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COST FUNCTION STUDIES FOR POWER REACTORS

by

J. Heestand and L. T. Wos

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J. Heestand and L. T. Wos

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TABLE OF CONTENTS

	Page
ABSTRACT	3
I. INTRODUCTION	3
II. DEVELOPMENT OF COST FUNCTION	3
A. Revenue	4
B. Capital Charges	4
C. Profit	5
D. Operating Expenses	5
1. Ad valorem Charges	5
2. Operation and Maintenance Costs	5
3. Fuel-cycle Cost	5
4. Liability Insurance	6
5. Taxes	7
III. CONCLUDING REMARKS	8
APPENDICES	11
A. Description of the IBM 704 Program 0908/RE224	11
B. Fast Reactor Fuel Cycle Cost Analysis	20
C. Operating Instructions	21
D. Flow Chart	22
E. Code Listing	27
F. Sample Problem Input and Output	53
G. Sample Work Sheet	60
REFERENCES	64
ACKNOWLEDGEMENTS	64

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ABSTRACT

A function to evaluate the cost of electricity produced by a nuclear power reactor is developed. The basic equation, revenue = capital charges + profit + operating expenses, is expanded in terms of various cost parameters to enable analysis of multiregion nuclear reactors with uranium and/or plutonium for fuel. A corresponding IBM 704 computer program, which will compute either the price of electricity or the value of plutonium, is presented in detail in the appendices.

I. INTRODUCTION

The industrial application of any large engineering system requires a critical examination of the economic factors involved in its use. Following the suggestion of the use of nuclear reactors for the generation of electric power, there has arisen an interest in examining the economic aspects of the operation of such a reactor power station. For this purpose a program directed toward carrying out a rather thorough analysis of reactor power stations has been initiated, the first step of which is the development of an appropriate cost function for the system. The purpose of this paper is to discuss the development of the cost function, which in this case gives the cost in mills per kilowatt hour of generated electricity as a function of the various cost parameters. The cost function contains minor simplifications whose effect on mills per kilowatt hour is insignificant; it is not intended to serve as an accounting technique. This work bears a close resemblance to that of J. M. McCampbell,[a] with revisions to incorporate recent changes in insurance laws, elaboration of the treatment of fuel cycle cost, and refinements to give access to more detailed information and to permit further studies which are contemplated.

II. DEVELOPMENT OF COST FUNCTION

The basis for the analysis is contained in the equation

$$\text{revenue} = \text{capital charges} + \text{profit} + \text{operating expenses}, \tag{1}$$

which is assumed to hold true for each period of time (one year in this program) in which the reactor is operated to produce electricity.

A. Revenue

There are two sources of revenue, the sale of electricity and the sale of plutonium (or U^{233}). We ignore all other fission byproducts as sources of revenue.

$$\text{Annual electric revenue (\$)} = 8.76 \times 10^3 \, P \eta \epsilon m \quad , \tag{2}$$

where P is the thermal power rating of the reactor in megawatts, η is the net thermal efficiency, ϵ is the plant factor, and m is the cost of electricity to the user in mills per kilowatt hour.

$$\text{Annual revenue (\$) from sale of plutonium} = 10^3 \, Av/\tau \quad , \tag{3}$$

where A is the amount in kilograms of plutonium produced by one fuel charge in exposure time τ years and v is the value in dollars of one gram of plutonium.

B. Capital Charges

Capital charges are just those charges needed to redeem capital spent on construction, research and development, the corresponding interest, and the interest on capital spent for land. We wish to redeem interest on the various sums involved, whether it occurs as a result of actually borrowing capital or as a result of interest lost by utilizing available funds in these connections instead of investing them. We make the assumptions that the value of land is a constant and that available interest on sinking funds is equal percentagewise to those interests referred to above. We then have

$$(\text{capital charges})\left(\frac{(1+i)^n - 1}{i}\right) + I_\ell = \frac{1}{\beta} I_d (1+i)^{n_d + n} + (I_c + I_\ell)(1+i)^{n_c + n} \quad , \tag{4}$$

where, remembering that the assumption with sinking funds is that the payment is made at the end of each period, $[(1+i)^n - 1]/i$ is the sinking fund factor which gives the value of a sinking fund consisting of n equal payments at interest i, n is the life of the plant in years, β is the number of plants over which research and development costs are distributed, I_d is the research and development cost, n_d is the average lead time in years for research and development, I_c and I_ℓ are the respective costs for construction and land, and n_c is the number of years capital is tied up in land and construction prior to startup. By transposing the cost of land and dividing by $(1+i)^n$, we have an equation stating that the present value of the sinking fund resulting from annual capital charges is equal to the present net value of the capital transaction. In other words, capital charges refer to that amount of money deposited in equal payments at the

end of each operating year in a sinking fund such that the value of that fund when the plant has zero salvage value is precisely the difference between the value of the invested capital at that time and the value of land; the value of invested capital at the end of the life of the plant is expressed by the right side of Equation (4).

C. Profit

The profit parameter ω is given as a percentage of the value of invested capital at startup, and is not to be confused with the present value of all capital transactions. The value of ω is obtained by levelizing the desired profit over the lifetime of the plant. The profit in dollars is thus $\omega\left[\frac{1}{\beta} I_d(1+i)^{n_d} + (I_c + I_\ell)(1+i)^{n_c}\right]$. At present, the value of ω is supplied to, rather than computed by, the program.

D. Operating Expenses

Operating expenses consist of: ad valorem charges, operation and maintenance, fuel-cycle costs, and insurance and taxes not proportional to the value of the plant.

1. Ad valorem Charges. Ad valorem charges (plant insurance, property damage insurance, and property taxes) are assessed against the appraised value of the property. The sum of these charges is given by

$$(\phi + \chi + \psi)\ \delta(I_c + I_\ell) \quad ,$$

where ϕ, χ, and ψ are the respective rates, and δ is the ratio of appraised value to actual.

2. Operation and Maintenance Costs. Operation and maintenance costs are estimated by the user of the program. They include salaries, equipment, supplies, and overhead.

3. Fuel-cycle Cost. Fuel-cycle cost is computed from supplied cost parameters; there is no attempt at this time to include any core design study or any technique for minimization of this cost. We are able to consider a multiregion core, a multiregion blanket, and, as fuel, enriched uranium, plutonium, or some combination of these fuels restricted to separate regions. The fuel-cycle cost is, therefore, the sum of the costs for the various regions. Any credit for plutonium production is added as revenue and not placed against fuel-cycle cost directly. For any one region, the fuel-cycle cost has four components: first, the product of the throughput of fuel, adjusted to compensate for various losses, and the sum of the unit costs for conversion, fabrication, reprocessing, shipping, and

waste disposal; second, a use-charge proportional to the use-charge rate, value of fuel at the appropriate enrichment, and the time in which the fuel is not in AEC possession; third, a burnup charge from the loss in value of the fuel; fourth, the cost of reducing produced plutonium to metal buttons. Since annual loading equals initial loading divided by residence time, fuel-cycle cost is given by the equation

$$
\begin{aligned}
fc = \sum_k \Bigg[& u L_{3k} V(e_1)_k + \frac{1}{\tau_k} \Bigg\{ \Big[c_{ck}(1 + \ell_{ck} + \ell_{fk}) + c_{fk}(1 + \ell_{fk}) + c_{rk} + c_{sk} + c_{s'k} + c_{wk}\ell_{wk} \Big] L_{1k} \\
& + \Big[(t_{ck} + t_{fk} + t_{sk}) V(e_1)_k + \tau_k \left(\frac{V(e_1)_k + V(e_2)_k}{2} \right) + (t_{dk} + t_{rk} + t_{s'k}) V(e_2)_k \Big] u L_{1k} (1 + \ell_{ck} + \ell_{fk}) \qquad (5) \\
& + \Big[V(e_1)_k L_{1k}(1 + \ell_{ck} + \ell_{fk}) - V(e_2)_k L_{2k} \Big] + A_k c_{pk} 10^3 \Bigg\} \Bigg] ,
\end{aligned}
$$

(the subscript k designates the region)

where: c_c, c_f, c_r, c_s, $c_{s'}$, and c_w are unit costs per kilogram of conversion, fabrication, reprocessing, shipping of new and irradiated fuel, and radioactive waste disposal, respectively; t_c, t_f, t_r, t_s and $t_{s'}$ are the corresponding times required for the processes; t_d is the time necessary for radioactive decay of spent fuel before reprocessing; τ is the residence time; u is the use-charge rate; $V(e_1)$ denotes the value at initial enrichment e_1, and $V(e_2)$ the value at enrichment e_2 at discharge; L_1, L_2, and L_3 are the weights of fuel at initial loading, after reprocessing and for the inventory; ℓ_c and ℓ_f are those percentages by which L_1 must be increased to compensate for losses in conversion and fabrication, respectively*; ℓ_w is the percentage of L_1 to be disposed of as radioactive waste; A is the amount of plutonium produced by one loading; and c_p is the cost per gram of reducing plutonium to metal buttons.

4. Liability Insurance. According to the latest law on liability insurance for power reactors, the required coverage is determined in the following manner. If the maximum allowable power does not exceed 10 kw(thermal), the required coverage is 1 million dollars; if greater than 10 kw(t) but does not exceed 1 mw(t), 1.5 million; if greater than 1 mw(t) but does not exceed 10 mw(t), 2.5 million. If the power rating in mw(electrical) exceeds 100, the required coverage is 60 million. For those reactors not yet covered, apply the formula x = Bp, where x is coverage in dollars rounded up to the nearest hundred thousand, B is the base amount of financial protection, and p is the population factor. The coverage x must be between 3.5 and 60 million; B equals 150 dollars times maximum allowable power in kw(t); p is between 1 and 1.5 and is determined by the magnitude of the nearby population.

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*To avoid confusion it should be understood that ℓ_c equals 0.15 if, for example, the loss from conversion is 15%.

The parameter of interest, however, is the amount of premium. Not allowing a premium rate to be less than 1,000 dollars per million of coverage, the premium schedule is: the base premium for the first million, 0.5 of base for each of the next 4 million, 0.2 of base for each of next 5, 0.1 for each of next 10, 0.05 for each of next 20, and 0.025 for each million of coverage above 40 million. Annual cost of liability insurance $P\ell$ is given by

$$P\ell = a_1 \kappa + 0.5\, a_1 \lambda + 0.2\, a_1 \mu + 0.1\, a_1 \nu + 0.05\, a_1 \xi + 0.025\, a_1 \zeta \,, \quad (6)$$

where a_1 is the base premium and $\kappa, \lambda, \mu, \nu, \xi$, and ζ are the number of millions at the corresponding premium.

5. Taxes. The taxes are of two kinds: state income and federal income. State tax S is assessed at the rate j_S on the difference between gross revenue and the tax deductibles. The tax deductibles consist of ad valorem charges, operation and maintenance cost, fuel-cycle cost, liability insurance, interest on the bonded fraction of invested capital at startup, and depreciation. For the tax calculation the shortest allowable time for straight-line depreciation is taken. The federal income tax F is obtained by taking that revenue taxable by the state, subtracting from it the money paid as state income tax, and taxing this modified revenue at the rate j_F. With b the bonded fraction of capitalization, $\underline{i}$ the interest rate on the bonds, and n' the depreciation time, the tax equations are

$$S = j_S \Bigg(8.76 \times 10^3 P \eta \epsilon m + 10^3 (Av/\tau) - (\phi + \psi + \chi)(I_c + I_\ell)\delta - OM - fc - P_\ell - \frac{1}{n'}\left[\frac{1}{\beta} I_d + I_c\right] - b_{\underline{i}}\left[\frac{1}{\beta} I_d (1+i)^{n_d} + (I_c + I_\ell)(1+i)^{n_c}\right]\Bigg) \quad (7)$$

and

$$F = j_F (1 - j_S)\, S/j_S \quad . \quad (8)$$

If the reactor power station is part of a larger complex and, therefore, its taxes are not computed separately but are instead assigned as a fraction g of the revenue dollar; its reduced revenue, 1-g times gross revenue, must equal the sum of capital charges and operating expenses exclusive of taxes. By using the selector α, which takes on the value 0 or 1, we can handle either tax situation. This is accomplished by replacing revenue in Equation (1) by $(1 - \alpha g)$ revenue and by replacing the tax contribution in Equation (1) by $(1 - \alpha)(F + S)$. Thus, when α is 0, we are in the first case; and when α is 1, the tax contribution is nullified and the gross revenue reduced accordingly, and we are in the second.

Using Equations (1) and (2) and letting I be the present value of all capital transactions and $a_{\overline{n}|} = [1 - (1 + i)^{-n}]/i$, we have

$$a_{\overline{n}|} \text{ revenue} = I + a_{\overline{n}|} \text{ profit} + a_{\overline{n}|} \text{ operating expenses} \quad , \tag{9}$$

which says that the present value of annual revenue equals the present value of annual capital charges plus the present value of annual profit plus the present annual operating expenses all taken over the life of the plant. By expanding Equation (9) in the parameters discussed above, we can solve for m, obtaining

$$m = \frac{1}{8.76 \times 10^3 \, P \eta \epsilon [(1 - \alpha g) - (1 - \alpha) j]} \times$$

$$\Big\{ I/a_{\overline{n}|} + [1 - (1 - \alpha) j][\phi + \chi + \psi) \delta (I_c + I_\ell) + OM + fc + P_\ell]$$

$$+ [\frac{1}{\beta} I_d (1 + i)^{n_d} + (I_c + I_\ell)(1 + i)^{n_c}][\omega - (1 - \alpha) j \, b_{\underline{i}}]$$

$$- (1 - \alpha) j \frac{1}{n'} \left[\frac{1}{\beta} I_d + I_c \right] + [(1 - \alpha) j - (1 - \alpha g)][10^3 \, Av/\tau] \Big\} \quad , \tag{10}$$

where $j = j_S + j_F - j_S j_F$. Thus, if we are given average values for the parameters involved, we can determine the average price to be charged for the electricity produced by the power reactor in order to cover the various costs and still yield the desired average profit. For the public power station operating on a nonprofit basis, we just set the profit parameter ω to 0 and follow our usual procedure. The question of a year with unusual operating conditions may be of interest to the utility - for example, the first year with its attendant startup problems and, therefore, costs. To compute the corresponding charge for electricity necessary to maintain the desired revenue cost balance when viewed as a one-year problem, we need only adjust the affected cost parameters accordingly, since the value of fixed charges is not changed by such considerations.

III. CONCLUDING REMARKS

Since the selling price of electricity produced by power reactors may be very dependent on the value placed on the simultaneously produced plutonium, the pricing of plutonium is a very relevant consideration. We have applied the analysis above to this problem, interchanging the roles of electricity cost and plutonium value, and thus developed an IBM 704 program to yield the value of plutonium when assigning a selling price for electricity therein produced.

By use of the cost function discussed in this paper, or the corresponding IBM 704 program, one can gain information about the economic competitiveness of a given reactor with other means of producing electricity. By a differential analysis of such cost functions, the importance of the various cost parameters can be seen. Thus, for example, the effect of a small change in use-charge rate or a change in tax rate can easily be assessed. Differentiating with respect to u, the use-charge, we have

$$\frac{\partial m}{\partial u} = \frac{[(1 - \alpha g) - (1 - \alpha)j]^{-1}}{8.76 \times 10^3 \, P\eta\epsilon} \times$$

$$\sum_k \left\{ L_{3k} V(e_1)_k + \frac{1}{\tau_k} \left[(t_{ck} + t_{fk} + t_{sk}) V(e_1)_k + \tau_k \left(\frac{V(e_1)_k + V(e_2)_k}{2} \right) \right.\right.$$

$$\left.\left. + (t_{dk} + t_{rk} + t_{s'k}) V(e_2)_k \right] L_{1k} (1 + \ell_{ck} + \ell_{fk}) \right\} , \qquad (11)$$

which shows that a doubling of the use-charge would cause the cost in mills per kilowatt hour to increase by

$$\frac{u[(1 - \alpha g) - (1 - \alpha)j]^{-1}}{8.76 \times 10^3 \, P\eta\epsilon} \times$$

$$\sum_k \left\{ L_{3k} V(e_1)_k + \frac{1}{\tau_k} \left[(t_{ck} + t_{fk} + t_{sk}) V(e_1)_k + \tau_k \left(\frac{V(e_1)_k + V(e_2)_k}{2} \right) \right.\right.$$

$$\left.\left. + (t_{dk} + t_{rk} + t_{s'k}) V(e_2)_k \right] L_{1k} (1 + \ell_{ck} + \ell_{fk}) \right\} .$$

Another partial, perhaps of equal interest, is that with respect to j, the tax rate:

$$\frac{\partial m}{\partial j} = (1 - \alpha) \left\{ I/a_{\overline{n}|} + [1 - (1 - \alpha g)] [(\phi + \psi + \chi) \delta (I_c + I_\ell) + OM + fc + P_\ell] \right.$$

$$+ [\omega - (1 - \alpha g) \, b\underline{i}] [\frac{1}{\beta} I_d (1 + i)^{n_d} + (I_c + I_\ell)(1 + i)^{n_c}] \qquad (12)$$

$$\left. - (1 - \alpha g) \frac{1}{n'} \left[\frac{1}{\beta} I_d + I_c \right] \right\} \div \left\{ 8.76 \times 10^3 \, P\eta\epsilon \, [(1 - \alpha g) - (1 - \alpha)j]^2 \right\} .$$

Such an analysis can indicate those areas in which, from an economic viewpoint, technological progress is needed.

APPENDIX A

DESCRIPTION OF THE IBM 704 PROGRAM 0908/RE224

STATEMENT OF THE PROBLEM: RE224 is a program for the IBM 704 that will evaluate m, the cost of electricity (mills/kwhr), or v, the value of plutonium ($/gm), for a nuclear power plant, given various cost parameters as input.

The cost of electricity, m, can be evaluated for either a nuclear power plant or a fossil-fueled power plant by the following equation:

$$m = \frac{1}{8.76 \times 10^3 \, P\eta\epsilon \, [(1-\alpha g) - (1-\alpha)j]}$$

$$\times \Big\{ (1/a_{\overline{n}|}) + [1-(1-\alpha)j][(\phi + \chi + \psi)\ \delta(I_c + I_\ell) + OM + P_\ell + fc_t]$$

$$+ [I + I_\ell(1+i)^{-n}][\omega - (1-\alpha)j\, b_{\overline{i}|} - (1-\alpha)j \frac{1}{n'}\left(\frac{1}{\beta} I_d + I_c\right)$$

$$+ [(1-\alpha)j - (1-\alpha g)][10^3 \, Av/\tau]\Big\} \quad ,$$

where

$$I = \frac{1}{\beta} I_d (1+i)^{n_d} + (I_c + I_\ell)(1+i)^{n_c} - I_\ell (1+i)^{-n} \quad ,$$

$$j = j_S + j_F - j_S j_F \quad ,$$

$$a_{\overline{n}|} = \frac{1-(1+i)^{-n}}{i} \quad ,$$

$$P_\ell = \begin{cases} 0 \text{ for fossil-fueled plant} \\ \kappa a_1 + \lambda 0.5\, a_1 + \mu 0.2\, a_1 + \nu 0.1\, a_1 + \xi 0.05\, a_1 + \zeta 0.025\, a_1 \text{ for nuclear power plant,} \end{cases}^{(1)*}$$

$$\tau_k = \begin{cases} \text{assumed one year for fossil-fueled plant} \\ \dfrac{2.7397 \times 10^{-3}\, E_{tk}}{\epsilon P} \text{ for nuclear power plant}^{(2)} \end{cases} = \text{residence time,}$$

$$Av/\tau = \begin{cases} 0 \text{ for fossil-fueled plant} \\ \sum_{k=1}^{NFCB+NFCC} A_k/\tau_k \text{ for nuclear power plant, and} \end{cases}$$

---

* See notes at end of Appendix A

$$fc_t = \begin{cases} \text{input for fossil-fueled plant} \\ Q_1 + Q_2 + Q_3\, v \cdot 10^3 \text{ for nuclear power plant} \end{cases}$$

In the equation for fc_t,

$$Q_1 = \sum_{k=1}^{NFCB+NFCC} 1/\tau_k \left\{ \left[c_{ck}(1+\ell_{ck}+\ell_{fk}) + c_{fk}(1+\ell_{fk}) + c_{rk} + c_{sk} + c_{s'k} + c_{wk}\ell_{wk} \right] L_{1k} + A_k c_{pk} 10^3 \right\}$$

$$Q_2 = \sum_{k=1}^{NFCB} u_k L_{3k} V(e_1)_k + \frac{1}{\tau_k} \left\{ \left[\left(t_{ck} + t_{fk} + t_{sk} \right) V(e_1)_k + \tau_k \left(\frac{V(e_1)_k + V(e_2)_k}{2} \right) \right.\right.$$

$$\left.\left. + \left(t_{dk} + t_{rk} + t_{s'k} \right) V(e_2)_k \right] u_k L_{1k}(1+\ell_{ck}+\ell_{fk}) + \left[V(e_1)_k L_{1k}(1+\ell_{ck}+\ell_{fk}) - V(e_2)_k L_{2k} \right] \right\} ,$$

and

$$Q_3 = \sum_{k=NFCB+1}^{NFCB+NFCC} u_k L_{3k} + 1/\tau_k \left\{ \left[(t_{ck} + t_{fk} + \tau_k + t_{dk} + t_{rk} + t_{sk} + t_{s'k}) u_k + 1 \right] L_{1k}(1+\ell_{ck}+\ell_{fk}) - L_{2k} \right\} ,$$

with

$$V(e_p) = \left\{ C_F \left(\frac{e_p - e_w}{e_F - e_w} \right) + C_\Delta \left[V_p + \left(\frac{e_p - e_F}{e_F - e_w} \right) V_w - \left(\frac{e_p - e_w}{e_F - e_w} \right) V_F \right] \right\}$$

defined as the value of the product fuel at enrichment e_p, $p = 1,2$, and

$$V_\zeta = (2e_\zeta - 1)\, \ell n \left(\frac{e_\zeta}{1 - e_\zeta} \right)$$

defined as the separation potential of the ζth stream, $\zeta = p, w, F^{(c)}$.

The parameter NFCB designates the number of uranium fuel regions in the reactor and NFCC, the number of plutonium fuel regions.

The value of plutonium, v, can be evaluated for a uranium- or a plutonium-fueled plant by the following equation:

$$v = \frac{1}{[(1-\alpha g) - (1-\alpha)j]\, 10^3 (A/\tau) - [1 - (1-\alpha)j]\, Q_3 \times 10^3}$$

$$\times \left\{ (I/a_{\bar{n}|}) - 8.76 \times 10^3\, P\, \eta \epsilon m [(1-\alpha g) - (1-\alpha)j] \right.$$

$$+ [\omega - (1-\alpha)j\, b_{\bar{i}|}][I + I_\ell (1+i)^{-n}] - (1-\alpha)j \frac{1}{n'} \left(\frac{1}{\beta} I_d + I_c \right)$$

$$\left. + [1 - (1-\alpha)j][(\phi + \psi + \chi)\, \delta(I_c + I_\ell) + OM + P_\ell + Q_1 + Q_2] \right\} ,$$

where I, j, $a_{\bar{n}|}$, P_ℓ, τ, Q_1, Q_2, and Q_3 are as defined above for uranium-fueled plants

and

$$A/\tau = \sum_{k=1}^{NFCB+NFCC} A_k/\tau_k .$$

Further analysis of the fuel cycle cost equation can be found in Appendix B.

MACHINE: This program is written in FORTRAN for an IBM 704 with core storage of at least 8K, an on-line card reader, and an on-line printer or one magnetic tape unit.

RUNNING TIME: A problem takes less than one-minute running time with tape output.

INPUT INFORMATION REQUIRED: The input parameters, together with the values of the associated index J (to be explained later), are as follows:

J	Parameter	Description
1	MCALC	0 - v-calculation 1 - m-calculation
2	NFCB	number of uranium regions; $0 \leq NFCB \leq 10$
3	NFCC	number of plutonium regions; $0 \leq NFCC \leq 10$; $0 \leq NFCB + NFCC \leq 10$ (both 0 for fossil-fuel case)
4	β	number of plants over which design and development costs are distributed
5	i	interest rate (% x 10^{-2})
6	I_c	investment in construction ($)
7	I_d	investment in design and development ($)
8	I_ℓ	investment in land ($)
9	n	plant life (yr)
10	n_c	average lead time for construction (yr)
11	n_d	average lead time for design (yr)
12	ϵ	plant factor (% x 10^{-2})
13	η	plant net thermal efficiency (% x 10^{-2})
14	P	thermal power rating of reactor (TMW)
15	v	value of plutonium as metal buttons ($/gm)
16	m	cost of generating electric power (mills/kwhr)
17	OM	operating and maintenance cost ($/yr)
18	ω	annual levelized return on investment (% x 10^{-2})

J	Parameter	Description
19	χ	ad valorem rate for property taxes (% x 10^{-2})
20	δ	appraisal fraction (% x 10^{-2})
21	ϕ	ad valorem rate for plant insurance (% x 10^{-2})
22	ψ	ad valrem rate for property damage insurance (% x 10^{-2})
23	a_1	base rate of premium on liability insurance ($ per $ million)
24	PF	population factor
25	α	0 - calculation for individual plant 1 - calculation for company as a whole
26	b	fraction of capitalization by bonds (% x 10^{-2})
27	$\underline{i}$	interest on bonds (% x 10^{-2})
28	j_F	federal income tax rate (% x 10^{-2})
29	j_S	state income tax rate (% x 10^{-2})
30	n'	shortest period allowed for straight line depreciation for tax deduction (yr)
31	g	average ratio of annual income tax payments to annual gross revenue (% x 10^{-2})
32	fc_t	0 for nuclear power case "fuel cycle cost" for fossil-fueled case ($/yr)
33-42	L_1	initial fuel loading (kg)
43-52	L_2	amount of fuel after reprocessing (kg)
53-62	L_3	amount of inventory fuel (kg)
63-72	ℓ_c	percent by which L_1 must be increased to compensate for loss due to conversion (% x 10^{-2})
73-82	ℓ_F	percent by which L_1 must be increased to compensate for loss due to fabrication (% x 10^{-2})
83-92	ℓ_w	percent of L_1 to be disposed of as radioactive waste (% x 10^{-2})
93-102	c_c	cost of conversion to fuel meat material ($/kg)
103-112	c_f	cost of fabricating fuel elements ($/kg)
113-122	c_r	cost of reprocessing fuel ($/kg)

J	Parameter	Description
123-132	c_w	cost of radioactive waste disposal ($/kg)
133-142	c_s	cost of shipping new fuel ($/kg)
143-152	c_s'	cost of shipping irradiated fuel ($/kg)
153-162	t_c	conversion time (yr)
163-172	t_f	fabrication time (yr)
173-182	t_r	reprocessing time (yr)
183-192	t_d	radioactive decay time for "cooling" (yr)
193-202	t_s	shipping time for new fuel (yr)
203-212	t_s'	shipping time for irradiated fuel (yr)
213-222	e_1*(3)	initial uranium fuel enrichment (wt % x 10^{-2})
223-232	e_2*	discharge uranium fuel enrichment (wt % x 10^{-2})
233-242	C_Δ*	cost of separative work ($/kg)
243-252	C_F*	cost of feed material ($/kg)
253-262	e_F*	feed stream enrichment in separation plant (wt % x 10^{-2})
263-272	e_w*	waste stream enrichment in separation plant (wt % x 10^{-2})
273-282	A	amount of plutonium produced with one fuel charge (kg)
283-292	c_p	cost of reducing plutonium nitrate to metal buttons ($/gm)
293-302	E_t	integrated fission energy (TMW day)
303-312	u	use charge rate (% x 10^{-2}/yr).

The input format is as follows:

Card 1	title card of up to 72 Hollerith characters including a 1 in column 1	
Card 2	3I12(4)	MCALC, NFCB, NFCC
Card 3	6E12.5	β, i, I_c, I_d, I_ℓ, n
Card 4	2E12.5	n_c, n_d
Card 5	5E12.5	ϵ, η, p, v, m

Card 6	1E12.5	OM
Card 7	1E12.5	ω
Card 8	4E12.5	χ, δ, ϕ, ψ
Card 9	2E12.5	a_1, PF
Card 10	6E12.5	α, b, $\underline{i}$, j_F, j_S, n'
Card 11	1E12.5	g
Card 12	1E12.5	fc_t
Card 13	6E12.5	L_1, L_2, L_3, ℓ_c, ℓ_f, ℓ_w
Card 14	6E12.5	c_c, c_f, c_r, c_w, c_s, c_s'
Card 15	6E12.5	t_c, t_f, t_r, t_d, t_s, t_s'
Card 16	6E12.5	e_1, e_2, C_Δ, C_F, e_F, e_w
Card 17	4E12.5	A, c_p, E_t, u.

There must be NFCB + NFCC sets of cards number 13 through 17, and the data for all the uranium regions (NFCB sets) must precede the data for the plutonium regions (NFCC sets).

To facilitate parameter studies, as many sets of the following NPC + 1 cards as desired (including 0) may follow the above data:

Card "1"	I12	NPC -	the number of parameter changes in the next case
Card "2"	I12,E12.5	J_1,PA(J_1) -	the index of the parameter to be changed and the new value of that parameter
.	.	.	
.	.	.	
.	.	.	
Card "NPC + 1"	I12,E12.5	J_{NPC},PA(J_{NPC}).	

A blank card must be the last card for each problem.

Any desired number of problems can be run consecutively.

POSSIBLE OUTPUT: Output from an m-calculation consists of:

m (mills-kwhr)

Capital charges = I ($/yr)

Ad valorem charges = $(\phi + \psi + \chi)\,\delta\,(I_c + I_\ell)$ ($/yr)

Liability insurance premium = P_ℓ ($/yr)

Total revenue = $8.76 \times 10^3 P\eta\epsilon m + 10^3 Av/\tau$ (\$/yr)

Electric revenue = $8.76 \times 10^3 P\eta\epsilon m$ (\$/yr)

Plutonium revenue = $10^3 Av/\tau$ (\$/yr)

Operating expenses = ad valorem + OM + P_ℓ + fc_t + taxes (\$/yr)

Profit = $\omega\ [I + I_\ell(1+i)^{-n}]$ (\$/yr)

State income tax = $j_S N_S$ (\$/yr)

Federal income tax = $j_F(1 - j_S) N_S$ (\$/yr)

Total fuel cycle costs = fc_t (\$/yr)

Value of fuel at initial and final enrichment = $V(e_1)$ and $V(e_2)$ (\$/kg) (for uranium regions of nuclear power plant only),

where

Taxes = federal income tax + state income tax

and

$$N_S = \text{revenue} - fc_t - \text{OM} - \text{ad valorem charges} - P_\ell - \frac{1}{n'}\left[\frac{1}{\beta} I_d + I_c\right] - bi\left[\frac{1}{\beta} I_d (1+i)^{n_d} + (I_c + I_\ell)(1+i)^{n_c}\right]$$

Output from a v-calculation is the same as that for an m-calculation except that m is replaced by v.

SPECIAL FEATURES, RESTRICTIONS, AND PROGRAM LIMITATIONS:

1. In computing federal and state taxes, a negative result is possible if tax deductibe expenses exceed the revenue. In this case the taxes are set equal to 0 and m or v appropriately adjusted.

2. Liability insurance coverage required is rounded up to the nearest \$100,000.

3. Parameter studies are possible without rereading the entire data deck, as is apparent from the description of the input format. To facilitate storage of the new values of changed parameters, an index J has been assigned to each parameter (see list of input parameters). The index J associated with a fuel-cycle-cost parameter has 10 possible values, one for each possible fuel cycle. For example, the value of A in the third fuel cycle would have index J = 275. The values of NFCB and NFCC may be changed to 0 and later restored to their original values to enable a comparison with fossil-fueled plants. No other changes in NFCB and NFCC are permitted. Any parameter changes made will remain in effect in succeeding cases until changed.

4. Depressing Sense Switch 1 will produce additional output (labelled) for use in debugging. This output consists of: $a_{\overline{n}|}$, Q_1, Q_2, and Q_3, which have been defined previously; $I_p = I - I_\ell(1 + i)^{-n}$; and T_1, T_2, T_3, and T_4 which are intermediate terms defined in the flowchart in boxes 402 and 404 for an m calculation and in box 401 for a v calculation.

NOTES:

(1) See reference (b), table on page 5 of reference (a), and Section II.D.4 of this report for details on liability insurance premiums.

(2) For theoretical physics purposes, τ, the residence time, may be defined as $y\theta/\phi_{100}\epsilon$, where

θ = integrated flux time (cm^{-2}),

ϕ_{100} = spatial average of neutron flux at 100% power ($cm^{-2}sec^{-1}$),

ϵ = plant factor (% x 10^{-2}), and

y = number of years per second = 3.1709×10^{-8}.

(3) Starred parameters are defined for uranium regions only. They should be set equal to zero for plutonium regions.

(4) MCALC, NFCB, NFCC, NPC, and J must be written as integers (no decimal point) and right adjusted in their respective card fields. For example, if NFCC = 4, the 4 goes in column 36 of card 2 and columns 25-35 must be blank. All other parameters must be written as floating point numbers with format E12.5. For example, the number -0.035 would be written as -3.50000E-02.

704 INPUT DATA
FORM I

PROBLEM SAMPLE INPUT FORM ORIGINATOR PROGRAM 0908/RE 224 DATE PAGE OF

1 Title						TITLE 1
MCALC	NFCB	NFCC				PARAMS 2
β	i	I_c	I_d	I_ℓ	n	FIXED 3
n_c	n_d					CHARGES 4
ϵ	η	P	ν	m		REVENUE 5
OM						OM 6
ω						PROFIT 7
χ	δ	ϕ	ψ			AD VAL 8
a_1	PF					INSUR 9
α	b	i	j_F	j_S	n'	TAXES 10
g						11
fc_t						FC 12
L_1	L_2	L_3	ℓ_c	ℓ_f	ℓ_w	FUEL 13
c_c	c_f	c_r	c_w	c_s	c_s'	CYCLE 14
t_c	t_f	t_r	t_d	t_s	t_s'	PARAM- 15
e_1	e_2	C_Δ	C_F	e_F	e_w	ETER 16
A	cp	E_t	u			SET 17
NPC						NPC-MOD 1
J(1)	Parameter(1)					PC(1)
⋮	⋮					
J(NPC)	Parameter(NPC)					PC(NPC)
blank card						

AMD-8 (5-58)

APPENDIX B

FAST REACTOR FUEL CYCLE COST ANALYSIS

Consider the reactor divided into up to ten fuel regions of two types - uranium regions and plutonium regions.

The fuel-cycle-cost equation for a uranium region is of the form

$$
\begin{aligned}
fc_U = {} & uL_3V(e_1) + \frac{1}{\tau}\Bigg\{\Big[c_c(1+\ell_c+\ell_f) + c_f(1+\ell_f) + c_r + c_s + c_{s'} + c_w\ell_w\Big] L_1 \\
& + \Big[(t_c + t_f + t_s)\, V(e_1) + \tau\left(\frac{V(e_1)+V(e_2)}{2}\right) \\
& + (t_d + t_r + t_{s'})V(e_2)\Big]\, uL_1(1+\ell_c+\ell_f) \\
& + [V(e_1)\, L_1\,(1+\ell_c+\ell_f) - V(e_2)L_2] + A\, c_p\, 10^3\Bigg\} \quad , \qquad (1)
\end{aligned}
$$

where all cost and weight variables and the use-charge rate are in terms of uranium.

For plutonium regions we assume that the cost of non-plutonium core materials is negligible and that all isotopes of plutonium are of equal value. Hence all costs and weights are in terms of plutonium only. In equation (1), replace $V(e_1)$ and $V(e_2)$ by $v \cdot 10^3$, the value of a kilogram of plutonium, and redefine all cost and weight variables and the use-charge rate in terms of plutonium. This yields

$$
\begin{aligned}
fc_{Pu} = {} & uL_3 v\cdot 10^3 + \frac{1}{\tau}\Big\{[c_c(1+\ell_c+\ell_f) + c_f(1+\ell_f) + c_r + c_s + c_{s'} + c_w\ell_w]\, L_1 \\
& + [(t_c + t_f + t_r + t_s + t_{s'} + t_d + \tau)\, v\cdot 10^3\, uL_1\,(1+\ell_c+\ell_f)] \\
& + [L_1\,(1+\ell_c+\ell_f) - L_2]v\cdot 10^3 + A\, c_p 10^3\Big\} \quad .
\end{aligned}
$$

The total fuel-cycle cost, fc_t, is the sum of all uranium and plutonium region costs.

APPENDIX C

GENERAL OPERATING INSTRUCTIONS

704 PROGRAM 0908/RE224

	USED	NOT USED
DRUM:		X
UF SWITCH:		X

READER: 72 x 72 board PUNCH: not used

PRINTER: SHARE board #2 if SS #2 is down, not used otherwise

SENSE SWITCH SETTINGS:

#1 - up #2 - up - output on tape #1
down - output on line
#3,4,5,6 - not used

TAPES: Tape #1 for output if SS #2 is up
None used if SS #2 is down

TIME BEFORE OUTPUT: negligible RUNNING TIME: about 1 minute/problem with off-line output

OFF-LINE PRINTING: Print tape #1 (if used) off-line under program control.

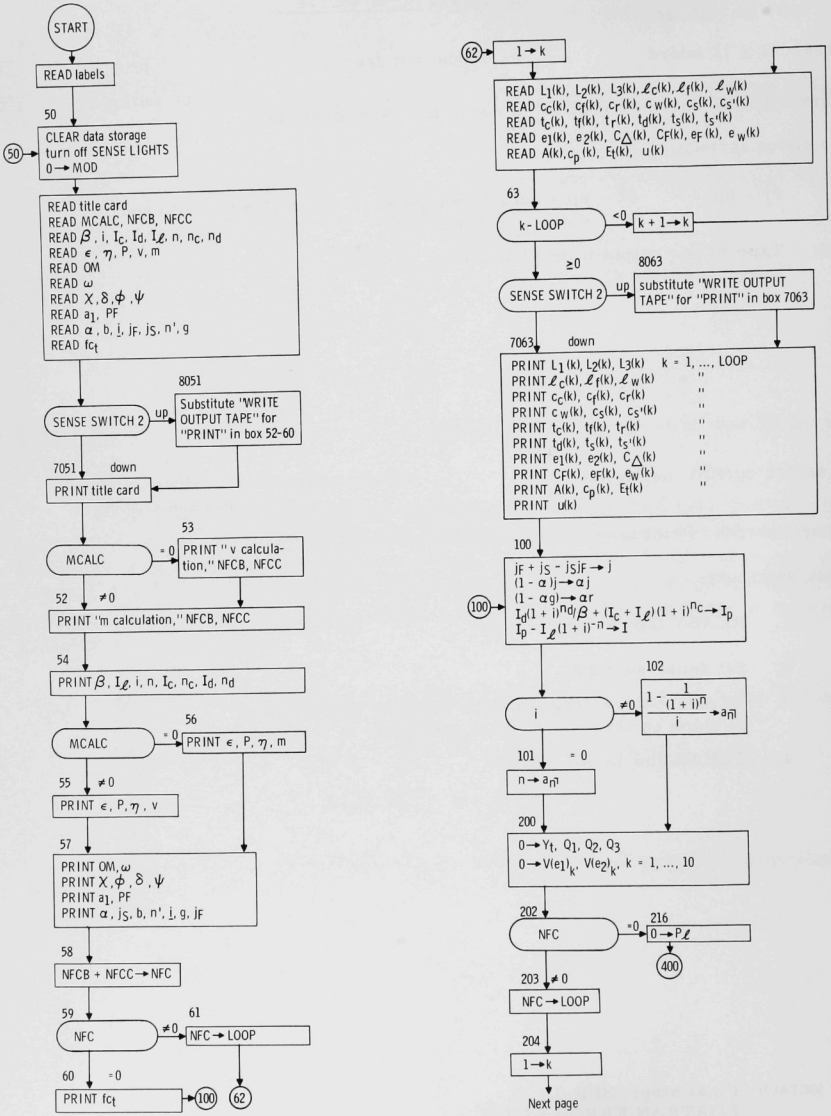
RUNNING PROCEDURE:

1. READY tape #1 or printer.
2. Set sense switches.
3. READY binary program deck followed by data input (a blank card must separate problems) in reader.
4. CLEAR and LOAD CARDS.

STOPS (OCTAL): Final stop: HPR 0,1
FORTRAN ERROR STOPS

APPENDIX D

FLOWCHART



$$2.7397 \times 10^{-3} \times E_t(k)/\epsilon \cdot P \rightarrow \tau(k)$$

$$A(k)/\tau(k) + Y_t \rightarrow Y_t$$

$$1/\tau(k)\left\{\left[c_c(k)\cdot\left(1+\ell_c(k)+\ell_f(k)\right)+c_f(k)\cdot\left(1+\ell_f(k)\right)+c_r(k)+c_s(k)+c_s'(k)+c_w(k)\cdot\ell_w(k)\right]\cdot L_1(k)+A(k)\cdot c_p(k)\cdot 10^3\right\}+Q_1\rightarrow Q_1$$

205 k - LOOP $<0 \rightarrow 1 + k \rightarrow k$

207 NFCB ≥ 0, $=0 \rightarrow$ 214

212 NFCB $\neq 0 \rightarrow$ LOOP

208 $1 \rightarrow k$

$$(2e_w(k)-1)\ln\left(\frac{e_w(k)}{1-e_w(k)}\right)\rightarrow V_w(k) \qquad \left(\frac{e_1(k)-e_w(k)}{e_F(k)-e_w(k)}\right)\rightarrow T_{1w}(k)$$

$$(2e_F(k)-1)\ln\left(\frac{e_F(k)}{1-e_F(k)}\right)\rightarrow V_F(k) \qquad \left(\frac{e_2(k)-e_w(k)}{e_F(k)-e_w(k)}\right)\rightarrow T_{2w}(k)$$

$$(2e_1(k)-1)\ln\left(\frac{e_1(k)}{1-e_1(k)}\right)\rightarrow V_1(k) \qquad \left(\frac{e_1(k)-e_F(k)}{e_F(k)-e_w(k)}\right)\rightarrow T_{1F}(k)$$

$$(2e_2(k)-1)\ln\left(\frac{e_2(k)}{1-e_2(k)}\right)\rightarrow V_2(k) \qquad \left(\frac{e_2(k)-e_F(k)}{e_F(k)-e_w(k)}\right)\rightarrow T_{2F}(k)$$

$$C_F(k)\cdot T_{1w}(k)+C_\triangle(k)\cdot\left(V_1(k)+T_{1F}(k)\cdot V_w(k)-T_{1w}(k)\cdot V_F(k)\right)\rightarrow Ve_1(k)$$

$$C_F(k)\cdot T_{2w}(k)+C_\triangle(k)\cdot\left(V_2(k)+T_{2F}(k)\cdot V_w(k)-T_{2w}(k)\cdot V_F(k)\right)\rightarrow Ve_2(k)$$

$$1/\tau(k)\left\{\left[\left(t_c(k)+t_f(k)+t_s(k)\right)\cdot Ve_1(k)+\tau(k)\cdot\left(\frac{Ve_1(k)+Ve_2(k)}{2}\right)+\left(t_d(k)+t_r(k)+t_s'(k)\right)\cdot Ve_2(k)\right]\cdot u(k)\cdot L_1(k)\cdot\left(1+\ell_c(k)+\ell_f(k)\right)+\left[Ve_1(k)\cdot L_1(k)\cdot\left(1+\ell_c(k)+\ell_f(k)\right)-Ve_2(k)\cdot L_2(k)\right]\right\}+u(k)\cdot L_3(k)\cdot Ve_1(k)+Q_2\rightarrow Q_2$$

209 k - LOOP $<0 \rightarrow 1 + k \rightarrow k$

214 $\rightarrow$ NFCC ≥ 0, $=0 \rightarrow$ 300

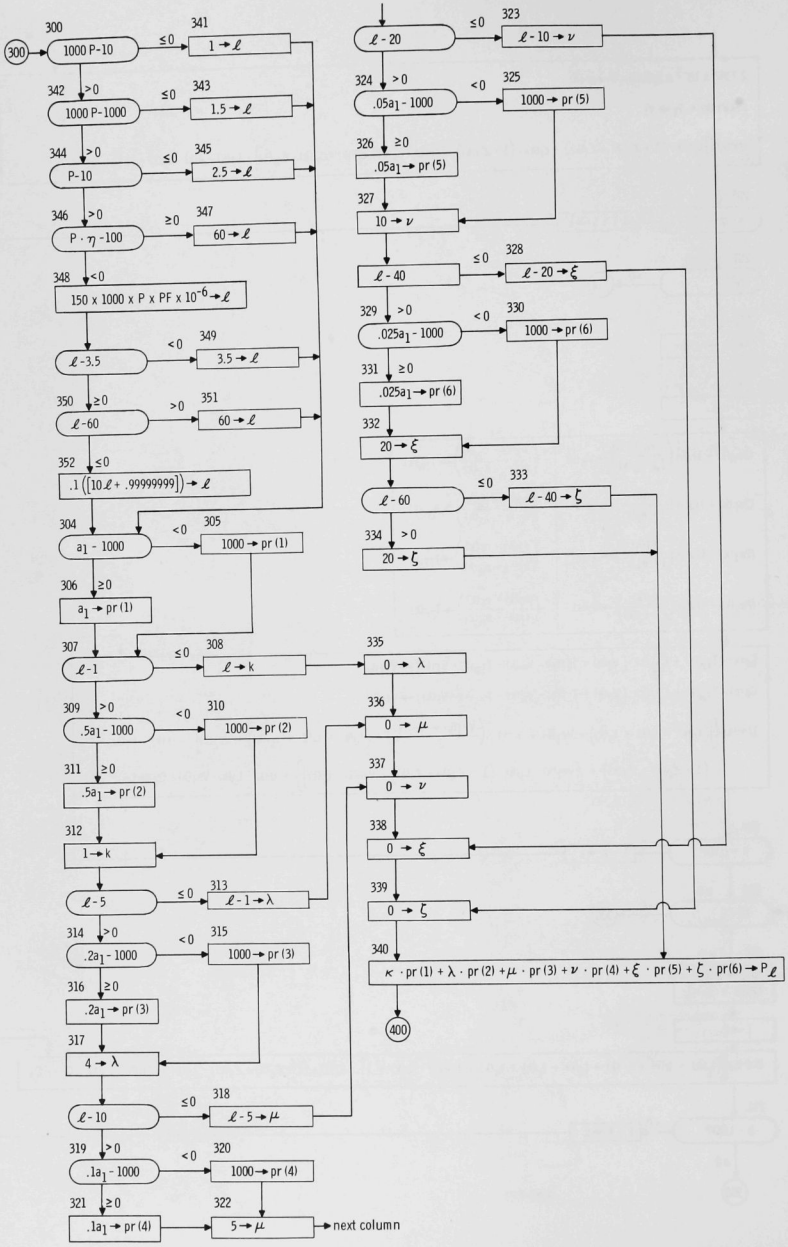
210 NFC $\neq 0 \rightarrow$ LOOP
NFCB + $1 \rightarrow L$

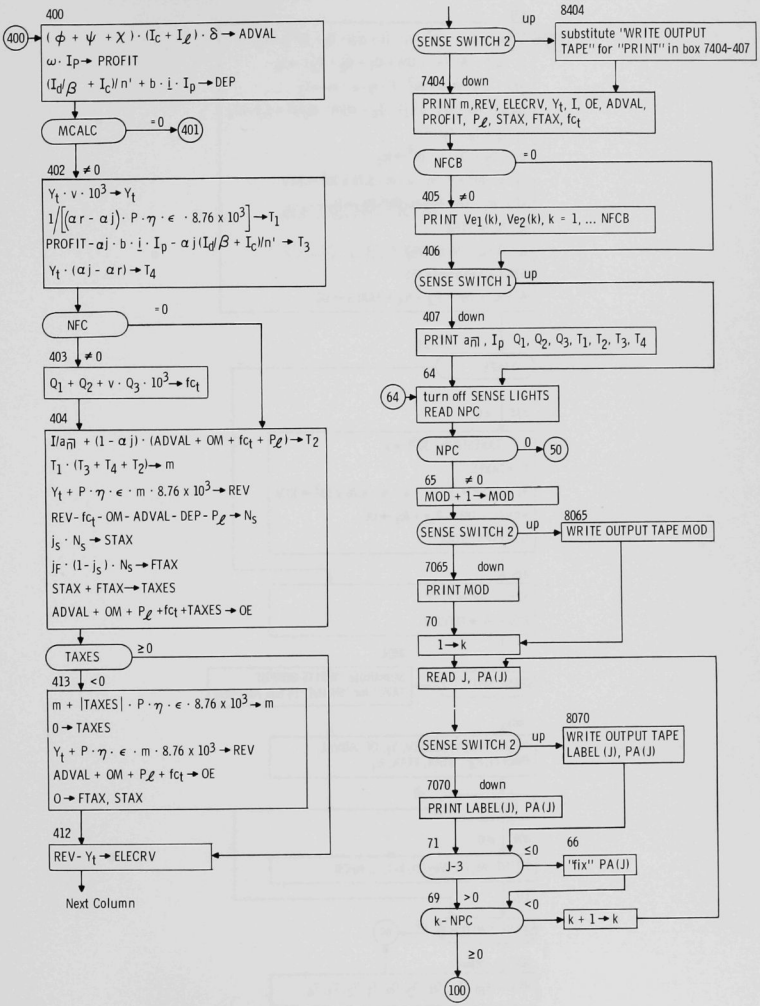
$L \rightarrow k$

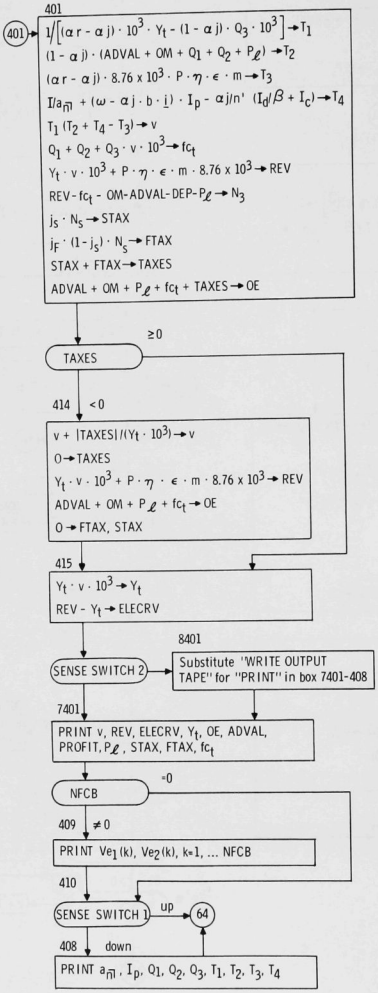
$$1/\tau(k)\left\{\left[\left(t_c(k)+t_f(k)+\tau(k)+t_d(k)+t_r(k)+t_s(k)+t_s'(k)\right)\cdot u(k)+1\right]\cdot L_1(k)\cdot\left(1+\ell_c(k)+\ell_f(k)\right)-L_2(k)\right\}+u(k)\cdot L_3(k)+Q_3\rightarrow Q_3$$

211 k - LOOP $<0 \rightarrow 1 + k \rightarrow k$

$\geq 0 \rightarrow$ 300


300
1000 P-10
≤0
341
1 → ℓ
342
>0
1000 P-1000
≤0
343
1.5 → ℓ
344
>0
P-10
≤0
345
2.5 → ℓ
346
>0
P · η -100
≥0
347
60 → ℓ
348
<0
150 x 1000 x P x PF x 10^-6 → ℓ
ℓ-3.5
<0
349
3.5 → ℓ
350
≥0
ℓ-60
>0
351
60 → ℓ
352
≤0
.1 ([10ℓ + .99999999]) → ℓ
304
a1 - 1000
<0
305
1000 → pr (1)
306
≥0
a1 → pr (1)
307
ℓ-1
≤0
308
ℓ → k
309
>0
.5a1 - 1000
<0
310
1000 → pr (2)
311
≥0
.5a1 → pr (2)
312
1 → k
ℓ-5
≤0
313
ℓ-1 → λ
314
>0
.2a1 - 1000
<0
315
1000 → pr (3)
316
≥0
.2a1 → pr (3)
317
4 → λ
ℓ-10
≤0
318
ℓ-5 → μ
319
>0
.1a1 - 1000
<0
320
1000 → pr (4)
321
≥0
.1a1 → pr (4)
322
5 → μ
next column
ℓ-20
≤0
323
ℓ-10 → ν
324
>0
.05a1 - 1000
<0
325
1000 → pr (5)
326
≥0
.05a1 → pr (5)
327
10 → ν
ℓ-40
≤0
328
ℓ-20 → ξ
329
>0
.025a1 - 1000
<0
330
1000 → pr (6)
331
≥0
.025a1 → pr (6)
332
20 → ξ
ℓ-60
≤0
333
ℓ-40 → ζ
334
>0
20 → ζ
335
0 → λ
336
0 → μ
337
0 → ν
338
0 → ξ
339
0 → ζ
340
κ · pr (1) + λ · pr (2) + μ · pr (3) + ν · pr (4) + ξ · pr (5) + ζ · pr(6) → Pℓ
400


400
(φ + ψ + χ) · (Ic + Iℓ) · δ → ADVAL
ω · Ip → PROFIT
(Id/β + Ic)/n' + b · i · Ip → DEP
MCALC
=0
401
402
≠0
Yt · v · 10^3 → Yt
1/[(α r - α j) · P · η · ε · 8.76 x 10^3] → T1
PROFIT - αj · b · i · Ip - α j (Id/β + Ic)/n' → T3
Yt · (α j - α r) → T4
NFC
=0
403
≠0
Q1 + Q2 + v · Q3 · 10^3 → fct
404
I/a_n̄| + (1 - α j) · (ADVAL + OM + fct + Pℓ) → T2
T1 · (T3 + T4 + T2) → m
Yt + P · η · ε · m · 8.76 x 10^3 → REV
REV - fct - OM - ADVAL - DEP - Pℓ → Ns
js · Ns → STAX
jF · (1 - js) · Ns → FTAX
STAX + FTAX → TAXES
ADVAL + OM + Pℓ + fct + TAXES → OE
TAXES
≥0
413
<0
m + |TAXES| · P · η · ε · 8.76 x 10^3 → m
0 → TAXES
Yt + P · η · ε · m · 8.76 x 10^3 → REV
ADVAL + OM + Pℓ + fct → OE
0 → FTAX, STAX
412
REV - Yt → ELECRV
Next Column
SENSE SWITCH 2
up
8404
substitute "WRITE OUTPUT TAPE" for "PRINT" in box 7404-407
7404
down
PRINT m, REV, ELECRV, Yt, I, OE, ADVAL, PROFIT, Pℓ, STAX, FTAX, fct
NFCB
=0
405
≠0
PRINT Ve1(k), Ve2(k), k = 1, ... NFCB
406
SENSE SWITCH 1
up
407
down
PRINT a_n̄|, Ip Q1, Q2, Q3, T1, T2, T3, T4
64
64
turn off SENSE LIGHTS
READ NPC
NPC
0
50
65
≠0
MOD + 1 → MOD
SENSE SWITCH 2
up
8065
WRITE OUTPUT TAPE MOD
7065
down
PRINT MOD
70
1 → k
READ J, PA(J)
SENSE SWITCH 2
up
8070
WRITE OUTPUT TAPE LABEL (J), PA(J)
7070
down
PRINT LABEL(J), PA(J)
71
J-3
≤0
66
"fix" PA(J)
69
>0
k - NPC
<0
k + 1 → k
≥0
100


401
401
$1/[(\alpha r - \alpha j) \cdot 10^3 \cdot Y_t - (1 - \alpha j) \cdot Q_3 \cdot 10^3] \rightarrow T_1$
$(1 - \alpha j) \cdot (ADVAL + OM + Q_1 + Q_2 + P_\ell) \rightarrow T_2$
$(\alpha r - \alpha j) \cdot 8.76 \times 10^3 \cdot P \cdot \eta \cdot \epsilon \cdot m \rightarrow T_3$
$I/a_{\overline{n}|} + (\omega - \alpha j \cdot b \cdot \underline{i}) \cdot I_p - \alpha j/n' \; (I_d/\beta + I_c) \rightarrow T_4$
$T_1 (T_2 + T_4 - T_3) \rightarrow v$
$Q_1 + Q_2 + Q_3 \cdot v \cdot 10^3 \rightarrow fc_t$
$Y_t \cdot v \cdot 10^3 + P \cdot \eta \cdot \epsilon \cdot m \cdot 8.76 \times 10^3 \rightarrow REV$
$REV - fc_t - OM - ADVAL - DEP - P_\ell \rightarrow N_3$
$j_s \cdot N_s \rightarrow STAX$
$j_F \cdot (1 - j_s) \cdot N_s \rightarrow FTAX$
$STAX + FTAX \rightarrow TAXES$
$ADVAL + OM + P_\ell + fc_t + TAXES \rightarrow OE$
TAXES
≥0
414
<0
$v + |TAXES|/(Y_t \cdot 10^3) \rightarrow v$
$0 \rightarrow TAXES$
$Y_t \cdot v \cdot 10^3 + P \cdot \eta \cdot \epsilon \cdot m \cdot 8.76 \times 10^3 \rightarrow REV$
$ADVAL + OM + P_\ell + fc_t \rightarrow OE$
$0 \rightarrow FTAX, STAX$
415
$Y_t \cdot v \cdot 10^3 \rightarrow Y_t$
$REV - Y_t \rightarrow ELECRV$
8401
SENSE SWITCH 2
Substitute "WRITE OUTPUT TAPE" for "PRINT" in box 7401-408
7401
PRINT v, REV, ELECRV, Y_t, OE, ADVAL, PROFIT, P_ℓ, STAX, FTAX, fc_t
NFCB
=0
409
≠0
PRINT $Ve_1(k)$, $Ve_2(k)$, k=1, ... NFCB
410
SENSE SWITCH 1
up
64
408
down
PRINT $a_{\overline{n}|}$, I_p, Q_1, Q_2, Q_3, T_1, T_2, T_3, T_4

APPENDIX E

CODE LISTING

```
C     0908/RE224 REACTOR ECONOMICS CALCULATIONS    J HEESTAND    7/5/61
      DIMENSION LABEL(350),PA(350),JPA(350),EL1(10),EL2(10),EL3(10),
     1          ELC(10),ELF(10),ELWD(10),CU(10),F(10),RPU(10),
     2          CWD(10),S1(10),S2(10),TC(10),TF(10),TRP(10),
     3          TD(10),TS1(10),TS2(10),E1(10),E2(10),CDELTA(10),
     4          CF(10),EF(10),EW(10),A(10),CP(10),ET(10),U(10),
     5          VW(10),VF(10),V1(10),V2(10),T1W(10),T2W(10),
     6          T1F(10),T2F(10),VE1(10),VE2(10),TAU(10),PR(6)
      EQUIVALENCE (PA(  1),MCALC  ),(PA(  2),NFCB     ),(PA(  3),NFCC   ),
     1          (PA(  4),BETA   ),(PA(  5),EYE      ),(PA(  6),EYEC   ),
     2          (PA(  7),EYED   ),(PA(  8),EYEL     ),(PA(  9),EN     ),
     3          (PA( 10),ENC    ),(PA( 11),END      ),(PA( 12),EPSLON),
     4          (PA( 13),ETA    ),(PA( 14),P        ),(PA( 15),V      ),
     5          (PA( 16),EM     ),(PA( 17),OM       ),(PA( 18),OMEGA  ),
     6          (PA( 19),CHI    ),(PA( 20),DELTA    ),(PA( 21),PHI    ),
     7          (PA( 22),PSI    ),(PA( 23),A1       ),(PA( 24),PF     ),
     8          (PA( 25),ALPHA  ),(PA( 26),B        ),(PA( 27),EYEBAR),
     9          (PA( 28),AJF    ),(PA( 29),AJS      ),(PA( 30),ENPRIM)
      EQUIVALENCE (PA( 31),R     ),(PA( 32),FCT      ),(PA( 33),EL1(1)),
     1          (PA( 43),EL2(1)),(PA( 53),EL3(1)    ),(PA( 63),ELC(1)),
     2          (PA( 73),ELF(1)),(PA( 83),ELWD(1)   ),(PA( 93),CU(1)  ),
     3          (PA(103),F(1)  ),(PA(113),RPU(1)    ),(PA(123),CWD(1)),
     4          (PA(133),S1(1) ),(PA(143),S2(1)     ),(PA(153),TC(1)  ),
     5          (PA(163),TF(1) ),(PA(173),TRP(1)    ),(PA(183),TD(1)  ),
     6          (PA(193),TS1(1)),(PA(203),TS2(1)    ),(PA(213),E1(1)  ),
     7          (PA(223),E2(1) ),(PA(233),CDELTA(1)),(PA(243),CF(1)  ),
     8          (PA(253),EF(1) ),(PA(263),EW(1)     ),(PA(273),A(1)   ),
     9          (PA(283),CP(1) ),(PA(293),ET(1)     ),(PA(303),U(1)   )
      EQUIVALENCE (PA(  1),JPA(1))
      COMMON LABEL,PA,AJ,ALPHAJ,ALPHAR,CAPIP,CAPI,AN,YT,PL,CAPPA,ELAMDA,
     1       EMU,ENU,XI,ZETA,T1,T2,T3,T4,EL,VW,VF,V1,V2,T1W,T2W,T1F,T2F,
     2       VE1,VE2,TAU,PR,Q1,Q2,Q3,J,K,L,LOOP,NPC,
     3       MOD,ADVAL,PROFIT,DEP,REV,ENS,STAX,FTAX,TAXES,OE,ELECRV,NFC
    1 FORMAT(72H                                                          )
    1
    2 FORMAT(6E12.5)
    3 FORMAT(/7H0 INPUT/16H0  FIXED CHARGES/8H     BETA1PE17.6,18H
     1        I(L)E17.6/8H     I    E17.6,18H                    N    E17.6/8H
     2I(C)E17.6,18H                N(C)E17.6/8H     I(D)E17.6,18H
     3    N(D)E17.6)
    4 FORMAT(10H0  REVENUE/11H     EPSILON1PE14.6,18H                    P   E1
     17.6/8H     ETA E17.6,18H                    V    E17.6)
    5 FORMAT(34H0  OPERATING AND MAINTENANCE COSTS/6H     OM1PE19.6/9H0
     1PROFIT/9H     OMEGAE16.6)
    6 FORMAT(21H0  AD VALOREM CHARGES/9H     CHI   1PE16.6,18H
     1  PHI E17.6/9H     DELTAE16.6,18H                    PSI E17.6)
    7 FORMAT(20H0  INSURANCE CHARGES/8H     A(1)1PE17.6,18H
     1PF   E17.6)
    8 FORMAT(8H0  TAXES/9H     ALPHA1PE16.6,18H                    J(S)E17.6/8H
     1     B    E17.6,20H                    NPRIMEE15.6/8H     IBARE17.6,18H
     2          G    E17.6/8H     J(F)E17.6)
    9 FORMAT(20H0  FUEL CYCLE COST =1PE13.6)
   10 FORMAT(19H0  FUEL CYCLE COSTS/7X,4HL(1)18X,4HL(2)19X,4HL(3)/(1PE15
     1.6,E22.6,E23.6))
   11 FORMAT(7X,4HL(C)18X,4HL(F)19X,5HL(W) /(1PE15.6,E22.6,E23.6))
   12 FORMAT(7X,4HC(C)18X,4HC(F)19X,4HC(R)/(1PE15.6,E22.6,E23.6))
   13 FORMAT(7X,4HC(W)18X,4HC(S)16X,10HC(S PRIME)/(1PE15.6,E22.6,E23.6))
   14 FORMAT(7X,4HT(C)18X,4HT(F)19X,5HT(R) /(1PE15.6,E22.6,E23.6))
   15 FORMAT(7X,4HT(D)18X,4HT(S)16X,10HT(S PRIME)/(1PE15.6,E22.6,E23.6))
   16 FORMAT(7X,4HE(1)18X,4HE(2)17X,8HC(DELTA)/(1PE15.6,E22.6,E23.6))
   17 FORMAT(/8H0 OUTPUT/4X,1HM8X,1PE14.6,13X,9HTOTAL REVE14.6/4X,9HELEC
     1T REVE14.6,13X,9HPU REV    E14.6/4X,1HI8X,E14.6,13X,4HO.E.5X,E14.6/
     24X,9HAD VAL    E14.6,13X,9HPROFIT    E14.6/4X,2HPL7X,E14.6,13X,9HS T
     3AX    E14.6/4X,9HF TAX    E14.6,13X,9HTOTAL FC E14.6)
   19 FORMAT(I12,E12.5)
```

```
 20 FORMAT(12A6)
 21 FORMAT(4H     1A6,1PE12.5)
 22 FORMAT(6I12)
 23 FORMAT(17H M CALCULATION    I2,19H URANIUM REGIONS    I2,18H PLUTONI
   1UM REGIONS)
 24 FORMAT(17H V CALCULATION    I2,19H URANIUM REGIONS    I2,18H PLUTONI
   1UM REGIONS)
 25 FORMAT(10H0  REVENUE/11H     EPSILON1PE14.6,18H                P   E1
   17.6/8H     ETA E17.6,18H                M    E17.6)
 26 FORMAT(7X,4HC(F)18X,4HE(F)19X,4HE(W)/(1PE15.6,E22.6,E23.6))
 27 FORMAT(/8H0 OUTPUT/4X,1HV8X,1PE14.6,13X,9HTOTAL REVE14.6/4X,9HELEC
   1T REVE14.6,13X,9HPU REV    E14.6/4X,1HI8X,E14.6,13X,4H0.E.5X,E14.6/
   24X,9HAD VAL    E14.6,13X,9HPROFIT    E14.6/4X,2HPL7X,E14.6,13X,9HS T
   3AX    E14.6/4X,9HF TAX    E14.6,13X,9HTOTAL FC E14.6)
 28 FORMAT(//13H0MODIFICATIONI6)
 29 FORMAT(4X,5HV(E1)31X,5HV(E2)/(13X,1PE14.6,22X,E14.6))
 31 FORMAT(8H     AN  1PE17.6,18H                IP   E17.6/8H     Q1  E17.
   16,18H                Q2  E17.6/8H     Q3  E17.6,18H                T1
   2E17.6/8H     T2  E17.6,18H                T3  E17.6/8H     T4  E17.6)
 32 FORMAT(9X,1HA19X,4HC(P)19X,4HE(T)/(1PE15.6,E22.6,E23.6))
 33 FORMAT(9X,1HU/(1PE15.6))
    READ 20,(LABEL(K),K=1,312)
 50 DO 51 K=1,350
 51 PA(K)=0.
    SENSE LIGHT 0
    MOD=0
    READ 1
    READ 22,MCALC,NFCB,NFCC
    READ 2,BETA,EYE,EYEC,EYED,EYEL,EN,ENC,END
    READ 2,EPSLON,ETA,P,V,EM
    READ 2,OM
    READ 2,OMEGA
    READ 2,CHI,DELTA,PHI,PSI
    READ 2,A1,PF
    READ 2,ALPHA,B,EYEBAR,AJF,AJS,ENPRIM,R
    READ 2,FCT
    IF (SENSE SWITCH 2) 7051,8051
7051 PRINT 1
    IF (MCALC) 52,53,52
 52 PRINT 23,NFCB,NFCC
    GO TO 54
 53 PRINT 24,NFCB,NFCC
 54 PRINT 3,BETA,EYEL,EYE,EN,EYEC,ENC,EYED,END
    IF (MCALC) 55,56,55
 55 PRINT 4,EPSLON,P,ETA,V
    GO TO 57
 56 PRINT 25,EPSLON,P,ETA,EM
 57 PRINT 5,OM,OMEGA
    PRINT 6,CHI,PHI,DELTA,PSI
    PRINT 7,A1,PF
    PRINT 8,ALPHA,AJS,B,ENPRIM,EYEBAR,R,AJF
 58 NFC=NFCB+NFCC
 59 IF (NFC) 61,60,61
 60 PRINT 9,FCT
    GO TO 100
 61 LOOP=NFC
 62 DO 63 K=1,LOOP
    READ 2,EL1(K),EL2(K),EL3(K),ELC(K),ELF(K),ELWD(K)
    READ 2,CU(K),F(K),RPU(K),CWD(K),S1(K),S2(K)
    READ 2,TC(K),TF(K),TRP(K),TD(K),TS1(K),TS2(K)
    READ 2,E1(K),E2(K),CDELTA(K),CF(K),EF(K),EW(K)
 63 READ 2,A(K),CP(K),ET(K),U(K)
    IF (SENSE SWITCH 2) 7063,8063
7063 PRINT 10,(EL1(K),EL2(K),EL3(K),K=1,LOOP)
    PRINT 11,(ELC(K),ELF(K),ELWD(K),K=1,LOOP)
    PRINT 12,(CU(K),F(K),RPU(K),K=1,LOOP)
```

```
      PRINT 13,(CWD(K),S1(K),S2(K),K=1,LOOP)
      PRINT 14,(TC(K),TF(K),TRP(K),K=1,LOOP)
      PRINT 15,(TD(K),TS1(K),TS2(K),K=1,LOOP)
      PRINT 16,(E1(K),E2(K),CDELTA(K),K=1,LOOP)
      PRINT 26,(CF(K),EF(K),EW(K),K=1,LOOP)
      PRINT 32,(A(K),CP(K),ET(K),K=1,LOOP)
      PRINT 33,(U(K),K=1,LOOP)
  100 AJ=AJF+AJS-AJF*AJS
      ALPHA J=(1.-ALPHA)*AJ
      ALPHA R=1.-ALPHA*R
      CAP I P=(EYED*(1.+EYE)**END)/BETA+(EYEC+EYEL)*(1.+EYE)**ENC
      CAP I=CAPIP-EYEL*(1.+EYE)**(-EN)
      IF(EYE)102,101,102
  101 AN=EN
      GO TO 200
  102 AN=(1.-1./(1.+EYE)**EN)/EYE
  200 YT=0.
      Q1=0.
      Q2=0.
      Q3=0.
      DO 217 K=1,10
      VE1(K)=0.
  217 VE2(K)=0.
  202 IF (NFC) 203,216,203
  216 PL=0.0
      GO TO 400
  203 LOOP=NFC
  204 DO 205 K=1,LOOP
      TAU(K)=(2.7397E-3*ET(K))/(EPSLON*P)
      YT=YT+A(K)/TAU(K)
  205 Q1=Q1+((CU(K)*(1.0+ELC(K)+ELF(K))+F(K)*(1.0+ELF(K))+RPU(K)+S1(K)+
     1S2(K)+CWD(K)*ELWD(K))*EL1(K)+A(K)*CP(K)*1E+3)/TAU(K)
  207 IF (NFCB) 212,214,212
  212 LOOP=NFCB
  208 DO 209 K=1,LOOP
      VW(K)=(2.*EW(K)-1.)*LOGF(EW(K)/(1.-EW(K)))
      VF(K)=(2.*EF(K)-1.)*LOGF(EF(K)/(1.-EF(K)))
      V1(K)=(2.*E1(K)-1.)*LOGF(E1(K)/(1.-E1(K)))
      V2(K)=(2.*E2(K)-1.)*LOGF(E2(K)/(1.-E2(K)))
      T1W(K)=(E1(K)-EW(K))/(EF(K)-EW(K))
      T2W(K)=(E2(K)-EW(K))/(EF(K)-EW(K))
      T1F(K)=(E1(K)-EF(K))/(EF(K)-EW(K))
      T2F(K)=(E2(K)-EF(K))/(EF(K)-EW(K))
      VE1(K)=(CF(K)*T1W(K)+CDELTA(K)*(V1(K)+T1F(K)*VW(K)-T1W(K)*VF(K)))
      VE2(K)=(CF(K)*T2W(K)+CDELTA(K)*(V2(K)+T2F(K)*VW(K)-T2W(K)*VF(K)))
  209 Q2=Q2+U(K)*EL3(K)*VE1(K)+(((TC(K)+TF(K)+TS1(K))*VE1(K)+TAU(K)*
     1(VE1(K)+VE2(K))/2.0+(TD(K)+TRP(K)+TS2(K))*VE2(K))*U(K)*EL1(K)*
     2(1.0+ELC(K)+ELF(K))+VE1(K)*EL1(K)*(1.0+ELC(K)+ELF(K))-
     3VE2(K)*EL2(K))/TAU(K)
  214 IF (NFCC) 210,300,210
  210 LOOP=NFC
      L=NFCB+1
      DO 211 K=L,LOOP
  211 Q3=Q3+U(K)*EL3(K)+(TC(K)+TF(K)+TRP(K)+TS1(K)+TS2(K)+TD(K)+TAU(K))*
     1U(K)*EL1(K)*(1.0+ELC(K)+ELF(K))/TAU(K)+
     2(EL1(K)*(1.0+ELC(K)+ELF(K))-EL2(K))/TAU(K)
  300 IF (1000.*P-10.) 341,341,342
  341 EL=1.0
      GO TO 304
  342 IF (1000.*P-1000.) 343,343,344
  343 EL=1.5
      GO TO 304
  344 IF (P-10.) 345,345,346
  345 EL=2.5
      GO TO 304
  346 IF (P*ETA-100.) 348,347,347
```

```
347 EL=60.
    GO TO 304
348 EL=(150.*1000.*P*PF)/1000000.
    IF (EL-3.5) 349,350,350
349 EL=3.5
    GO TO 304
350 IF (EL-60.) 352,352,351
351 EL=60.
    GO TO 304
352 EL=.1*INTF(10.*EL+.99999999)
304 IF(A1-1000.)305,306,306
305 PR(1)=1000.
    GO TO 307
306 PR(1)=A1
307 IF(EL-1.)308,308,309
308 CAPPA=EL
    GO TO 335
309 IF(.5*A1-1000.)310,311,311
310 PR(2)=1000.
    GO TO 312
311 PR(2)=.5*A1
312 CAPPA=1.
    IF(EL-5.)313,313,314
313 ELAMDA=EL-1.
    GO TO 336
314 IF(.2*A1-1000.)315,316,316
315 PR(3)=1000.
    GO TO 317
316 PR(3)=.2*A1
317 ELAMDA=4.
    IF(EL-10.)318,318,319
318 EMU=EL-5.
    GO TO 337
319 IF(.1*A1-1000.)320,321,321
320 PR(4)=1000.
    GO TO 322
321 PR(4)=.1*A1
322 EMU=5.
    IF(EL-20.)323,323,324
323 ENU=EL-10.
    GO TO 338
324 IF(.05*A1-1000.)325,326,326
325 PR(5)=1000.
    GO TO 327
326 PR(5)=.05*A1
327 ENU=10.
    IF(EL-40.)328,328,329
328 XI=EL-20.
    GO TO 339
329 IF(.025*A1-1000.)330,331,331
330 PR(6)=1000.
    GO TO 332
331 PR(6)=.025*A1
332 XI=20.
    IF(EL-60.)333,333,334
333 ZETA=EL-40.
    GO TO 340
334 ZETA=20.0
    GO TO 340
335 ELAMDA=0.
336 EMU=0.
337 ENU=0.
338 XI=0.
339 ZETA=0.
340 PL=CAPPA*PR(1)+ELAMDA*PR(2)+EMU*PR(3)+ENU*PR(4)+XI*PR(5)+ZETA*PR(6
   1   )
```

```
400 ADVAL=(PHI+CHI+PSI)*(EYEC+EYEL)*DELTA
    PROFIT=OMEGA*CAPIP
    DEP=1.0/ENPRIM*(1.0/BETA*EYED+EYEC)+B*EYEBAR*CAPIP
    IF (MCALC) 402,401,402
401 T1=1.0/((ALPHAR-ALPHAJ)*1E+3*YT-(1.0-ALPHAJ)*Q3*1E+3)
    T2=(1.-ALPHAJ)*(ADVAL+OM+Q1+Q2+PL)
    T3=(ALPHAR-ALPHAJ)*8.76E+3*P*ETA*EPSLON*EM
    T4=CAPI/AN+(OMEGA-ALPHAJ*B*EYEBAR)*CAPIP-
   1ALPHAJ*(1.0/BETA*EYED+EYEC)/ENPRIM
    V=T1*(T2+T4-T3)
    FCT=Q1+Q2+Q3*V*1E+3
    REV=YT*V*1E3+P*ETA*EPSLON*EM*8.76E+3
    ENS=REV-FCT-OM-ADVAL-DEP-PL
    STAX=AJS*ENS
    FTAX=AJF*(1.-AJS)*ENS
    TAXES=STAX+FTAX
    OE=ADVAL+OM+PL+FCT+TAXES
    IF(TAXES)414,415,415
414 V=V+ABSF(TAXES)/(YT*1E+3)
    TAXES=0.0
    REV=YT*V*1E3+P+ETA*EPSLON*EM*8.76E+3
    OE=ADVAL+OM+PL+FCT
    FTAX=0.0
    STAX=0.0
415 YT=YT*V*1E+3
    ELECRV=REV-YT
    IF (SENSE SWITCH 2) 7401,8401
7401 PRINT 27,V,REV,ELECRV,YT,CAPI,OE,ADVAL,PROFIT,PL,STAX,FTAX,FCT
    IF (NFCB) 409,410,409
409 PRINT 29,(VE1(K),VE2(K),K=1,NFCB)
410 IF (SENSE SWITCH 1) 408,64
408 PRINT 31,AN,CAPIP,Q1,Q2,Q3,T1,T2,T3,T4
    GO TO 64
402 YT=YT*V*1E3
411 T1=1./((ALPHAR-ALPHAJ)*P*ETA*EPSLON*8.76E+3)
    T3=PROFIT-ALPHAJ*B*EYEBAR*CAPIP-ALPHAJ*(1.0/BETA*EYED+EYEC)/ENPRIM
    T4=YT*(ALPHAJ-ALPHAR)
    IF(NFC)403,404,403
403 FCT=Q1+Q2+Q3*V*1E3
404 T2=CAPI/AN+(1.-ALPHAJ)*(ADVAL+OM+FCT+PL)
    EM=T1*(T3+T4+T2)
    REV=YT+P*ETA*EPSLON*EM*8.76E+3
    ENS=REV-FCT-OM-ADVAL-DEP-PL
    STAX=AJS*ENS
    FTAX=AJF*(1.-AJS)*ENS
    TAXES=STAX+FTAX
    OE=ADVAL+OM+PL+FCT+TAXES
    IF(TAXES)413,412,412
413 EM=EM+ABSF(TAXES)/(P*ETA*EPSLON*8.76E+3)
    TAXES=0.0
    REV=YT+P*ETA*EPSLON*EM*8.76E+3
    OE=ADVAL+OM+PL+FCT
    FTAX=0.0
    STAX=0.0
412 ELECRV=REV-YT
    IF (SENSE SWITCH 2) 7404,8404
7404 PRINT 17,EM,REV,ELECRV,YT,CAPI,OE,ADVAL,PROFIT,PL,STAX,FTAX,FCT
    IF (NFCB) 405,406,405
405 PRINT 29,(VE1(K),VE2(K),K=1,NFCB)
406 IF (SENSE SWITCH 1) 407,64
407 PRINT 31,AN,CAPIP,Q1,Q2,Q3,T1,T2,T3,T4
 64 SENSE LIGHT 0
    READ19,NPC
    IF (NPC) 65,50,65
 65 MOD=MOD+1
    IF (SENSE SWITCH 2) 7065,8065
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```
7065 PRINT 28,MOD
  70 DO 69 K=1,NPC
     READ 19,J,(PA(J))
     IF (SENSE SWITCH 2) 7070,8070
7070 PRINT 21,LABEL(J),PA(J)
  71 IF (J-3) 66,66,69
  66 JPA(J)=PA(J)
  69 CONTINUE
     GO TO 100
8051 WRITE OUTPUT TAPE 1,1
     IF (MCALC) 8052,8053,8052
8052 WRITE OUTPUT TAPE 1,23,NFCB,NFCC
     GO TO 8054
8053 WRITE OUTPUT TAPE 1,24,NFCB,NFCC
8054 WRITE OUTPUT TAPE 1,3,BETA,EYEL,EYE,EN,EYEC,ENC,EYED,END
     IF (MCALC) 8055,8056,8055
8055 WRITE OUTPUT TAPE 1,4,EPSLON,P,ETA,V
     GO TO 8057
8056 WRITE OUTPUT TAPE 1,25,EPSLON,P,ETA,EM
8057 WRITE OUTPUT TAPE 1,5,OM,OMEGA
     WRITE OUTPUT TAPE 1,6,CHI,PHI,DELTA,PSI
     WRITE OUTPUT TAPE 1,7,A1,PF
     WRITE OUTPUT TAPE 1,8,ALPHA,AJS,B,ENPRIM,EYEBAR,R,AJF
8058 NFC=NFCB+NFCC
8059 IF (NFC) 61,8060,61
8060 WRITE OUTPUT TAPE 1,9,FCT
     GO TO 100
8063 WRITE OUTPUT TAPE 1,10,(EL1(K),EL2(K),EL3(K),K=1,LOOP)
     WRITE OUTPUT TAPE 1,11,(ELC(K),ELF(K),ELWD(K),K=1,LOOP)
     WRITE OUTPUT TAPE 1,12,(CU(K),F(K),RPU(K),K=1,LOOP)
     WRITE OUTPUT TAPE 1,13,(CWD(K),S1(K),S2(K),K=1,LOOP)
     WRITE OUTPUT TAPE 1,14,(TC(K),TF(K),TRP(K),K=1,LOOP)
     WRITE OUTPUT TAPE 1,15,(TD(K),TS1(K),TS2(K),K=1,LOOP)
     WRITE OUTPUT TAPE 1,16,(E1(K),E2(K),CDELTA(K),K=1,LOOP)
     WRITE OUTPUT TAPE 1,26,(CF(K),EF(K),EW(K),K=1,LOOP)
     WRITE OUTPUT TAPE 1,32,(A(K),CP(K),ET(K),K=1,LOOP)
     WRITE OUTPUT TAPE 1,33,(U(K),K=1,LOOP)
     GO TO 100
8401 WRITE OUTPUT TAPE 1,27,V,REV,ELECRV,YT,CAPI,OE,ADVAL,PROFIT,PL,
    1                        STAX,FTAX,FCT
     IF (NFCB) 8409,8410,8409
8409 WRITE OUTPUT TAPE 1,29,(VE1(K),VE2(K),K=1,NFCB)
8410 IF (SENSE SWITCH 1) 8408,64
8408 WRITE OUTPUT TAPE 1,31,AN,CAPIP,Q1,Q2,Q3,T1,T2,T3,T4
     GO TO 64
8404 WRITE OUTPUT TAPE 1,17,EM,REV,ELECRV,YT,CAPI,OE,ADVAL,PROFIT,PL,
    1                        STAX,FTAX,FCT
     IF (NFCB) 8405,8406,8405
8405 WRITE OUTPUT TAPE 1,29,(VE1(K),VE2(K),K=1,NFCB)
8406 IF (SENSE SWITCH 1) 8407,64
8407 WRITE OUTPUT TAPE 1,31,AN,CAPIP,Q1,Q2,Q3,T1,T2,T3,T4
     GO TO 64
8065 WRITE OUTPUT TAPE 1,28,MOD
     GO TO 70
8070 WRITE OUTPUT TAPE 1,21,LABEL(J),PA(J)
     GO TO 71
     END (0,1,0,1,1)
```

STORAGE FOR VARIABLES APPEARING IN COMMON SENTENCES

	DEC	OCT
FTAX	31712	75740
EYED	32556	77454
ETA	32550	77446
ENPRIM	32533	77425
ELWD	32480	77340
ELAMDA	31953	76155
E2	32340	77124
CU	32470	77326
CAPPA	31854	76156
A	32290	77042
AJS	32534	77426
JPA	32562	77462
L	31722	75752
NFC	31708	75734
PA	32562	77462
PR	31733	75765
Q3	31725	75755
S2	32420	77244
T2F	31773	76035
TAU	31743	75777
TRP	32390	77206
V2	31813	76105
VW	31843	76143

	DEC	OCT
F	32460	77314
EYEC	32557	77455
EPSLON	32551	77447
END	32552	77450
EL	31844	76144
EL3	32510	77376
E1	32350	77136
CP	32280	77030
CAPI	31858	76162
AN	31857	76161
AJ	31862	76166
J	31724	75754
MCALC	32562	77462
NPC	31720	75750
PF	32539	77433
P	32549	77445
REV	31715	75743
STAX	31713	75741
T2	31847	76147
TAXES	31711	75737
TS1	32370	77162
VE1	31763	76023
XI	31850	76152

	DEC	OCT
FCT	32531	77423
FYEBAR	32536	77430
ENU	31851	76163
ENC	32553	77451
ELF	32420	77352
EL2	32520	77410
DEP	31716	75744
CHI	32544	77440
CAPIP	31859	76163
ALPHA	32538	77432
AJF	32535	77427
K	31723	75753
MOD	31719	75747
OE	31710	75736
PHI	32542	77436
PSI	32541	77435
RPU	32450	77302
T1F	31783	76047
T2W	31793	76061
TC	32410	77232
TS2	32360	77150
VE2	31753	76011
YT	31856	76160

	DEC	OCT
EYE	32558	77456
EW	32300	77054
ENS	31714	75742
EMU	31852	76154
ELECRV	31709	75735
EL1	32530	77422
DELTA	32543	77437
CF	32320	77100
B	32537	77431
ALPHAR	31860	76164
ADVAL	31718	75746
LABEL	32212	76724
NFCB	32561	77461
OMEGA	32545	77441
PL	31855	76157
Q1	31727	75757
R	32532	77424
T1	31848	76150
T3	31846	76146
TD	32380	77174
U	32260	77004
VF	31833	76131
ZETA	31849	76151

	DEC	OCT
EYEL	32555	77453
ET	32270	77016
EN	32554	77452
EM	32547	77443
ELC	32500	77364
EF	32310	77066
CWD	32440	77270
CDELTA	32330	77112
BETA	32559	77457
ALPHAJ	31861	76165
A1	32540	77434
LOOP	31721	75751
NFCC	32560	77460
OM	32546	77442
PROFIT	31717	75745
Q2	31726	75756
S1	32430	77256
T1W	31803	76073
T4	31845	76145
TF	32400	77220
V1	31823	76117
V	32548	77444

EXTERNAL FORMULA NUMBERS WITH CORRESPONDING INTERNAL FORMULA NUMBERS AND OCTAL LOCATIONS

EFN	IFN	LOC
1	6	00000
6	11	00000
11	16	00000
16	21	00000
22	26	00000
27	31	00000
33	36	00000
52	80	00274
54	89	00350
57	98	00413
60	114	00527
7063	134	00666
200	203	01314
204	214	01345
209	231	01653
341	238	02023
346	246	02045
351	254	02104
307	261	02131
312	268	02153
317	276	02200
322	284	02225
327	292	02252
332	300	02277
337	308	02320
401	316	02421
409	342	02751
402	353	03023
412	374	03272
406	386	03353
7065	397	03425
71	410	03510
8052	417	03544
8054	426	03620

EFN	IFN	LOC
2	7	00000
7	12	00000
12	17	00000
17	22	00000
23	27	00000
28	32	00000
50	43	00033
52	82	00307
55	91	00354
57	100	00426
61	116	00532
7063	139	00710
217	209	01327
205	217	01365
214	232	01743
342	240	02026
347	247	02053
352	256	02107
308	262	02135
313	270	02161
318	278	02206
323	286	02233
328	294	02260
333	302	02305
338	309	02322
414	329	02637
409	347	02772
411	354	03031
7404	376	03277
407	387	03355
7065	399	03437
66	411	03514
8052	419	03557
8055	428	03624

EFN	IFN	LOC
3	8	00000
8	13	00000
13	18	00000
19	23	00000
24	28	00000
29	33	00000
51	44	00034
53	84	00312
55	93	00371
58	110	00506
62	117	00534
100	194	01175
202	210	01333
207	218	01432
210	233	01745
343	241	02033
348	249	02056
304	257	02120
309	264	02140
314	272	02165
319	280	02212
324	288	02237
329	296	02264
334	304	02311
339	310	02324
415	335	02705
410	348	02774
403	358	03106
7404	378	03324
407	389	03377
70	400	03441
69	412	03525
8053	421	03562
8055	430	03641

EFN	IFN	LOC
4	9	00000
9	14	00000
14	19	00000
20	24	00000
25	29	00000
31	34	00000
7051	77	00261
53	86	00325
56	95	00374
59	111	00511
63	130	00643
101	200	01273
216	211	01337
212	219	01434
211	236	01755
344	243	02036
349	251	02074
305	258	02124
310	265	02145
315	273	02172
320	281	02217
325	289	02244
330	297	02271
335	306	02314
340	311	02326
7401	338	02720
408	349	02776
404	359	03116
405	380	03330
64	390	03401
7070	407	03473
8051	414	03531
8053	423	03575
8056	432	03644

EFN	IFN	LOC
5	10	00000
10	15	00000
15	20	00000
21	25	00000
26	30	00000
32	35	00000
7051	78	00270
54	87	00327
56	97	00411
60	112	00515
63	132	00660
102	202	01276
203	213	01343
208	220	01436
300	237	02016
345	244	02042
350	253	02077
306	260	02127
311	267	02150
316	275	02175
321	283	02222
326	291	02247
331	299	02274
336	307	02316
400	312	02357
7401	340	02745
408	351	03020
413	368	03222
405	385	03351
65	395	03420
7070	409	03506
8051	415	03540
8054	424	03577
8056	434	03661

8057	435	03663	8057	437	03676	8058	447	03756	8059	448	03761	8060	449	03765
8060	451	03777	8063	453	04002	8063	458	04024	8401	514	04311	8401	516	04336
8409	518	04342	8409	523	04363	8410	524	04365	8408	525	04367	8408	527	04411
8404	529	04414	8404	531	04441	8405	533	04445	8405	538	04466	8406	539	04470
8407	540	04472	8407	542	04514	8065	544	04517	8065	546	04531	8070	548	04534
8070	550	04547												

STORAGE NOT USED BY PROGRAM

DEC	OCT	DEC	OCT
2868	05464	31707	75733

LOCATIONS OF NAMES IN TRANSFER VECTOR

	DEC	OCT		DEC	OCT		DEC	OCT		DEC	OCT		DEC	OCT
EXP(3	2	00002	LOG	1	00001	(CSH)	7	00007	(FIL)	3	00003	(IOH)I	8	00010
(IOH)O	5	00005	(LEV)	9	00011	(RTN)	6	00006	(SPH)	4	00004	(STH)	0	00000

STORAGE LOCATIONS FOR SYMBOLS NOT APPEARING IN SOURCE PROGRAM

	DEC	OCT		DEC	OCT		DEC	OCT		DEC	OCT		DEC	OCT
E)48	1879	03527	E)47	1876	03524	E)43	1847	03467	D)439	1262	02356	D)41D	738	01342
D)403	26	00032	D)116	636	01174	C)G2	2867	05463	8)11	2444	04614	8)10	2453	04625
8)V	2485	04665	8)T	2493	04675	8)S	2497	04701	8)R	2538	04752	8)Q	2547	04763
8)P	2565	05005	8)O	2577	05021	8)N	2589	05035	8)M	2590	05036	8)L	2594	05042
8)K	2595	05043	8)J	2597	05045	8)H	2638	05116	8)G	2648	05130	8)F	2658	05142
8)E	2667	05153	8)D	2677	05165	8)C	2686	05176	8)B	2695	05207	8)A	2708	05224
8)9	2714	05232	8)8	2741	05265	8)7	2753	05301	8)6	2773	05325	8)5	2787	05343
8)4	2805	05365	8)3	2840	05430	8)2	2842	05432	8)1	2855	05447	1)	2857	05451
2)	2410	04552	3)	2413	04555	6)	2437	04605	7)	2856	05450			

SUBROUTINES PUNCHED FROM LIBRARY

LOG	EXP	EXP(3	(RTN)	(LEV)	(STH)	(SPH)	(CSH)	(FIL)	(BDC)
(DBC)	(IOH)O	(IOH)I							

```
00000 (STH)   BCD 1(STH)
00001 LOG     BCD 1LOG
00002 EXP(3   BCD 1EXP(3
00003 (FIL)   BCD 1(FIL)
00004 (SPH)   BCD 1(SPH)
00005 (IOH)O  BCD 1(IOH)O
00006 (RTN)   BCD 1(RTN)
00007 (CSH)   BCD 1(CSH)
00010 (IOH)I  BCD 1(IOH)I
00011 (LEV)   BCD 1(LEV)
00012 37A     CAL *
00013         XIT (LEV)
00014         ETM
00015         CAL (IOH)I
00016         SLW 1
00017         CAL (CSH)
00020 37D1    NTR 8)K,0,81
00021 38A     LXD 2)+1,1
00022 39A     ETM
00023         NTR LABEL+1,1
00024         LTM
00025 39A1    TXI *+1,1,1
00026 39A2    TXL 39A,1,312
00027 41A     LTM
00030 42A     CAL *
00031         XIT (RTN)
00032 D)403   LXD C)G2,4
00033 43A     LXD 2)+1,2
00034 44A     CLA 3)
00035         STO PA+1,2
00036 44A1    TXI *+1,2,1
00037 44A2    TXL 44A,2,350
00040 45A     PSE 96
00041 46A     CLA 2)
00042         STO MOD
00043 47A     CAL *
00044         XIT (LEV)
00045         ETM
00046         CAL (IOH)I
00047         SLW 1
00050         CAL (CSH)
00051 47D1    NTR 8)1,0,81
00052 48A     CAL *
00053         XIT (RTN)
00054 49A     CAL *
00055         XIT (LEV)
00056         ETM
00057         CAL (IOH)I
00060         SLW 1
00061         CAL (CSH)
00062 49D1    NTR 8)M,0,81
00063 50A     ETM
00064         NTR MCALC
00065         NTR NFCB
00066         NTR NFCC
00067         LTM
00070 51A     CAL *
00071         XIT (RTN)
00072 52A     CAL *
00073         XIT (LEV)
00074         ETM
00075         CAL (IOH)I
00076         SLW 1
00077         CAL (CSH)
00100 52D1    NTR 8)2,0,81
00101 53A     ETM
00102         NTR BETA
00103         NTR EYE
00104         NTR EYEC
00105         NTR EYED
00106         NTR EYEL
00107         NTR EN
00110         NTR ENC
00111         NTR END
00112         LTM
00113 54A     CAL *
00114         XIT (RTN)
00115 55A     CAL *
00116         XIT (LEV)
00117         ETM
00120         CAL (IOH)I
00121         SLW 1
00122         CAL (CSH)
00123 55D1    NTR 8)2,0,81
00124 56A     ETM
00125         NTR EPSLON
00126         NTR ETA
00127         NTR P
00130         NTR V
00131         NTR EM
00132         LTM
00133 57A     CAL *
00134         XIT (RTN)
00135 58A     CAL *
00136         XIT (LEV)
00137         ETM
00140         CAL (IOH)I
00141         SLW 1
00142         CAL (CSH)
00143 58D1    NTR 8)2,0,81
00144 59A     ETM
00145         NTR OM
00146         LTM
00147 60A     CAL *
00150         XIT (RTN)
00151 61A     CAL *
00152         XIT (LEV)
00153         ETM
00154         CAL (IOH)I
00155         SLW 1
00156         CAL (CSH)
00157 61D1    NTR 8)2,0,81
00160 62A     ETM
00161         NTR OMEGA
00162         LTM
00163 63A     CAL *
00164         XIT (RTN)
00165 64A     CAL *
00166         XIT (LEV)
00167         ETM
00170         CAL (IOH)I
00171         SLW 1
00172         CAL (CSH)
00173 64D1    NTR 8)2,0,81
00174 65A     ETM
00175         NTR CHI
00176         NTR DELTA
00177         NTR PHI
00200         NTR PSI
00201         LTM
00202 66A     CAL *
00203         XIT (RTN)
00204 67A     CAL *
00205         XIT (LEV)
00206         ETM
00207         CAL (IOH)I
00210         SLW 1
00211         CAL (CSH)
00212 67D1    NTR 8)2,0,81
00213 68A     ETM
00214         NTR A1
00215         NTR PF
00216         LTM
00217 69A     CAL *
00220         XIT (RTN)
00221 70A     CAL *
00222         XIT (LEV)
00223         ETM
00224         CAL (IOH)I
00225         SLW 1
00226         CAL (CSH)
00227 70D1    NTR 8)2,0,81
00230 71A     ETM
00231         NTR ALPHA
00232         NTR B
00233         NTR EYEBAR
00234         NTR AJF
00235         NTR AJS
00236         NTR ENPRIM
00237         NTR R
00240         LTM
00241 72A     CAL *
00242         XIT (RTN)
00243 73A     CAL *
00244         XIT (LEV)
00245         ETM
00246         CAL (IOH)I
00247         SLW 1
00250         CAL (CSH)
00251 73D1    NTR 8)2,0,81
00252 74A     ETM
00253         NTR FCT
00254         LTM
00255 75A     CAL *
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00256          XIT (RTN)
00257 76A      PSE 114
00260          TRA 414A
00261 77A      CAL *
00262          XIT (LEV)
00263          ETM
00264          CAL (IOH)0
00265          SLW 1
00266          CAL (SPH)
00267 77D1     NTR 8)1
00270 78A      CAL *
00271          XIT (FIL)
00272 79A      CLA MCALC
00273 79A1     TZE 84A
00274 80A      CAL *
00275          XIT (LEV)
00276          ETM
00277          CAL (IOH)0
00300          SLW 1
00301          CAL (SPH)
00302 80D1     NTR 8)N
00303 81A      ETM
00304          NTR NFCB
00305          NTR NFCC
00306          LTM
00307 82A      CAL *
00310          XIT (FIL)
00311 83A      TRA 87A
00312 84A      CAL *
00313          XIT (LEV)
00314          ETM
00315          CAL (IOH)0
00316          SLW 1
00317          CAL (SPH)
00320 84D1     NTR 8)0
00321 85A      ETM
00322          NTR NFCB
00323          NTR NFCC
00324          LTM
00325 86A      CAL *
00326          XIT (FIL)
00327 87A      CAL *
00330          XIT (LEV)
00331          ETM
00332          CAL (IOH)0
00333          SLW 1
00334          CAL (SPH)
00335 87D1     NTR 8)3
00336 88A      ETM
00337          NTR BETA
00340          NTR EYEL
00341          NTR EYE
00342          NTR EN
00343          NTR EYEC
00344          NTR ENC
00345          NTR EYED
00346          NTR END
00347          LTM
00350 89A      CAL *
00351          XIT (FIL)
00352 90A      CLA MCALC
00353 90A1     TZE 95A
00354 91A      CAL *
00355          XIT (LEV)
00356          ETM
00357          CAL (IOH)0
00360          SLW 1
00361          CAL (SPH)
00362 91D1     NTR 8)4
00363 92A      ETM
00364          NTR EPSLON
00365          NTR P
00366          NTR ETA
00367          NTR V
00370          LTM
00371 93A      CAL *
00372          XIT (FIL)
00373 94A      TRA 98A
00374 95A      CAL *
00375          XIT (LEV)
00376          ETM
00377          CAL (IOH)0
00400          SLW 1
00401          CAL (SPH)
00402 95D1     NTR 8)P
00403 96A      ETM
00404          NTR EPSLON
00405          NTR P
00406          NTR ETA
00407          NTR EM
00410          LTM
00411 97A      CAL *
00412          XIT (FIL)
00413 98A      CAL *
00414          XIT (LEV)
00415          ETM
00416          CAL (IOH)0
00417          SLW 1
00420          CAL (SPH)
00421 98D1     NTR 8)5
00422 99A      ETM
00423          NTR OM
00424          NTR OMEGA
00425          LTM
00426 100A     CAL *
00427          XIT (FIL)
00430 101A     CAL *
00431          XIT (LEV)
00432          ETM
00433          CAL (IOH)0
00434          SLW 1
00435          CAL (SPH)
00436 101D1    NTR 8)6
00437 102A     ETM
00440          NTR CHI
00441          NTR PHI
00442          NTR DELTA
00443          NTR PSI
00444          LTM
00445 103A     CAL *
00446          XIT (FIL)
00447 104A     CAL *
00450          XIT (LEV)
00451          ETM
00452          CAL (IOH)0
00453          SLW 1
00454          CAL (SPH)
00455 104D1    NTR 8)7
00456 105A     ETM
00457          NTR A1
00460          NTR PF
00461          LTM
00462 106A     CAL *
00463          XIT (FIL)
00464 107A     CAL *
00465          XIT (LEV)
00466          ETM
00467          CAL (IOH)0
00470          SLW 1
00471          CAL (SPH)
00472 107D1    NTR 8)8
00473 108A     ETM
00474          NTR ALPHA
00475          NTR AJS
00476          NTR B
00477          NTR ENPRIM
00500          NTR EYEBAR
00501          NTR R
00502          NTR AJF
00503          LTM
00504 109A     CAL *
00505          XIT (FIL)
00506 110A     CLA NFCB
00507          ADD NFCC
00510          STO NFC
00511 111A     CLA NFC
00512 111A1    TZE 112A
00513          TPL 116A
00514          TRA 116A
00515 112A     CAL *
00516          XIT (LEV)
00517          ETM
00520          CAL (IOH)0
00521          SLW 1
00522          CAL (SPH)
00523 112D1    NTR 8)9
00524 113A     ETM
00525          NTR FCT
00526          LTM
00527 114A     CAL *
00530          XIT (FIL)
00531 115A     TRA D)116
00532 116A     CLA NFC
00533          STO LOOP
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00534  117A   LXD 2)+1,2
00535         CLA LOOP
00536         STD 132A2
00537  118A   CAL *
00540         XIT (LEV)
00541         ETM
00542         CAL (IOH)I
00543         SLW 1
00544         CAL (CSH)
00545  118D1  NTR 8)2,0,81
00546  119A   ETM
00547         NTR EL1+1,2
00550         NTR EL2+1,2
00551         NTR EL3+1,2
00552         NTR ELC+1,2
00553         NTR ELF+1,2
00554         NTR ELWD+1,2
00555         LTM
00556  120A   CAL *
00557         XIT (RTN)
00560  121A   CAL *
00561         XIT (LEV)
00562         ETM
00563         CAL (IOH)I
00564         SLW 1
00565         CAL (CSH)
00566  121D1  NTR 8)2,0,81
00567  122A   ETM
00570         NTR CU+1,2
00571         NTR F+1,2
00572         NTR RPU+1,2
00573         NTR CWD+1,2
00574         NTR S1+1,2
00575         NTR S2+1,2
00576         LTM
00577  123A   CAL *
00600         XIT (RTN)
00601  124A   CAL *
00602         XIT (LEV)
00603         ETM
00604         CAL (IOH)I
00605         SLW 1
00606         CAL (CSH)
00607  124D1  NTR 8)2,0,81
00610  125A   ETM
00611         NTR TC+1,2
00612         NTR TF+1,2
00613         NTR TRP+1,2
00614         NTR TD+1,2
00615         NTR TS1+1,2
00616         NTR TS2+1,2
00617         LTM
00620  126A   CAL *
00621         XIT (RTN)
00622  127A   CAL *
00623         XIT (LEV)
00624         ETM
00625         CAL (IOH)I
00626         SLW 1
00627         CAL (CSH)
00630  127D1  NTR 8)2,0,81
00631  128A   ETM
00632         NTR E1+1,2
00633         NTR E2+1,2
00634         NTR CDELTA+1,2
00635         NTR CF+1,2
00636         NTR EF+1,2
00637         NTR EW+1,2
00640         LTM
00641  129A   CAL *
00642         XIT (RTN)
00643  130A   CAL *
00644         XIT (LEV)
00645         ETM
00646         CAL (IOH)I
00647         SLW 1
00650         CAL (CSH)
00651  130D1  NTR 8)2,0,81
00652  131A   ETM
00653         NTR A+1,2
00654         NTR CP+1,2
00655         NTR ET+1,2
00656         NTR U+1,2
00657         LTM
00660  132A   CAL *
00661         XIT (RTN)
00662  132A1  TXI *+1,2,1
00663  132A2  TXL 118A,2
00664  133A   PSE 114
00665         TRA 453A
00666  134A   CAL *
00667         XIT (LEV)
00670         ETM
00671         CAL (IOH)O
00672         SLW 1
00673         CAL (SPH)
00674  134D1  NTR 8)A
00675  135A   LXD 2)+1,2
00676         CLA LOOP
00677         STD 136A2
00700  136A   ETM
00701         NTR EL1+1,2
00702         NTR EL2+1,2
00703         NTR EL3+1,2
00704         LTM
00705  136A1  TXI *+1,2,1
00706  136A2  TXL 136A,2
00707  138A   LTM
00710  139A   CAL *
00711         XIT (FIL)
00712  140A   CAL *
00713         XIT (LEV)
00714         ETM
00715         CAL (IOH)O
00716         SLW 1
00717         CAL (SPH)
00720  140D1  NTR 8)B
00721  141A   LXD 2)+1,2
00722         CLA LOOP
00723         STD 142A2
00724  142A   ETM
00725         NTR ELC+1,2
00726         NTR ELF+1,2
00727         NTR ELWD+1,2
00730         LTM
00731  142A1  TXI *+1,2,1
00732  142A2  TXL 142A,2
00733  144A   LTM
00734  145A   CAL *
00735         XIT (FIL)
00736  146A   CAL *
00737         XIT (LEV)
00740         ETM
00741         CAL (IOH)O
00742         SLW 1
00743         CAL (SPH)
00744  146D1  NTR 8)C
00745  147A   LXD 2)+1,2
00746         CLA LOOP
00747         STD 148A2
00750  148A   ETM
00751         NTR CU+1,2
00752         NTR F+1,2
00753         NTR RPU+1,2
00754         LTM
00755  148A1  TXI *+1,2,1
00756  148A2  TXL 148A,2
00757  150A   LTM
00760  151A   CAL *
00761         XIT (FIL)
00762  152A   CAL *
00763         XIT (LEV)
00764         ETM
00765         CAL (IOH)O
00766         SLW 1
00767         CAL (SPH)
00770  152D1  NTR 8)D
00771  153A   LXD 2)+1,2
00772         CLA LOOP
00773         STD 154A2
00774  154A   ETM
00775         NTR CWD+1,2
00776         NTR S1+1,2
00777         NTR S2+1,2
01000         LTM
01001  154A1  TXI *+1,2,1
01002  154A2  TXL 154A,2
01003  156A   LTM
01004  157A   CAL *
01005         XIT (FIL)
01006  158A   CAL *
01007         XIT (LEV)
01010         ETM
01011         CAL (IOH)O
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01012          SLW 1
01013          CAL (SPH)
01014 158D1    NTR 8)E
01015 159A     LXD 2)+1,2
01016          CLA LOOP
01017          STD 160A2
01020 160A     ETM
01021          NTR TC+1,2
01022          NTR TF+1,2
01023          NTR TRP+1,2
01024          LTM
01025 160A1    TXI *+1,2,1
01026 160A2    TXL 160A,2
01027 162A     LTM
01030 163A     CAL *
01031          XIT (FIL)
01032 164A     CAL *
01033          XIT (LEV)
01034          ETM
01035          CAL (IOH)0
01036          SLW 1
01037          CAL (SPH)
01040 164D1    NTR 8)F
01041 165A     LXD 2)+1,2
01042          CLA LOOP
01043          STD 166A2
01044 166A     ETM
01045          NTR TD+1,2
01046          NTR TS1+1,2
01047          NTR TS2+1,2
01050          LTM
01051 166A1    TXI *+1,2,1
01052 166A2    TXL 166A,2
01053 168A     LTM
01054 169A     CAL *
01055          XIT (FIL)
01056 170A     CAL *
01057          XIT (LEV)
01060          ETM
01061          CAL (IOH)0
01062          SLW 1
01063          CAL (SPH)
01064 170D1    NTR 8)G
01065 171A     LXD 2)+1,2
01066          CLA LOOP
01067          STD 172A2
01070 172A     ETM
01071          NTR E1+1,2
01072          NTR E2+1,2
01073          NTR CDELTA+1,2
01074          LTM
01075 172A1    TXI *+1,2,1
01076 172A2    TXL 172A,2
01077 174A     LTM
01100 175A     CAL *
01101          XIT (FIL)
01102 176A     CAL *
01103          XIT (LEV)
01104          ETM
01105          CAL (IOH)0
01106          SLW 1
01107          CAL (SPH)
01110 176D1    NTR 8)Q
01111 177A     LXD 2)+1,2
01112          CLA LOOP
01113          STD 178A2
01114 178A     ETM
01115          NTR CF+1,2
01116          NTR EF+1,2
01117          NTR EW+1,2
01120          LTM
01121 178A1    TXI *+1,2,1
01122 178A2    TXL 178A,2
01123 180A     LTM
01124 181A     CAL *
01125          XIT (FIL)
01126 182A     CAL *
01127          XIT (LEV)
01130          ETM
01131          CAL (IOH)0
01132          SLW 1
01133          CAL (SPH)
01134 182D1    NTR 8)10
01135 183A     LXD 2)+1,2
01136          CLA LOOP
01137          STD 184A2
01140 184A     ETM
01141          NTR A+1,2
01142          NTR CP+1,2
01143          NTR ET+1,2
01144          LTM
01145 184A1    TXI *+1,2,1
01146 184A2    TXL 184A,2
01147 186A     LTM
01150 187A     CAL *
01151          XIT (FIL)
01152 188A     CAL *
01153          XIT (LEV)
01154          ETM
01155          CAL (IOH)0
01156          SLW 1
01157          CAL (SPH)
01160 188D1    NTR 8)11
01161 189A     LXD 2)+1,2
01162          CLA LOOP
01163          STD 190A2
01164 190A     ETM
01165          NTR U+1,2
01166          LTM
01167 190A1    TXI *+1,2,1
01170 190A2    TXL 190A,2
01171 192A     LTM
01172 193A     CAL *
01173          XIT (FIL)
01174 D)116    LXD C)G2,1
01175 194A     LDQ AJF
01176          FMP AJS
01177          CHS
01200          FAD AJS
01201          FAD AJF
01202          STO AJ
01203 195A     CLA 3)+1
01204          FSP ALPHA
01205          STO 1)+1
01206          LDQ 1)+1
01207          FMP AJ
01210          STO ALPHAJ
01211 196A     LDQ ALPHA
01212          FMP R
01213          CHS
01214          FAD 3)+1
01215          STO ALPHAR
01216 197A     CLA 3)+1
01217          FAD EYE
01220          STO 1)+1
01221          LDQ ENC
               BSS
01222          TSX EXP(3,4
01223          NTR *+2,0,100
01224          PZE 0,0,197
01225          STO 1)+2
01226          CLA EYEC
01227          FAD EYEL
01230          STO 1)+3
01231          LDQ 1)+3
01232          FMP 1)+2
01233          STO 1)+4
01234          CLA 1)+1
01235          LDQ END
               BSS
01236          TSX EXP(3,4
01237          NTR *+2,0,100
01240          PZE 0,0,197
01241          STO 1)+5
01242          LDQ EYEC
01243          FMP 1)+5
01244          FDP BETA
01245          STO 1)+6
01246          CLA 1)+6
01247          FAD 1)+4
01250          STO CAPIP
01251 198A     CLS EN
01252          STO 1)+1
01253          CLA 3)+1
01254          FAD EYE
01255          LDQ 1)+1
               BSS
01256          TSX EXP(3,4
01257          NTR *+2,0,100
01260          PZE 0,0,198
01261          STO 1)+2
01262          LDQ EYEL
01263          FMP 1)+2
01264          CHS
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01265          FAD CAPIP
01266          STO CAPI
01267 199A     CLA EYE
01270 199A1    TZE 200A
01271          TPL 202A
01272          TRA 202A
01273 200A     CLA EN
01274          STO AN
01275 201A     TRA 203A
01276 202A     CLA 3)+1
01277          FAD EYE
01300          LDQ EN
               BSS
01301          TSX EXP(3,4
01302          NTR *+2,0,102
01303          PZE 0,0,202
01304          STO 1)+1
01305          CLA 3)+1
01306          FDP 1)+1
01307          STQ 1)+2
01310          CLA 3)+1
01311          FSB 1)+2
01312          FDP EYE
01313          STQ AN
01314 203A     CLA 3)
01315          STO YT
01316 204A     CLA 3)
01317          STO Q1
01320 205A     CLA 3)
01321          STO Q2
01322 206A     CLA 3)
01323          STO Q3
01324 207A     LXD 2)+1,2
01325 208A     CLA 3)
01326          STO VE1+1,2
01327 209A     CLA 3)
01330          STO VE2+1,2
01331 209A1    TXI *+1,2,1
01332 209A2    TXL 208A,2,10
01333 210A     CLA NFC
01334 210A1    TZE 211A
01335          TPL D)41D
01336          TRA D)41D
01337 211A     CLA 3)
01340          STO PL
01341 212A     TRA D)439
01342 D)41D    LXD C)G2,4
01343 213A     CLA NFC
01344          STO LOOP
01345 214A     LXD 2)+1,2
01346          CLA LOOP
01347          STD 217A2
01350 215A     LDQ EPSLON
01351          FMP P
01352          STO 1)+1
01353          LDQ 3)+2
01354          FMP ET+1,2
01355          FDP 1)+1
01356          STQ TAU+1,2
01357 216A     CLA A+1,2
01360          FDP TAU+1,2
01361          STQ 1)+1
01362          CLA YT
01363          FAD 1)+1
01364          STO YT
01365 217A     LDQ 3)+3
01366          FMP A+1,2
01367          STO 7)
01370          LDQ 7)
01371          FMP CP+1,2
01372          STO 1)+1
01373          LDQ CWD+1,2
01374          FMP ELWD+1,2
01375          STO 1)+2
01376          CLA 3)+1
01377          FAD ELF+1,2
01400          STO 1)+3
01401          LDQ F+1,2
01402          FMP 1)+3
01403          STO 1)+4
01404          CLA 3)+1
01405          FAD ELC+1,2
01406          FAD ELF+1,2
01407          STO 1)+5
01410          LDQ CU+1,2
01411          FMP 1)+5
01412          FAD 1)+4
01413          FAD RPU+1,2
01414          FAD S1+1,2
01415          FAD S2+1,2
01416          FAD 1)+2
01417          STO 1)+6
01420          LDQ 1)+6
01421          FMP EL1+1,2
01422          FAD 1)+1
01423          FDP TAU+1,2
01424          STQ 1)+7
01425          CLA Q1
01426          FAD 1)+7
01427          STO Q1
01430 217A1    TXI *+1,2,1
01431 217A2    TXL 215A,2
01432 218A     CLA NFCB
01433 218A1    TZE 232A
01434 219A     CLA NFCB
01435          STO LOOP
01436 220A     LXD 2)+1,2
01437          CLA LOOP
01440          STD 231A2
01441 221A     CLA 3)+1
01442          FSB EW+1,2
01443          STO 1)+1
01444          CLA EW+1,2
01445          FDP 1)+1
01446          STQ 1)+2
01447          CLA 1)+2
01450          SXD 6)+4,4
01451          TSX LOG,4
01452          NTR *+2,0,208
01453          PZE 0,0,221
01454          LXD 6)+4,4
01455          STO 1)+3
01456          LDQ 3)+4
01457          FMP EW+1,2
01460          FSB 3)+1
01461          STO 1)+4
01462          LDQ 1)+4
01463          FMP 1)+3
01464          STO VW+1,2
01465 222A     CLA 3)+1
01466          FSB EF+1,2
01467          STO 1)+1
01470          CLA EF+1,2
01471          FDP 1)+1
01472          STQ 1)+2
01473          CLA 1)+2
01474          SXD 6)+4,4
01475          TSX LOG,4
01476          NTR *+2,0,208
01477          PZE 0,0,222
01500          LXD 6)+4,4
01501          STO 1)+3
01502          LDQ 3)+4
01503          FMP EF+1,2
01504          FSB 3)+1
01505          STO 1)+4
01506          LDQ 1)+4
01507          FMP 1)+3
01510          STO VF+1,2
01511 223A     CLA 3)+1
01512          FSB E1+1,2
01513          STO 1)+1
01514          CLA E1+1,2
01515          FDP 1)+1
01516          STQ 1)+2
01517          CLA 1)+2
01520          SXD 6)+4,4
01521          TSX LOG,4
01522          NTR *+2,0,208
01523          PZE 0,0,223
01524          LXD 6)+4,4
01525          STO 1)+3
01526          LDQ 3)+4
01527          FMP E1+1,2
01530          FSB 3)+1
01531          STO 1)+4
01532          LDQ 1)+4
01533          FMP 1)+3
01534          STO V1+1,2
01535 224A     CLA 3)+1
01536          FSB E2+1,2
01537          STO 1)+1
01540          CLA E2+1,2
01541          FDP 1)+1
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01542          STQ 1)+2
01543          CLA 1)+2
01544          SXD 6)+4,4
01545          TSX LOG,4
01546          NTR *+2,0,208
01547          PZE 0,0,224
01550          LXD 6)+4,4
01551          STO 1)+3
01552          LDQ 3)+4
01553          FMP E2+1,2
01554          FSB 3)+1
01555          STO 1)+4
01556          LDQ 1)+4
01557          FMP 1)+3
01560          STO V2+1,2
01561  225A    CLA EF+1,2
01562          FSB EW+1,2
01563          STO 1)+1
01564          CLA E1+1,2
01565          FSB EW+1,2
01566          FDP 1)+1
01567          STQ T1W+1,2
01570  226A    CLA EF+1,2
01571          FSB EW+1,2
01572          STO 1)+1
01573          CLA E2+1,2
01574          FSB EW+1,2
01575          FDP 1)+1
01576          STQ T2W+1,2
01577  227A    CLA EF+1,2
01600          FSB EW+1,2
01601          STO 1)+1
01602          CLA E1+1,2
01603          FSB EF+1,2
01604          FDP 1)+1
01605          STQ T1F+1,2
01606  228A    CLA EF+1,2
01607          FSB EW+1,2
01610          STO 1)+1
01611          CLA E2+1,2
01612          FSB EF+1,2
01613          FDP 1)+1
01614          STQ T2F+1,2
01615  229A    LDQ T1W+1,2
01616          FMP VF+1,2
01617          STO 1)+1
01620          LDQ T1F+1,2
01621          FMP VW+1,2
01622          FAD V1+1,2
01623          FSB 1)+1
01624          STO 1)+2
01625          LDQ CDELTA+1,2
01626          FMP 1)+2
01627          STO 1)+3
01630          LDQ CF+1,2
01631          FMP T1W+1,2
01632          FAD 1)+3
01633          STO VE1+1,2
01634  230A    LDQ T2W+1,2
01635          FMP VF+1,2
01636          STO 1)+1
01637          LDQ T2F+1,2
01640          FMP VW+1,2
01641          FAD V2+1,2
01642          FSB 1)+1
01643          STO 1)+2
01644          LDQ CDELTA+1,2
01645          FMP 1)+2
01646          STO 1)+3
01647          LDQ CF+1,2
01650          FMP T2W+1,2
01651          FAD 1)+3
01652          STO VE2+1,2
01653  231A    LDQ VE2+1,2
01654          FMP EL2+1,2
01655          STO 1)+1
01656          CLA 3)+1
01657          FAD ELC+1,2
01660          FAD ELF+1,2
01661          STO 1)+2
01662          LDQ 1)+2
01663          FMP VE1+1,2
01664          STO 7)
01665          LDQ 7)
01666          FMP EL1+1,2
01667          STO 1)+3
01670          CLA TD+1,2
01671          FAD TRP+1,2
01672          FAD TS2+1,2
01673          STO 1)+4
01674          LDQ 1)+4
01675          FMP VE2+1,2
01676          STO 1)+5
01677          CLA VE1+1,2
01700          FAD VE2+1,2
01701          FDP 3)+4
01702          FMP TAU+1,2
01703          STO 1)+6
01704          CLA TC+1,2
01705          FAD TF+1,2
01706          FAD TS1+1,2
01707          STO 1)+7
01710          LDQ 1)+7
01711          FMP VE1+1,2
01712          FAD 1)+6
01713          FAD 1)+5
01714          STO 1)+8
01715          LDQ 1)+2
01716          FMP 1)+8
01717          STO 7)
01720          LDQ 7)
01721          FMP U+1,2
01722          STO 7)
01723          LDQ 7)
01724          FMP EL1+1,2
01725          FAD 1)+3
01726          FSB 1)+1
01727          FDP TAU+1,2
01730          STQ 1)+9
01731          LDQ VE1+1,2
01732          FMP U+1,2
01733          STO 7)
01734          LDQ 7)
01735          FMP EL3+1,2
01736          FAD Q2
01737          FAD 1)+9
01740          STO Q2
01741  231A1   TXI **+1,2,1
01742  231A2   TXL 221A,2
01743  232A    CLA NFCC
01744  232A1   TZE 237A
01745  233A    CLA NFC
01746          STO LOOP
01747  234A    CLA NFCB
01750          ADD 2)+1
01751          STO L
01752  235A    LXD L,2
01753          CLA LOOP
01754          STD 236A2
01755  236A    CLA 3)+1
01756          FAD ELC+1,2
01757          FAD ELF+1,2
01760          STO 1)+1
01761          LDQ EL1+1,2
01762          FMP 1)+1
01763          FSB EL2+1,2
01764          FDP TAU+1,2
01765          STQ 1)+2
01766          CLA TC+1,2
01767          FAD TF+1,2
01770          FAD TRP+1,2
01771          FAD TS1+1,2
01772          FAD TS2+1,2
01773          FAD TD+1,2
01774          FAD TAU+1,2
01775          STO 1)+3
01776          LDQ U+1,2
01777          FMP 1)+3
02000          FDP TAU+1,2
02001          FMP EL1+1,2
02002          STO 7)
02003          LDQ 7)
02004          FMP 1)+1
02005          STO 1)+4
02006          LDQ U+1,2
02007          FMP EL3+1,2
02010          FAD Q3
02011          FAD 1)+4
02012          FAD 1)+2
02013          STO Q3
02014  236A1   TXI *+1,2,1
02015  236A2   TXL 236A,2
02016  237A    LDQ 3)+3
02017          FMP P
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02020          FSB  3)+5
02021  237A1   TZE  238A
02022          TPL  240A
02023  238A    CLA  3)+1
02024          STO  EL
02025  239A    TRA  257A
02026  240A    LDQ  3)+3
02027          FMP  P
02030          FSB  3)+3
02031  240A1   TZE  241A
02032          TPL  243A
02033  241A    CLA  3)+6
02034          STO  EL
02035  242A    TRA  257A
02036  243A    CLA  P
02037          FSB  3)+5
02040  243A1   TZE  244A
02041          TPL  246A
02042  244A    CLA  3)+7
02043          STO  EL
02044  245A    TRA  257A
02045  246A    LDQ  P
02046          FMP  ETA
02047          FSB  3)+8
02050  246A1   TZE  247A
02051          TPL  247A
02052          TRA  249A
02053  247A    CLA  3)+9
02054          STO  EL
02055  248A    TRA  257A
02056  249A    LDQ  PF
02057          FMP  3)+10
02060          STO  7)
02061          LDQ  7)
02062          FMP  3)+3
02063          STO  7)
02064          LDQ  7)
02065          FMP  P
02066          FDP  3)+11
02067          STQ  EL
02070  250A    CLA  EL
02071          FSB  3)+12
02072  250A1   TZE  253A
02073          TPL  253A
02074  251A    CLA  3)+12
02075          STO  EL
02076  252A    TRA  257A
02077  253A    CLA  EL
02100          FSB  3)+9
02101  253A1   TZE  256A
02102          TPL  254A
02103          TRA  256A
02104  254A    CLA  3)+9
02105          STO  EL
02106  255A    TRA  257A
02107  256A    LDQ  3)+5
02110          FMP  EL
02111          FAD  3)+14
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02112          UFA  6)
02113          FAD  6)
02114          STO  1)+1
02115          LDQ  3)+13
02116          FMP  1)+1
02117          STO  EL
02120  257A    CLA  A1
02121          FSB  3)+3
02122  257A1   TZE  260A
02123          TPL  260A
02124  258A    CLA  3)+3
02125          STO  PR
02126  259A    TRA  261A
02127  260A    CLA  A1
02130          STO  PR
02131  261A    CLA  EL
02132          FSB  3)+1
02133  261A1   TZE  262A
02134          TPL  264A
02135  262A    CLA  EL
02136          STO  CAPPA
02137  263A    TRA  306A
02140  264A    LDQ  3)+15
02141          FMP  A1
02142          FSB  3)+3
02143  264A1   TZE  267A
02144          TPL  267A
02145  265A    CLA  3)+3
02146          STO  PR-1
02147  266A    TRA  268A
02150  267A    LDQ  3)+15
02151          FMP  A1
02152          STO  PR-1
02153  268A    CLA  3)+1
02154          STO  CAPPA
02155  269A    CLA  EL
02156          FSB  3)+16
02157  269A1   TZE  270A
02160          TPL  272A
02161  270A    CLA  EL
02162          FSB  3)+1
02163          STO  ELAMDA
02164  271A    TRA  307A
02165  272A    LDQ  3)+17
02166          FMP  A1
02167          FSB  3)+3
02170  272A1   TZE  275A
02171          TPL  275A
02172  273A    CLA  3)+3
02173          STO  PR-2
02174  274A    TRA  276A
02175  275A    LDQ  3)+17
02176          FMP  A1
02177          STO  PR-2
02200  276A    CLA  3)+18
02201          STO  ELAMDA
02202  277A    CLA  EL
02203          FSB  3)+5
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02204  277A1   TZE  278A
02205          TPL  280A
02206  278A    CLA  EL
02207          FSB  3)+16
02210          STO  EMU
02211  279A    TRA  308A
02212  280A    LDQ  3)+13
02213          FMP  A1
02214          FSB  3)+3
02215  280A1   TZE  283A
02216          TPL  283A
02217  281A    CLA  3)+3
02220          STO  PR-3
02221  282A    TRA  284A
02222  283A    LDQ  3)+13
02223          FMP  A1
02224          STO  PR-3
02225  284A    CLA  3)+16
02226          STO  EMU
02227  285A    CLA  EL
02230          FSB  3)+19
02231  285A1   TZE  286A
02232          TPL  288A
02233  286A    CLA  EL
02234          FSB  3)+5
02235          STO  ENU
02236  287A    TRA  309A
02237  288A    LDQ  3)+20
02240          FMP  A1
02241          FSB  3)+3
02242  288A1   TZE  291A
02243          TPL  291A
02244  289A    CLA  3)+3
02245          STO  PR-4
02246  290A    TRA  292A
02247  291A    LDQ  3)+20
02250          FMP  A1
02251          STO  PR-4
02252  292A    CLA  3)+5
02253          STO  ENU
02254  293A    CLA  EL
02255          FSB  3)+21
02256  293A1   TZE  294A
02257          TPL  296A
02260  294A    CLA  EL
02261          FSB  3)+19
02262          STO  XI
02263  295A    TRA  310A
02264  296A    LDQ  3)+22
02265          FMP  A1
02266          FSB  3)+3
02267  296A1   TZE  299A
02270          TPL  299A
02271  297A    CLA  3)+3
02272          STO  PR-5
02273  298A    TRA  300A
02274  299A    LDQ  3)+22
02275          FMP  A1
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02276          STO PR-5
02277 300A     CLA 3)+19
02300          STO XI
02301 301A     CLA EL
02302          FSB 3)+9
02303 301A1    TZE 302A
02304          TPL 304A
02305 302A     CLA EL
02306          FSB 3)+21
02307          STO ZETA
02310 303A     TRA 311A
02311 304A     CLA 3)+19
02312          STO ZETA
02313 305A     TRA 311A
02314 306A     CLA 3)
02315          STO ELAMDA
02316 307A     CLA 3)
02317          STO EMU
02320 308A     CLA 3)
02321          STO ENU
02322 309A     CLA 3)
02323          STO XI
02324 310A     CLA 3)
02325          STO ZETA
02326 311A     LDQ ZETA
02327          FMP PR-5
02330          STO 1)+1
02331          LDQ XI
02332          FMP PR-4
02333          STO 1)+2
02334          LDQ ENU
02335          FMP PR-3
02336          STO 1)+3
02337          LDQ EMU
02340          FMP PR-2
02341          STO 1)+4
02342          LDQ ELAMDA
02343          FMP PR-1
02344          STO 1)+5
02345          LDQ CAPPA
02346          FMP PR
02347          FAD 1)+5
02350          FAD 1)+4
02351          FAD 1)+3
02352          FAD 1)+2
02353          FAD 1)+1
02354          STO PL
02355          TTR 312A
02356 D)439    LXD C)G2,4
02357 312A     CLA EYEC
02360          FAD EYEL
02361          STO 1)+1
02362          CLA PHI
02363          FAD CHI
02364          FAD PSI
02365          STO 1)+2
02366          LDQ DELTA
02367          FMP 1)+2
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02370          STO 7)
02371          LDQ 7)
02372          FMP 1)+1
02373          STO ADVAL
02374 313A     LDQ OMEGA
02375          FMP CAPIP
02376          STO PROFIT
02377 314A     LDQ CAPIP
02400          FMP B
02401          STO 7)
02402          LDQ 7)
02403          FMP EYEBAR
02404          STO 1)+1
02405          CLA 3)+1
02406          FDP BETA
02407          FMP EYED
02410          FAD EYEC
02411          FDP ENPRIM
02412          FMP 3)+1
02413          FAD 1)+1
02414          STO DEP
02415 315A     CLA MCALC
02416 315A1    TZE 316A
02417          TPL 353A
02420          TRA 353A
02421 316A     CLA 3)+1
02422          FSB ALPHAJ
02423          STO 1)+1
02424          LDQ 3)+3
02425          FMP 1)+1
02426          STO 7)
02427          LDQ 7)
02430          FMP Q3
02431          STO 1)+2
02432          CLA ALPHAR
02433          FSB ALPHAJ
02434          STO 1)+3
02435          LDQ YT
02436          FMP 1)+3
02437          STO 7)
02440          LDQ 7)
02441          FMP 3)+3
02442          FSB 1)+2
02443          STO 1)+4
02444          CLA 3)+1
02445          FDP 1)+4
02446          STQ T1
02447 317A     CLA ADVAL
02450          FAD OM
02451          FAD Q1
02452          FAD Q2
02453          FAD PL
02454          STO 1)+1
02455          CLA 3)+1
02456          FSB ALPHAJ
02457          STO 1)+2
02460          LDQ 1)+2
02461          FMP 1)+1
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02462          STO T2
02463 318A     CLA ALPHAR
02464          FSB ALPHAJ
02465          STO 1)+1
02466          LDQ EM
02467          FMP 1)+1
02470          STO 7)
02471          LDQ 7)
02472          FMP 3)+23
02473          STO 7)
02474          LDQ 7)
02475          FMP P
02476          STO 7)
02477          LDQ 7)
02500          FMP ETA
02501          STO 7)
02502          LDQ 7)
02503          FMP EPSLON
02504          STO T3
02505 319A     CLA 3)+1
02506          FDP BETA
02507          FMP EYED
02510          FAD EYEC
02511          FDP ENPRIM
02512          FMP ALPHAJ
02513          STO 1)+1
02514          LDQ EYEBAR
02515          FMP ALPHAJ
02516          STO 7)
02517          LDQ 7)
02520          FMP B
02521          CHS
02522          FAD OMEGA
02523          STO 1)+2
02524          LDQ 1)+2
02525          FMP CAPIP
02526          STO 1)+3
02527          CLA CAPI
02530          FDP AN
02531          STO 1)+4
02532          CLA 1)+4
02533          FAD 1)+3
02534          FSB 1)+1
02535          STO T4
02536 320A     CLA T2
02537          FAD T4
02540          FSB T3
02541          STO 1)+1
02542          LDQ T1
02543          FMP 1)+1
02544          STO V
02545 321A     LDQ 3)+3
02546          FMP Q3
02547          STO 7)
02550          LDQ 7)
02551          FMP V
02552          FAD Q2
02553          FAD Q1
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02554          STO FCT
02555  322A    LDQ 3)+23
02556          FMP P
02557          STO 7)
02560          LDQ 7)
02561          FMP ETA
02562          STO 7)
02563          LDQ 7)
02564          FMP EPSLON
02565          STO 7)
02566          LDQ 7)
02567          FMP EM
02570          STO 1)+1
02571          LDQ 3)+3
02572          FMP YT
02573          STO 7)
02574          LDQ 7)
02575          FMP V
02576          FAD 1)+1
02577          STO REV
02600  323A    CLA REV
02601          FSB FCT
02602          FSB OM
02603          FSB ADVAL
02604          FSB DEP
02605          FSB PL
02606          STO ENS
02607  324A    LDQ AJS
02610          FMP ENS
02611          STO STAX
02612  325A    CLA 3)+1
02613          FSB AJS
02614          STO 1)+1
02615          LDQ ENS
02616          FMP AJF
02617          STO 7)
02620          LDQ 7)
02621          FMP 1)+1
02622          STO FTAX
02623  326A    CLA STAX
02624          FAD FTAX
02625          STO TAXES
02626  327A    CLA ADVAL
02627          FAD OM
02630          FAD PL
02631          FAD FCT
02632          FAD TAXES
02633          STO OE
02634  328A    CLA TAXES
02635  328A1   TZE 335A
02636          TPL 335A
02637  329A    LDQ YT
02640          FMP 3)+3
02641          STO 1)+1
02642          CLA TAXES
02643          SSP
02644          FDP 1)+1
02645          STQ 1)+2
02646          CLA V
02647          FAD 1)+2
02650          STO V
02651  330A    CLA 3)
02652          STO TAXES
02653  331A    LDQ 3)+23
02654          FMP ETA
02655          STO 7)
02656          LDQ 7)
02657          FMP EPSLON
02660          STO 7)
02661          LDQ 7)
02662          FMP EM
02663          STO 1)+1
02664          LDQ 3)+3
02665          FMP YT
02666          STO 7)
02667          LDQ 7)
02670          FMP V
02671          FAD P
02672          FAD 1)+1
02673          STO REV
02674  332A    CLA ADVAL
02675          FAD OM
02676          FAD PL
02677          FAD FCT
02700          STO OE
02701  333A    CLA 3)
02702          STO FTAX
02703  334A    CLA 3)
02704          STO STAX
02705  335A    LDQ 3)+3
02706          FMP YT
02707          STO 7)
02710          LDQ 7)
02711          FMP V
02712          STO YT
02713  336A    CLA REV
02714          FSB YT
02715          STO ELECRV
02716  337A    PSE 114
02717          TRA 514A
02720  338A    CAL *
02721          XIT (LEV)
02722          ETM
02723          CAL (IOH)0
02724          SLW 1
02725          CAL (SPH)
02726  338D1   NTR 8)R
02727  339A    ETM
02730          NTR V
02731          NTR REV
02732          NTR ELECRV
02733          NTR YT
02734          NTR CAPI
02735          NTR OE
02736          NTR ADVAL
02737          NTR PROFIT
02740          NTR PL
02741          NTR STAX
02742          NTR FTAX
02743          NTR FCT
02744          LTM
02745  340A    CAL *
02746          XIT (FIL)
02747  341A    CLA NFCB
02750  341A1   TZE 348A
02751  342A    CAL *
02752          XIT (LEV)
02753          ETM
02754          CAL (IOH)0
02755          SLW 1
02756          CAL (SPH)
02757  342D1   NTR 8)T
02760  343A    LXD 2)+1,2
02761          CLA NFCB
02762          STD 344A2
02763  344A    ETM
02764          NTR VE1+1,2
02765          NTR VE2+1,2
02766          LTM
02767  344A1   TXI *+1,2,1
02770  344A2   TXL 344A,2
02771  346A    LTM
02772  347A    CAL *
02773          XIT (FIL)
02774  348A    PSE 113
02775          TRA 390A
02776  349A    CAL *
02777          XIT (LEV)
03000          ETM
03001          CAL (IOH)0
03002          SLW 1
03003          CAL (SPH)
03004  349D1   NTR 8)V
03005  350A    ETM
03006          NTR AN
03007          NTR CAPIP
03010          NTR Q1
03011          NTR Q2
03012          NTR Q3
03013          NTR T1
03014          NTR T2
03015          NTR T3
03016          NTR T4
03017          LTM
03020  351A    CAL *
03021          XIT (FIL)
03022  352A    TRA 390A
03023  353A    LDQ 3)+3
03024          FMP YT
03025          STO 7)
03026          LDQ 7)
03027          FMP V
03030          STO YT
03031  354A    CLA ALPHAR
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03032          FSB  ALPHAJ
03033          STO  1)+1
03034          LDQ  3)+23
03035          FMP  1)+1
03036          STO  7)
03037          LDQ  7)
03040          FMP  P
03041          STO  7)
03042          LDQ  7)
03043          FMP  ETA
03044          STO  7)
03045          LDQ  7)
03046          FMP  EPSLON
03047          STO  1)+2
03050          CLA  3)+1
03051          FDP  1)+2
03052          STQ  T1
03053  355A    CLA  3)+1
03054          FDP  BETA
03055          FMP  EYED
03056          FAD  EYEC
03057          FDP  ENPRIM
03060          FMP  ALPHAJ
03061          STO  1)+1
03062          LDQ  CAPIP
03063          FMP  ALPHAJ
03064          STO  7)
03065          LDQ  7)
03066          FMP  B
03067          STO  7)
03070          LDQ  7)
03071          FMP  EYEBAR
03072          CHS
03073          FAD  PROFIT
03074          FSB  1)+1
03075          STO  T3
03076  356A    CLA  ALPHAJ
03077          FSB  ALPHAR
03100          STO  1)+1
03101          LDQ  YT
03102          FMP  1)+1
03103          STO  T4
03104  357A    CLA  NFC
03105  357A1   TZE  359A
03106  358A    LDQ  3)+3
03107          FMP  Q3
03110          STO  7)
03111          LDQ  7)
03112          FMP  V
03113          FAD  Q2
03114          FAD  Q1
03115          STO  FCT
03116  359A    CLA  ADVAL
03117          FAD  OM
03120          FAD  FCT
03121          FAD  PL
03122          STO  1)+1
03123          CLA  3)+1
03124          FSB  ALPHAJ
03125          STO  1)+2
03126          LDQ  1)+2
03127          FMP  1)+1
03130          STO  1)+3
03131          CLA  CAPI
03132          FDP  AN
03133          STQ  1)+4
03134          CLA  1)+4
03135          FAD  1)+3
03136          STO  T2
03137  360A    CLA  T3
03140          FAD  T4
03141          FAD  T2
03142          STO  1)+1
03143          LDQ  T1
03144          FMP  1)+1
03145          STO  EM
03146  361A    LDQ  3)+23
03147          FMP  P
03150          STO  7)
03151          LDQ  7)
03152          FMP  ETA
03153          STO  7)
03154          LDQ  7)
03155          FMP  EPSLON
03156          STO  7)
03157          LDQ  7)
03160          FMP  EM
03161          FAD  YT
03162          STO  REV
03163  362A    CLA  REV
03164          FSB  FCT
03165          FSB  OM
03166          FSB  ADVAL
03167          FSB  DEP
03170          FSB  PL
03171          STO  ENS
03172  363A    LDQ  AJS
03173          FMP  ENS
03174          STO  STAX
03175  364A    CLA  3)+1
03176          FSB  AJS
03177          STO  1)+1
03200          LDQ  ENS
03201          FMP  AJF
03202          STO  7)
03203          LDQ  7)
03204          FMP  1)+1
03205          STO  FTAX
03206  365A    CLA  STAX
03207          FAD  FTAX
03210          STO  TAXES
03211  366A    CLA  ADVAL
03212          FAD  OM
03213          FAD  PL
03214          FAD  FCT
03215          FAD  TAXES
03216          STO  OE
03217  367A    CLA  TAXES
03220  367A1   TZE  374A
03221          TPL  374A
03222  368A    LDQ  3)+23
03223          FMP  P
03224          STO  7)
03225          LDQ  7)
03226          FMP  ETA
03227          STO  7)
03230          LDQ  7)
03231          FMP  EPSLON
03232          STO  1)+1
03233          CLA  TAXES
03234          SSP
03235          FDP  1)+1
03236          STQ  1)+2
03237          CLA  EM
03240          FAD  1)+2
03241          STO  EM
03242  369A    CLA  3)
03243          STO  TAXES
03244  370A    LDQ  3)+23
03245          FMP  P
03246          STO  7)
03247          LDQ  7)
03250          FMP  ETA
03251          STO  7)
03252          LDQ  7)
03253          FMP  EPSLON
03254          STO  7)
03255          LDQ  7)
03256          FMP  EM
03257          FAD  YT
03260          STO  REV
03261  371A    CLA  ADVAL
03262          FAD  OM
03263          FAD  PL
03264          FAD  FCT
03265          STO  OE
03266  372A    CLA  3)
03267          STO  FTAX
03270  373A    CLA  3)
03271          STO  STAX
03272  374A    CLA  REV
03273          FSB  YT
03274          STO  ELECRV
03275  375A    PSE  114
03276          TRA  529A
03277  376A    CAL  *
03300          XIT  (LEV)
03301          ETM
03302          CAL  (IOH)0
03303          SLW  1
03304          CAL  (SPH)
03305  376D1   NTR  8)H
03306  377A    ETM
03307          NTR  EM
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03310          NTR REV
03311          NTR ELECRV
03312          NTR YT
03313          NTR CAPI
03314          NTR OE
03315          NTR ADVAL
03316          NTR PROFIT
03317          NTR PL
03320          NTR STAX
03321          NTR FTAX
03322          NTR FCT
03323          LTM
03324  378A    CAL *
03325          XIT (FIL)
03326  379A    CLA NFCB
03327  379A1   TZE 386A
03330  380A    CAL *
03331          XIT (LEV)
03332          ETM
03333          CAL (IOH)O
03334          SLW 1
03335          CAL (SPH)
03336  380D1   NTR 8)T
03337  381A    LXD 2)+1,2
03340          CLA NFCB
03341          STD 382A2
03342  382A    ETM
03343          NTR VE1+1,2
03344          NTR VE2+1,2
03345          LTM
03346  382A1   TXI *+1,2,1
03347  382A2   TXL 382A,2
03350  384A    LTM
03351  385A    CAL *
03352          XIT (FIL)
03353  386A    PSE 113
03354          TRA 390A
03355  387A    CAL *
03356          XIT (LEV)
03357          ETM
03360          CAL (IOH)O
03361          SLW 1
03362          CAL (SPH)
03363  387D1   NTR 8)V
03364  388A    ETM
03365          NTR AN
03366          NTR CAPIP
03367          NTR Q1
03370          NTR Q2
03371          NTR Q3
03372          NTR T1
03373          NTR T2
03374          NTR T3
03375          NTR T4
03376          LTM
03377  389A    CAL *
03400          XIT (FIL)
03401  390A    PSE 96
03402  391A    CAL *
03403          XIT (LEV)
03404          ETM
03405          CAL (IOH)I
03406          SLW 1
03407          CAL (CSH)
03410  391D1   NTR 8)J,0,81
03411  392A    ETM
03412          NTR NPC
03413          LTM
03414  393A    CAL *
03415          XIT (RTN)
03416  394A    CLA NPC
03417  394A1   TZE 43A
03420  395A    CLA MOD
03421          ADD 2)+1
03422          STO MOD
03423  396A    PSE 114
03424          TRA 544A
03425  397A    CAL *
03426          XIT (LEV)
03427          ETM
03430          CAL (IOH)O
03431          SLW 1
03432          CAL (SPH)
03433  397D1   NTR 8)S
03434  398A    ETM
03435          NTR MOD
03436          LTM
03437  399A    CAL *
03440          XIT (FIL)
03441  400A    LXD 2)+1,2
03442          CLA NPC
03443          STD 412A2
03444  401A    CAL *
03445          XIT (LEV)
03446          ETM
03447          CAL (IOH)I
03450          SLW 1
03451          CAL (CSH)
03452  401D1   NTR 8)J,0,81
03453  402A    ETM
03454          NTR J
03455          LTM
03456          LXD J,1
03457  404A    ETM
03460          NTR PA+1,1
03461          LTM
03462  405A    CAL *
03463          XIT (RTN)
03464  406A    PSE 114
03465          TRA E)43
03466          TRA 407A
03467  E)43    SXD C)G2,1
03470  406A1   PXD 0,2
03471          STO K
03472          TRA 548A
03473  407A    CAL *
03474          XIT (LEV)
03475          ETM
03476          CAL (IOH)O
03477          SLW 1
03500          CAL (SPH)
03501  407D1   NTR 8)L
03502  408A    ETM
03503          NTR LABEL+1,1
03504          NTR PA+1,1
03505          LTM
03506  409A    CAL *
03507          XIT (FIL)
03510  410A    CLA J
03511          SUB 2)+2
03512  410A1   TZE 411A
03513          TPL E)47
03514  411A    CLA PA+1,1
03515          UFA 6)
03516          LRS
03517          ANA 6)+1
03520          LLS
03521          ALS 18
03522          STO JPA+1,1
03523          TTR 412A
03524  E)47    SXD C)G2,1
       412A    BSS
03525  412A1   TXI *+1,2,1
03526  412A2   TXL 401A,2
03527  E)48    SXD C)G2,1
03530  413A    TRA 194A
03531  414A    CAL *
03532          XIT (LEV)
03533          ETM
03534          CAL (IOH)O
03535          SLW 1
03536          CAL (STH)
03537  414D1   NTR 8)1,0,1
03540  415A    CAL *
03541          XIT (FIL)
03542  416A    CLA MCALC
03543  416A1   TZE 421A
03544  417A    CAL *
03545          XIT (LEV)
03546          ETM
03547          CAL (IOH)O
03550          SLW 1
03551          CAL (STH)
03552  417D1   NTR 8)N,0,1
03553  418A    ETM
03554          NTR NFCP
03555          NTR NFCC
03556          LTM
03557  419A    CAL *
03560          XIT (FIL)
03561  420A    TRA 424A
03562  421A    CAL *
03563          XIT (LEV)
03564          ETM
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03565          CAL (IOH)O
03566          SLW 1
03567          CAL (STH)
03570 421D1    NTR 8)0,0,1
03571 422A     ETM
03572          NTR NFCB
03573          NTR NFCC
03574          LTM
03575 423A     CAL *
03576          XIT (FIL)
03577 424A     CAL *
03600          XIT (LEV)
03601          ETM
03602          CAL (IOH)O
03603          SLW 1
03604          CAL (STH)
03605 424D1    NTR 8)3,0,1
03606 425A     ETM
03607          NTR BETA
03610          NTR EYEL
03611          NTR EYE
03612          NTR EN
03613          NTR EYEC
03614          NTR ENC
03615          NTR EYED
03616          NTR END
03617          LTM
03620 426A     CAL *
03621          XIT (FIL)
03622 427A     CLA MCALC
03623 427A1    TZE 432A
03624 428A     CAL *
03625          XIT (LEV)
03626          ETM
03627          CAL (IOH)O
03630          SLW 1
03631          CAL (STH)
03632 428D1    NTR 8)4,0,1
03633 429A     ETM
03634          NTR EPSLON
03635          NTR P
03636          NTR ETA
03637          NTR V
03640          LTM
03641 430A     CAL *
03642          XIT (FIL)
03643 431A     TRA 435A
03644 432A     CAL *
03645          XIT (LEV)
03646          ETM
03647          CAL (IOH)O
03650          SLW 1
03651          CAL (STH)
03652 432D1    NTR 8)P,0,1
03653 433A     ETM
03654          NTR EPSLON
03655          NTR P
03656          NTR ETA
03657          NTR EM
03660          LTM
03661 434A     CAL *
03662          XIT (FIL)
03663 435A     CAL *
03664          XIT (LEV)
03665          ETM
03666          CAL (IOH)O
03667          SLW 1
03670          CAL (STH)
03671 435D1    NTR 8)5,0,1
03672 436A     ETM
03673          NTR OM
03674          NTR OMEGA
03675          LTM
03676 437A     CAL *
03677          XIT (FIL)
03700 438A     CAL *
03701          XIT (LEV)
03702          ETM
03703          CAL (IOH)O
03704          SLW 1
03705          CAL (STH)
03706 438D1    NTR 8)6,0,1
03707 439A     ETM
03710          NTR CHI
03711          NTR PHI
03712          NTR DELTA
03713          NTR PSI
03714          LTM
03715 440A     CAL *
03716          XIT (FIL)
03717 441A     CAL *
03720          XIT (LEV)
03721          ETM
03722          CAL (IOH)O
03723          SLW 1
03724          CAL (STH)
03725 441D1    NTR 8)7,0,1
03726 442A     ETM
03727          NTR A1
03730          NTR PF
03731          LTM
03732 443A     CAL *
03733          XIT (FIL)
03734 444A     CAL *
03735          XIT (LEV)
03736          ETM
03737          CAL (IOH)O
03740          SLW 1
03741          CAL (STH)
03742 444D1    NTR 8)8,0,1
03743 445A     ETM
03744          NTR ALPHA
03745          NTR AJS
03746          NTR B
03747          NTR ENPRIM
03750          NTR EYEBAR
03751          NTR R
03752          NTR AJF
03753          LTM
03754 446A     CAL *
03755          XIT (FIL)
03756 447A     CLA NFCB
03757          ADD NFCC
03760          STO NFC
03761 448A     CLA NFC
03762 448A1    TZE 449A
03763          TPL 116A
03764          TRA 116A
03765 449A     CAL *
03766          XIT (LEV)
03767          ETM
03770          CAL (IOH)O
03771          SLW 1
03772          CAL (STH)
03773 449D1    NTR 8)9,0,1
03774 450A     ETM
03775          NTR FCT
03776          LTM
03777 451A     CAL *
04000          XIT (FIL)
04001 452A     TRA D)116
04002 453A     CAL *
04003          XIT (LEV)
04004          ETM
04005          CAL (IOH)O
04006          SLW 1
04007          CAL (STH)
04010 453D1    NTR 8)A,0,1
04011 454A     LXD 2)+1,2
04012          CLA LOOP
04013          STD 455A2
04014 455A     ETM
04015          NTR EL1+1,2
04016          NTR EL2+1,2
04017          NTR EL3+1,2
04020          LTM
04021 455A1    TXI *+1,2,1
04022 455A2    TXL 455A,2
04023 457A     LTM
04024 458A     CAL *
04025          XIT (FIL)
04026 459A     CAL *
04027          XIT (LEV)
04030          ETM
04031          CAL (IOH)O
04032          SLW 1
04033          CAL (STH)
04034 459D1    NTR 8)B,0,1
04035 460A     LXD 2)+1,2
04036          CLA LOOP
04037          STD 461A2
04040 461A     ETM
04041          NTR ELC+1,2
04042          NTR ELF+1,2
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04043          NTR ELWD+1,2
04044          LTM
04045 461A1    TXI *+1,2,1
04046 461A2    TXL 461A,2
04047 463A     LTM
04050 464A     CAL *
04051          XIT (FIL)
04052 465A     CAL *
04053          XIT (LEV)
04054          ETM
04055          CAL (IOH)0
04056          SLW 1
04057          CAL (STH)
04060 465D1    NTR 8)C,0,1
04061 466A     LXD 2)+1,2
04062          CLA LOOP
04063          STD 467A2
04064 467A     ETM
04065          NTR CU+1,2
04066          NTR F+1,2
04067          NTR RPU+1,2
04070          LTM
04071 467A1    TXI *+1,2,1
04072 467A2    TXL 467A,2
04073 469A     LTM
04074 470A     CAL *
04075          XIT (FIL)
04076 471A     CAL *
04077          XIT (LEV)
04100          ETM
04101          CAL (IOH)0
04102          SLW 1
04103          CAL (STH)
04104 471D1    NTR 8)D,0,1
04105 472A     LXD 2)+1,2
04106          CLA LOOP
04107          STD 473A2
04110 473A     ETM
04111          NTR CWD+1,2
04112          NTR S1+1,2
04113          NTR S2+1,2
04114          LTM
04115 473A1    TXI *+1,2,1
04116 473A2    TXL 473A,2
04117 475A     LTM
04120 476A     CAL *
04121          XIT (FIL)
04122 477A     CAL *
04123          XIT (LEV)
04124          ETM
04125          CAL (IOH)0
04126          SLW 1
04127          CAL (STH)
04130 477D1    NTR 8)E,0,1
04131 478A     LXD 2)+1,2
04132          CLA LOOP
04133          STD 479A2
04134 479A     ETM
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04135          NTR TC+1,2
04136          NTR TF+1,2
04137          NTR TRP+1,2
04140          LTM
04141 479A1    TXI *+1,2,1
04142 479A2    TXL 479A,2
04143 481A     LTM
04144 482A     CAL *
04145          XIT (FIL)
04146 483A     CAL *
04147          XIT (LEV)
04150          ETM
04151          CAL (IOH)0
04152          SLW 1
04153          CAL (STH)
04154 483D1    NTR 8)F,0,1
04155 484A     LXD 2)+1,2
04156          CLA LOOP
04157          STD 485A2
04160 485A     ETM
04161          NTR TD+1,2
04162          NTR TS1+1,2
04163          NTR TS2+1,2
04164          LTM
04165 485A1    TXI *+1,2,1
04166 485A2    TXL 485A,2
04167 487A     LTM
04170 488A     CAL *
04171          XIT (FIL)
04172 489A     CAL *
04173          XIT (LEV)
04174          ETM
04175          CAL (IOH)0
04176          SLW 1
04177          CAL (STH)
04200 489D1    NTR 8)G,0,1
04201 490A     LXD 2)+1,2
04202          CLA LOOP
04203          STD 491A2
04204 491A     ETM
04205          NTR E1+1,2
04206          NTR E2+1,2
04207          NTR CDELTA+1,2
04210          LTM
04211 491A1    TXI *+1,2,1
04212 491A2    TXL 491A,2
04213 493A     LTM
04214 494A     CAL *
04215          XIT (FIL)
04216 495A     CAL *
04217          XIT (LEV)
04220          ETM
04221          CAL (IOH)0
04222          SLW 1
04223          CAL (STH)
04224 495D1    NTR 8)Q,0,1
04225 496A     LXD 2)+1,2
04226          CLA LOOP
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04227          STD 497A2
04230 497A     ETM
04231          NTR CF+1,2
04232          NTR EF+1,2
04233          NTR EW+1,2
04234          LTM
04235 497A1    TXI *+1,2,1
04236 497A2    TXL 497A,2
04237 499A     LTM
04240 500A     CAL *
04241          XIT (FIL)
04242 501A     CAL *
04243          XIT (LEV)
04244          ETM
04245          CAL (IOH)0
04246          SLW 1
04247          CAL (STH)
04250 501D1    NTR 8)10,0,1
04251 502A     LXD 2)+1,2
04252          CLA LOOP
04253          STD 503A2
04254 503A     ETM
04255          NTR A+1,2
04256          NTR CP+1,2
04257          NTR ET+1,2
04260          LTM
04261 503A1    TXI *+1,2,1
04262 503A2    TXL 503A,2
04263 505A     LTM
04264 506A     CAL *
04265          XIT (FIL)
04266 507A     CAL *
04267          XIT (LEV)
04270          ETM
04271          CAL (IOH)0
04272          SLW 1
04273          CAL (STH)
04274 507D1    NTR 8)11,0,1
04275 508A     LXD 2)+1,2
04276          CLA LOOP
04277          STD 509A2
04300 509A     ETM
04301          NTR U+1,2
04302          LTM
04303 509A1    TXI *+1,2,1
04304 509A2    TXL 509A,2
04305 511A     LTM
04306 512A     CAL *
04307          XIT (FIL)
04310 513A     TRA D)116
04311 514A     CAL *
04312          XIT (LEV)
04313          ETM
04314          CAL (IOH)0
04315          SLW 1
04316          CAL (STH)
04317 514D1    NTR 8)R,0,1
04320 515A     ETM
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04321          NTR V
04322          NTR REV
04323          NTR ELECRV
04324          NTR YT
04325          NTR CAPI
04326          NTR OE
04327          NTR ADVAL
04330          NTR PROFIT
04331          NTR PL
04332          NTR STAX
04333          NTR FTAX
04334          NTR FCT
04335          LTM
04336  516A    CAL *
04337          XIT (FIL)
04340  517A    CLA NFCB
04341  517A1   TZE 524A
04342  518A    CAL *
04343          XIT (LEV)
04344          ETM
04345          CAL (IOH)O
04346          SLW 1
04347          CAL (STH)
04350  518D1   NTR 8)T,0,1
04351  519A    LXD 2)+1,2
04352          CLA NFCB
04353          STD 520A2
04354  520A    ETM
04355          NTR VE1+1,2
04356          NTR VE2+1,2
04357          LTM
04360  520A1   TXI *+1,2,1
04361  520A2   TXL 520A,2
04362  522A    LTM
04363  523A    CAL *
04364          XIT (FIL)
04365  524A    PSE 113
04366          TRA 390A
04367  525A    CAL *
04370          XIT (LEV)
04371          ETM
04372          CAL (IOH)O
04373          SLW 1
04374          CAL (STH)
04375  525D1   NTR 8)V,0,1
04376  526A    ETM
04377          NTR AN
04400          NTR CAPIP
04401          NTR Q1
04402          NTR Q2
04403          NTR Q3
04404          NTR T1
04405          NTR T2
04406          NTR T3
04407          NTR T4
04410          LTM
04411  527A    CAL *
04412          XIT (FIL)
04413  528A    TRA 390A
04414  529A    CAL *
04415          XIT (LEV)
04416          ETM
04417          CAL (IOH)O
04420          SLW 1
04421          CAL (STH)
04422  529D1   NTR 8)H,0,1
04423  530A    ETM
04424          NTR EM
04425          NTR REV
04426          NTR ELECRV
04427          NTR YT
04430          NTR CAPI
04431          NTR OE
04432          NTR ADVAL
04433          NTR PROFIT
04434          NTR PL
04435          NTR STAX
04436          NTR FTAX
04437          NTR FCT
04440          LTM
04441  531A    CAL *
04442          XIT (FIL)
04443  532A    CLA NFCB
04444  532A1   TZE 539A
04445  533A    CAL *
04446          XIT (LEV)
04447          ETM
04450          CAL (IOH)O
04451          SLW 1
04452          CAL (STH)
04453  533D1   NTR 8)T,0,1
04454  534A    LXD 2)+1,2
04455          CLA NFCB
04456          STD 535A2
04457  535A    ETM
04460          NTR VE1+1,2
04461          NTR VE2+1,2
04462          LTM
04463  535A1   TXI *+1,2,1
04464  535A2   TXL 535A,2
04465  537A    LTM
04466  538A    CAL *
04467          XIT (FIL)
04470  539A    PSE 113
04471          TRA 390A
04472  540A    CAL *
04473          XIT (LEV)
04474          ETM
04475          CAL (IOH)O
04476          SLW 1
04477          CAL (STH)
04500  540D1   NTR 8)V,0,1
04501  541A    ETM
04502          NTR AN
04503          NTR CAPIP
04504          NTR Q1
04505          NTR Q2
04506          NTR Q3
04507          NTR T1
04510          NTR T2
04511          NTR T3
04512          NTR T4
04513          LTM
04514  542A    CAL *
04515          XIT (FIL)
04516  543A    TRA 390A
04517  544A    CAL *
04520          XIT (LEV)
04521          ETM
04522          CAL (IOH)O
04523          SLW 1
04524          CAL (STH)
04525  544D1   NTR 8)S,0,1
04526  545A    ETM
04527          NTR MOD
04530          LTM
04531  546A    CAL *
04532          XIT (FIL)
04533  547A    TRA 400A
04534  548A    CAL *
04535          XIT (LEV)
04536          ETM
04537          CAL (IOH)O
04540          SLW 1
04541          CAL (STH)
04542  548D1   NTR 8)L,0,1
04543  549A    ETM
04544          NTR LABEL+1,1
04545          NTR PA+1,1
04546          LTM
04547  550A    CAL *
04550          XIT (FIL)
04551  551A    TRA 410A
04552  2)      OCT +000000000000
04553          OCT +000001000000
04554          OCT +000003000000
04555  3)      OCT +000000000000
04556          OCT +201400000000
04557          OCT +170547062117
04560          OCT +212764000000
04561          OCT +202400000000
04562          OCT +204500000000
04563          OCT +201600000000
04564          OCT +202500000000
04565          OCT +207620000000
04566          OCT +206740000000
04567          OCT +210454000000
04570          OCT +224750220000
04571          OCT +202700000000
04572          OCT +175631463146
04573          OCT +200777777776
04574          OCT +200400000000
04575          OCT +203500000000
04576          OCT +176631463146
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04577          OCT +203400000000
04600          OCT +205500000000
04601          OCT +174631463146
04602          OCT +206500000000
04603          OCT +173631463146
04604          OCT +216421600000
04605  6)      OCT +233000000000
04606          OCT +000000077777
04607          OCT +000000000000
04610          OCT +000001000000
04611          OCT +000000000000
04612          BCD 115.6))
04613          BCD 1U/(1PE
04614  8)11    BCD 1(9X,1H
04615          BCD 1))
04616          BCD 1,E23.6
04617          BCD 1,E22.6
04620          BCD 1PE15.6
04621          BCD 1(T)/(1
04622          BCD 19X,4HE
04623          BCD 1HC(P)1
04624          BCD 1A19X,4
04625  8)10    BCD 1(9X,1H
04626          BCD 117.6)
04627          BCD 1 T4  E
04630          BCD 1/8H
04631          BCD 1 E17.6
04632          BCD 1   T3
04633          BCD 1
04634          BCD 1H
04635          BCD 17.6,18
04636          BCD 1T2  E1
04637          BCD 18H
04640          BCD 1E17.6/
04641          BCD 1  T1
04642          BCD 1
04643          BCD 1
04644          BCD 1.6,18H
04645          BCD 13  E17
04646          BCD 1H    Q
04647          BCD 117.6/8
04650          BCD 1 Q2  E
04651          BCD 1
04652          BCD 1
04653          BCD 16,18H
04654          BCD 1  E17.
04655          BCD 1    Q1
04656          BCD 17.6/8H
04657          BCD 1IP  E1
04660          BCD 1
04661          BCD 1
04662          BCD 1,18H
04663          BCD 1PE17.6
04664          BCD 1 AN  1
04665  8)V     BCD 1(8H
04666          BCD 14.6))
04667          BCD 122X,E1
04670          BCD 1E14.6,
04671          BCD 113X,1P
04672          BCD 1(E2)/(
04673          BCD 11X,5HV
04674          BCD 1V(E1)3
04675  8)T     BCD 1(4X,5H
04676          BCD 1NI6)
04677          BCD 1ICATIO
04700          BCD 10MODIF
04701  8)S     BCD 1(//13H
04702          BCD 114.6)
04703          BCD 1L FC E
04704          BCD 19HTOTA
04705          BCD 16,13X,
04706          BCD 1  E14.
04707          BCD 1 TAX
04710          BCD 14X,9HF
04711          BCD 1E14.6/
04712          BCD 1AX
04713          BCD 1,9HS T
04714          BCD 1,6,13X
04715          BCD 17X,E14
04716          BCD 1X,2HPL
04717          BCD 114.6/4
04720          BCD 1IT   E
04721          BCD 19HPROF
04722          BCD 16,13X,
04723          BCD 1  E14.
04724          BCD 1D VAL
04725          BCD 14X,9HA
04726          BCD 1E14.6/
04727          BCD 1.E.5X,
04730          BCD 13X,4HO
04731          BCD 114.6,1
04732          BCD 1HI8X,E
04733          BCD 16/4X,1
04734          BCD 1  E14.
04735          BCD 1U REV
04736          BCD 13X,9HP
04737          BCD 114.6,1
04740          BCD 1T REVE
04741          BCD 19HELEC
04742          BCD 1.6/4X,
04743          BCD 1REVE14
04744          BCD 1TOTAL
04745          BCD 113X,9H
04746          BCD 1E14.6,
04747          BCD 1V8X,1P
04750          BCD 1/4X,1H
04751          BCD 1OUTPUT
04752  8)R     BCD 1(/8HO
04753          BCD 13.6))
04754          BCD 12.6,E2
04755          BCD 15.6,E2
04756          BCD 1/(1PE1
04757          BCD 14HE(W)
04760          BCD 1F)19X,
04761          BCD 1X,4HE(
04762          BCD 1C(F)18
04763  8)Q     BCD 1(7X,4H
04764          BCD 117.6)
04765          BCD 1 M   E
04766          BCD 1
04767          BCD 1
04770          BCD 16,18H
04771          BCD 1A E17.
04772          BCD 1    ET
04773          BCD 17.6/8H
04774          BCD 1P   E1
04775          BCD 1
04776          BCD 1
04777          BCD 1,18H
05000          BCD 1PE14.6
05001          BCD 1SILONI
05002          BCD 1   EP
05003          BCD 1UE/11H
05004          BCD 1 REVEN
05005  8)P     BCD 1(10H0
05006          BCD 11ONS)
05007          BCD 1UM REG
05010          BCD 1LUTONI
05011          BCD 1,18H P
05012          BCD 1S   I2
05013          BCD 1REGION
05014          BCD 1ANIUM
05015          BCD 119H UR
05016          BCD 1   I2,
05017          BCD 1LATION
05020          BCD 1 CALCU
05021  8)O     BCD 1(17H V
05022          BCD 11ONS)
05023          BCD 1UM REG
05024          BCD 1LUTONI
05025          BCD 1,18H P
05026          BCD 1S   I2
05027          BCD 1REGION
05030          BCD 1ANIUM
05031          BCD 119H UR
05032          BCD 1   I2,
05033          BCD 1LATION
05034          BCD 1 CALCU
05035  8)N     BCD 1(17H M
05036  8)M     BCD 1(6I12)
05037          BCD 1)
05040          BCD 1PE12.5
05041          BCD 1 1A6,1
05042  8)L     BCD 1(4H
05043  8)K     BCD 1(12A6)
05044          BCD 112.5)
05045  8)J     BCD 1(I12,E
05046          BCD 114.6)
05047          BCD 1L FC E
05050          BCD 19HTOTA
05051          BCD 16,13X,
05052          BCD 1  E14.
05053          BCD 1 TAX
05054          BCD 14X,9HF
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05055          BCD 1E14.6/
05056          BCD 1AX
05057          BCD 1,9HS T
05060          BCD 1.6,13X
05061          BCD 17X,E14
05062          BCD 1X,2HPL
05063          BCD 114.6/4
05064          BCD 1IT   E
05065          BCD 19HPROF
05066          BCD 16,13X,
05067          BCD 1  E14.
05070          BCD 1D VAL
05071          BCD 14X,9HA
05072          BCD 1E14.6/
05073          BCD 1.E.5X,
05074          BCD 13X,4HO
05075          BCD 114.6,1
05076          BCD 1HI8X,E
05077          BCD 16/4X,1
05100          BCD 1  E14.
05101          BCD 1U REV
05102          BCD 13X,9HP
05103          BCD 114.6,1
05104          BCD 1T REVE
05105          BCD 19HELEC
05106          BCD 1.6/4X,
05107          BCD 1REVE14
05110          BCD 1TOTAL
05111          BCD 113X,9H
05112          BCD 1E14.6,
05113          BCD 1M8X,1P
05114          BCD 1/4X,1H
05115          BCD 1OUTPUT
05116 8)H      BCD 1(/8HO
05117          BCD 16))
05120          BCD 16,E23.
05121          BCD 16,E22.
05122          BCD 11PE15.
05123          BCD 1LTA)/(
05124          BCD 18HC(DE
05125          BCD 12)17X,
05126          BCD 1X,4HE(
05127          BCD 1E(1)18
05130 8)G      BCD 1(7X,4H
05131          BCD 123.6))
05132          BCD 122.6,E
05133          BCD 115.6,E
05134          BCD 1)/(1PE
05135          BCD 1 PRIME
05136          BCD 110HT(S
05137          BCD 1S)16X,
05140          BCD 1X,4HT(
05141          BCD 1T(D)18
05142 8)F      BCD 1(7X,4H
05143          BCD 123.6))
05144          BCD 122.6,E
05145          BCD 115.6,E
05146          BCD 1 /(1PE
05147          BCD 15HT(R)
05150          BCD 1F)19X,
05151          BCD 1X,4HT(
05152          BCD 1T(C)18
05153 8)E      BCD 1(7X,4H
05154          BCD 123.6))
05155          BCD 122.6,E
05156          BCD 115.6,E
05157          BCD 1)/(1PE
05160          BCD 1 PRIME
05161          BCD 110HC(S
05162          BCD 1S)16X,
05163          BCD 1X,4HC(
05164          BCD 1C(W)18
05165 8)D      BCD 1(7X,4H
05166          BCD 13.6))
05167          BCD 12.6,E2
05170          BCD 15.6,E2
05171          BCD 1/(1PE1
05172          BCD 14HC(R)
05173          BCD 1F)19X,
05174          BCD 1X,4HC(
05175          BCD 1C(C)18
05176 8)C      BCD 1(7X,4H
05177          BCD 123.6))
05200          BCD 122.6,E
05201          BCD 115.6,E
05202          BCD 1 /(1PE
05203          BCD 15HL(W)
05204          BCD 1F)19X,
05205          BCD 1X,4HL(
05206          BCD 1L(C)18
05207 8)B      BCD 1(7X,4H
05210          BCD 1.6))
05211          BCD 1.6,E23
05212          BCD 1.6,E22
05213          BCD 1(1PE15
05214          BCD 1HL(3)/
05215          BCD 1)19X,4
05216          BCD 1,4HL(2
05217          BCD 1(1)18X
05220          BCD 17X,4HL
05221          BCD 1COSTS/
05222          BCD 1CYCLE
05223          BCD 1 FUEL
05224 8)A      BCD 1(19HO
05225          BCD 16)
05226          BCD 11PE13.
05227          BCD 1COST =
05230          BCD 1CYCLE
05231          BCD 1 FUEL
05232 8)9      BCD 1(20HO
05233          BCD 1E17.6)
05234          BCD 1  J(F)
05235          BCD 16/8H
05236          BCD 1  E17.
05237          BCD 1    G
05240          BCD 1
05241          BCD 18H
05242          BCD 117.6,1
05243          BCD 1 IBARE
05244          BCD 1/8H
05245          BCD 1EE15.6
05246          BCD 1 NPRIM
05247          BCD 1
05250          BCD 1
05251          BCD 16,20H
05252          BCD 1  E17.
05253          BCD 1    P
05254          BCD 17.6/8H
05255          BCD 1J(S)E1
05256          BCD 1
05257          BCD 1
05260          BCD 1,18H
05261          BCD 1PE16.6
05262          BCD 1ALPHA1
05263          BCD 19H
05264          BCD 1TAXES/
05265 8)8      BCD 1(8HO
05266          BCD 17.6)
05267          BCD 1PF  E1
05270          BCD 1
05271          BCD 1
05272          BCD 1,18H
05273          BCD 1PE17.6
05274          BCD 1 A(1)1
05275          BCD 1/8H
05276          BCD 1HARGES
05277          BCD 1ANCE C
05300          BCD 1 INSUR
05301 8)7      BCD 1(20HO
05302          BCD 16)
05303          BCD 1I E17.
05304          BCD 1    PS
05305          BCD 1
05306          BCD 18H
05307          BCD 116.6,1
05310          BCD 1DELTAE
05311          BCD 19H
05312          BCD 1E17.6/
05313          BCD 1  PHI
05314          BCD 1
05315          BCD 1
05316          BCD 1.6,18H
05317          BCD 1 1PE16
05320          BCD 1  CHI
05321          BCD 1S/9H
05322          BCD 1CHARGE
05323          BCD 1LOREM
05324          BCD 1 AD VA
05325 8)6      BCD 1(21HO
05326          BCD 1E16.6)
05327          BCD 1 OMEGA
05330          BCD 1/9H
05331          BCD 1PROFIT
05332          BCD 1/9HO
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05333          BCD 1PE19.6
05334          BCD 1   OM1
05335          BCD 1TS/6H
05336          BCD 1CE COS
05337          BCD 1NTENAN
05340          BCD 1ND MAI
05341          BCD 1TING A
05342          BCD 1 OPERA
05343  8)5     BCD 1(34H0
05344          BCD 117.6)
05345          BCD 1 V    E
05346          BCD 1
05347          BCD 1
05350          BCD 16,18H
05351          BCD 1A E17.
05352          BCD 1     ET
05353          BCD 17.6/8H
05354          BCD 1P    E1
05355          BCD 1
05356          BCD 1
05357          BCD 1,18H
05360          BCD 1PE14.6
05361          BCD 1SILON1
05362          BCD 1     EP
05363          BCD 1UE/11H
05364          BCD 1 REVEN
05365  8)4     BCD 1(10H0
05366          BCD 16)
05367          BCD 1D)E17.
05370          BCD 1     N(
05371          BCD 1
05372          BCD 18H
05373          BCD 117.6,1
05374          BCD 1 I(D)E
05375          BCD 1/8H
05376          BCD 1)E17.6
05377          BCD 1    N(C
05400          BCD 1
05401          BCD 1H
05402          BCD 17.6,18
05403          BCD 1I(C)E1
05404          BCD 18H
05405          BCD 1E17.6/
05406          BCD 1  N
05407          BCD 1
05410          BCD 1
05411          BCD 1.6,18H
05412          BCD 1    E17
05413          BCD 1H     I
05414          BCD 117.6/8
05415          BCD 1 I(L)E
05416          BCD 1
05417          BCD 1
05420          BCD 16,18H
05421          BCD 11PE17.
05422          BCD 1  BETA
05423          BCD 1S/8H
05424          BCD 1CHARGE
05425          BCD 1FIXED
05426          BCD 116H0
05427          BCD 1INPUT/
05430  8)3     BCD 1(/7H0
05431          BCD 15)
05432  8)2     BCD 1(6E12.
05433          BCD 1     )
05434          BCD 1
05435          BCD 1
05436          BCD 1
05437          BCD 1
05440          BCD 1
05441          BCD 1
05442          BCD 1
05443          BCD 1
05444          BCD 1
05445          BCD 1
05446          BCD 1
05447  8)1     BCD 1(72H
```

APPENDIX F

SAMPLE PROBLEM INPUT AND OUTPUT

704 INPUT DATA
FORM I

PROBLEM SAMPLE PROBLEM ORIGINATOR J. HEESTAND PROGRAM 0908/RE224 DATE 2/24/61 PAGE 1 OF 3

1	2	3	4	5	6	7	
1 0 9 0 8 / R E 2 2 4	S A M P L E P R O B L E M	2 / 2 4 / 6 1					TITLE 1
1	3	3					PARAMS 2
1. 0	.0 6 3 5	1. 0 5 E+0 8	1. 5 E+0 7	3. 6 E+0 5	2 5. 0		FIXED 3
1. 5	1. 0						CHARGES 4
.8	.3	1 0 0 0. 0	1 2. 0	0. 0			REVENUE 5
2. 0 E+0 6							OM 6
.0 4 4							PROFIT 7
.0 5	1. 0	.0 0 2 5	.0 0 1 3				AD VAL 8
4. 0 E+0 4	1. 0						INSUR 9
0. 0	.5	.0 4 5	.5 2	.2 7	2 5. 0		TAXES 10
0. 0							11
0. 0							FC 12
5. 0 E+0 4	4. 9 E+0 4	0. 0	.0 1	.0 1	0. 0		FUEL 13
1 5. 0	8 5. 0	2 5. 0	0. 0	3. 0	1 6. 0		CYCLE 14
.0 1 1	.2 5	.2	.3 3	.1 1	.0 5 5		PARAM- 15
.0 3	.0 2	3 7. 2 9	3 9. 2 7	.0 0 7 1 4	.0 0 2 2 1		ETER 16
3 4 3. 0	1. 5	5. 2 E+0 5	.0 4				SET 17

AMD-8 (5-58)

704 INPUT DATA
FORM I

PROBLEM ORIGINATOR PROGRAM DATE PAGE 2 OF 3

1	2	3	4	5	6	7	8
5.0 E+04	4.8 E+04	1.0 E+04	.01	.01	.05	2	13
15.0	100.0	25.0	100.0	3.0	16.0	2	14
.011	.25	.2	.5	.11	.055	2	15
.03	.025	37.29	39.27	.0714	.0021	2	16
300.0	1.5	5.0 E+05	.04			2	17
4.0 E+04	3.5 E+04	1.0 E+04	.01	.01	.05	3	13
15.0	75.0	25.0	100.0	3.0	16.0	3	14
.011	.25	.2	.25	.11	.055	3	15
.025	.02	37.29	39.27	.0714	.0021	3	16
400.0	1.5	4.0 E+05	.04			3	17
5.0 E+04	4.9 E+04	1.0 E+04	.01	.01	.05	4	13
10.0	70.0	30.0	100.0	3.0	16.0	4	14
.01	.2	.3	.4	.1	.05	4	15
0.0	0.0	0.0	0.0	0.0	0.0	4	16
0.0	1.5	5.0 E+05	.05			4	17
5.1 E+04	5.0 E+04	1.0 E+04	.01	.01	.05	5	13
15.0	80.0	20.0	100.0	3.0	16.0	5	14
.01	.2	.3	.4	.1	.05	5	15
0.0	0.0	0.0	0.0	0.0	0.0	5	16
1.0	1.5	5.0 E+05	.05			5	17

AMD-8 (5-58)

704 INPUT DATA
FORM I

PROBLEM | ORIGINATOR | PROGRAM | DATE | PAGE 3 OF 3

1	2	3	4	5	6	7	8
4.9 E+04	4.8 E+04	1.0 E+04	.01	.01	.05	63	
20.0	90.0	10.0	100.0	3.0	16.0	64	
.01	.2	.3	.4	.1	.05	65	
0.0	0.9	0.0	0.0	0.0	0.0	66	
0.0	1.5	5.0 E+05	.05			67	

AMD-8 (5-58)

0908/RE224 SAMPLE PROBLEM 2/24/61
M CALCULATION 3 URANIUM REGIONS 3 PLUTONIUM REGIONS

INPUT

FIXED CHARGES

BETA	1.000000E 00	I(L)	3.600000E 05
I	6.350000E-02	N	2.500000E 01
I(C)	1.050000E 08	N(C)	1.500000E 00
I(D)	1.500000E 07	N(D)	1.000000E 00

REVENUE

EPSILON	8.000000E-01	P	1.000000E 03
ETA	3.000000E-01	V	1.200000E 01

OPERATING AND MAINTENANCE COSTS

OM	2.000000E 06

PROFIT

OMEGA	4.400000E-02

AD VALOREM CHARGES

CHI	5.000000E-02	PHI	2.500000E-03
DELTA	1.000000E 00	PSI	1.300000E-03

INSURANCE CHARGES

A(1)	4.000000E 04	PF	1.000000E 00

TAXES

ALPHA	0.	J(S)	2.700000E-01
B	5.000000E-01	NPRIME	2.500000E 01
IBAR	4.500000E-02	G	0.
J(F)	5.200000E-01		

FUEL CYCLE COSTS

L(1)	L(2)	L(3)
5.000000E 04	4.900000E 04	0.
5.000000E 04	4.800000E 04	1.000000E 04
4.000000E 04	3.500000E 04	1.000000E 04
5.000000E 04	4.900000E 04	1.000000E 04
5.100000E 04	5.000000E 04	1.000000E 04
4.900000E 04	4.800000E 04	1.000000E 04

L(C)	L(F)	L(W)
10.000000E-03	10.000000E-03	0.
10.000000E-03	10.000000E-03	5.000000E-02
10.000000E-03	10.000000E-03	5.000000E-02
10.000000E-03	10.000000E-03	5.000000E-02
10.000000E-03	10.000000E-03	5.000000E-02
10.000000E-03	10.000000E-03	5.000000E-02

C(C)	C(F)	C(R)
1.500000E 01	8.500000E 01	2.500000E 01
1.500000E 01	1.000000E 02	2.500000E 01
1.500000E 01	7.500000E 01	2.500000E 01

1.000000E 01
1.500000E 01
2.000000E 01
C(W)
0.
1.000000E 02
1.000000E 02
1.000000E 02
1.000000E 02
1.000000E 02
T(C)
1.100000E-02
1.100000E-02
1.100000E-02
10.000000E-03
10.000000E-03
10.000000E-03
T(D)
3.300000E-01
5.000000E-01
2.500000E-01
4.000000E-01
4.000000E-01
4.000000E-01
E(1)
3.000000E-02
3.000000E-02
2.500000E-02
0.
0.
0.
C(F)
3.927000E 01
3.927000E 01
3.927000E 01
0.
0.
0.
A
3.430000E 02
3.000000E 02
4.000000E 02
0.
1.000000E 00
0.
U
4.000000E-02
4.000000E-02
4.000000E-02
5.000000E-02
5.000000E-02
5.000000E-02

7.000000E 01
8.000000E 01
9.000000E 01
C(S)
3.000000E 00
3.000000E 00
3.000000E 00
3.000000E 00
3.000000E 00
3.000000E 00
T(F)
2.500000E-01
2.500000E-01
2.500000E-01
2.000000E-01
2.000000E-01
2.000000E-01
T(S)
1.100000E-01
1.100000E-01
1.100000E-01
10.000000E-02
10.000000E-02
10.000000E-02
E(2)
2.000000E-02
2.500000E-02
2.000000E-02
0.
0.
0.
E(F)
7.140000E-03
7.140000E-03
7.140000E-03
0.
0.
0.
C(P)
1.500000E 00
1.500000E 00
1.500000E 00
1.500000E 00
1.500000E 00
1.500000E 00

3.000000E 01
2.000000E 01
1.000000E 01
C(S PRIME)
1.600000E 01
1.600000E 01
1.600000E 01
1.600000E 01
1.600000E 01
1.600000E 01
T(R)
2.000000E-01
2.000000E-01
2.000000E-01
3.000000E-01
3.000000E-01
3.000000E-01
T(S PRIME)
5.500000E-02
5.500000E-02
5.500000E-02
5.000000E-02
5.000000E-02
5.000000E-02
C(DELTA)
3.729000E 01
3.729000E 01
3.729000E 01
0.
0.
0.
E(W)
2.210000E-03
2.210000E-03
2.210000E-03
0.
0.
0.
E(T)
5.200000E 05
5.000000E 05
4.000000E 05
5.000000E 05
5.000000E 05
5.000000E 05

OUTPUT

M	1.336895E 02	TOTAL REV	2.889936E 08
ELECT REV	2.810688E 08	PU REV	7.924775E 06
I	1.314285E 08	O.E.	2.725817E 08
AD VAL	5.668368E 06	PROFIT	5.786251E 06
PL	2.600000E 05	S TAX	6.667537E 06
F TAX	9.374063E 06	TOTAL FC	2.486118E 08
V(E1)		V(E2)	
	3.729599E 02		2.184147E 02
	3.729599E 02		2.948872E 02
	2.948872E 02		2.184147E 02

APPENDIX G

SAMPLE WORK SHEET

The following is a sample work sheet proposed by T. Heckman of the AEC, to be of aid to the problem originator.

0908/RE224 REACTOR ECONOMICS WORK SHEET

ORIGINATOR _____ DATE _____

PARAMETER	(J) INDEX	UNITS	PLANT _____ PROBLEM NO. _____			PLANT _____ PROBLEM NO. _____		
			VALUE	REFERENCE (AUTHOR AND/OR DOCUMENT)	ACCURACY G GOOD F FAIR P POOR	VALUE	REFERENCE (AUTHOR AND/OR DOCUMENT)	ACCURACY G GOOD F FAIR P POOR
MCALC	1	-						
NFCB	2	-						
NFCC	3	-						
β	4	-						
i	5	% x 10^{-2}						
I_c	6	$						
I_d	7	$						
I_ℓ	8	$						
n	9	yr						
n_c	10	yr						
n_d	11	yr						
ϵ	12	% x 10^{-2}						
η	13	% x 10^{-2}						
P	14	TMW						
v	15	$/gm						
m	16	mills/kwh						
OM	17	$/yr						
ω	18	% x 10^{-2}						
χ	19	% x 10^{-2}						
δ	20	% x 10^{-2}						
ϕ	21	% x 10^{-2}						
ψ	22	% x 10^{-2}						
a_1	23	per million						

ORIGINATOR _____ DATE _____

PARAMETER	(J) INDEX	UNITS	PLANT _____ PROBLEM NO. _____			PLANT _____ PROBLEM NO. _____		
			VALUE	REFERENCE (AUTHOR AND/OR DOCUMENT)	ACCURACY G GOOD F FAIR P POOR	VALUE	REFERENCE (AUTHOR AND/OR DOCUMENT)	ACCURACY G GOOD F FAIR P POOR
PF	24	-						
α	25	-						
b	26	% x 10^{-2}						
$\underline{i}$	27	% x 10^{-2}						
j_F	28	% x 10^{-2}						
j_S	29	% x 10^{-2}						
n'	30	yr						
g	31	% x 10^{-2}						
fc_t	32	\$/yr						
L_1	33-42	kg						
L_2	43-52	kg						
L_3	53-62	kg						
ℓ_c	63-72	% x 10^{-2}						
ℓ_f	73-82	% x 10^{-2}						
ℓ_w	83-92	% x 10^{-2}						
c_c	93-102	\$/kg						
c_f	103-112	\$/kg						
c_r	113-122	\$/kg						
c_w	123-132	\$/kg						
c_s	133-142	\$/kg						
c_s'	143-152	\$/kg						
t_c	153-162	yr						
t_f	163-172	yr						

ORIGINATOR _____ DATE _____

PARAMETER	(J) INDEX	UNITS	PLANT_____ PROBLEM NO. _____			PLANT_____ PROBLEM NO._____		
			VALUE	REFERENCE (AUTHOR AND/OR DOCUMENT)	ACCURACY G GOOD F FAIR P POOR	VALUE	REFERENCE (AUTHOR AND/OR DOCUMENT)	ACCURACY G GOOD F FAIR P POOR
t_r	173-182	yr						
t_d	183-192	yr						
t_s	193-202	yr						
t_s'	203-212	yr						
e_1	213-222	wt % x 10^{-2}						
e_2	223-232	wt % x 10^{-2}						
C_Δ	233-242	$/kg						
C_F	243-252	$/kg						
e_F	253-262	wt % x 10^{-2}						
e_w	263-272	wt % x 10^{-2}						
A	273-282	kg						
c_p	283-292	$/gm						
E_t	293-302	TMW day						
u	303-312	% x 10^{-2}/yr						
fc_{core}		$/yr						
fc_{AB}		$/yr						
fc_{IB}		$/yr						
fc_{OB}		$/yr						

REFERENCES

(a) J. M. McCampbell, Paper 16-6, Analytical Treatment of Power Reactor Economics, presented at the American Nuclear Society meeting in December, 1958.

(b) Indemnity regulations, 10 CFR 140, Federal Register, April 7, 1960.

(c) H. L. Hollister, and A. J. Burington, Pricing Enriched Uranium, Nucleonics, 16 (January 1958).

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