	1.756	.97E-01
.10E-07	.10E-03	.32E-12	2.400	1.0E-04	43	1.1E+02	1.869	.97E-01
.10E-07	.10E-03	.32E-12	2.600	1.0E-04	39	9.2E+01	1.979	.97E-01
.10E-07	.10E-03	.32E-12	2.800	1.0E-04	36	8.0E+01	2.086	.97E-01
.10E-07	.10E-03	.32E-12	3.000	1.0E-04	33	7.0E+01	2.192	.97E-01
.10E-07	.10E-03	.32E-12	3.200	1.0E-04	31	6.3E+01	2.295	.97E-01
.10E-07	.10E-03	.10E-12	1.200	1.0E-04	226	2.8E+03	1.139	.97E-01
.10E-07	.10E-03	.10E-12	1.400	1.0E-04	121	8.2E+02	1.272	.97E-01
.10E-07	.10E-03	.10E-12	1.600	1.0E-04	86	4.2E+02	1.399	.97E-01
.10E-07	.10E-03	.10E-12	1.800	1.0E-04	69	2.7E+02	1.522	.97E-01
.10E-07	.10E-03	.10E-12	2.000	1.0E-04	58	1.9E+02	1.641	.97E-01
.10E-07	.10E-03	.10E-12	2.200	1.0E-04	51	1.5E+02	1.756	.97E-01
.10E-07	.10E-03	.10E-12	2.400	1.0E-04	46	1.2E+02	1.869	.97E-01
.10E-07	.10E-03	.10E-12	2.600	1.0E-04	42	1.0E+02	1.979	.97E-01
.10E-07	.10E-03	.10E-12	2.800	1.0E-04	38	8.9E+01	2.086	.97E-01
.10E-07	.10E-03	.10E-12	3.000	1.0E-04	35	7.8E+01	2.192	.97E-01
.10E-07	.10E-03	.10E-12	3.200	1.0E-04	33	7.0E+01	2.295	.97E-01
.10E-07	.10E-03	.32E-13	1.200	1.0E-04	238	3.0E+03	1.139	.97E-01
.10E-07	.10E-03	.32E-13	1.400	1.0E-04	128	9.0E+02	1.272	.97E-01
.10E-07	.10E-03	.32E-13	1.600	1.0E-04	91	4.6E+02	1.399	.97E-01
.10E-07	.10E-03	.32E-13	1.800	1.0E-04	73	3.0E+02	1.522	.97E-01
.10E-07	.10E-03	.32E-13	2.000	1.0E-04	61	2.1E+02	1.641	.97E-01
.10E-07	.10E-03	.32E-13	2.200	1.0E-04	54	1.7E+02	1.756	.97E-01
.10E-07	.10E-03	.32E-13	2.400	1.0E-04	48	1.3E+02	1.869	.97E-01
.10E-07	.10E-03	.32E-13	2.600	1.0E-04	44	1.1E+02	1.979	.97E-01
.10E-07	.10E-03	.32E-13	2.800	1.0E-04	40	9.8E+01	2.086	.97E-01
.10E-07	.10E-03	.32E-13	3.000	1.0E-04	38	8.6E+01	2.192	.97E-01
.10E-07	.10E-03	.32E-13	3.200	1.0E-04	35	7.7E+01	2.295	.97E-01
.10E-07	.10E-03	.10E-13	1.200	1.0E-04	251	3.3E+03	1.139	.97E-01
.10E-07	.10E-03	.10E-13	1.400	1.0E-04	135	9.8E+02	1.272	.97E-01
.10E-07	.10E-03	.10E-13	1.600	1.0E-04	96	5.0E+02	1.399	.97E-01
.10E-07	.10E-03	.10E-13	1.800	1.0E-04	77	3.2E+02	1.522	.97E-01
.10E-07	.10E-03	.10E-13	2.000	1.0E-04	64	2.3E+02	1.641	.97E-01

Table B-10 (Continued)

X1	X2	X3	A	P	N	T	A1	Y2
.10E-07	.10E-03	.10E-13	2.200	1.0E-04	57	1.8E+02	1.756	.97E-01
.10E-07	.10E-03	.10E-13	2.400	1.0E-04	51	1.5E+02	1.869	.97E-01
.10E-07	.10E-03	.10E-13	2.600	1.0E-04	46	1.2E+02	1.979	.97E-01
.10E-07	.10E-03	.10E-13	2.800	1.0E-04	42	1.1E+02	2.086	.97E-01
.10E-07	.10E-03	.10E-13	3.000	1.0E-04	40	9.4E+01	2.192	.97E-01
.10E-07	.10E-03	.10E-13	3.200	1.0E-04	37	8.4E+01	2.295	.97E-01
.10E-07	.10E-03	.32E-14	1.200	1.0E-04	264	3.6E+03	1.139	.97E-01
.10E-07	.10E-03	.32E-14	1.400	1.0E-04	141	1.1E+03	1.272	.97E-01
.10E-07	.10E-03	.32E-14	1.600	1.0E-04	101	5.4E+02	1.399	.97E-01
.10E-07	.10E-03	.32E-14	1.800	1.0E-04	80	3.5E+02	1.522	.97E-01
.10E-07	.10E-03	.32E-14	2.000	1.0E-04	68	2.5E+02	1.641	.97E-01
.10E-07	.10E-03	.32E-14	2.200	1.0E-04	59	2.0E+02	1.756	.97E-01
.10E-07	.10E-03	.32E-14	2.400	1.0E-04	54	1.6E+02	1.869	.97E-01
.10E-07	.10E-03	.32E-14	2.600	1.0E-04	49	1.3E+02	1.979	.97E-01
.10E-07	.10E-03	.32E-14	2.800	1.0E-04	45	1.2E+02	2.086	.97E-01
.10E-07	.10E-03	.32E-14	3.000	1.0E-04	42	1.0E+02	2.192	.97E-01
.10E-07	.10E-03	.32E-14	3.200	1.0E-04	39	9.1E+01	2.295	.97E-01
.10E-07	.10E-03	.10E-14	1.200	1.0E-04	276	3.9E+03	1.139	.97E-01
.10E-07	.10E-03	.10E-14	1.400	1.0E-04	148	1.1E+03	1.272	.97E-01
.10E-07	.10E-03	.10E-14	1.600	1.0E-04	106	5.9E+02	1.399	.97E-01
.10E-07	.10E-03	.10E-14	1.800	1.0E-04	84	3.8E+02	1.522	.97E-01
.10E-07	.10E-03	.10E-14	2.000	1.0E-04	71	2.7E+02	1.641	.97E-01
.10E-07	.10E-03	.10E-14	2.200	1.0E-04	62	2.1E+02	1.756	.97E-01
.10E-07	.10E-03	.10E-14	2.400	1.0E-04	56	1.7E+02	1.869	.97E-01
.10E-07	.10E-03	.10E-14	2.600	1.0E-04	51	1.4E+02	1.979	.97E-01
.10E-07	.10E-03	.10E-14	2.800	1.0E-04	47	1.2E+02	2.086	.97E-01
.10E-07	.10E-03	.10E-14	3.000	1.0E-04	44	1.1E+02	2.192	.97E-01
.10E-07	.10E-03	.10E-14	3.200	1.0E-04	41	9.8E+01	2.295	.97E-01
.10E-07	.10E-03	.32E-15	1.200	1.0E-04	289	4.2E+03	1.139	.97E-01
.10E-07	.10E-03	.32E-15	1.400	1.0E-04	155	1.2E+03	1.272	.97E-01
.10E-07	.10E-03	.32E-15	1.600	1.0E-04	111	6.3E+02	1.399	.97E-01
.10E-07	.10E-03	.32E-15	1.800	1.0E-04	88	4.0E+02	1.522	.97E-01
.10E-07	.10E-03	.32E-15	2.000	1.0E-04	74	2.9E+02	1.641	.97E-01
.10E-07	.10E-03	.32E-15	2.200	1.0E-04	65	2.3E+02	1.756	.97E-01
.10E-07	.10E-03	.32E-15	2.400	1.0E-04	59	1.8E+02	1.869	.97E-01
.10E-07	.10E-03	.32E-15	2.600	1.0E-04	54	1.5E+02	1.979	.97E-01
.10E-07	.10E-03	.32E-15	2.800	1.0E-04	49	1.3E+02	2.086	.97E-01
.10E-07	.10E-03	.32E-15	3.000	1.0E-04	46	1.2E+02	2.192	.97E-01
.10E-07	.10E-03	.32E-15	3.200	1.0E-04	43	1.0E+02	2.295	.97E-01
.10E-07	.10E-03	.10E-15	1.200	1.0E-04	302	4.4E+03	1.139	.97E-01
.10E-07	.10E-03	.10E-15	1.400	1.0E-04	162	1.3E+03	1.272	.97E-01
.10E-07	.10E-03	.10E-15	1.600	1.0E-04	116	6.7E+02	1.399	.97E-01
.10E-07	.10E-03	.10E-15	1.800	1.0E-04	92	4.3E+02	1.522	.97E-01
.10E-07	.10E-03	.10E-15	2.000	1.0E-04	78	3.1E+02	1.641	.97E-01
.10E-07	.10E-03	.10E-15	2.200	1.0E-04	68	2.4E+02	1.756	.97E-01
.10E-07	.10E-03	.10E-15	2.400	1.0E-04	62	2.0E+02	1.869	.97E-01
.10E-07	.10E-03	.10E-15	2.600	1.0E-04	56	1.6E+02	1.979	.97E-01
.10E-07	.10E-03	.10E-15	2.800	1.0E-04	51	1.4E+02	2.086	.97E-01
.10E-07	.10E-03	.10E-15	3.000	1.0E-04	48	1.3E+02	2.192	.97E-01
.10E-07	.10E-03	.10E-15	3.200	1.0E-04	45	1.1E+02	2.295	.97E-01

Table B-10 (Continued)

X1	X2	X3	A	P	N	T	AI	Y2
.10E-07	.10E-03	.32E-16	1.200	1.0E-04	314	4.7E+03	1.139	.97E-01
.10E-07	.10E-03	.32E-16	1.400	1.0E-04	169	1.4E+03	1.272	.97E-01
.10E-07	.10E-03	.32E-16	1.600	1.0E-04	121	7.1E+02	1.399	.97E-01
.10E-07	.10E-03	.32E-16	1.800	1.0E-04	96	4.6E+02	1.522	.97E-01
.10E-07	.10E-03	.32E-16	2.000	1.0E-04	81	3.3E+02	1.641	.97E-01
.10E-07	.10E-03	.32E-16	2.200	1.0E-04	71	2.6E+02	1.756	.97E-01
.10E-07	.10E-03	.32E-16	2.400	1.0E-04	64	2.1E+02	1.869	.97E-01
.10E-07	.10E-03	.32E-16	2.600	1.0E-04	58	1.7E+02	1.979	.97E-01
.10E-07	.10E-03	.32E-16	2.800	1.0E-04	54	1.5E+02	2.086	.97E-01
.10E-07	.10E-03	.32E-16	3.000	1.0E-04	50	1.3E+02	2.192	.97E-01
.10E-07	.10E-03	.32E-16	3.200	1.0E-04	47	1.2E+02	2.295	.97E-01

Table B-11

X1	X2	X3	A	P	N	T	A1	Y2
.43E-10	.43E-08	.87E-14	2.000	1.0E-02	36	1.4E+02	1.641	.40E-02
.43E-10	.43E-08	.87E-14	4.000	1.0E-02	17	3.6E+01	2.692	.40E-02
.43E-10	.43E-08	.87E-14	6.000	1.0E-02	13	2.2E+01	3.596	.40E-02
.43E-10	.43E-08	.87E-14	8.000	1.0E-02	11	1.7E+01	4.416	.40E-02
.43E-10	.43E-08	.87E-14	10.000	1.0E-02	10	1.4E+01	5.180	.40E-02
.43E-10	.43E-08	.87E-14	12.000	1.0E-02	8	1.2E+01	5.900	.40E-02
.43E-10	.43E-08	.87E-14	14.000	1.0E-02	8	1.1E+01	6.587	.40E-02
.43E-10	.43E-08	.87E-14	16.000	1.0E-02	8	1.0E+01	7.246	.40E-02
.43E-10	.43E-08	.87E-14	18.000	1.0E-02	7	9.4E+00	7.882	.40E-02
.43E-10	.43E-08	.87E-14	20.000	1.0E-02	7	8.8E+00	8.498	.40E-02
.43E-10	.43E-08	.87E-14	22.000	1.0E-02	6	8.4E+00	9.097	.40E-02

NOMENCLATURE

X1 = mole fraction tritium in feed

X2 = mole fraction tritium in product

X3 = mole fraction tritium in waste

Y2 = mole fraction deuterium in product

A = tritium-hydrogen separation constant

A1 = deuterium-hydrogen separation constant

P = product flow moles/mole feed

W = waste flow moles/mole feed

N = total number of stages

T = total flow moles/mole feed

D = separative duty moles/mole feed

APPENDIX C

TYPICAL DATA OUTPUT FOR AN EXAMPLE CASE

IDEAL CASCADE FOR TRITIUM SEPARATION

	FLOW (MOLES/MOLE FEED)	CONCENTRATION (MOLE FRACTION TRITIUM)
FEED	1	0 4.3400E-11
PRODUCT	9.9980E-03	4.3400E-09
WASTE	9.9000E-01	8.6800E-15

SEPARATION CONSTANT 3.200000

	NUMBER OF STAGES
STRIPPING SECTION	13
ENRICHING SECTION	7
TOTAL	20

	HEADS FLOW MOLES/MOLE FEED	TAILS FLOW MOLES/MOLE FEED
STRIPPING	1.4725E+01	3.2878E+01
ENRICHING	2.7450E+00	4.9103E+00

TOTAL FLOW 5.0977E+01 MOLES / MOLE FEED
SEPARATIVE DUTY 8.3860E+00 MOLES / MOLE FEED

STAGE NUMBER	RATIO OF HEADS TO PRODUCT
1	5.5354E+01
2	8.6297E+01
4	1.1327E+02
6	1.2169E+02
8	1.2433E+02
10	1.2515E+02
12	1.2541E+02
13	1.2546E+02
14	7.1039E+01
15	3.8271E+01
16	1.9953E+01
17	9.7132E+00
18	3.9889E+00
19	7.8885E-01

DEUTERIUM SEPARATION IN THE SAME CASCADE

DEUTERIUM SEPARATION FACTOR = 2.29524

DEUTERIUM MOLE FRACTION IN PRODUCT STREAM = .4003E-02

REFERENCES

1. S. V. Ribnokoy and J. D. Pupezin, Decontamination of Tritium Activities from Waste Waters of Nuclear Industry - A Feasibility Study, EPA Report, Laboratory of Physical Chemistry, Boris Kidric Institute, Belgrade, Yugoslavia (Contract EPA-PR-2-516-1), February 28, 1973.
2. K. H. Lin, Tritium Enrichment by Isotope Separation Technique, USAEC Report, Oak Ridge National Laboratory, ORNL-TM-3976, December 1972.
3. M. Benedict and T. H. Pigford, Nuclear Chemical Engineering, McGraw-Hill, New York 1957.

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